Healthy sustainable communities

What works?

Ben Cave
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Milton Keynes South Midlands Health and Social Care Group exists to develop proposals with partners towards evolving an appropriate local health and social care infrastructure in support of the Government's sub regional strategy to help deliver unprecedented population growth in six key areas – Northampton and West Northamptonshire, North Northamptonshire, Milton Keynes, Aylesbury, Bedford, and Luton and Dunstable. Membership comprises representatives from Social Care and Health, Health, Local Government and Voluntary Sector organisations. The group's remit includes commissioning research into models of care and receipt of research outputs, pre-consultation and consultation with key stakeholders and their publics, producing recommendations and feeding these back before developing an agreed planning framework for the future provision of health and social care in the Milton Keynes South Midlands sub region.

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– arts and health; and
– community development.
Ben Cave Associates Ltd work with regional bodies, local authorities, NHS organisations, regeneration partnerships and the voluntary and the private sectors and can be contacted at www.caveconsult.co.uk

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About the authors

Ben Cave provides training and policy advice to, and writes for, a range of organisations. He has extensive experience of conducting health and social impact assessments on policies and programmes in the UK and abroad. He is experienced at integrating health into other forms of impact assessment, and recently worked with the London Health Commission to identify ways to address health in Strategic Environmental Assessment. He is developing innovative models of consultation and involvement and is currently working with young people and service providers in the Isle of Wight using art and theatre to evaluate and inform the Children’s Fund programme.

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Foreword

High levels of population growth are projected for Milton Keynes and the South Midlands. Between now and 2031 the population is expected to grow by 750,000 people. We will need an extra 300,000 new jobs and 370,000 new homes in an area stretching from Corby to Northampton, Bedford, Milton Keynes and Luton. Similarly rapid levels of development are anticipated across other major growth areas in the south east with Ashford, the Thames Gateway, and the London-Stansted-Cambridgeshire Corridor each seeing considerable increases in population.

Such unprecedented growth has major implications for the health and wellbeing of both the present and the future communities. The Office of the Deputy Prime Minister has set out an action plan for meeting these challenges in Sustainable Communities: building for the future. The new spatial planning system is a key mechanism for the delivery of this plan.

Health and wellbeing are central to sustainability. Strategies for sustainability are likely to improve health and the NHS is committed to tackling the underlying determinants of ill health and reducing social exclusion in all its forms. The NHS is also a major landowner, employer and a procurer of goods and services. As both a service provider and a major organisation it is absolutely imperative, therefore, that the health and social care sector plays a full and active role in servicing this substantial population growth over the coming years.

Delivering sustainable communities requires NHS organisations to develop joint approaches with local and regional government and to work across traditional organisational boundaries. Tackling deprivation and social exclusion requires co-ordination and the seamless integration of the planning, commissioning and delivery of new services and infrastructure.

This review is designed to support all those involved in the growth areas to ensure that proposed changes in land use are sustainable and health promoting. Overall we want to create places where people want to live and work.

One size does not fit all – delivery mechanisms, partnership arrangements and other crucial details need to be worked out at a local level. This document provides a background for issues which need to be explored at the different stages of the planning process and particularly at the pre-application stage. This review and the accompanying documents are designed to provide a basis for locating health and sustainability within these discussions.

There are no instant solutions to this opportunity. Meeting today’s demands and tomorrow’s needs requires hard work and depends on a wide and diverse range of people becoming involved to share a single vision. This checklist explores the potential for establishing common ground between these disparate stakeholders and their different agendas.

As chairman of the MKSM health and social care subgroup overseeing the developments, I am delighted that the regional directors of public health for the four growth areas have joined me in signing and supporting this document.

David Sidling
Chairman, Milton Keynes, Health and Social Care Group

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Regional Director of Public Health, East of England
1. Introduction

1.1 This document has been prepared as part of a programme of work funded by the Office of the Deputy Prime Minister in the MKSM growth area. The programme has been managed in association with the 3 Regional Public Health Groups based in the East Midlands, East of England, and South East Government Offices. It forms part of an overall programme designed to help the Health and Social Care community play its full part in implementing the Sustainable Communities strategy.

1.2 The purpose of this document is to develop an understanding amongst key stakeholders of the ways in which health, and health change, links to the wider determinants of health. It is intended to assist stakeholders identifying opportunities for health improvement. This review is part of a suite of materials which aim to promote imaginative, flexible and effective partnership working at local level to develop social inclusion and to contribute to developing sustainable communities. The other materials are available on www.mksm.mhsf.co.uk and include
- a spatial planning checklist (1);
- key elements of the new planning system (2); and
- planning for accessibility – how to integrate accessibility into masterplans (3).

Health and health change

1.3 The World Health Organisation give a broad definition of health as "a resource for everyday life, not the object of living. It is a positive concept emphasising social and personal resources as well as physical capabilities" (cited in 3). Health encompasses mental health and physical health and is affected by a broad range of factors including housing, employment status, transport and the social and the built environment: these are all determinants of health. This paper identifies how the proposed developments may affect the determinants of health for people in the growth area.

1.4 The evidence in this review identifies areas where changes in health might occur: it does not provide quantifiable estimates of the magnitude of possible health effects. We have attempted to show causal pathways and mechanisms by which socio-economic conditions relate to health inequality (4).

1.5 Curtis et al (4) note a general presumption that renewal is beneficial for health because schemes act on working and living conditions which are, in turn, determinants of health. It may appear self-evident that improvements in health determinants for disadvantaged groups will lead to health improvement and so reduce health inequalities in society. However, this assumption must be considered in the light of the evidence from research on health inequalities. Otherwise such an assumption becomes a ‘given’ based on a perspective that is too narrow and inflexible (5, p144). It is important to note that while there is a wealth of evidence linking poor health and deprivation, there is less evidence to show how what happens when determinants of health improve (6). It is thus important to consider, in a local context, how this evidence can be acted upon.

Sustainable development

1.6 In February 2003, the Government published Sustainable Communities: building for the future (7). This sets out the policies, resources and partnerships that are necessary to address the need to accommodate the economic success of London and parts of the South East, and the need to alleviate problems associated with the pressures on housing and services within existing towns and cities.

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Sustainable Communities envisages a considerable acceleration in the provision of housing. This brings challenges in terms of the planning system and the capacity of the construction industry. It remains largely unclear what types of household will be living in these new properties and the likely demographic of the resulting neighbourhoods. It is important that the lessons from previous periods of rapid growth are learnt. It will also be important that the dwellings and neighbourhoods created are attractive, well designed and promote liveability and health. Key to this are the quality of build, the materials used, the spatial relationships, and the availability of useable public space whilst protecting or increasing the area of green belt.

The principles of sustainable development are coterminous with principles for building healthier communities. These include the need to address issues such as income, employment, opportunities for a healthy lifestyle, housing, education and the cohesion of the community itself (9). The Egan Review looks at the skills needed to deliver sustainable communities within the new planning agenda (8). They define sustainable communities as ones which:

- meet the diverse needs of existing and future residents, their children and other users, contribute to a high quality of life and provide opportunity and choice. They achieve this in ways that make effective use of natural resources, enhance the environment, promote social cohesion and inclusion and strengthen economic prosperity.

This definition is backed up by seven components (see Box 1), which constitute the ‘common goal’. The Egan Review makes no explicit link between sustainability and health; local authorities have the lead role in delivering sustainability and health services are in the second tier with other service providers. The diagram in Box 1 has many similarities with the social model of health shown in Box 2. This shows how people’s health is affected by different factors including housing, employment, transport, social support, crime and community safety and education. Issues within the components often overlap with each other for example noise is a symptom of transport, it is also an issue in housing. We have sought to deal with each issue within the
appropriate component and if the issue occurs elsewhere to refer the reader to the relevant text.

1.10 The Egan Review (8) suggests that their definition of sustainable communities provides a ‘common goal for everyone involved in planning - central and local government, service providers, communities, the private and the voluntary sectors’ and so we have structured this review around their seven components. It should be noted that there is considerable interdependency between each of the health determinants.

How this review has been developed

1.11 The conceptual framework for this work rests on the premise that population health is influenced by a broad range of factors operating interdependently at multiple levels. The framework is based upon literature from public health, social epidemiology, human geography which have considered the social and economic determinants of population health.

1.12 This document draws on earlier reviews and on peer reviewed articles. Reviews looking at links between wider determinants of health and health e.g.

- Literature reviews commissioned and carried out for HfAs of draft London Mayoral strategies eg Transport: on the move (11); Biodiversity; Air Quality; Rapid review of health evidence for ‘Towards the London Plan (12) and Energy.
- HfA for regeneration projects. Volume II: Selected evidence base (13);
- The Acheson Report on Inequalities in health (14);
- Health evidence base for the London Cultural Strategy (15)
- Crime and fear of crime and health ... a rapid review (16);
- Kings Cross development and determinants of health (17);
- The solid facts (18); and
- Evidence from systematic reviews of research relevant to implementing the ‘wider public health’ agenda (19).

1.13 Reviews looking at particular determinants eg

- New roads and human health: a systematic review (20)
• Review of environmental and health effects of waste management: municipal solid waste and similar wastes (21)

1.14 Expert papers eg
• Rapid review on noise and health in London (22);
• Guidelines for community noise (23);
• Occupational and community noise (24).

1.15 Further sources of evidence for this rapid review were found through keyword searches on bibliographic databases, specifically:
• IBSS database of the British Library of Political and Economic Science;
• BIDS (Bath Information and Data Services);
• the Medline database;
• Pub Med database; and.
• EconLit database

1.16 References were also identified by a cascade method from the sources generated. The studies are all English language.

Search terms

1.17 The following terms were identified as relevant to the update for this review.
• economic growth
• economic development
• neighbourhoods and health
• urban design
• access to public services
• social services/care
• environmental health
• leisure,
• recreation,
• entertainment (with reference to sports and other activities for children and young people)
• community facilities
• green / open spaces
• design (with reference to the urban environment, community safety and cohesion/integration)
2. Governance

2.1 A consumer focused public service has long been a rhetorical aspiration. Philosophical discourses emphasizing participation as a key feature of democracy and citizenship have a long history in western political theory (25, p15-20,26). The principle of participation in public processes is widely accepted as a desirable symbol of the democratic rights of citizens. In the following sections we surmise some evidence that it is also beneficial to health and well-being. However, detailed consideration of participation in practice may sometimes be neglected. The distinctions between different forms and levels of participation are important in large, plural societies. Strategies for participation to local circumstances in order to be effective.

2.2 Political participation may be broadly defined as ‘taking part in the process of formulation, passage and implementation of public policies’ (27, p16). Some political theorists suggest that all stakeholders should be involved, on equal terms, in ‘face-to-face’ consultation. For example, Catt (28, p49) suggests that as ‘equality is the primary motivation behind participatory democracy, the involvement of all members of the group in each step of the decision making process is vital’.

2.3 Participation through direct involvement is different to participation through representation (29). Some theorists see political participation as the role of the private citizen in selecting leaders and influencing their actions (30). Dahl (31, p45) suggests it may be impractical to involve each individual directly in every consultation process; it may be more important to ensure that all members in a society have an equal capacity to influence their democratically chosen representatives. Participation in local politics then refers to action which citizens take to influence the decisions of public officials and elected representatives. This includes voting and other forms of electoral activity: for example campaigning, financial contributions, contacting public officials, protesting, and getting involved formally and informally in local issues (32).

Community involvement

2.4 Some forms of democratic participation may be beneficial for the health and wellbeing of those who take part. Participation may benefit individual health by enhancing one’s sense of self-esteem and self-efficacy and by provided social support. Participation in a community is related to the degree of equity in income distribution and to population health outcomes (35). Cattell’s (36) qualitative study of deprived housing estates in a part of London showed how social networks (37), affected the health of socially excluded individuals. Benefits to psycho-social health were seen to come from close bonding relations via the provision of emotional support, information and practical mutual aid, through a number of different networks, including extended families, work-based networks, neighbours and voluntary organizations representing shared interests. This and later studies (36,38,39) demonstrated health benefits including hopefulness, enjoyment, increased confidence, enhanced sense of esteem and control.

2.5 However, some forms of ‘bonding’ relations can be a barrier to both personal development and social cohesion with wider society. A tightly knit group may be less orientated to trust and cooperate with the wider community level (40), and this can impede individuals from expanding their contacts with a wider network.

2.6 If participative processes strengthen networks which draw on both bonding and bridging relations there may be positive health effects for socially excluded groups. Within renewal programme this may help to reduce health inequalities.

Participative strategies in public policy

2.7 Despite the emphasis on local participation in policy formulation and delivery, there are wide variations among localities in the volume and range of participation, and also in demand for
participation from local communities (41). A number of authors have reviewed the factors that need to be addressed if the effectiveness of community involvement is not going to be limited (42-44).

2.9 It is difficult to ensure that members of a society have an equal capacity to participate, and that lay participants from local communities are on an equal footing with stakeholders from statutory agencies and private industry. While attention may be paid to issues that are most important for disadvantaged, or marginalised, minority communities, there is a risk that these issues will continue to be viewed in terms set by the elite or dominant groups. Regeneration which benefits the majority of the population, in the ‘mainstream’ of society, may also cause ‘displacement’ of excluded groups, moving them to the edge or out of the community, to their further disadvantage.

2.10 The likelihood of civic participation depends upon the resources people have at their disposal (41). The amount of resource devoted to political participation has typically been quite small. Considerable effort and time is needed to develop effective community participation. This may run contrary to the timescale of the development scheme, and may also appear to result in small added value, especially in the short term.

2.11 Certain groups (for example, refugees, asylum seekers, travellers, users of illicit drugs) have particular characteristics (diversity, high mobility, ties which cross geographical and political boundaries, marginalised lifestyles and social exclusion) which may limit their power to participate effectively. Non participation in local politics and consultation may also result from poor access to information on participation opportunities and perceptions that the statutory agencies are not sufficiently responsive or inclusive to make participation possible (45).

2.12 Although development in Britain often aims to improve the physical infrastructure in a community, provision of physical facilities does not of itself constitute, or develop, social capital (46). Supportive social networks can be encouraged by strategies such as fostering established networks and associations which actively encourage newcomers to get involved; providing a range of meeting places; paying close attention to equitable distribution of resources; reducing tension between different groups (38).
3. Social and cultural

3.1 A starting point for understanding how the social and cultural environment affects health is to distinguish between social processes that are 'pathogenic', i.e. those that are 'bad' for health versus those that promote health which are referred to below as 'salutogenic', (see Box 3).

3.2 This framework is deliberately simplified; for example, processes listed on the 'positive' or 'salutogenic' side of the table (such as social capital) do not always promote good health, and vice versa. The concepts listed in the table also overlap each other; for instance, 'social disorganization' can be partly defined by an absence of social capital. We discuss each concept in turn below.

Box 3 Social processes and health

<table>
<thead>
<tr>
<th>Pathogenic influences</th>
<th>Salutogenic influences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social disorganization (47)</td>
<td>Collective socialization (48)</td>
</tr>
<tr>
<td>Residential exposure to crime fear of crime and violence (49)</td>
<td>Adult role models (51)</td>
</tr>
<tr>
<td>Incivilities and broken windows (50)</td>
<td>Informal social control (52)</td>
</tr>
<tr>
<td>Social isolation</td>
<td>Collective efficacy (52)</td>
</tr>
<tr>
<td>Wilson (53)</td>
<td>Social capital</td>
</tr>
<tr>
<td></td>
<td>Coleman (54), Lochner (55), Putnam (56)</td>
</tr>
<tr>
<td></td>
<td>Psychological sense of community (57,58)</td>
</tr>
<tr>
<td></td>
<td>Neighbouring and neighbourhood cohesion (59-61)</td>
</tr>
<tr>
<td></td>
<td>Community competence (62,63)</td>
</tr>
</tbody>
</table>

adapted from Coutts and Kawachi (64)

3.3 We present a detailed discussion looking at factors which promote a supportive and harmonious social environment.

Social environment

3.4 Social disorganization theory has been developed from seminal work by the Chicago School, which sought to explain the existence and persistence of crime and delinquency in an urban setting (47). According to Shaw and McKay, structural characteristics of certain urban neighbourhoods such as persistent poverty, high population turnover, and ethnic heterogeneity impeded the establishment of social connections and community attachment, resulting in the inability of residents to realise common goals. These conditions, which Shaw and McKay referred to as 'social disorganization', resulted in the lowered ability of communities to exercise social control over the development of delinquency and crime. Various offshoots of the theory have been examined in public health settings. For example, residential exposure to crime and violence (a direct manifestation of social disorganization) has been linked to health outcomes such as asthma prevalence (49) as well as patterns of physical activity (65).

3.5 An additional instance of the application of social disorganization theory to health outcomes is represented by attempts to measure residential exposure to physical and social disorder – or what have termed 'incivilities', consisting of environmental manifestations of vandalism and deterioration in public infrastructure, accompanied by a decline in the reputation of the neighbourhood (66).

3.6 Broken windows theory represents a variation on this theme, and suggests that the appearance of the local physical environment provides certain cues that control and influence behaviours, such as high risk sexual behaviours (67). An ecological study of 107 US cities found that the prevalence of abandoned housing was associated with rates of sexually-transmitted disease, homicides, suicides, and all-cause premature mortality rates, even after controlling for sociodemographic factors (68). In an earlier study the researchers (50) found that an index of broken windows (made up of the proportion of houses with major structural damage, street segments with graffiti, street segments with accumulated garbage, and street segments with...
abandoned vehicles) explained more of the community variance in gonorrhoea rates within New Orleans than measures of poverty. Among communities with a low broken window index, poverty rates were not associated with gonorrhoea rates, whereas the highest rates were found among communities with both high poverty and high broken windows. The authors speculated that boarded-up housing and broken windows may be related to worse health outcomes because of their potential adverse impact on social relationships and opportunities to engage in health-promoting behaviours (68).  

3.7 Ross et al (69) analysed a 1995 survey of a representative sample of 2,482 Illinois residents, and found that individuals who report living in neighbourhoods with high levels of crime, vandalism, graffiti, danger, noise, and drugs were more likely to mistrust others. They suggested that the sense of powerlessness, which is common in such neighbourhoods, amplifies the effect of neighbourhood disorder on mistrust (see discussion of social capital, below).

Social isolation  

3.8 Wilson’s theory of social isolation provides an additional mechanism by which individual well-being may be affected by larger social and economic processes affecting urban areas (53,70). Specifically, Wilson argues that middle class flight from the inner city over decades (combined with residential segregation) has resulted in the progressive decline of the social and economic viability of local institutions – such as churches, schools, voluntary organizations, and the family. This process has been accompanied by subsequent declines in the capacity of residents to maintain informal social control. As the regulatory power of the local community dwindles, residents have been increasingly exposed to problem behaviours, such as crime, substance abuse, and violence, at the same time as becoming isolated from mainstream norms (such as regular employment). In turn, potentially health-compromising behavioural orientations have been transmitted across generations, further contributing to community decline.  

3.9 According to Wilson, the combination of persistent poverty and social immobility gives rise to the social and spatial isolation of residents from mainstream sources of influence. Residents adopt (or are socialized into) orientations in order to survive (such as display of ‘toughness’). The cultural transmission of violent and other risky behaviours such as smoking, drinking, risky sexual activity, and poor diet in these contexts may have serious health consequences. Indeed, we suggest that disadvantaged communities with limited access to local mainstream institutions may experience the emergence of ‘health related subcultures’ (72). These subcultures may in turn promote a tolerance for risky lifestyles and detachment from mainstream values.

Behavioural contagion  

3.10 According to the ‘Contagion Model’ (22), if children grow up in a community where ‘their neighbours commit criminal acts, or drink too much’, children will be more likely to do these things themselves. Conversely, if the children grow up in a neighbourhood where most others ‘set a good example’, the children will tend to follow that example (48, p441). In other words, the contagion model can be thought of as analogous to the spread of infectious disease; the uptake of adverse health behaviours is hypothesised to occur through social learning. Since undesirable behaviours are also more prevalent in disadvantaged neighbourhoods, the contagion model has been put forward as a potential mechanism to account for the clustering of poor health outcomes among people in lower socioeconomic groups. A child raised in a disadvantaged neighbourhood is more likely to take up health-harming behaviours than one raised in a more affluent neighbourhood, regardless of his/her own family background (48).  

3.11 Social epidemiologists have sometimes referred to this phenomenon as ‘dependent happenings’, i.e., an individual’s risk of engaging in a particular behaviour is determined by the population (or community) rate of that same behaviour. Some evidence suggests that contagious processes apply to rates of attempted suicide, as well as to the initiation of smoking among minors.

Collective socialization  

3.12 Turning to the ‘positive’ side of the table in Box 3, collective socialization refers to the role of community adults – not just a child’s own parents – on child development, behaviours, and health outcomes. Three overlapping processes can be distinguished:  

- adult role models,  
- informal social control, and  
- collective efficacy.

abandoned vehicles) explained more of the community variance in gonorrhoea rates within New Orleans than measures of poverty. Among communities with a low broken window index, poverty rates were not associated with gonorrhoea rates, whereas the highest rates were found among communities with both high poverty and high broken windows. The authors speculated that boarded-up housing and broken windows may be related to worse health outcomes because of their potential adverse impact on social relationships and opportunities to engage in health-promoting behaviours (68).  

3.7 Ross et al (69) analysed a 1995 survey of a representative sample of 2,482 Illinois residents, and found that individuals who report living in neighbourhoods with high levels of crime, vandalism, graffiti, danger, noise, and drugs were more likely to mistrust others. They suggested that the sense of powerlessness, which is common in such neighbourhoods, amplifies the effect of neighbourhood disorder on mistrust (see discussion of social capital, below).

Social isolation  

3.8 Wilson’s theory of social isolation provides an additional mechanism by which individual well-being may be affected by larger social and economic processes affecting urban areas (53,70). Specifically, Wilson argues that middle class flight from the inner city over decades (combined with residential segregation) has resulted in the progressive decline of the social and economic viability of local institutions – such as churches, schools, voluntary organizations, and the family. This process has been accompanied by subsequent declines in the capacity of residents to maintain informal social control. As the regulatory power of the local community dwindles, residents have been increasingly exposed to problem behaviours, such as crime, substance abuse, and violence, at the same time as becoming isolated from mainstream norms (such as regular employment). In turn, potentially health-compromising behavioural orientations have been transmitted across generations, further contributing to community decline.  

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- adult role models,  
- informal social control, and  
- collective efficacy.
3.13 Adult role models within the community provide important cues to youth, such as labour market attachment. Crane (51) examined the effect of the number of adult role models in a community, as assessed by the proportion of adult residents who were in professional and managerial occupations, i.e., jobs that were perceived as high status. He found little differences across communities in pregnancy rates or school drop-outs rates when the proportion of professional adults within communities ranged between 5 to 40 percent. However, when the number of professionals fell below 5 percent, a ‘tipping point’ was reached. Among young and very young children, as the percentage of local community adults in professional occupations fell from 5.6% to 3.4%, community rates of school drop-outs and teenage child-bearing doubled. It should be noted that the ability of adults in the community to serve as role models hinges upon upstream structural conditions.

3.14 A second aspect of collective socialization, informal social control, refers to the capacity of a group to regulate the behaviour of its members according to collectively desired (as opposed to enforced) goals. In other words, in contrast to externally enforced actions (such as a police crackdown), informal social control focuses on the effectiveness of informal mechanisms by which residents themselves achieve public order (52). Examples of informal social control include the monitoring of spontaneous play groups among children, a willingness to intervene to prevent such acts a truancy and street-corner ‘hanging out’ or loitering by peer groups, and the confrontation of persons who are exploiting or disturbing public space (52). As is evident from the foregoing description, informal social control has been primarily evoked in the context of the community’s ability to control deviant (and criminal) behaviour. However, the concept can also be generalized to health behaviours and health outcomes. For example, the prevalence of smoking and drinking by minors, as well as drug abuse and other ‘anti-social’ health behaviours, are likely to be influenced by the extent to which adults in the community (not just the children’s parents) exercise informal social control over such behaviours.

3.15 A third dimension of collective socialisation is collective efficacy, which is the neighbourhood counterpart to the concept of individual efficacy, i.e., the global willingness of residents to intervene on behalf of the common good (52). In terms of measurement, collective efficacy is conceptualised as the combination of informal social control and neighbourhood social cohesion. According to the theory of collective efficacy, the willingness of local residents to intervene on behalf of the common good depends crucially on the presence of mutual trust and solidarity among neighbours (52). To this extent, the concept of collective efficacy overlaps with social capital (see below). The theory thus links mutual trust and solidarity (i.e., elements of social capital) within a community with shared expectations for pro-social action (informal social control) (73).

3.16 The pathways through which neighbourhood collective efficacy may influence health outcomes include – in addition to informal control over anti-social behaviours – the ability of residents to engage in sustained collective action to manage neighbourhood physical hazards (e.g., the location of toxic waste sites) (73,74). Initially Sampson et al. (52) demonstrated the association of collective efficacy with neighbourhood crime rates in communities within Chicago city, suggesting that health may be indirectly promoted by limiting the health damaging consequences of violent victimization. There are plausible grounds to believe, however, that the concept of collective efficacy may be associated with health outcomes through additional pathways such as the ability of residents to undertake coordinated action (e.g., pass local ordinances to restrict smoking in public places).

Social capital

3.17 The concept of social capital broadly refers to ‘the resources available to individuals and groups through social connections’ (55). The ‘capital’ aspect of social capital is embodied in the exchange of social support, levels of interpersonal trust, as well as patterns of civic engagement and voluntarism that exist within communities.

3.18 In one sense, the concept of social capital is not new (76). Extensive research in community psychology has identified related constructs such as ‘the psychological sense of community’ (57,58), ‘neighbouring’ (61), as well as ‘community competence’ (62,63), which share much in common with the core dimensions of social capital.

3.19 An important and widely acknowledged distinction made in the field is between the ‘bonding’, ‘bridging’, and ‘linking’ forms of social capital (77). Box 4 shows how bonding social capital refers

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to close ties and or relations / social support between members of a network who are similar in terms of social identity (e.g., race/ethnicity/socio-economic group). This is a resource that helps individuals get by whereas bridging social capital refers to the social leverage and connections between groups who are unlike each other yet are ‘more or less equal in terms of their status and power’ and which help individuals get on (78,79). ‘Linking social capital’ on the other hand has been defined as ‘norms of respect and networks of trusting relationships between persons who are interacting across explicit, formal or institutionalized power or authority gradients in society’ (77). To date, few studies have attempted to distinguish between the bonding/bridging/linking forms of social capital, mainly due to the paucity of instruments to measure bridging or linking social capital (for an exception see 80).

3.20 Despite the increasing usage of the concept, social capital remains a ‘fuzzy’ and contested concept. There is lack of uniformity across studies in the choice of indicators to measure social capital. Most studies have used some combination of measures of trust, perceived reciprocity, and collective efficacy/aggregation (81), aggregated to the community (or other group) level. However, other proxy measures have also been used, including volunteerism, community attachment, and even electoral participation (82). The heterogeneity of indicators used to measure social capital reflects the changing use of the concept (which was originally imported from sociology, political science, and criminology), as well as the reliance of investigators on secondary sources of data (i.e., surveys carried out for purposes other than public health) (83).

Box 4 Bonding, bridging and linking social capital

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Empirical evidence linking social capital to health

3.21 An increasing number of ecological studies have demonstrated an association between community social capital and population health outcomes: Kawachi et al review this evidence (82). For example in a study utilizing the Community Survey data collected as part of the Project on Human Development in Chicago Neighbourhoods (55) found that neighbourhood social capital—as measured by reciprocity, trust, and civic participation—was associated with lower neighbourhood mortality rates, after adjustment for neighbourhood material deprivation. Higher levels of neighbourhood social capital were associated with lower neighbourhood death rates for total mortality as well as death from heart disease and “other” causes for white men and women and, to a less consistent extent, for black men and women.

3.22 However, empirical studies of neighbourhoods are susceptible to the ecological fallacy (84). This is a common methodological problem. It refers to a situation that can occur when one makes an inference about an individual based on aggregate data for a group. A rigorous test of social capital as a contextual variable affecting health requires a multi-level approach (85) ie, individuals and their health outcomes nested within neighbourhoods that vary with respect to their levels of social capital. Multi-level data enables us to disentangle the role of individual and place / contextual factors in health change.

3.23 Greater theoretical and methodological sophistication within multi-level studies is beginning to reveal a rather complex pattern of the associations between social capital and individual health. Explicit tests of cross-level interactions have begun to demonstrate the simultaneous presence of both the beneficial and negative aspects of community social capital. In an analysis of the Social Capital Community Benchmark Survey involving 21,455 individuals nested within 40 US communities, (86) found that individuals who reported high levels of trust of others in the community benefited from living in places where others also shared the same opinion. The higher the level of trust within the community, the lower was the probability of reporting poor self-rated health among trusting individuals. On the other hand, a trend was found in the opposite direction for individuals expressing mistrust of others: the more trusting the community in which they lived, the worse their health status. In another study, (87) examined 200 African American families with young children residing in 39 Baltimore neighbourhoods. They found that for children living in poor areas, having a mother with low community attachment was associated with lower levels of behavioural and mental health problems, whereas for children to close ties and or relations / social support between members of a network who are similar in terms of social identity (e.g., race/ethnicity/socio-economic group). This is a resource that helps individuals get by whereas bridging social capital refers to the social leverage and connections between groups who are unlike each other yet are ‘more or less equal in terms of their status and power’ and which help individuals get on (78,79). ‘Linking social capital’ on the other hand has been defined as ‘norms of respect and networks of trusting relationships between persons who are interacting across explicit, formal or institutionalized power or authority gradients in society’ (77). To date, few studies have attempted to distinguish between the bonding/bridging/linking forms of social capital, mainly due to the paucity of instruments to measure bridging or linking social capital (for an exception see 80).

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3.24 These interesting but preliminary findings suggest that any intervention to strengthen social capital within communities is likely to be associated with both risks and benefits to different groups. It also points to the necessary consideration in policy delivery of the interactions between individuals and their social contexts.

Mechanisms linking community social capital to health

3.25 The specific mechanisms underlying the link between community social capital and health outcomes aren't yet clear. There are several distinct pathways through which social capital may influence individual health outcomes (Box 5). First, at the community level (indicated by the top half of the Box), social capital may enhance the health of residents through two processes already alluded to: collective efficacy (i.e., the ability of communities to undertake collective action to introduce local smoke-free ordinances, or to lobby against the closure of local clinics), and collective socialisation (e.g., informal social control over deviant health behaviours, such as underage smoking and drinking) (74, 89). In addition to the community-level pathway, community social capital may operate at the individual level via the provision of mutual aid and social support (indicated by the lower half of the diagram). A convincing body of empirical evidence from epidemiology suggests that social support is an important determinant of longevity and quality of life (90). Lastly, residence in a high social capital community may promote health via direct psychosocial mechanisms, by promoting feelings of security, identity, shared emotional connection, and ‘belongingness’ (indicated in the Box by the dotted arrow leading directly from social capital to health outcomes).

Box 5 Pathways linking community social capital to health outcomes
from Kawachi et al (88)

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3.26 As Putnam (56) has noted, strong attachments to community increase the likelihood that indicators of health problems may receive notice (e.g., a community member who is missing from a local meeting is more likely to elicit the concern of neighbours). Moreover, sentiments of solidarity and trust may lead community members to act on others’ behalf independently of prior network connections.

3.27 An excellent example of how these processes may function to affect health is provided by a case study of the 1995 Chicago heat wave, during which hundreds of elderly residents died of heat exhaustion (91). Death rates were highest amongst individuals who resided in communities characterised by low levels of social interaction in public places as well as high crime rates. A lack of community life combined with a fear of crime kept many elderly residents sequestered within their homes and prevented them from reaching emergency cooling centres. Communities with an active street life where neighbours saw each other and interacted on a daily basis were more likely to be more resilient and be able to respond to heat waves effectively.

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Better together? The downsides of social capital

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3.29 This section has been confined to how the urban social environment can potentially impact on a person’s health, however, it goes without saying that the urban social environment is shaped by the surrounding physical environment, and vice versa. As demonstrated in the housing and the built environment section there is a vast empirical literature establishing the ways in which housing affects physical and psychological health (see for instance (96-100). Indeed in neighbourhood renewal and regeneration, emphasis tends to be placed upon the physical improvement of the house and the built environment in order to generate health changes amongst residents. However, the social environmental context has receive far less systematic attention from researchers and policy makers. The nascent research field examining the pathways linking neighbourhood social environments to health marks a promising development in efforts to address the interdependent and multi-level nature of the social determinants of urban health.

More successful at protecting vulnerable residents against the risk of death. Access to social capital within the broader community (including trusting relationships between neighbours) looms in importance for isolated, elderly people who have limited opportunity for engagement outside their homes (92).

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4. Environmental

4.1 The physical environment is often divided into land, water, and air. Each of these has different dimensions: for example, we can consider the multi-functional ‘recreational’ aspects of open space, water and woodland, or we can consider remedial aspects, or look at the efficient use of these resources and their sustainable management. Egan defines the environment in terms of managing and husbanding physical resources (8). We consider who might enjoy using ‘green’ open spaces and how this might be achieved in the following chapter. We look at issues associated with land, water and air. We also look at some of the health effects associated with noise.

Land

4.2 The Environment Agency estimates that there are some 300,000 hectares of land in the UK affected to some extent by contamination left by industrial activity (101). Developing brownfield sites means using land at a more sustainable population density. It also means building on land which may be contaminated: contamination is likely to have arisen from the activities of past industrial uses. Elevated levels of heavy metals, oils, pesticides, asbestos or landfill gas are a few examples of substances or materials which could be considered contaminants and which where not properly managed could cause harm to health or the environment (102). The current definition of contaminated land means that it is possible for land to be contaminated and to pose no threat to human health or the environment (103).

Waste management

4.3 The following text is from a detailed review of environmental and health effects of waste management (21). We refer the reader to this review for further information.

4.4 Waste management is a very large scale activity which inevitably has consequences for human health and the environment. At the very least it involves transporting waste materials. The various waste management processes such as landfill and incineration are very different in character and give rise to different kinds of human health hazards. Domestic waste is the main component of municipal solid waste and this can contain hazardous substances such as pesticides used within the home. If such substances are volatile then it is likely that they will be released on to a landfill. Incineration may destroy such substances but combustion itself is well known to create toxic substances such as sulphur dioxide, oxides of nitrogen, dioxins and furans. Composting can also generate hazardous substances – for example, some of the micro-organisms which flourish in the composting process may be able to release spores with allergic properties which can stimulate or exacerbate respiratory diseases. Even recycling processes are not without risk. These may well involve the expenditure of energy and consequent release of combustion gases and/or produce contaminated wash waters (21).

4.5 We look below at

- materials recycling facilities;
- composting;
- incineration; and
- landfill.

4.6 Epidemiological studies of the health of workers in materials recycling facilities (MRFs) are very few in number, and only one has demonstrated clear exposure-response gradients for a range of conditions amongst the workers. The concentrations of suspended particles, endotoxin and glucan to which those workers were exposed were far in excess of those to which the general public are exposed in the vicinity of an MRF. There do not appear to be any reported studies of the health of local populations in the vicinity of MRFs and therefore it is not possible to recommend any quantitative health impact functions. It should not, however, be assumed that effects on the general population are negligible, as the shape of the exposure response functions is unknown and the general public is likely to include individuals of far greater susceptibility than the workforce (21).

4.7 Composting: the composting process may be defined as the controlled biological decomposition and stabilisation of organic substrates, such as vegetable, plant and some food wastes, under conditions that are predominantly aerobic and that allow the development of thermophilic temperatures as a result of biologically produced heat (104). It results in a final product typically referred to as “compost” that has been sanitised and stabilised, is high in humic

4. Environmental

4.1 The physical environment is often divided into land, water and air. Each of these has different dimensions: for example, we can consider the multi-functional ‘recreational’ aspects of open space, water and woodland, or we can consider remedial aspects, or look at the efficient use of these resources and their sustainable management. Egan defines the environment in terms of managing and husbanding physical resources (8). We consider who might enjoy using ‘green’ open spaces and how this might be achieved in the following chapter. We look at issues associated with land, water and air. We also look at some of the health effects associated with noise.

Land

4.2 The Environment Agency estimates that there are some 300,000 hectares of land in the UK affected to some extent by contamination left by industrial activity (101). Developing brownfield sites means using land at a more sustainable population density. It also means building on land which may be contaminated: contamination is likely to have arisen from the activities of past industrial uses. Elevated levels of heavy metals, oils, pesticides, asbestos or landfill gas are a few examples of substances or materials which could be considered contaminants and which where not properly managed could cause harm to health or the environment (102). The current definition of contaminated land means that it is possible for land to be contaminated and to pose no threat to human health or the environment (103).

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substances and can be beneficially applied to land. Composting is now employed as a treatment process for a wide range of organic substrates such as municipal solid wastes, sewage sludges and agricultural and industrial bio-products. Actively composting materials or finished composts have been shown to degrade a wide range of organic pollutants and are thus used in the bioremediation of contaminated soils. Organic materials received at a composting facility require pre-processing, involving four main activities, namely shredding, mixing different feedstocks together to improve homogeneity and adjust the carbon to nitrogen ratio and/or moisture content, adding water to optimise moisture content and removing contaminants. The pre-processed waste then goes into one of a number of large scale composting processes which include windrow systems, aerated static piles, inverted systems and vermicomposting (104).

Following the composting process, post-processing takes place in order to screen out large particles and blend with other materials. As outlined above, none of the epidemiological work carried out on occupationally exposed workers provides exposure-response functions usable for quantitative health effects evaluation (21).

4.8 Incineration: modern, well-managed incinerators can be an effective means of reducing and disposing of waste materials. However the by-products of the combustion process may contain hazardous or toxic pollutants and emissions will add to background pollution levels. As a result, there is often considerable public concern over the possible health effects of living near to incinerators processing hazardous, clinical or municipal waste. The report (21) presents a systematic review of epidemiological studies of the public health effects of waste incinerators.

4.9 There is no doubt that air pollution (from all sources) can have an adverse effect on the health of susceptible people (e.g. young children, the elderly and particularly those with pre-existing respiratory disease). Recent work in the UK by the Committee on the Medical Effects of Air Pollutants (COMEAP) demonstrates that exposure to air pollution can bring forward death in patients with severe preexisting disease, although the degree of life shortening is typically of the order of a few weeks at most per individual (105). However, there is currently little convincing evidence that ambient levels of air pollution cause adverse health effects in healthy people (21).

4.10 Whilst incinerators generate a considerable amount of public concern, there have been few published epidemiological studies that examine the health of communities living in close proximity to them. The majority of published studies concentrate on the effects of exposure to emissions from older generation incinerators which were phased out in the UK in the mid-1990s, and on the introduction of stricter emission controls implemented through the Integrated Pollution Control regime. This is inevitable, in view of the latency period associated with many cancers. The level of public exposure from such facilities was substantially higher than occurs from modern incinerators (21).

4.11 Most of the epidemiological studies of possible health outcomes in populations living close to incinerators have not given clear indications of the presence or absence of an effect. Of necessity, many of the studies examining possible health effects are retrospective and employ routinely collected data such as cancer registrations, birth and death records. Whilst such observational studies can provide evidence of association between a health outcome and an environmental pollutant, they cannot, by themselves, demonstrate a cause and effect relationship. The interpretation of these findings is also crucially dependent on well-known limitations, including possible sources of bias and confounding, together with the ever-present difficulty in obtaining reliable and accurate population exposure data (21).

4.12 Direct measurements of exposure from incinerators are seldom made and often the distance from the incinerator site is used as a proxy for exposure, a technique that can be unreliable. Many studies use concentration circles to identify “at risk” populations, a technique that does not take into account the influence of meteorological conditions or process characteristics (e.g. stack height, efflux velocity, plume temperature). Furthermore, the zones of influence used, up to 7.5 km from the site, introduce considerable possibilities for confounding coexposures to emissions from other industries, past and present (21).

4.13 Another problem is that most studies are, by their very nature, post hoc (i.e. after the event) since they were prompted by complaints of apparent clusters ofill health in areas around incinerators. As a result unintentional bias (such as in the reporting of health outcomes) can be built into the study, which can give spurious results. In addition, many studies analyse only a small number of cases which reduces the statistical power to detect an association between exposure and ill health. As noted above, the majority of the studies, and any associated environmental data, originate from incineration facilities whose emission profile was significantly different from today’s modern incinerators. As a result unintentional bias (such as in the reporting of health outcomes) can be built into the study, which can give spurious results. In addition, many studies analyse only a small number of cases which reduces the statistical power to detect an association between exposure and ill health. As noted above, the majority of the studies, and any associated environmental data, originate from incineration facilities whose emission profile was significantly different from today’s modern incinerators. Up until mid-1990s, incinerators were seldom fitted with emission controls of lower efficiency and therefore emitted much larger amounts of substances and can be beneficially applied to land. Composting is now employed as a treatment process for a wide range of organic substrates such as municipal solid wastes, sewage sludges and agricultural and industrial bio-products. Actively composting materials or finished composts have been shown to degrade a wide range of organic pollutants and are thus used in the bioremediation of contaminated soils. Organic materials received at a composting facility require pre-processing, involving four main activities, namely shredding, mixing different feedstocks together to improve homogeneity and adjust the carbon to nitrogen ratio and/or moisture content, adding water to optimise moisture content and removing contaminants. The pre-processed waste then goes into one of a number of large scale composting processes which include windrow systems, aerated static piles, inverted systems and vermicomposting (104).

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Potential pathways and exposure routes: the general public can be exposed to pollutants associated with incinerator emissions through a number of routes, with inhalation and the food chain of particular importance. For many pollutants, including some of the trace metals and potentially carcinogenic organic compounds (such as dioxins and furans), the major route of exposure is-through the food chain. People with pre-existing respiratory and cardiovascular disease can have their health ill effects exacerbated by exposure to air pollutants such as SO₂, NOₓ and PM₁₀ which occur in incinerator emissions. Children and the elderly are also particularly vulnerable to air pollution (see page 24 for a summary of air pollution and health effects). Exposure via the food chain will also arise if locally grown or reared produce is consumed. Individuals are also exposed to the diet of local people. Groups such as local allotment owners and farmers may need particular consideration (21).

Possible health effects associated with the process: as discussed above, studies in the UK have focused on the possible effects of living near to older generations of incinerators where levels of substances emitted from the incinerator would be expected to be greater than for modern incinerators. Most concern has focused on the effects of exposure to dioxins and furans and polycyclic aromatic hydrocarbons (PAHs), substances that are known or suspected carcinogens. It has been hypothesised that exposure to dioxins and furans (either directly via inhalation or indirectly via the food-chain) may be major causes of cancer in communities around incinerators. Whilst older incinerators were often significant sources of dioxins and furans in the local environment, modern incinerators are significantly cleaner. A recent study around a modern incinerator in Spain found no difference in the levels of exposure (based on analysis of substances in blood samples) in residents living near to the incinerator and those living further away (106). Cancer: stomach, colorectal and liver cancers: several epidemiological studies have suggested a possible association between incinerator emissions and stomach, colorectal and liver cancers. In the UK a possible distance-related link with the old generation of incinerators has been reported (21). Despite reports of cancer clusters, no consistent or convincing evidence of a link between cancer and incineration has been published. In the UK, the large epidemiological studies by Elliott and colleagues in the Small Area Health Statistics Unit (SAHUSU) examined all 14 million people living with 7.5 km of 72 municipal solid waste incinerators. This included essentially all incineration plants irrespective of age up to 1987. Despite the consequent inclusion of older incinerators with emissions of potential carcinogens much higher than would occur from modern incinerators, both studies were unable to convincingly demonstrate an excess of cancers once socio-economic confounding was taken into account (107-109). As a result of these studies, the Department of Health’s Committee on Carcinogenicity published a statement in March 2000 evaluating the evidence linking cancer with proximity to municipal solid waste incinerators in the UK (110). The Committee specifically examined the results of these studies and concluded that, "...there is no excess of cancer due to residence (for periods in excess of ten years) near to municipal solid waste incinerators...". The Committee agreed that the observed excess of all cancers, stomach, lung and colorectal cancers was due to socio-economic confounding and was not associated with emissions from incinerators. The Committee agreed that, at the present time, there was no need for any further epidemiological investigations of cancer incidence near municipal solid waste incinerators (21). It has been hypothesised that exposure to dioxins and furans (either directly via inhalation or indirectly via the food-chain) is responsible for increased cancer risk near incinerators. However, epidemiological studies on the older generation of incinerators that emitted significantly greater amounts of dioxins than newer facilities have failed to identify an excess. Conversely, the emissions of dioxins and furans from modern incinerators are an order of magnitude lower than from older incinerators, it can be said with some confidence that any impacts of dioxin and furan on cancer rates in local people are small or non-existent and unlikely to be quantified through epidemiology (21). There is little evidence to suggest that waste incinerators are associated with increased prevalence of respiratory symptoms in the surrounding population. This is consistent with the data from risk assessments, emissions and ambient air monitoring in the vicinity of incinerators which indicate that modern, well-managed waste incinerators will make a very small contribution to background levels of air pollution. In many cases, air monitoring data do not demonstrate that emissions from the incinerators are a major contributtor to ambient air pollution (21).
4.19 Landfill: the practice of landfill involves the use or creation of contained void spaces. These are normally in the form of cells which can be lined, then filled with waste materials which are progressively compressed and enclosed with further soil, and eventually with a permanent cap. Since much of the waste is not processed prior to disposal in a landfill, biodegradable materials of the subsequently decay releasing landfill gas. Landfill gas comprises mainly methane and carbon dioxide, and is increasingly collected for combustion and energy conversion. Detailed chemical analysis of landfill gas shows the presence of potentially toxic components to which adjacent populations could be exposed due to incomplete collection of gas. Landfills are susceptible to the ingress of water principally from rainfall. Modern landfills are lined with a comprehensive low permeability system which limits seepage of leachate to a level assessed to be acceptable, and capped when full. For older landfills, however, greater movement of leachate is a potential pathway for human exposure. Concern over the health effects of landfill stems in the main from historical waste sites from when poorly regulated industrial sites which local environment is in some cases well documented. However, municipal solid waste can include some hazardous materials from domestic sources. Both the disposal of hazardous materials and their biodegradation processes can lead to the potential for environmental releases of hazardous materials from municipal solid waste (21).

4.20 The sole criterion used by Elliott et al. (111) for judging exposure to the landfill activity was proximity of residence. For 70% of landfill sites, distances were measured from the site centroid whilst for the remainder the location of the site gateway at the time of reporting was used. A 2km zone was constructed around each landfill site corresponding to an assumed likely limit of dispersion for landfill emissions. Persons with residential postcodes within the 2km zone were classified as within the exposed population, whilst people living more than 2 km from all known landfill sites during the study period comprised the reference population. Fifty-five percent of the national population resided within the 2km zones around the 9565 landfill sites operational between 1982 and 1987, which comprised 774 sites for hazardous waste, 7803 sites for non-hazardous waste and 988 sites which handled unknown wastes. Congenital anomalies which were examined included neural tube defects, cardiovascular defects, abdominal wall defects, epispadias, gastroschisis and epidermolysis, surgical correction of gastroschisis and epimastigal. The instances of low and very low birth weights defined as less than 2500g and less than 1500 g respectively were also examined (21).

4.21 Risks for the population within 2 km of landfill relative to the reference population were calculated by the Poisson distribution standardising a non-relative risk. The regression function included year of birth, administrative region, sex, (for birth weight and stillbirths) and deprivation. The latter was based on the national distribution of the Carstairs deprivation index based on 1991 census statistics at enumeration district level. The results for risks of congenital anomalies, stillbirths and low birth weights during operation or after closure of a landfill site combining all waste types are provided in Table 3.20 of the original review (21). After the initial adjustment for deprivation, there remains a small but nonetheless statistically significant excess relative risk for those living within 2km of a landfill site for all congenital anomalies, neural tube defects, hypospadias and epispadias, abdominal wall defects, surgical correction of gastroschisis and epimastigal, low birth weight and very low birth weight (21).

4.22 The analysis was also carried out separately for sites handling special (i.e. hazardous) waste and non-special waste as well as for sites that opened during the study period, relative risks before opening and during operation or after closure. The authors (111) commented that sites listed as handling hazardous waste (i.e. landfill and co-disposal of hazardous waste) due to the practice of co-disposal of these special wastes may in fact only handle small volumes of hazardous waste; they are likely to be subject to stricter management and design standards than other UK sites therefore minimising potential exposure and the exposure of the local population. On the other hand, there is no possibility that hazardous waste may have been disposed of in non-special waste sites. Given the strict regulatory regime in place, this appears unlikely to have occurred in recent years. The results indicate that no statistically significant association was found between birth outcomes with residence within 2 km of a landfill site, the relative risk appears to be greater for special waste than non-special waste sites. Those birth outcomes which show an excess for non-special waste sites and non-special waste sites are abdominal wall defects, hypospadias and epispadias, surgical correction of gastroschisis and epimastigal, low birth weight and very low birth weight. For the latter two outcomes the relative risk is marginally higher for non-special waste sites than for special waste sites (21).

4.23 When risks associated with sites that opened during the study period (irrespective of waste type) were compared over the periods before opening with those during operation or after closure, rather few of the estimated relative risks were significant. Whilst relative risks were higher for
some birth outcomes during operation or after closure of the site, for certain birth outcomes, most notably abdominal wall defects, the relative risk before opening of the site was greater than during operation or after closure. Whilst stillbirths, low birth weights and very low birth weights were all significantly associated with residence within 2 km of a landfill site during operation or after closure, prior to opening none was significantly associated. The authors comment that this latter kind of analysis involving rates of disease both before and after the opening of landfill sites being restricted to one set of areas is less subject to confounding by socio-demographic factors than comparisons between different areas, although confounding by temporal trends is possible (21).

4.24 Commenting on the paper by Elliott et al (111), McMann and Doik (112) drew attention to the fact that it occurs in adjusting for confounders, for example, by using socioeconomic status to increase or decrease relative risk for landfill versus reference areas quite appreciably. They also questioned whether residence within 2 km of a landfill was the best measure of exposure and or other reasons why misclassification occurred. For example, the duration of exposure might have been restricted because the study was based on residence at pregnancy outcome, misclassification would occur if women moved home between the critical period of early pregnancy and the end of pregnancy (21).

4.25 Whilst there are weaknesses in the Small Area Health Statistics Unit study (113), the review authors (21) state that it is the strongest piece of epidemiological research carried out in the UK and probably internationally on the issue of risks of congenital anomalies in relation to landfill. The small positive association found between certain adverse birth outcomes and residence in proximity to a landfill cannot be stated with certainty to be causal, but provide the best currently available estimate of relative risk (21).

4.26 Although not included in the main published paper, the study also examined a number of cancer outcomes, specifically childhood and adult leukaemias, hepatobiliary cancers and cancers of bladder and brain. After controlling for socioeconomic status, no excess risk for those living within 2 km of a landfill site was found for each of the cancer types studied (114). This result was less than the findings reported in the other studies (115). The study examines the association of childhood leukaemia and leukaemias and the likely latency period in developing a cancer. SAHSU used a lag period of one year for childhood leukaemia and five years for other cancer outcomes which may be unduly short for the latency period. The sensitivity analysis taken in order to increase the number of potential approaches taken on for analysis and to reduce the potential of dilution by migration. The Committee on Toxicity (115) state that if the latency period is longer, this index of potential exposure may be inappropriate leading to dilution of any potential effect (21).

Water

4.27 The provision of clean water is a key public health issue and requires constant vigilance (116). Water has other areas for consideration eg the need to husband resources, water as a leisure commodity and the risk of flooding.

4.28 Work in the US suggests that urban sprawl can threaten both the quantity and the quality of the water supply. As forest cover is cleared, and impervious surfaces built over large areas, rainfall is less effectively absorbed and returned to groundwater aquifers. Instead, relatively more stormwater flows to streams and rivers and is carried downstream. Modelling shows that higher density development patterns can reduce peak flows and total runoff volumes. With better control of ‘point sources’ of water pollution – factories, sewage treatment plants, and similar facilities it is now ‘non-point source’ pollution that has emerged as a major threat to water supplies. This occurs when rainfall or snowmelt moves over and through the ground, picking up contaminants and depositing them into surface water (lakes, rivers, wetlands, and coastal waters) and ground water. Much of this problem relates to agricultural land, the primary source of contamination by fertilisers, and insecticides. However, a growing form of non-point source pollution is oil, grease, and toxic chemicals from roadways, car parks and other surfaces, and sediment from improperly managed construction sites, other areas from which foliage has been cleared, and ending stream banks (117).

4.29 Carpeting rural areas with concrete parking lots has a serious effect on the water supplies. Naturally, rainfall is captured by vegetation, swamps, trees, permeable soil, or other natural absorbents. These areas act to retain and purify water for further recycling. However, when natural habitats are covered over with impermeable surfaces, the hydrologic cycle is negatively affected, causing runoffs, floods, and water contamination. The volume of storm water that washes off a parking lot is 16 times greater than the amount that can be absorbed in a field. Invariably, rainfall from parking lots mixes with grit, oil, and other debris, contaminating its flow some birth outcomes during operation or after closure of the site, for certain birth outcomes, most notably abdominal wall defects, the relative risk before opening of the site was greater than during operation or after closure. Whilst stillbirths, low birth weights and very low birth weights were all significantly associated with residence within 2 km of a landfill site during operation or after closure, prior to opening none was significantly associated. The authors comment that this latter kind of analysis involving rates of disease both before and after the opening of landfill sites being restricted to one set of areas is less subject to confounding by socio-demographic factors than comparisons between different areas, although confounding by temporal trends is possible (21).

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The water industry is increasingly required to provide water supplies to properties built on areas of land contamination. The potential impact of the contaminants within such sites on the water supply pipes and therefore water quality needs to be seriously considered. Acidic land contaminants lead to corrosion problems for metal pipes, however, plastic pipes are susceptible to physical degradation or permeation by organic chemicals (120).

Flood risk is defined as ‘a combination of two components, the chance (or probability) of a particular flood event and the impact (or consequence) that the event would cause if it occurred. Flood risk management can reduce the probability of occurrence through the management of land, river systems and flood defences, and reduce the impact through influencing development in flood risk areas, flood warning and emergency response’ (122). The estimation of future flood risks is difficult due to uncertainties, however, all scenarios point to substantial increases (123). This projection of increased flood risk applies to flooding from rivers and coasts and also to localised flooding. Localised flooding is caused by sewer and drainage systems in towns and cities being overwhelmed by sudden downpours. Events in the Thames in August 2004 show the effect of sudden downpours. It is estimated that the numbers of properties at high risk of localised flooding could increase four-fold (123). Regulating and influencing development is essential. Flood defences can be constructed so that flood risk is minimised, but controls are also needed to prevent development that could increase flood risk (122). Floods in Britain are typically small-scale, short-lived and shallow. However, the health effects which can result from these floods are often very severe. These health impacts range from premature death, clinical problems requiring hospitalisation or consultation with doctors, to an increase in the use of non-prescription drugs or alcohol, depression, insomnia, low self esteem and general feelings of ill-health (124).

We look at two studies of the health effects of flooding in England (124,125).

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<th>Perceived health effects of flood reported by flood victims</th>
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</tbody>
</table>

from Flood Hazard Research Centre (124)

A small exploratory study in the Thames Region, conducted six focus groups with flood victims of the 1998 Easter flooding in Banbury and Kidlington. This is a small study however the mechanisms by which people are affected are considered in detail and are worthy of further exploration. Where possible, participants for the focus groups were selected from particularly vulnerable populations, those more severely impacted included the elderly, single parents, ethnic minority groups, and those of lower socio-economic status (124). Although pre-existing health conditions were reported by participants in all focus groups, a substantial proportion of flood victims believed that their physical health, or the health of a member of their household, had suffered as a result of the flooding (124). The health effects reported by flood victims are shown in Box 6. In addition many people experienced a number of associated problems which contributed to the levels of stress suffered, including:

- problems with personal relationships;
- problems with employment; and
- feelings of isolation.

A further influencing factor can be described as a loss in the level of confidence in the authorities and institutions perceived to be associated with providing flood protection and recovery support, and a fear that they will also fail to protect or warn against any future event. Explanations given...
for the cause of flooding as being 'natural' forces may not be believed by flood victims, exacerbating the loss of confidence in authorities to predict a flood or issue a warning. This leads to anxiety when storms or rain are forecast, worry about the possibility of future flooding, and associated changes in behaviour such as regular monitoring of river levels (124).

4.35 A final group of factors seen to influence all of the above, to a greater or lesser extent, are socio-economic and cultural variables, such as gender, age, ethnicity, pre-existing health conditions, the number of persons within the household, employment situation, and level of income. Particular groups within society may be especially vulnerable to the impacts of flooding. In Banbury and Kidlington women generally suffered more from the disruption to the home and often had to deal more directly with the recovery from the flood, in addition to bearing the main responsibility for their family's health care. Cultural factors were also highlighted among the Asian community in Banbury. Not only were some women confined to their damp homes for much of the day, but lack of ability to speak and understand English exacerbated the impacts of recovery for many women (124).

4.36 The 1998 flood, despite being relatively small-scale, seriously disrupted many people's lives. The cumulative effects of the events affected, to greater or lesser degrees, the majority of victims' physical, mental and social well-being. The 'intangible' effects of flooding, such as stress, anxiety and ill-health are extremely complex and result from a combination of inter-dependent factors (124):

- the event itself and subsequent losses and damage;
- the disruption and problems of recovery;
- worry and anxiety about the risk of reoccurrence.

4.37 These stressors, along with any pre-existing health conditions, and subsequent loss of confidence in authorities, may have significant impacts upon the overall health and well-being of flood victims (124).

A historical cohort study was conducted for new episodes of illness in all age groups, and for psychological distress in adults, following severe river flooding on 12th October 2000 in the town of Lewes in Southern England (125). Two hundred and twenty-seven residents of 103 flooded households and 240 residents of 104 non-flooded households in the same postal district were recruited. The results indicate that having been flooded was significantly associated with earache and a significant increase in risk of gastrointestinal illness with depth of flooding. Specifically adults had four-times the elevated risk of psychological distress. The association between flooding and new episodes of physical illness in adults diminished after adjustment for psychological distress. Flooding remained significantly associated with psychological distress after adjustment for physical illnesses. Psychological distress may explain some of the excess physical illness reported by flooded adults and possibly by children as well. These observations suggest that the risk of psychological distress from being flooded was independent of reported physical illness and sanitary disruption within flooded households. It is possible that psychological distress may also have been important in children, but it was not possible to measure this.

Air

4.39 There are serious health effects to people exposed to the current levels of air pollution in European countries. Box 7 summarises the pollutants in air from transport and lists their main effects on health. COMEAP (United Kingdom Government Committee on the Medical Effects of Air Pollution) (126) also states that air pollution:

- has short term and long term damaging effects on health;
- can worsen the condition of those with heart disease or lung disease;
- can aggravate but does not appear to cause asthma; and
- in the longer term, probably has additional effects on individuals including some reduction in average life expectancy, though the extent of this is not fully understood at present.

for the cause of flooding as being 'natural' forces may not be believed by flood victims, exacerbating the loss of confidence in authorities to predict a flood or issue a warning. This leads to anxiety when storms or rain are forecast, worry about the possibility of future flooding, and associated changes in behaviour such as regular monitoring of river levels (124).

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### Box 7: Air pollution and health

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Main sources</th>
<th>% in UK from road transport</th>
<th>Effect on health</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Benzene</strong></td>
<td>Combustion and distribution of petrol</td>
<td>4%</td>
<td>Genotoxic carcinogen; causes leukemia; increases hospital admissions for respiratory &amp; CVD hospital admissions brought forward. Construction of airways.</td>
</tr>
<tr>
<td><strong>1,3-Butadiene</strong></td>
<td>Combustion of petrol</td>
<td>4%</td>
<td>Genotoxic carcinogen; causes leukemia; increases hospital admissions for respiratory &amp; CVD hospital admissions brought forward. Construction of airways.</td>
</tr>
<tr>
<td><strong>Carbon monoxide</strong></td>
<td>Road transport, electrical supply industry, industry &amp; commerce</td>
<td>46-61%</td>
<td>Long-term: affects lung function, delayed diagnoses to allergens. Acute: asthmatic episodes as particulates.</td>
</tr>
<tr>
<td><strong>Nitrogen dioxide</strong></td>
<td>Combustion in air: road transport, electrical supply industry, industry &amp; commerce</td>
<td>46-61%</td>
<td>Long-term: affects lung function, delayed diagnoses to allergens. Acute: asthmatic episodes as particulates.</td>
</tr>
<tr>
<td><strong>Ozone</strong></td>
<td>Sunlight acting on NOx, and VOCs, etc</td>
<td>Long distance pollutant</td>
<td>Deaths &amp; Respiratory hospital admission. Respiratory symptoms &amp; lung function.</td>
</tr>
<tr>
<td><strong>Particulate matter</strong></td>
<td>1: Combustion (road traffic), 2: chemical reactions in air. Coarse: eg dust, soil, salt, pollen, tyre construction</td>
<td>2%</td>
<td>Respiratory &amp; CVD death and respiratory hospital admissions brought forward. Construction of airways.</td>
</tr>
<tr>
<td><strong>Sulphur dioxide</strong></td>
<td>Combustion of fuel containing fuel</td>
<td>2%</td>
<td>Respiratory &amp; CVD death and respiratory hospital admissions brought forward. Construction of airways.</td>
</tr>
</tbody>
</table>

(adapted from Transport and Health Study Group (127))

**Noise**

4.40 COMEAP confirm there is evidence to show that some people with cardiopulmonary diseases can be adversely affected by day-to-day changes in the levels of air pollutants and that numbers of deaths and hospital admissions go up when air pollution levels are high, particularly for those with cardiovascular and lung disorders and especially amongst the elderly. COMEAP state that while it is not possible, at the moment, to say how premature these deaths are most people studying this field believe that is likely to be a matter of weeks and months rather than years (126).

4.41 Finally, they advise that the scientific evidence suggests that exposure to air pollution has a long-term effect on health, though the effects varying depending on where one lives and the type of pollutant that people are exposed to. Though the full extent of the health effects of air pollution are hard to quantify, if life-long exposure to fine particles was cut by half, life expectancy from birth could be increased, on average, by between 1 and 11 months (depending on assumptions as described in the COMEAP report on the quantification of the health effects of air pollution) (126).

---

**Communication**

The following paragraphs are adapted from the World Health Organisation Guidelines for community noise (23).

4.43 Exposure to noise from various sources is most commonly expressed as the average sound pressure level over a specific time period, such as 24 hours. This means that identical average sound levels for a given time period could be derived from either a large number of sound events with relatively low, almost inaudible levels, or from a few events with high sound levels. This does not fully relate with common experience of how environmental noise is experienced, or with the characteristics of the human hearing (23, p55).

4.44 **Communication:** noise tends to interfere with auditory communication, in which speech is a most important signal. However, it is also vital to be able to hear alarming and informative signals such as door bells, telephone signals, alarm clocks, fire alarms etc., as well as sounds...
and signals involved in occupational tasks. The effects of noise on speech discrimination have been studied extensively and deal with this problem in lexical terms (mostly words but also sentences).

4.45 For communication distances beyond a few metres, speech interference starts at sound pressure levels below 50 dB for octave bands centred on the main speech frequencies at 500, 1000 and 2000 Hz. Box 8 below lists critical health effects associated with particular levels of noise and shows the relationship between noise levels and speech intelligibility in a single diagram, based on the following assumptions and empirical observations, and for speaker-to-listener distance of about 1m:

- speech in relaxed conversation is 100% intelligible in background noise levels of about 35 dBA, and can be understood fairly well in background levels of 45 dBA;
- speech with more vocal effort can be understood when the background sound pressure level is about 65 dBA.

4.46 A majority of the population belongs to groups sensitive to interference with speech perception. Most sensitive are the elderly and persons with impaired hearing. Even slight hearing impairments in the high-frequency range may cause problems with speech perception in a noisy environment. From about 40 years of age, people demonstrate impaired ability to interpret difficult, spoken messages when compared to people aged 20–30 years. It has also been shown that children, before language acquisition has been completed, have more adverse effects than young adults to high noise levels and long reverberation times.

4.47 The effects of environmental noise may be evaluated by assessing the extent to which it interferes with different activities. For many community noises, interference with rest, recreation and watching television seem to be the most important issues. However, there is evidence that noise has other effects on social behaviour: helping behaviour is reduced by noise in excess of 80 dBA; and loud noise increases aggressive behaviour in individuals predisposed to aggressiveness. There is concern that schoolchildren exposed to high levels of chronic noise could be more susceptible to helplessness. Guidelines on these issues must await further research (23, p60).

4.48 **Effects on performance:** chronic exposure to aircraft noise during early childhood appears to damage reading acquisition. Evidence indicates that the longer the exposure, the greater the damage. Although there is insufficient information on these effects to set specific guideline values, it is clear that day-care centres and schools should not be located near major noise sources, such as highways, airports and industrial sites (23, p59).

4.49 **Mental health effects:** studies that have examined the effects of noise on mental health are inconclusive. On the basis of guideline values can be given. However, in noisy areas, it has been observed that there is an increased use of prescription drugs such as tranquillizers and sleeping pills, and an increased frequency of psychiatric symptoms and mental hospital admissions. This strongly suggests that adverse mental health effects are associated with community noise (23).

4.50 **Cardiovascular and psychophysiological effects:** epidemiological studies show that cardiovascular effects occur after long-term exposure to noise (aircraft and road traffic) with LAeq,24h values of 65–70 dB (energy equivalent sound pressure level in dBA). However, the associations are weak. The association is somewhat stronger for ischaemic heart disease than for hypertension. Such small risks are important, however, because a large number of persons are currently exposed to these noise levels, or are likely to be exposed in the future. Other possible effects, such as changes in stress hormone levels and blood magnesium levels, and changes in the immune system and gastro-intestinal tract, are too inconsistent to draw conclusions. Thus, more research is required to estimate the long-term cardiovascular and psychophysiological risks due to noise. In view of the equivocal findings, no guideline values can be given (23).
<table>
<thead>
<tr>
<th>Specific environment</th>
<th>Critical health effect(s)</th>
<th>LAeq [dB]</th>
<th>Time base [hours]</th>
<th>LAmax fast [dB]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor living area</td>
<td>Serious annoyance, daytime and evening</td>
<td>55</td>
<td>16</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Moderate annoyance, daytime and evening</td>
<td>35</td>
<td>8</td>
<td>45</td>
</tr>
<tr>
<td>Inside bedrooms</td>
<td>Sleep disturbance, window open (outdoor values)</td>
<td>50</td>
<td>during class</td>
<td>60</td>
</tr>
<tr>
<td>School class rooms and pre-schools, indoors</td>
<td>Speech intelligibility, disturbance of information extraction, message communication</td>
<td>45</td>
<td>during play</td>
<td>45</td>
</tr>
<tr>
<td>Pre-school, bedrooms, indoors</td>
<td>Sleep disturbance</td>
<td>35</td>
<td>sleeping-time</td>
<td>45</td>
</tr>
<tr>
<td>School, playground outdoor</td>
<td>Annoyance (external source)</td>
<td>35</td>
<td>during play</td>
<td>-</td>
</tr>
<tr>
<td>Hospital, ward rooms, indoors</td>
<td>Sleep disturbance, night-time</td>
<td>30</td>
<td>8</td>
<td>45</td>
</tr>
<tr>
<td>Hospitals, treatment rooms, indoors</td>
<td>Sleep disturbance, daytime and evenings</td>
<td>55</td>
<td>16</td>
<td>-</td>
</tr>
<tr>
<td>Ceremonies, festivities and entertainment events</td>
<td>Hearing impairment (patrons:&lt;5 times/year)</td>
<td>60</td>
<td>8</td>
<td>70</td>
</tr>
<tr>
<td>Public addresses, indoors</td>
<td>Hearing impairment</td>
<td>#1</td>
<td>1</td>
<td>110</td>
</tr>
<tr>
<td>and outdoors</td>
<td>Hearing impairment (free-field value)</td>
<td>#1</td>
<td>1</td>
<td>110</td>
</tr>
<tr>
<td>Headphones/Earphones</td>
<td>Hearing impairment (adults)</td>
<td>100</td>
<td>1</td>
<td>140 92</td>
</tr>
<tr>
<td>Impulse sounds from toys, fireworks and firearms</td>
<td>Hearing impairment (children)</td>
<td>80</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>Outdoors in parkland and conservation areas</td>
<td>Hearing impairment (children)</td>
<td>80</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>#1: as low as possible;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#2: peak sound pressure (not LAmax, fast), measured 100 mm from the ear;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#3: existing quiet outdoor areas should be preserved and the ratio of intruding noise to natural background sound should be kept low;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#4: under headphones, adapted to free-field values from Berglund et al (23)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. Housing and the built environment

5.1 A considerable amount of work has been carried out establishing the ways in which housing affects physical and psychological health. The social role for housing in Britain has fostered the assumption that re-housing can be an effective health intervention and that residential change can alleviate suffering, cure illness, enhance access to care or enhance quality of life (128). Numerous studies have sought to show the link between poor housing conditions with poor health (129-131). Recently, as part of the push towards showing the evidence to support different public health interventions and as part of the growth in the methodologies such as Health Inequalities Impact Assessment there have been a number of evidence bases developed that focus on housing issues including those at

- Queen Mary University of London (www.geog.qmul.ac.uk/healthy);
- Scottish Office Central Research Unit, www.scotland.gov.uk/cru/documents/poor-housing/;
- University of Glasgow, www.msoc-mrc.gla.ac.uk/evidence/research;
- University of Wales www.wrum.ac.uk

Box 9 Evidence on the health impact of poor housing

<table>
<thead>
<tr>
<th>Impact</th>
<th>Household Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infectious Diseases</td>
<td>Unsafe drinking water, lack of hot water, poor waste disposal, inadequate food storage, over-crowding, building design and materials.</td>
</tr>
<tr>
<td>Chronic Diseases</td>
<td>Damp, mould, water intrusion, interior moisture, allergens, infestation, toxic substances, air quality, temperature extremes.</td>
</tr>
<tr>
<td>Mental Health</td>
<td>Damp, cold, mould, overcrowding, housing tenure, moving home, homelessness, temporary housing, housing design e.g., high rise.</td>
</tr>
<tr>
<td>Accidents</td>
<td>Exposed heating sources, unprotected upper windows, building design and materials.</td>
</tr>
</tbody>
</table>

source HDA 2004

5.2 Homes in poor condition damage the health of those who live in them. The effects of poor housing conditions fall disproportionately on older people and on children (11). Box 9 shows some of the key direct and indirect relationships (as reported by the Health Development Agency in 2004).

5.3 Improving people’s housing may reduce health inequality. For example, improving housing quality to tackle cold and dampness, improve indoor air quality and increase safety at home should reduce levels of respiratory disease, hypothermia, and accidents in the home.

5.4 Currently, there is extensive evidence of the association between housing and health. The impacts on health are complex and adaptive (132). For most people, their gender or the income of their parents are likely to have the biggest impact on their lifetime health. Even so, small changes can have big impacts and interventions particularly in the early years can make a significant improvement to health and development in later life.
<table>
<thead>
<tr>
<th>Housing conditions</th>
<th>Health impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dampness and condensation</td>
<td>Increased respiratory illnesses, coughing, asthma, diarrhoea, and gastro enteritis.</td>
</tr>
<tr>
<td>2. Poor heating and insulation</td>
<td>Illness and death from hypothermia, frostbite, cold stress and long term depression and anxiety.</td>
</tr>
<tr>
<td>3. Flooding</td>
<td>Increased risk of transmission of infectious disease such as TB as well as illness caused by damp and condensation.</td>
</tr>
<tr>
<td>4. Disrepair, unfitness and lack of fitness</td>
<td>Disrepair can make houses cold, and difficult to heat. Lack of basic amenities leads to increased rates of gastrointestinal illness such as dysentery. Both increase levels of stress, long term depression and anxiety.</td>
</tr>
<tr>
<td>5. Lead water pipes</td>
<td>Cause damage to the central nervous system, affect the mental development of children and cause a general reduction in the speed of reaction and reflex, possibly increasing risk of accident in the home.</td>
</tr>
<tr>
<td>6. Inadequate noise insulation</td>
<td>Causes increased blood pressure and pulse rate, long term chronic stress, headaches, depression etc.</td>
</tr>
<tr>
<td>7. Structural hazards, internal layout and home safety</td>
<td>Increased risk of accidents in the home.</td>
</tr>
<tr>
<td>8. Air quality – Carbon monoxide, asbestos, Radon Gas</td>
<td>Increased risk of illness and death from respiratory illness, appliances and central heating boilers, car exhaust fumes.</td>
</tr>
<tr>
<td>9. Over-crowding</td>
<td>Increases the risk of respiratory infections, infectious diseases such as TB and digestive tract infections such as dysentery. Lack of space increases risk from accidents and levels of stress.</td>
</tr>
<tr>
<td>10. HMO’s</td>
<td>Risk of death from fire increases by about 10 times. Increased risk of a range of health problems due to layout and standards increase anxiety, stress, depression, increased blood pressure, respiratory illness and transmission of infectious disease.</td>
</tr>
<tr>
<td>11. Design and layout</td>
<td>Poor design and layout can lead to increased stress and depression among residents, prompting violent behaviours and contributing to longer term mental health problems. Poor design and layout may also inhibit child development.</td>
</tr>
<tr>
<td>12. Air quality, pollution and neighbourhood issues</td>
<td>Concentration of outdoor pollution and noise from neighbour uses affect the quality of life and may cause anxiety, stress and depression. Specific pollutants that are harmful to health may be passed into local eco-systems via industrial process or accidents. Contaminated land can endanger health through the escape contaminants into soil.</td>
</tr>
<tr>
<td>13. Security</td>
<td>A secure environment gives comfort and confidence to residents, while poor security can lead to stress, anxiety, depression and potentially violent behaviour. There is also the possibility of physical harm to residents from intruders in the home or from the street violence outside.</td>
</tr>
<tr>
<td>14. High-rise housing</td>
<td>The design and layout, and the associated quality of service provision, can have an impact on a variety of conditions including stress, anxiety, depression, violent behaviour, increased blood pressure, isolation, inhibition of child development, presence of infectious diseases and respiratory problems.</td>
</tr>
</tbody>
</table>
5.5 The problem is that whilst there is some chance that consistent interventions for a whole population will, overall, have a beneficial impact, we cannot predict the outcome of a specific intervention for a specific individual. Therefore any intervention has to be assessed on the basis of its impact on the population as a whole. Box 10 brings together a summary of housing conditions where there is evidence of a range of health impacts at a population level.

Improving housing quality

5.6 There is a lively debate about the standard to which housing needs to be developed in order to improve health. Work is currently ongoing, funded by the Housing Corporation to bring together the health improving aspects of different standards and the risks associated with builder higher standards. To date this work has focused on five key areas accessibility, indoor air quality, thermal comfort, noise, and safety (www.sustainabilityworks, 2003):

Accessibility

5.7 It is important that the home offers accessibility and design features that make the home flexible enough to meet changing needs e.g. a teenager with a broken leg, a family member with a serious illness, or parents manhandling heavy shopping and a pushchair.

5.8 Part M of the Building Regulations covers accessibility, and Lifetime Homes features add to this the built-in flexibility that make homes easy to adapt as people's lives change. Designers of new homes often need to take account of 3 sets of requirements:

- Part M of the Building Regulations, recently extended to include all new homes;
- Housing Corporation's Scheme Development Standards, which all housing funded with Housing Corporation money must meet;
- Lifetime Homes standards, which many commissioning clients and local authorities now require.

5.9 Joseph Rowntree Foundation provides information on meeting Building Regulations Part M and Housing Corporation Scheme Development Standards at www.jrf.org.uk/housingandcare/lifetimehomes. For further information see also Carroll et al (133).

Thermal comfort

5.10 Even relatively minor problems in keeping warm or cool can lead to discomfort. In temperate climates being and feeling warm is essential to health and quality of life and an inability to keep warm can have major effects on both physical and mental health.

5.11 In the UK cold homes have a major impact on winter mortality. Around 40,000 excess deaths (a 20% increase) occur between December and March, compared to other months of the year (134). For every ten deaths which occur in summer, more than 14 occur in winter (131). The main causes of winter mortality are cardiovascular and respiratory disease. The human body's key defence against cold is to minimise bodily heat loss by reducing blood supply to the skin, leading to an increase in blood concentration and a heightened risk of clot formation (135,136). Respiratory disease pathways are more compact can involve the weakening of respiratory tract defences, thereby increasing susceptibility to infections, asthma and chronic obstructive pulmonary disease; and inflammation of the lower airways - also affecting asthma (137).

5.12 Excess winter mortality is not just caused by cold homes but by ineffective preparation for the cold by families living outside. A large European study has indicated an approximately equal contribution of outdoor cold conditions to excess winter deaths (138). At a given level of outdoor cold, people in cold climates had warmer houses, wore warmer clothes and kept moving more often outdoors than their counterparts in warmer climates. In Yakutsk, Siberia, the coldest city in the world, there is no increase in all-cause mortality during the winter months due to the attention paid by inhabitants to keeping warm (139).

5.13 Cold, damp homes encourage the spread of mould. Mould thrives in the organic materials in walls and cavities such as wallpaper paste and can easily spread to carpets, furniture and clothing. Mould growth can cause respiratory illness and infections, although its contribution to asthma is small (137). Damp and mould are linked in adults to a range of problems including nausea, breathlessness, backache, fainting and bad nerves. In children, symptoms are worse and include vomiting, wheezing, irritability, fever and poor appetite. Respiratory problems are more pronounced where mould is prevalent as well as damp (140).

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5.10 Even relatively minor problems in keeping warm or cool can lead to discomfort. In temperate climates being and feeling warm is essential to health and quality of life and an inability to keep warm can have major effects on both physical and mental health.

5.11 In the UK cold homes have a major impact on winter mortality. Around 40,000 excess deaths (a 20% increase) occur between December and March, compared to other months of the year (134). For every ten deaths which occur in summer, more than 14 occur in winter (131). The main causes of winter mortality are cardiovascular and respiratory disease. The human body's key defence against cold is to minimise bodily heat loss by reducing blood supply to the skin, leading to an increase in blood concentration and a heightened risk of clot formation (135,136). Respiratory disease pathways are more compact can involve the weakening of respiratory tract defences, thereby increasing susceptibility to infections, asthma and chronic obstructive pulmonary disease; and inflammation of the lower airways - also affecting asthma (137).

5.12 Excess winter mortality is not just caused by cold homes but by ineffective preparation for the cold by families living outside. A large European study has indicated an approximately equal contribution of outdoor cold conditions to excess winter deaths (138). At a given level of outdoor cold, people in cold climates had warmer houses, wore warmer clothes and kept moving more often outdoors than their counterparts in warmer climates. In Yakutsk, Siberia, the coldest city in the world, there is no increase in all-cause mortality during the winter months due to the attention paid by inhabitants to keeping warm (139).

5.13 Cold, damp homes encourage the spread of mould. Mould thrives in the organic materials in walls and cavities such as wallpaper paste and can easily spread to carpets, furniture and clothing. Mould growth can cause respiratory illness and infections, although its contribution to asthma is small (137). Damp and mould are linked in adults to a range of problems including nausea, breathlessness, backache, fainting and bad nerves. In children, symptoms are worse and include vomiting, wheezing, irritability, fever and poor appetite. Respiratory problems are more pronounced where mould is prevalent as well as damp (140).
5.14 Cold and damp homes also have effects on mental health. Problems arise because of the struggle to keep warm and pay fuel bills, the sight and smell of mould, and the stigma of living in unclean conditions. Even in warm homes there are health issues if humidity remains high, usually due to poor ventilation. The key problem for health in all homes with high humidity values is the proliferation of house dust mites. There is a strong link between dust mites and asthma (141,142). They are also implicated in eczema, dermatitis and perennial rhinitis (142-144). Very low humidity levels can lead to dehydration, headaches, dry throat and eye irritation.

Indoor air quality and well-being

5.15 There are many possible adverse health impacts of air pollutants indoors. The quality of indoor air profoundly affects individual perceptions of well being within dwellings. Exposure to pollutants, especially the number of airborne particles can be greater indoors than outdoors. The most basic need is the regular replenishment of fresh air through ventilation, yet most homes in the UK have poor, uncontrolled ventilation. This can lead to stuffiness, stale air, damp and the build up of pollutants.

5.16 Indoor pollutant levels are determined by local environmental conditions and may increase through
- infiltration from outdoors, such as traffic and industrial emissions;
- the generation of pollutants inside the home, especially tobacco smoke particulates, nitrogen dioxide and carbon monoxide;
- the breakdown of organic material e.g. skin cells and food particles and
- emissions from building materials, especially formaldehyde.

5.17 Strategies to improve air quality and well-being must therefore address both the ways in which dwellings are ventilated and the materials used.

5.18 Airborne particles created by road traffic and industry are a significant outdoor pollutant. Approximately 60-75% of outdoor Particles (for respirable particles < 2.5 (μm) enter indoors. Indoor sources of respirable particles include smoking and cooking. Coarse or inhalable particles (> 2.5 (μm) indoors include particles generated by indoor human activities such as breathing, cooking, and cleaning. Particles such as microorganisms, mould and dust mites (145). Short-term increases in particle levels can have significant effects on health and mortality rates. The elderly and infirm are especially vulnerable to heart and lung problems caused by increased particle concentrations. Long-term exposure to low levels of particles can also affect respiratory health (140).

5.19 Tobacco smoking generates large numbers of fine particles, which spread throughout a building. ETS (environmental tobacco smoke) is difficult to remove, is toxic and acute exposure can cause eye, nose and throat irritation and precipitate asthma and angina attacks in susceptible individuals. Long term exposure causes lung cancer and coronary heart disease. It also causes fetal growth retardation and cot death. Fungi are a source of particles (spores). The presence of fungi, mainly mould, is strongly associated with the indoor temperature and humidity of a house. Moulds can cause a wide range of symptoms, especially respiratory problems, which are particularly acute in children (140). Allergens are in particles from house dust mite faeces, pets (all types) and from pests such as cockroaches and rodents and can aggravate a number of respiratory problems e.g. asthma.

5.20 Carbon monoxide (CO) & Nitrogen dioxide (NO₂) are combustion related gases. The major indoor source of the build up of CO and NO₂ is inadequately ventilated or malfunctioning gas cookers, and gas, wood, coal or paraffin burners / heating systems. Symptoms of CO poisoning, which are often misdiagnosed, include headache, nausea and dizziness. Immune damage and neurological problems are also possible – as is fatality (142). The main health impact of high levels of NO₂ is that it may increase the sensitivity of children to respiratory illness (142).

5.21 Radon is a naturally occurring radioactive gas, which is given off from rocks and soil. Radon has cancerogenic properties but environmental levels are usually too low to pose a significant risk. However, in some areas of the country preventative measures are a statutory requirement. The National Radiological Protection Board maintains detailed radon maps at www.nrpb.org/index.htm.

5.22 Volatile organic compounds (VOCs) are a large group of organic chemicals, including organic solvents, that are gaseous at room temperature. VOCs are released from a range of building materials and household products e.g. paints, cleaning products, and glues. Organic
compounds released in a dwelling include Pththalates widely used as a plasticiser in plastics such as PVC.

5.23 PVC is relatively inert in use (but see under the specification of materials) but will emit its constituent chemicals as gases for some time after manufacture. These include vinyl chloride monomer (VCM), which is very toxic and is carcinogenic. Pththalates are oestrogen mimics or feminising agents and may cause falling sperm counts and rising male infertility. However, the real hazard is in case of fire, when dioxins, hydrogen chloride (a very corrosive gas) and heavy metals are given off and together cause acid burns on inhalation, poisoning, cancer, immune system damage and hormone disruption. There are alternatives to all applications of PVC in buildings.

5.24 Formaldehyde is a VOC present in many building products as a constituent of glue and is given off by many synthetic products, including medium density fibre board (MDF), urea-formaldehyde foam insulation, water-based paints, and household cleaning products. It is also present in small quantities in new wood. Formaldehyde is very irritating to skin, eyes and the respiratory system and may cause cancer, asthma or behavioural problems. Problems if present in high levels. Current levels in UK homes are unlikely to pose a health risk other than sensory and airway irritation among sensitised individuals (142). It is important that current levels do not rise as some individuals are particularly sensitive.

5.25 Paints based on solvents contain a wide range of ingredients, many potentially harmful. Prolonged exposure to hydrocarbon-based solvents can lead to tremors, loss of coordination, depression, and lung cancer. Even when dry, paint will continue to give off VOCs. Most shades of synthetic paint contain titanium dioxide white pigment which can cause respiratory problems and skin irritation.

5.26 Polycyclic aromatic hydrocarbons (PAHs) are the products of incomplete combustion processes. In most urban areas they are caused by vehicle exhaust gases, smoking, cooking and fuel use (146). Although there is little evidence of their impacts within homes, certain PAHs (especially Benzenes) are known to be carcinogenic, and may enter the dwelling from car exhaust fumes, say, from an integral garage (142).

5.27 Wood preservatives are used to prevent fungal and insect damage and are generally toxic and should be avoided if possible. The preservatives attack the nervous system or liver and can be carcinogenic in large quantities. They may be ingested, absorbed through the skin or inhaled. There has been a tendency for timber treatments to replace the proper specification, design and maintenance of timber buildings as a means of preventing fungal and insect damage. Chemical treatment is thought by many in the field to be less effective, more expensive and more dangerous than avoiding the problem by good design and specification.

Noise

5.28 Environmental noise can have a profound on quality of life and some circumstances can lead to hypertension. Noise is generally defined as unwanted sound. As such, noise has both auditory and psychological components. Auditory characteristics include the intensity, pitch and duration of the noise. In general, intermittent, higher frequency, short-duration, intense sounds have greater effects on well-being and health than do continuous, low-frequency, long-duration, low-intensity sounds. Psychological characteristics include the predictability of noise, attitudes to the noise source, the meaning of the noise and the degree of personal control over the noise. Box 8 on page 26 provides a summary of noise and critical health effects.

Noise and quality of life

5.29 The main sources of domestic noise are neighbours, road and rail traffic and aircraft. Of these, noise from neighbours provokes the greatest proportion of objections, relative to the number of people who hear it. Environmental noise can have a profound effect on quality of life: it spoils the home life of one in three people to some extent, and totally spoils the home life of one in a hundred people (147).

5.30 The most widespread effects of environmental noise are general annoyance and sleep disturbance. The extent of the annoyance is relative to the nature of the activity that is disturbed. Domestic activities such as sleeping, resting and listening to television or radio are the most commonly disturbed. Noise is especially disturbing at night when background noise levels are lower and sleep can be disturbed by relatively quiet sounds.

5.31 Unwanted noise can elicit different emotions including anger, fear and depression. The impact of noise is likely to be greatest if it makes the individual feel fearful (148). Noise from neighbours
can be particularly difficult to cope with since it often has a content – it conveys meaning – unlike most other forms of noise. Environmental noise is often seen as a threat to personal integrity and privacy.

5.32 Noise problems are inevitably more common in flats than in other types of dwelling. Older people are less likely to be disturbed than younger people, and people who own their properties are less likely to be disturbed than those renting from a local authority. Overall, younger people (aged 25–34 years), with children, living in attached properties, especially flats, rented from a local authority are seven times more likely to report annoyance from noise than people in upper age brackets, with no children present, living in a property that is owned outright (149).

5.33 Beyond annoyance and sleep disturbance, there is good evidence for a causal relationship between environmental noise and both hypertension and heart disease. There is limited evidence of impacts on hearing loss, immune functions, birth weight, and psychiatric disorders and well-being (150).

5.34 The link between noise and heart disease has been identified in occupational settings where people are exposed to high levels of noise. However, there is also evidence that aircraft and road traffic noise contribute to heightened risk in dwellings, although this increase in risk is small compared to other risk factors such as smoking.

5.35 Although there is no consistent evidence that noise causes mental ill-health, people who have existing mental health problems such as depression or anxiety are more prone to be annoyed by environmental exposure than the general population.

5.36 Environmental noise has a more pronounced effect on children's health. Chronic exposure to high levels of aircraft, rail and road traffic noise can lead to attention deficits, concentration difficulties, and poorer speech discrimination, memory and reading ability (151).

Design

5.37 Linking community safety entirely with the design of the built environment shifts the focus away from the social and political causes of crime (152). It is doubtful whether environmental changes can reduce attacks on women due to the fact that most incidents take place in the private realm, i.e., the home (152). Designing out fear is underpinned by the assumption that most crime is opportunistic and offenders respond in a mechanistic way to environmental stimuli (153).

Street design and public places

5.38 A systematic review of public health research on the environmental determinants of physical activity in adults (154) concluded that the most consistent evidence regarding effects of environmental factors on physical activity in adults is observed for accessibility of facilities, opportunities for activity, and aesthetic qualities of the area.

5.39 In a survey of nearly 3,400 adults in Australia, it was found that the men and women reporting a more convenient environment (including proximity of a park or beach, a cycle path, or shops) or a more aesthetically pleasing environment (a friendly, attractive, or pleasant neighbourhood) were more likely to report walking for exercise or recreation (155). A national phone survey of nearly 2,000 US adults and found that the odds of meeting physical activity recommendations were significantly higher in persons who reported access to places to exercise, walking or jogging routes, or a park. The presence of pavements and enjoyable scenery in the neighbourhood was also associated with increased rates of meeting physical activity recommendations. Awareness of facilities, satisfaction with facilities, and the perception that the area offers opportunities to be physically active were also found to be associated with greater physical activity in other studies (156,157).

5.40 In another study access to local facilities was positively associated with physical activity participation in a sample of 450 Australian elderly adults (158). King and colleagues discovered that the presence of enjoyable scenery and the frequency of seeing others exercising were positively associated with walking. In a population-based sample of 2,900 middle-aged US women (65). In a study sample of 5,000 US women enrolled in a large health maintenance organisation, self-reported lack of facilities was associated with decreased sports and exercise (159).

5.41 Berrigan and Troiano investigated whether walking, and moderate and vigorous physical activity could be explained by neighbourhood design and recreational environmental variables (160). Minutes of walking and of moderate-intensity activity were related to quality of sidewalks and accessibility of shopping and public transportation. Vigorous physical activity was related to can be particularly difficult to cope with since it often has a content – it conveys meaning – unlike most other forms of noise. Environmental noise is often seen as a threat to personal integrity and privacy.

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presence of activity supplies in the home and the number of convenient activity facilities outside the home.

5.42 Population density, employment density, and mixed land use are positively related to transit use and walking for shopping and work related trips (161). Using data from a household survey of five selected neighbourhoods, researchers found that less travel by car and more use of road travel (such as walking and cycling) in neighbourhoods characterised by a mix of land uses, high density, and pedestrian-friendly designs (162,163). Pedestrian-oriented design (including pavements, street lighting, and planted strips) has been found not to encourage motorised transport (164).

5.43 Feldman and Steptoe (165) examined pathways through which low neighbourhood socioeconomic status (SES) and associated subjective neighbourhood characteristics may be associated with self-reported physical functioning. The study showed that living in a lower socioeconomic neighbourhood was associated with greater perceived neighbourhood strain, which, in turn, was associated with poorer physical functioning. Lower neighbourhood SES and greater perceived neighbourhood strain were associated with poorer physical functioning of individuals through less social integration, less perceived control, and greater financial strain. They conclude that neighbourhood SES and associated perceptions of neighbourhoods are associated with physical functioning through the shaping of the social and psychological experiences of individuals living within them.

5.44 Molnar et al (166) examined the role of neighbourhood disorder and the lack of physical activity amongst poor urban children. More specifically they looked at the associations between activity levels of urban youth and limited access to safe recreation areas in their neighbourhoods of residence. The investigators found that physical activity averaged 2.7 hours/week and varied significantly across neighbourhoods. Socio-economic status, age, and sex (being male), but not body mass index, were independently associated with physical activity. Lower neighbourhood safety and social disorder were significantly associated with less activity. They propose that an important mechanism for reduced physical activity among youth may be the influence of unsafe neighbourhoods.

5.45 Urban design features such as lighting, the installation of CCTV and certain architectural designs are associated with fear of crime levels. Residents of highly walkable neighbourhoods have been found to do 70 minutes more physical activity and have lower obesity prevalence than residents of low walkability neighbourhoods (167,168). High walkability neighbourhoods were classed as those possessing mixed land use, high density, street connectivity, and safety. This is particularly important for older people who may otherwise become socially isolated (169).

5.46 A review (170) analyses the literature on the effectiveness of street lighting improvements in preventing crime. The following conclusions are supported:

- precisely targeted increases in street lighting generally have crime reduction effects;
- more general increases in street lighting seem to have crime prevention effects, but this outcome is not universal;
- even untargeted increases in crime prevention generally make residents less fearful of crime or more confident of their own safety at night;
- in the most recent and sophisticated studies, street lighting improvements have been associated with crime reductions in the daytime as well as during the hours of darkness; and
- the debate about lighting effects has served to preclude a more refined analysis of the means by and circumstances in which lighting might reduce crime.

(Cited in 19.)

5.47 An analysis of studies that have evaluated the effectiveness of closed-circuit television (CCTV) in reducing crime, disorder and fear of crime in a variety of sites (171) states that CCTV can be effective in deterring property crime, but the findings are more mixed in relation to personal crime, public order offences, and fear of crime. (Cited in 19.)

5.48 Ditton (172) looked at fear of crime and the effects of closed circuit television. The majority of people expressed support for the CCTV installation. They thought it would make them feel safer. However, when the actual as opposed to the prospective feelings of safety are compared over time there was no improvement after installation. CCTV did not make people feel safer. Researchers believed that CCTV is better than the police at detecting crime but that police patrolling is more effective than CCTV in making people feel safer.

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Links between green space, aggression and violence

5.49 Mental fatigue symptoms such as irritability, inattentiveness and decreased control over impulses are well established precursors to violence (173-176). Attentional performance is measured by mood and stress. Levels of aggression were compared for 145 urban public housing residents in Chicago. The authors examined the amounts of trees and grass in the nearby areas. Residents living in relatively barren buildings reported more aggression and violence than residents in greener areas. Levels of mental fatigue were higher in barren buildings as well as levels of aggressive/antisocial demands, severe concerns about rent and food, associated with poverty and the inner city environment and are likely to place the local population at special risk for chronic mental fatigue and fatigue related aggression.

5.50 Kuo and Sullivan (177) examined the crime rate of a large housing development in Chicago. They asked whether lower levels of vegetation reduce crime: the authors found that the greener a building’s surroundings were the fewer crimes (property and violent) reported. Dense vegetation has been linked to the fear of crime, lower perceived security (175). View distance is an important factor as vegetation blocks views and provides potential cover for criminal activity.

5.51 Poverty is accompanied by increased vulnerability to drastic life changes. The ever present possibility of crime or violence places high demands on attention. Danger requires people to be super-vigilant for signs of trouble and to consider the consequences of being attacked. This is mediated by attentional fatigue. Attentional performance predicted levels of aggression. Attention Restoration Theory proposes that exposure to nature reduces mental fatigue. Residents living in buildings without trees and grass have reported more procrastination in dealing with their problems. They felt their problems were more severe than residents living in greener environments. The authors suggest that public housing environments may be conducive to enhance residents’ psychological resources for coping with poverty.

5.52 Kweon (178) looked at physical environment, green space, in relation to levels of social integration with neighbours (and a possible link to social capital). The sample were 91 elderly residents (62-91 years old) of a inner city Chicago public housing association. Kweon reports that the use of green outdoor common spaces predicted the strength of neighbourhood social ties and sense of community. Neighbourhood community ties are very important for the elderly.

5.53 Run down, noisy, high rise living conditions discourage older people from social interaction: they have been labelled sociofugal (179). Settings which encourage older residents to develop social ties with neighbours are known as sociopetal: these settings include features such as access to transport and safe public spaces. The study suggests that the use of trees near older people’s homes may be an inexpensive way to enhance their social integration. Caring for their local environment may also enhance their health.

Urban sprawl

5.54 Urban sprawl is a major contributing cause of car and pedestrian traffic fatalities, but data supporting this suspicion are sparse (180). Although ‘sprawl’ has been variously defined, the term may apply to any environment characterised by the following:

- a population widely dispersed in low-density residential development;
- rigid separation of homes, shops, and workplaces;
- a lack of distinct, thriving activity centres, such as strong downtowns or suburban town centres; and
- a network of roads marked by very large block size and poor access from one place to another.

5.55 The economic, environmental, and social costs of sprawl have been widely debated, but the specific health implications have received less attention (180). Existing and colleagues report that for every 1% increase in their index of sprawl (ie, more compact, less sprawl), all-cause traffic fatality rates fell by 1.49% and pedestrian fatality rates fell by 1.47% to 3.56%, after adjustment for confounding factors (180). All-cause trauma exposure was measured at one point in time. Residents of sprawling counties were likely to walk less during leisure time, weigh more, and have greater prevalence of hypertension than residents of compact counties (181). A systematic review and critical appraisal of 32 studies of the health impacts of new roads suggests that out-of-town bypasses decrease injuries on main roads through or around towns (20). New major urban roads have statistically insignificant effects on injury incidence. New major roads between towns decrease injuries. Out-of-town bypasses reduce disturbance and community severance in towns but increase them elsewhere and major

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urban roads increase disturbance and severance. This operates through reduced access to local amenities and disruption of social networks caused by a physical barrier running through the community.

5.56 There is a link between sprawl and respiratory health. Sprawl is associated with high levels of driving, and driving contributes to air pollution, and air pollution causes morbidity and mortality. In heavily automobile-dependent cities, air pollution can rise to hazardous levels, and driving can account for a majority of the emissions (117). The health hazards of air pollution are well known (see Box 7 on page 24). Ozone is an irritant, higher ozone levels are associated with more respiratory symptoms, worse lung function, more emergency room visits and hospitalizations, more medication use, and more absenteeism from school and work (117).

5.57 A considerable body of research establishes that sprawl-measured by low residential density, low employment density, low ‘connectivity,’ is associated with less walking and bicycling, and with more automobile travel. Land use and travel patterns are closely linked. If land uses are separated, and the distances among them are great, and roads are more available than sidewalks and paths, then people tend to shift from walking and bicycling to driving (117).

5.58 Heat island: suburban areas can be six to eight degrees warmer than surrounding areas which can cause relatively minor disorders including heat syncope, or fainting; heat oedema, or swelling, usually of dependent parts such as the legs (117). The heat island effect is caused by two factors:

- Dark surfaces such as roadways and rooftops efficiently absorb heat from sunlight and reradiate it as thermal infrared radiation; these surfaces can reach temperatures of 50 to 70 degrees Fahrenheit higher than surrounding air.
- Urban areas are also devoid of vegetation, especially trees, that would provide shade and cool the air through ‘evapotranspiration.’ As cities sprawl outward, the heat island effect expands, both in geographic extent and in intensity.

5.59 Sturm and Cohen (182) examined the association between objective measures of urban sprawl and chronic medical conditions and mental health disorders in the USA. The authors found that sprawl significantly predicts chronic medical conditions and health-related quality of life, but not mental health disorders. An increase in sprawl from one standard deviation less to one standard deviation more than average implies 96 more chronic medical problems per 1000 residents, which is approximately similar to an aging of the population of 4 years. They suggest that the robust association between sprawl and physical (but not mental) health demonstrates that suburban design may be an important new avenue for health promotion and disease prevention. The authors also found that sprawl tends to have differential impacts, i.e., the elderly and socio-economic poor. This may be due to the fact that the poor and the elderly possess fewer resources which enable them to cope with the limitations imposed by their environment, such as having less access to cars. The elderly also suffer declining physical mobility and reduced vision/hearing, and thus may be less able to navigate environments withspeeding cars or wide streets. In sprawling cities, they may have more difficulty walking the greater distances to destinations such as markets or parks. Urban form may be an important contributor to elderly ‘shut-ins’ and sedentary lifestyles (182).

5.60 Macintyre and Ellaway (183) propose a classification which distinguishes between five dimensions of the urban environment:

- physical features of the environment shared by all residents;
- availability of healthy environments not shared;
- services supporting people in daily lives;
- socio-cultural features of a locality; and
- the reputation of an area.

Construction

5.61 This review found very few studies which examine the effects of construction on residents who live near construction sites. The literature tends to focus on the occupational hazards associated with the construction industry.

5.62 Construction workers face multiple and varied threats to safety (184). The risk of injury varies within the construction industry. Previous analyses have shown that risk of injury is higher for workers in certain construction domains, such as building construction and site development, than in others, such as roadway construction (185). A study of construction workers in the United States found that:

urban roads increase disturbance and severance. This operates through reduced access to local amenities and disruption of social networks caused by a physical barrier running through the community.

5.56 There is a link between sprawl and respiratory health. Sprawl is associated with high levels of driving, and driving contributes to air pollution, and air pollution causes morbidity and mortality. In heavily automobile-dependent cities, air pollution can rise to hazardous levels, and driving can account for a majority of the emissions (117). The health hazards of air pollution are well known (see Box 7 on page 24). Ozone is an irritant, higher ozone levels are associated with more respiratory symptoms, worse lung function, more emergency room visits and hospitalizations, more medication use, and more absenteeism from school and work (117).

5.57 A considerable body of research establishes that sprawl-measured by low residential density, low employment density, low ‘connectivity,’ is associated with less walking and bicycling, and with more automobile travel. Land use and travel patterns are closely linked. If land uses are separated, and the distances among them are great, and roads are more available than sidewalks and paths, then people tend to shift from walking and bicycling to driving (117).

5.58 Heat island: suburban areas can be six to eight degrees warmer than surrounding areas which can cause relatively minor disorders including heat syncope, or fainting; heat oedema, or swelling, usually of dependent parts such as the legs (117). The heat island effect is caused by two factors:

- Dark surfaces such as roadways and rooftops efficiently absorb heat from sunlight and reradiate it as thermal infrared radiation; these surfaces can reach temperatures of 50 to 70 degrees Fahrenheit higher than surrounding air.
- Urban areas are also devoid of vegetation, especially trees, that would provide shade and cool the air through ‘evapotranspiration.’ As cities sprawl outward, the heat island effect expands, both in geographic extent and in intensity.

5.59 Sturm and Cohen (182) examined the association between objective measures of urban sprawl and chronic medical conditions and mental health disorders in the USA. The authors found that sprawl significantly predicts chronic medical conditions and health-related quality of life, but not mental health disorders. An increase in sprawl from one standard deviation less to one standard deviation more than average implies 96 more chronic medical problems per 1000 residents, which is approximately similar to an aging of the population of 4 years. They suggest that the robust association between sprawl and physical (but not mental) health demonstrates that suburban design may be an important new avenue for health promotion and disease prevention. The authors also found that sprawl tends to have differential impacts, i.e., the elderly and socio-economic poor. This may be due to the fact that the poor and the elderly possess fewer resources which enable them to cope with the limitations imposed by their environment, such as having less access to cars. The elderly also suffer declining physical mobility and reduced vision/hearing, and thus may be less able to navigate environments withspeeding cars or wide streets. In sprawling cities, they may have more difficulty walking the greater distances to destinations such as markets or parks. Urban form may be an important contributor to elderly ‘shut-ins’ and sedentary lifestyles (182).

5.60 Macintyre and Ellaway (183) propose a classification which distinguishes between five dimensions of the urban environment:

- physical features of the environment shared by all residents;
- availability of healthy environments not shared;
- services supporting people in daily lives;
- socio-cultural features of a locality; and
- the reputation of an area.

Construction

5.61 This review found very few studies which examine the effects of construction on residents who live near construction sites. The literature tends to focus on the occupational hazards associated with the construction industry.

5.62 Construction workers face multiple and varied threats to safety (184). The risk of injury varies within the construction industry. Previous analyses have shown that risk of injury is higher for workers in certain construction domains, such as building construction and site development, than in others, such as roadway construction (185). A study of construction workers in the United States found that:
6.3 Construction materials can pose threats to the health of builders and to family members: lead paint is a potent source of risk for children (186). Sources of chemical hazard from building materials include solid materials used in construction eg treated timber; liquid substances eg water from the public supply could be contaminated with hydrocarbons (see 120) or lead solder may have been used in the water tank in the home or apartment block; and airborne substances such as lead paint and dust from breeze blocks or asbestos, carbon monoxide from faulty central heating or formaldehyde from resin.

6.4 Evidence suggests that contractors on medium size housing developments are unable to benefit from economies of scale and may use sub-standard building materials which can pose a risk to health (186).

Noise

6.5 Noise pollution is an environmental concern in cities. Noise, defined as unwanted sound (187), is likely to have certain physical characteristics (eg impulsive, high intensity, or high frequency). A review conducted as part of an assessment of the Kings Cross development (17) found a single study which looked at the health effects of noise from construction sites: this was a study in which the sound level in a hall of residence which was next to a construction site (188). The construction site was for a three-storey, 41,000 ft² multi-purpose academic building. One edge of the site was only 15 feet away from some of the rooms. At times, the sound level at the residence hall was as high as 80 dB. Construction started early in the morning and continued until late afternoon. The construction works lasted for about a year, starting in August and continued until the fall of the following year. The student residents reported being distracted more frequently than those farther away from the construction site – a finding consistent with earlier studies which showed that subjects exposed to constant noise pollution made more everyday errors. The students also reported interference with and disruption of a number of their daily activities related to their academic activities, i.e., interruption of thought, difficulty in studying, and difficulty in reading. Construction noise woke residents up, and made sleeping and relaxing difficult. No harmful health effect was reported. However, the author states that great caution needs to be taken in generalizing from these results.

Dust

6.5 Dust is ubiquitous at construction sites and exposure can occur during all construction activities from excavation to the final stripping before the building is complete. Dust sources associated with construction processes can be subdivided into two groups (189):
- stationary sources eg outdoor stockpiles of loose material, material crushing, screening and segregation plant and the transfer of material along a conveyor belt
- mobile sources eg vehicles traveling over unpaved surfaces and the transport and handling of dry loose materials using loaders, excavators and lorries.

6.6 Dust emissions vary substantially from day-to-day depending on the level of activity and the prevailing weather (190). There are currently no UK statutory standards or limits appropriate for the assessment of deposited dust. An annual deposition rate of 200mg/m²/day (189) is often referred to as a threshold for nuisance. This is not applicable to shorter periods or sensitive to the different ways in which dust may spread.

6.7 Yung (191) writes how specific particulates are associated with particular toxicological effects or health endpoints. However mere exposure to specific particulates does not mean that we will see a common response or effect. Exposure does not determine the dose ie the fate of the particle once it has entered the body (192,193).
Concrete is an important part of modern life and has to be replaced as it ages. Many of the methods of removing, repairing, or altering existing concrete structures have the potential for producing vast quantities of respirable dust (194). Since crystalline silica in the form of quartz is a major component of concrete, airborne respirable quartz dust may be produced during construction work involving the disturbance of concrete, thereby producing a silicosis hazard for exposed workers.

Dose relates to the deposition, uptake and retention of each component of the particulate and it is affected by a number of factors. The Department of Health (193) list these as

- particle size, shape and solubility
- number and concentration of particles
- local environment ie temperature, humidity, ventilation and lifestyle
- anatomical and physiological factors such as a s inter-subject variability, gender, age, physique and disease
- personal exposure relative to area sampling concentrations

Box 9 describes the ways in which particulate matter can affect health. Yung (191) notes that studies regarding health effects from particulate matter focus on particles which penetrate far into the lungs eg those which are respirable size. She goes on to write that only a small percentage of particulate matter caused by construction works falls into this category. While dust may pose a small or negligible biological hazard the volume of particulate may have still a large impact on people's wellbeing.

The average adult breathes 13,000 litres of air per day; children breathe 50% more air per pound of body weight than adults. Because children's respiratory systems are still developing, they are more susceptible to environmental threats than healthy adults. Exposure to fine particles is associated with increased frequency of childhood illnesses, which are of concern both in the short run, and for the future development of healthy lungs in the affected children. Fine particles are also associated with increased respiratory symptoms and reduced lung function in children, including symptoms such as aggravated coughing and difficulty or pain in breathing. These can result in school absences and limitations in normal childhood activities (195).

Yung (191) cites two studies on odour and annoyance and suggests that the mechanisms might be similar for displeasure, annoyance and adverse health impacts caused by dust.

- Studies that have looked at the possible health effects caused by annoyance about odors from landfill sites and petroleum refineries have concluded that intuitive or implicit ideas about toxicity can be summarised as 'if environments smell bad they are probably damaging to health' (196).
- Odour perception and annoyance may act as sensory cues for the manifestation of stress-related illness (or that it heightens awareness of underlying symptoms) among individuals concerned about the quality of their environment (197). The recorded levels of exposure at the sites under study were well below levels where adverse effects would be expected as a result of recognised toxicological symptoms. Yung (191) suggests that this may be applicable to dust perception and annoyance.
Particulate matter (PM) is the term used for a mixture of solid particles and liquid droplets found in the air. Coarse particles (larger than 2.5 micrometers) come from a variety of sources including windblown dust and grinding operations. Fine particles (less than 2.5 micrometers) often come from fuel combustion, power plants, and diesel buses and trucks. These fine particles are so small that several thousand of them could fit on the full-stop at the end of this sentence. They are a health concern because they easily reach the deepest recesses of the lungs. Numerous scientific studies have linked particulate matter, especially fine particles (alone or in combination with other air pollutants), with a series of significant health problems, including:

- Premature death
- Respiratory related hospital admissions and emergency room visits
- Aggravated asthma
- Acute respiratory symptoms, including aggravated coughing and difficult or painful breathing
- Chronic bronchitis
- Decreased lung function that can be experienced as shortness of breath; and
- Work and school absences.

Studies estimate that tens of thousands of elderly people die prematurely each year from exposure to ambient levels of fine particles. Studies also indicate that exposure to fine particles is associated with thousands of hospital admissions each year. Many of these hospital admissions are elderly people suffering from lung or heart disease. Breathing fine particles can also adversely affect individuals with heart disease, emphysema, and chronic bronchitis by causing additional medical treatment. Inhaling fine particulate matter has been attributed to increased hospital admissions, emergency room visits and premature death among sensitive populations.

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More and more people are being diagnosed with asthma every year. Fourteen Americans die every day from asthma, a rate three times greater than just 20 years ago. Children make up 25% of the population, but comprise 40% of all asthma cases. Breathing fine particles, alone or in combination with other pollutants, can aggravate asthma, causing greater use of medication and resulting in more medical treatment and hospital visits.

Particulate matter originates from a variety of sources, including diesel trucks, power plants, wood stoves and industrial processes. The chemical and physical composition of these various particles vary widely. While individual particles cannot be seen with the naked eye, collectively they can appear as black soot, dust clouds, or grey haze.

Those particles that are less than 2.5 micrometers in diameter are known as ‘fine’ particles; those larger than 2.5 micrometers are known as ‘coarse’ particles. Fine particles result from fuel combustion (from motor vehicles, power generation, industrial facilities), residential fireplances and wood stoves. Fine particles can be formed in the atmosphere from gases such as sulphur dioxide (SO₂), nitrogen oxides, and volatile organic compounds (VOCs). Coarse particles are generally emitted from sources such as vehicles traveling on unpaved roads, materials handling, and crushing and grinding operations, and windblown dust.

Air pollutants called particulate matter include dust, dirt, soot, smoke and liquid droplets directly emitted into the air by sources such as factories, power plants, cars, construction activity, fires and natural windblown dust. Particles formed in the atmosphere by condensation or the transformation of emitted gases such as SO₂ and VOCs are also considered particulate matter. Based on studies of human populations exposed to high concentrations of particles (sometimes in the presence of SO₂) and laboratory studies of animals and humans, there are major effects of concern for human health. These include effects on breathing and respiratory symptoms, aggarvation of existing respiratory and cardiovascular disease, alterations in the body’s defence systems against foreign materials, damage to lung tissue, carcinomaogenesis and premature death. The major subgroup of the population that appears to be most sensitive to the effects of particulate matter include individuals with chronic obstructive pulmonary or cardiovascular disease or influenza, asthmatics, the elderly and children. Particulate matter also soils and damages materials, and is a major cause of visibility impairment in the United States.

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6. Transport and connectivity

6.1 Transport has a number of features that contribute positively to determinants of health, by improving access to a range of services, facilities and amenities and providing social interaction. Improvements to transport infrastructure such as major roads or airports may also impact negatively on health through pollution, accidental injury, severance of communities and reduction in some forms of travel which are healthy and sustainable, such as walking and cycling. Socially and economically disadvantaged communities are particularly at risk of these detrimental effects and so it is important to minimize or mitigate the potential negative health effects of transport development to avoid exacerbating health inequality.

6.2 Transport's primary function is to enable access to people, goods and services ((199 cited in (14))). In so doing transport promotes health indirectly through the achievement and maintenance of social networks and by enabling people to access employment opportunities.

6.3 A review for the DETR (200) suggested a link between transport and health and commented that transport provides:

- access to work, food, health facilities, training, education, leisure;
- practical services (eg in isolated rural areas, buses serve variety of functions such as carrying parcels, and a ‘bank’);
- social interaction, through greater levels of contact between people; and
- symbolic expression of an area as well connected with wider society in the city as a whole.

6.4 While transport systems may have these sorts of benefits for local populations, they can also present a hazard to health: traffic volume and speed, the design of transport systems and the travel behaviour of individuals may all influence mental and physical health in a number of ways. The pathways that might result in detrimental health effects are likely to operate through:

- restrictions which may hinder journeys and limit access for some populations (eg 14, p56);
- road traffic injury (201-206);
- emissions that cause populations to be exposed to air and noise pollution (22, eg 207);
- reduction in healthy physical activity such as walking and cycling (eg 208); and
- physical severance of communities by transport routes that are difficult to cross ((eg 209 cited in (210, p102))).

6.5 A systematic review looking at the links between new roads and health found that most studies examined either disturbance amongst local residents, or road injuries (20). No studies were identified which examined the impact of new roads on access to health care, health inequalities, or physical activity. There was sparse evidence on outcomes involving specific physical or mental illnesses. The authors state that while the building of new roads is a public health issue the evidence base relating to the health impacts of new roads is disparate and incomplete.

Access/mobility

6.6 Deficient transport systems and exposure to the health risks associated with traffic may be unevenly distributed for different socio economic groups and this may contribute to health inequality.

6.7 Lack of access to transport is experienced disproportionately by women, children and disabled people, people from minority ethnic groups, older people and people with low socio-economic status. These groups find their access is reduced to services such as shops and health care and they spend a higher proportion of their resources on transport (14, p56). Disadvantaged urban areas tend to be characterized by high traffic volume, leading to increased levels of air and noise pollution and higher rates of road traffic accidents without the benefits of access to private transport (199).

6.8 Public transport must be affordable if it is to contribute to social inclusion: the cost of rail and local bus fares has risen by nearly one third in real terms since 1980, whereas motoring costs have decreased by 5% (cited in 14, p56).

6.9 Lack of public or accessible transport is a key concern and the cause of social exclusion for many rural residents. Hooper (211) working with rural lone parents, for example, found social networks to be fairly limited and somewhat fragile. Financial constraints were not only restricting
social activity but social contact too because this was mediated by access to either a telephone or a car and two-thirds had no access to the latter.

6.10 Particular groups are disproportionately affected, primarily the elderly, many women and young people (212). Storey and Brannen (213) for instance, found that, out of a sample of young people (15-24 years) in South West England, over 40% reported that transport issues had influenced their post-16 education decisions. Employment opportunities and social activities are often severely restricted by the availability of transport and there is often little or no provision in the evenings and at weekends.

Road traffic injuries

6.11 Transport is also responsible for injuries. A community based case-control study (214) looking at traffic volume, speed and curbside parking found that

- the risk of injury, especially for child pedestrians, increased with traffic volume;
- a high density of curb parking was associated with increased risk; and
- risk increased with mean traffic speeds over 40kph (approximately 25mph).

6.12 Road traffic injury data is not a reliable measure of risk (208,215,216): pedestrians, and vulnerable road users, avoid roads which they perceive to be dangerous (see Box 12 for other issues related to road traffic data). Looking at information from North America Jacobsen writes that motorists adjust their behaviour in the presence of people walking and bicycling (217). Policies that increase the numbers of people walking and bicycling appear to be an effective route to improving the safety of people walking and bicycling (217).

6.13 Egan and Petticrew et al (20) state that out-of-town bypasses reduce the incidence of injury accidents on main routes through or around towns. They go on to write that secondary roads within towns may be affected differently (eg bypasses may lead to an increase in injuries on secondary roads and intersections (218)). Unfortunately, detailed injury statistics are not always available for secondary roads (219). This perhaps explains a relative lack of robust evidence on how new bypasses affect the distribution of injuries across broader road networks.

<table>
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Injuries are coded according to their severity. A collision is classified as a fatal incident if any person involved dies within 30 days as a result of their injuries. ‘Serious’ includes any casualty who sustains a fracture, a head injury, internal injury, burns, severe cuts, crushing or an overnight stay in hospital, including for observation only. All other injuries are classified as ‘slight’. Information about the ages of the people involved, the road conditions, the lighting and the vehicle manoeuvres are also recorded.

Road traffic injury data is an important source of information about the relative safety of the roads. It does have certain limitations:

- the database only holds information about incidents which the police attend, or which are reported to the police;
- the incident is coded by the police officer who attends the scene and there can be variation in the way the officers code traffic incidents; and
- police data under-report pedestrian injuries by one-half to two-thirds (220) (US finding).

These factors suggest that the traffic injury record is an underestimate of the number occurring. A further feature of the injury record is that it indicates collisions which have occurred, but not hazards which are present. A given area may be hazardous in arrangement, but these hazards may not have resulted in actual injuries. An example would be an area where traffic speeds are very high near residential properties, but where this has not caused collisions as people avoid walking near the roads. The risk remains, and may cause injuries in future. Conversely, there may be many collisions which do not reflect hazards in the highway environment. Examples would include drivers being taken ill at the wheel; tyre blow-outs or animals in the road causing a driver to swerve. These incidents occur randomly, and do not indicate a greater likelihood of them occurring in the same place in future.

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6.14 Rural roads

6.14 In terms of main roads, Barker et al (221) found that accidents in rural single carriageways are not well clustered in terms of their location or characteristics. Further work by Barker et al (222) suggests that topographical features of rural roads such as ‘bendiness’ were particularly associated with pedestrian accidents. They argue that bends might be more likely than junctions to have hidden hazards (ie unsignaled or not visible on the approach) (cited in 223).

6.15 The risks for cyclists on non-built up roads in Britain has also been investigated. Gardner and Gray (224) commented that accidents on non-built up roads account for only 9% of all cyclist casualties, but almost one half (45%) of all cyclist deaths. The rate of fatal accidents per 100 million vehicles on a non-built up road is almost three times higher than on a built up road. Few clusters are observed which make spot treatment and route treatment difficult, expensive and hard to justify investment in rural areas where fewer people benefit from them (cited in 223).

6.15 Gardner and Gray (224) also comment that the mix of traffic in rural communities may also be an important issue for safety. Heavy goods vehicles (HGV) are generally considered to be the most economically efficient areas of rural because of agriculture and the dispersed settlement pattern. However, the chances of a cyclist being killed are around 30% with a car and 50% with collision with an HGV > 1.5 tons (cited in 223).

6.16 There is some evidence to suggest that the casualties in rural accidents are less likely to be treated as quickly as those occurring in urban areas. This may be because lower traffic densities in rural areas means that the accident may not be notified as quickly as those in urban areas and emergency medical services may have longer journeys (225) (cited in 223).

6.17 Blatt and Furman (226) proposed a number of reasons for the greater likelihood and severity of crashes on rural roads. This includes the design of rural roads with narrow or non-existent shoulders and limited sight distance due to hills and curves and high speed – 40% of all 1992 fatal crashes occurred on rural roads with speed limits of 55 mph or higher. They also suggest that economic and behavioural factors play a role with lower rates of seat belt use and child safety use by rural residents. Delays in the response of emergency medical services may also be factors with the lengthy travel time decrease likelihood of survival of a crash victim in a remote area. They argued that geo-demographic information would help target interventions at rural communities (cited in 223).

6.18 Rural villages face real problems of driver compliance with speed limits (223). As Christie et al found, “the difference between the speed limits in and outside the village can be large, and so speed observed through such villages can be particularly high compared to what is appropriate for the conditions. Thus potential for conflict between pedestrians, cyclists and motor vehicles can be great” (221).

Child development and child safety

6.20 The requirements of motorized transport have tended to dominate planning. This conflict between vehicles and road users whether these are pedestrians or cyclists are inevitable and impact particularly on child development (208). Accidents show a social class gradient (227) cited in (228). In the UK road traffic accident deaths for children in poorest families (social class V) are more than 4 times greater than those in the richest (social class I). A decrease in the use of cars would lead to a reduction of accidents. This is likely, but not certain, to be accompanied by a reduction in inequalities in accident rates (14).

6.21 Box 13 describes particular issues surrounding pedestrian injuries in children. Motorised transport has made the environment more dangerous for children and their mobility is restricted through town planning, road width, street furniture and, importantly, the priority given to motorists in law (208). Children’s play territory has been reduced as roads and pavements become more and more dangerous. Children’s psychological development may be impaired by curtailing their sense of independence and personal mobility. The acquisition of personal autonomy promotes esteem.

6.22 Carlin et al (201) conducted a cross sectional survey of six- and nine-year-old children in two Australian cities to look at pedestrian activity in young children. They concluded that it is important to measure unaccompanied street crossing as opposed to total streets crossed or simply walking to school. All comparisons using indicators of socioeconomic status show clear trends toward less walking with higher socioeconomic status. Unaccompanied street crossing was associated with age, sex and maternal education. There was little difference in overall walking levels between boys and girls but boys were significantly more likely to cross streets
Air quality

6.23 The World Health Organisation report Transport, Environment and Health (234) looks at the links between air pollution from vehicles and health. The report makes the important point that traffic contributes disproportionately to human exposure to air pollutants, as these pollutants are emitted near nose height and in close proximity to people. People are exposed whether they are indoors, inside cars or on the roadside. While people spend most of their time indoors, it is unaccompanied. The predominant use of cars for transporting children may lead to an increased risk of road traffic accident for children whose parents are unable, or less willing, to drive their children.

Box 13 Child pedestrian injuries

Children are among the groups at highest risk of pedestrian injuries, especially when the amount of walking done by children is taken into consideration. The risk to child pedestrians is very clearly related to the number of roads they cross (229). The greater the number of roads crossed, the higher the risk of pedestrian injuries. Poorer children under the age of 9 have higher rates of pedestrian injuries at least in part because of their increased exposure to traffic. The reduction in pedestrian fatalities to children in the US, UK, and other countries in recent years is probably due to a reduction in walking by children, (230).

Pedestrian injuries are most common among 5-9 year old children, and in this age group, pedestrian injuries are the most common cause of serious head trauma. Pedestrian motor vehicle collisions are qualitatively different from other types of trauma in that very few of the victims escape injury. In contrast, 94% of occupants of vehicles involved in crashes are uninjured. Police data under-report pedestrian injuries by one-half to two-thirds.

The difficulty with changing behaviour, particularly children’s behaviour, makes environmental modification particularly attractive. Changes in the traffic environment are a traditional component of pedestrian safety programmes for many years. Comprehensive programmes, such as those in Europe, often go under the rubric of ‘traffic calming’ to denote efforts to slow down traffic, thereby improving safety as well as the aesthetics of the environment.

Traffic calming refers to a group of measures designed to control traffic in an urban residential area. The definition of traffic calming adopted at the 1997 international ITE conference is, ‘the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behaviour and improve conditions for non-motorized street users’ (231).

Measures are designed to reduce the number of commuters using residential streets and to reduce the speed of remaining traffic. Measures can include establishing a hierarchical road network, reallocation of main roads to children, traffic and restricting or removing traffic from residential streets with road closures or one-way designations. Environmental changes designed to reduce speed include vertical changes in the street (speed cushions, humped pelican crossings, raised junctions), lateral changes in the street (off-set intersections), constrictions (narrowings, pinch points, pedestrian refuges), gateways at the entrances to the area, build-outs to protect on-street parking spaces, and mini-roundabouts (traffic circles).

Epidemiological studies of environmental risk factors for child pedestrian injury indicate that the likelihood of injury increases for the following conditions: increase in traffic volume (13-14 times) or speed limit (6 times), absence of play areas (5.3 times), poorly protected play area (3.5 times) and high proportion of kerbside parking (3.4 times) (232,233).

quoted from Harborview Injury Prevention and Research Centre (220)

Air quality

6.23 The World Health Organisation report Transport, Environment and Health (234) looks at the links between air pollution from vehicles and health. The report makes the important point that traffic contributes disproportionately to human exposure to air pollutants, as these pollutants are emitted near nose height and in close proximity to people. People are exposed whether they are indoors, inside cars or on the roadside. While people spend most of their time indoors, it is unaccompanied. The predominant use of cars for transporting children may lead to an increased risk of road traffic accident for children whose parents are unable, or less willing, to drive their children.

Box 13 Child pedestrian injuries

Children are among the groups at highest risk of pedestrian injuries, especially when the amount of walking done by children is taken into consideration. The risk to child pedestrians is very clearly related to the number of roads they cross (229). The greater the number of roads crossed, the higher the risk of pedestrian injuries. Poorer children under the age of 9 have higher rates of pedestrian injuries at least in part because of their increased exposure to traffic. The reduction in pedestrian fatalities to children in the US, UK, and other countries in recent years is probably due to a reduction in walking by children, (230).

Pedestrian injuries are most common among 5-9 year old children, and in this age group, pedestrian injuries are the most common cause of serious head trauma. Pedestrian motor vehicle collisions are qualitatively different from other types of trauma in that very few of the victims escape injury. In contrast, 94% of occupants of vehicles involved in crashes are uninjured. Police data under-report pedestrian injuries by one-half to two-thirds.

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outdoor air pollution which is the main determinant of indoor air quality (except in homes where people smoke). CO and particulate matter enter indoors quite freely, while O₃ reaches relevant concentrations indoors only when windows are opened. Levels of CO and benzene inside cars are around 2–5 times higher than at the roadside, and car users are exposed to more pollutants than pedestrians, cyclists or users of public transport sharing the same road ((235) cited in (234)).

6.24 Lester and Temple (236) state that high-risk groups for adverse effects of particulates include the elderly, infants and those with existing acute respiratory infection or cardiovascular problems (237). There is increasing evidence that elevated levels of particulate matter can exacerbate existing asthma, but only limited evidence that it induces asthma (238). Box 11 on page 38 looks in more detail at the health effects associated with particulate matter.

Noise

6.25 Box 8 on page 26 provides a summary of noise and critical health effects. We provide a brief summary below of noise effects associated specifically with transport.

Performance and sleep disturbance

6.26 A DETR report ((239) cited in (11, p53)) concludes there is sufficient evidence that exposure to noise has detrimental effects on performance in school children. Road traffic noise at 50 to 60 dBA intensity increases the time taken to fall asleep. In particular, the number of noise events seems important in this effect (240) cited in (22, p20)). The first third of the night seems to be the time that is most vulnerable to sleep disturbance. A study of Japanese women found that living less than 20 metres from a busy road predicts insomnia ((241) cited in (22, p20)).

Mental health

6.27 Noise per se in the community at large, does not seem to be a frequent, severe, pathogenic factor causing mental illness but that it is associated with symptomatic responses in selected subgroups of the population (242, p73). Many of these studies have been carried out on aircraft noise but a British study of road traffic noise did find a small association between one traffic noise level index and a mental health symptoms scale.

6.28 Altogether, there is not strong evidence that noise causes mental ill-health although it is possible that certain vulnerable groups, who are exposed to noise over which they have no control, may be vulnerable to mental health problems. What is certain, is that those with existing mental health problems, especially either depression or anxiety, are more prone to be annoyed and disturbed by environmental noise exposure than the general population (22).

Coronary heart disease

6.29 Community studies provide little evidence that environmental noise is related to high blood pressure but there is some evidence to suggest that environmental noise may be a risk factor for coronary heart disease, in people who live in noisy areas with outdoor noise levels of more than 65-70 dBA, although the size of the effect is likely to be small (243,244).

6.30 Babisch and colleagues' (244) analyses within the Caerphilly Study do suggest a small increased risk of coronary events in relation to noise, but the association between noise and coronary risk factors is inconsistent and may be confined to groups annoyed by noise (245). Overall, the risk of coronary heart disease associated with road and aircraft noise exposure is small, especially compared with other coronary risk factors such as smoking (from Stansfeld et al, 22).

Physical activity

6.31 The list of health aspects associated with low levels of exercise includes some major causes of death and disability (246); physical exercise has the capacity to diminish morbidity and mortality within the population for example:

- coronary artery disease
- stroke
- systemic hypertension
- obesity
- emotional disorders
- incapacity of ageing

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- coronary artery disease
- stroke
- systemic hypertension
- obesity
- emotional disorders
- incapacity of ageing
• osteoporosis
• diabetes mellitus
• cancer of the colon
• chronic back disease
• athletic injuries

6.32 This list is composed almost exclusively of disorders that affect the health of adults: most involve lifelong processes that begin during the child or adolescent years and surface clinically in later adulthood. Physical exercise reduces the likelihood of developing, and of dying from many of these diseases and it can improve control of the disease (e.g., hypertension, diabetes).

6.33 Physical activity may play an important role in the management of mild-to-moderate mental health diseases, especially depression and anxiety (247). Although people with depression tend to be less physically active than non-depressed individuals, increased aerobic exercise or strength training has been shown to reduce depressive symptoms significantly. Acute anxiety responds better to exercise than chronic anxiety, studies of older adults and adolescents with depression or anxiety have been limited, but physical activity appears beneficial to these populations as well.

Physical severance

6.34 Traffic affects social networks on a very local basis: as traffic volumes increase people’s sense of neighbourliness and the geographic density of their friendships decreases (see (209) cited in (210, p102)).

6.35 Egan and Petticrew et al (20) describe a qualitative study which examined the ways in which people adapted to the opening of a large new road (248). The author noted three types of adaptation:
  • attitudinal adaptation eg reconciling oneself to the inevitability and/or usefulness of the new road;
  • behavioural adaptation eg spending less time in certain rooms or the garden; and
  • environmental adaptation eg installing double-glazing, fences etc.

6.36 Egan and Petticrew et al (20) report a study which investigated community severance by roads (249-251). Movements across neighbourhoods were found to be on average 14% lower in the new road areas. Irrespective of whether a major road was 5, 10 or 30 years old residents adapted to the ‘barrier effect’ produced by the major roads by expanding the boundaries of what they considered to be their neighbourhood to include amenities situated further away from their homes, but on their own side of the road.
7. Economy

7.1 Critics of urban regeneration (252-254) have pointed out that new jobs created by regeneration initiatives are often filled by workers from other parts of the city, rather than local populations in areas targeted for regeneration.

7.2 Recently the Medical Research Council conducted a systematic review of the health impacts of state subsidised economic development (255). They examined over 9,000 titles and abstracts and found only 11 studies that provided robust and rigorous evidence on health impacts. The majority of this evidence points to the negative health effects of development particularly in terms of the health status of the existing population.

7.3 For example Glenn et al (256) conducted a longitudinal study measuring the health and economic changes experienced by a cohort of non-migrants residents in Johnson County, Tennessee, USA. After a period of economic recession, the local economy improved between 1990 and 1993. The authors found that between 1990 and 1993, long term, non-migrating residents did not experience average benefit economically from the regeneration. They experienced a significant decrease in average household income. These residents had a statistically significant worsening in the Duke Health Profile measure of physical health status. Their mental health, measured by the Duke Health Profile, showed slight (insignificant) improvement. Their decline in health was tentatively attributed to either direct or indirect effects of the decline in family income. There was a rapid population increase during the expansion, attributable to inward migrants who were younger and healthier than existing residents. They conclude that local economic development can leave long term area residents poorer and less healthy, and this problem may be masked by an increase in healthier, wealthier inward migrants (256). The authors note also that the economic expansion was accompanied by an expansion of health care services availability. This expansion of services was not accompanied by reduced driving times or increased number of visits.

7.4 There is some evidence that reemployment can reverse the negative health effects of unemployment (257-264). However, other research suggests that negative health effects are not always quickly or easily reversed by improvements in labour market conditions or income (256,265). Reemployment into satisfying work may be beneficial. However, a transition from unemployment to 'inadequate' work is unlikely to be beneficial to health (266-269). It may take the longest time for the 'damage' to health resulting from unemployment to be repaired.

7.5 Brenner (270) looked at all cause mortality in the population in England and Wales from 1936-1976: the study looked at aggregated data and not at individual associations and it made no comparison with 'control' population. The study found that:
- all cause mortality in the population increases as unemployment rises;
- suicide increases within a year of increased job loss; and
- cardiovascular mortality increases within 3 years of job loss.

7.6 These findings are criticised and questioned by authors such as Eyer (271) and Gravelle et al (222). Shortt (273) notes that the authors fail to establish, in precise pathophysiological terms, the mechanism by which economic change induces morbidity

7.7 Eyer (271) argues against Brenner. Looking at employment data against population level mortality, rb aggregated data, not individual association. The causes of death include infectious diseases, accidents, heart disease, cancer and cirrhosis of the liver. Eyer found that mortality in the population increases during and after periods of prosperity and that suicide rates and psychiatric admissions rise and fall with the unemployment rate.

7.8 The lowest urban class experiences the hardest conditions at the peak of any economic boom. Stress is felt through a range of mechanisms including workers anticipating unemployment, workers being overworked and an increase in health-damaging behaviours eg cigarettes and alcohol. Eyer concludes that increased production, income and consumption, the product of contemporary capitalist society, is not homogenous and health-promoting.

7.9 Employment opportunities created by regeneration schemes risk being dominated by low paid, insecure, secondary sector, non-standard forms of employment which may contain many of the negative attributes described above (274-276).

7.10 Re-employment in low quality work may be actually worse for psychological health than the experience of unemployment (266,277,278).
7.11 Even if employment prospects do improve, for some groups of workers such as lone mothers, there may be conflicts between the demands of employment and other salient roles and responsibilities (279-281).

7.12 People with mental health problems are less likely to be employed than any other group of people with disabilities. In the UK in 2001, people with mental health problems (including common and severe disorders) were almost three times more likely to be unemployed than all other groups of people with disabilities (282).
8. Services

8.1 Services is very a broad term describing the institutional resources available to a community. It includes local institutions such as police, health and social care, schools, community services and public, community, voluntary and private services eg food, retail outlets. In this section we look at health services: we provide some information on primary and secondary care and on mental health services. These observations are extracts from the Independent inquiry into inequalities in health (283). We consider how health and social services might link with each other. We also look at the conclusions of Policy Action Team 13 (284) which reported on improving shopping access for people living in deprived neighbourhoods. We look at the links between education and health and conclude with a look at the effects which crime, and the fear of crime, can have on people's health.

Health services

8.2 The urban environment is characterized by a variety of health and social services (285). Even the poorest urban neighbourhood often possess innumerable social agencies, each with a distinct purpose such as community regeneration. Galea et al (286) note that many of the inner city public health successes in the United States, such as the reduction in HIV transmission, teen pregnancy rates, TB control, and new cases of childhood lead poisoning, have depended in part on the efforts of these groups. Poor, urban residents continue to face significant obstacles in accessing good quality services particularly health care. Social services for disadvantaged populations are often susceptible to changing fiscal realities with a resultant decrease in service frequency coinciding with times of greater need in the urban population.

8.3 Many cities and urban environments are also characterised by disparities in wealth between relatively proximate neighbourhoods. These inequalities are often associated with disparities in quality of care (287). The presence of well-equipped GP practice opportunities in the same area or city decrease the likelihood that providers will work in deprived neighbourhood particularly when these latter services face limited resources and declining political commitment.

8.4 There is a relative lack of involvement of people with low income and educational levels in social and civic activities. This lack of participation seems to be a further expression of a range of disadvantage that combines to exclude people from being active participants in their societies (288).

8.5 Measures of health service use and activity, which are routinely collected or gathered in a survey, can be used to estimate population health status however they are proxy measures; it is important to be aware of the different influences on the data and the range of ways in which the information might have been collected (289).

8.6 The indicators listed in Box 14 are responsive to health services interventions (290). The charts are derived from similar charts which look at the impact of primary care on overall health (not just equity) (291).

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### Box 14 Indicators for examining how health services affect equity in health

#### Infancy
- Neonatal mortality (specialty care)
- Postneonatal mortality (primary care)
- Breastfeeding*
- Tetanus toxoid*
- HIV/AIDS

#### Childhood
- Immunizations (primary care)
- Child survival to age 5
- from external causes through public health and
- from medical causes through primary and specialty care
- Malaria protection and treatment*
- Management of gastroenteritis*
- HIV/AIDS*
- Treatment of respiratory infection*

#### Teenage period (all primary care)
- Preventive and health-promoting behaviors, especially those not related to specific diseases
- Adverse effects of medications
- Rates of attempted suicide
- Emergency visits for asthma

#### Early and middle adulthood (all primary care)
- Low birth weight
- Breastfeeding, seat belts, physical activity
- Low smoking rates
- Asthma death rates
- Hypertension and cerebrovascular disease: premature mortality and age-adjusted death rates
- Hospitalizations for ambulatory care sensitive conditions
- Suicide rates
- Symptoms of peptic ulcers
- Adverse effects of medications

#### Later adulthood (all primary care)
- Asthma death rates
- Deaths from cerebrovascular disease
- Suicide rates
- Adverse effects of medications (post-marketing surveillance)
- Hospitalization for ambulatory care sensitive conditions
- Symptoms of peptic ulcer
- Heart mortality; cancer mortality

*especially developing countries from Starfield (291) and Jones et al (292)

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8.7 The following sections are extracts from the Independent inquiry into inequalities in health (283).

### Primary care

8.8 Higher rates of general practitioner (GP) consultation are associated with greater social and economic deprivation (293). Communities most at risk of ill health tend to experience the least satisfactory access to the full range of preventative services: these preventative services include cancers screening programmes, health promotion and immunisation. Differences are most notable among socio-economic groups; there are also differences and inequalities within groups. For example, a lack of access to a female GP or nurse.

8.9 Saxena et al (294) examined how health status and use of health services varies in children of different social class and ethnic group. They conducted a cross sectional study using data from the 1999 Health Survey for England: 6,648 children and young adults aged 2-20 years. The
authors report large socioeconomic differences between ethnic subgroups; a higher proportion of Afro-Caribbean, Indian, Pakistani, and Bangladeshi children belonged to lower social classes than the general population. The proportion of children and young adults reporting acute illnesses in the preceding two weeks was lower in Bangladesh and Chinese subgroups.

8.10 Self reported health status rather than socioeconomic status or ethnicity is the best predictor of use of primary and secondary services.
- Indian, Pakistani, and Bangladeshi children reported less acute and chronic illness, asthma, and injuries than the general population, whereas Afro-Caribbean children reported more;
- Children's self-reported health status and use of healthcare services did not vary by social class.
- Indian and Pakistani children make more use of general practitioners' services, but Indian, Pakistani, Bangladeshi, and Chinese children are less likely to be referred to outpatient clinics.

8.11 Children's use of health services was reflected by their health status rather than ethnic group or social class, implying that equity of access has been achieved; BUT need to investigate reasons why children from ethnic minority groups are able to access primary care but receive less secondary care

8.12 Smaje and Grand (295) look at the extent to which equity of treatment is received by people of different ethnic groups from the British National Health Service. General Household Surveys of 1984-91 it examines the use of general practitioner, outpatient and inpatient services. The results do not suggest there is any gross pattern of inequity between ethnic groups, except perhaps with respect to the Chinese population which displays consistently low levels of utilisation. While the use of GP services by minority ethnic groups is in general as high or higher than the white population, the use of outpatient services is low. Females of Pakistani origin report low levels of GP use. More generally, excess use of GP services among several minority ethnic groups appears to be associated with need, while people from most minority ethnic groups who do not report illness display especially low use of outpatient services relative to the corresponding group in the white population.

8.13 Sproston et al (296) assess rates of general practitioner consultation among Chinese people compared with the general population and other minority ethnic groups. They conclude that Chinese people in England are less likely than people from other minority ethnic groups to consult their general practitioner, even after their relative health status is taken into consideration.

8.14 The authors conducted a survey of a representative sample of Chinese people aged 16-74 living in private households in metropolitan areas of England. One thousand and twenty-two people were interviewed. General practitioners as 'of Chinese origin' were interviewed. General practitioner consultations were analysed in relation to self-reported general health and long-standing illness or disability, gender, age, social class, country of birth, whether the respondent spoke English, use of traditional Chinese medicine, and the ethnicity and gender of the respondent's general practitioner. The authors report that levels of general practitioner consultation by Chinese people is low compared with the general population and with other minority ethnic groups. Among the Chinese population, general practitioner consultation is related to gender, self-reported health status and the ability to speak English. Ability to speak English is the strongest positive predictor of general practitioner consultations.

8.15 Chinese people who speak English are more likely than those who do not, to consult their general practitioner. Health service providers should accommodate the needs of this group by providing access to advocacy services.

Secondary care

8.16 There is a positive relationship between levels of deprivation in an area and hospital admission rates although there are great variations in hospital admission rates between GP practices (297,298). Deprivation is not the only factor influencing hospital admission: higher admission rates could also reflect poorer access to primary and community care services, eg services for diabetes and asthma. Attendance for out-patients, and specialist care, consultation rates and self-reported health status has been observed in relationship to socioeconomic factors, ethnic group, gender, age and geography.

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Mental health services

8.17 The use of psychiatric, and especially inpatient hospital services, is associated with high levels of deprivation and unemployment (293). There is evidence of high inpatient admission rates for schizophrenia but lower consultation rates for mental health problems among young Afro-Caribbean men (293). By contrast women and men from South Asian populations have much lower rates of GP consultation for mental health problems than the white population (299,301).

Social services

8.18 Partnership working has become a central feature of British social welfare policy since 1997. Although this development is applicable to all areas of public welfare, nowhere is it more evident than in the planning and provision of care that overlaps health and social services. Dowling et al (302) looked at the impact of partnership working in these areas, They report that the success of partnerships is seen in two main ways:

- process issues, such as how well the partners work together in addressing joint aims and the long-term sustainability of the partnership;
- outcome issues, including changes in service delivery, and subsequent effects on the health or well-being of service users.

8.19 Research into partnerships has centred heavily on process issues, while much less emphasis has been given to outcome success (302). Dowling et al (302) identify this as a knowledge gap that urgently needs to be filled.

8.20 Support for carers in employment is one of the five priority action areas underpinning the National Strategy for Carers (303). However, Seddon (304) reveals that carers in employment have a limited profile at strategic level and their specific needs are rarely addressed in mainstream health and social care planning processes. The findings also suggest that assessment and care management practices are failing to support carers in relation to their employment aspirations. The effectiveness of health and social care assessments in identifying and exploring the needs of carers in employment is limited and very few separate carer assessments are completed.

Food

8.21 PAT 13 (284) states that Government (national and local) needs to better understand the wider economic importance of small retailers as the linchpin of a sustainable business base in deprived neighbourhoods. Small retailers provide employment opportunities (part-time jobs in particular), and so have a positive impact on the quality of life of people living in these communities. This also has a positive effect on those sectors that supply them — wholesalers and cash and carries in the convenience store sector. Local post offices are noted as being of particular importance.

8.22 Many small retailers have fewer than 5 employees with their business occupying floorspace of less than 300ft². These trades are:-

- the most likely source of supply of shops and services to those living in deprived neighbourhoods;
- operating in probably one of the most competitive sectors, often with barely sustainable profit margins; and
- in a sector which has been declining for many years.

8.23 Small retailers are operating in probably one of the most competitive sectors, often with barely sustainable profit margins (around 1%) and with a host of issues (economy, legislation and the competition for consumers) to cope with, many of which are outside their control. As a consequence many retailers work 15 hours a day, 7 days a week.

8.24 The majority of shops that traditionally serve those living in deprived neighbourhoods were small, independent, convenience type stores. And these have been declining for years. PAT 13 reported that while the number of supermarkets increased from 457 in 1986 to 1102 by 1997, some eight independent shops disappeared everyday between 1986 and 1996 (284). The number of independent stores has declined by almost 40% in the eleven years between 1986 and 1997. For people on low income, shopping journeys by car and the average distance travelled to shops has increased. The opening of large multiples have decimated many small shops. A focus on price competitiveness has lead to margins falling. The prices in large wholesalers for goods are often under-cut by the large multiples. In many cases the person on
the street can buy goods cheaper from these multiples than the shopkeeper can from the wholesalers.

8.25 There has been growing interest in the ways in which features of the local food environment may be related to the dietary habits of individuals. There is some evidence that the dietary patterns of individuals differ across neighbourhoods and that these differences may not be wholly attributable to individual-level socioeconomic characteristics. Studies in the United States have shown that the number of supermarkets is lower (305) and the number of off-licences (liquor stores) and fast food outlets higher (306-308) in more deprived neighbourhoods. In turn, the availability of services and amenities (such as grocery stores, pharmacies, as well as recreational spaces) may facilitate or constrain a person's ability to engage in health-promoting behaviours such as eating fresh vegetables, obtaining medicines, or getting regular exercise (55,309).

8.26 There is also evidence which argues against the processes described above. A recent study (310) examined the relationship between being overweight in preschool children and three environmental factors:

- the proximity of the children's residences to playgrounds
- the proximity of the children's residences to fast food restaurants
- the safety of the children's neighbourhoods.

8.27 The authors found that within the study population of urban low-income preschoolers, being overweight was not associated with proximity to playgrounds and fast food restaurants or with the level of neighbourhood crime.

**Education**

8.28 The Organisation for Economic Co-operation and Development report that the economic importance of knowledge and skills is growing: they also report that the social impact of learning is equally as significant as the economic impact (37). Learning and the acquisition of skills and knowledge takes place from birth to death. The OECD (37) emphasises the importance of adult learning and training and the importance of learning at all stages of life: this is known as lifelong learning. According to the report, training and learning play important roles in providing the foundations for economic growth, social cohesion and personal development (37). Education is positively correlated with employment earnings. Independently of qualifications, adult literacy has a strong impact on earnings (in one generation has positive effects on the educational attainment of the next generation: better schooled parents have children with a higher level of cognitive development as well as children with higher future earnings potential (312).

8.29 Whitty et al (313) describe how improved educational attainment in childhood is linked to a range of improved adult health outcomes. In contrast, low school attainment is linked to an imposing array of life outcomes from occupational status to income to health. Beyond its impact on improving individual student deviance also create a negative school climate, frustrate teachers and can be intimidating distractions for other students (314).

8.30 The importance which a child's parents and the child's social network attach to learning have a profound influence on children's attitudes and behaviour (37). Coleman (311) emphasised the importance of a surrounding community of adults for young people who are 'embedded' in enclaves of adults closest to them: social networks are important for learning. Different types of supportive social relations among adults help learning eg help with homework, out of school activities and direct parental involvement in school activities (311). Strong neighbourhood connections can provide an environment which reinforces achievements in school. Exchange and support between parents, schools and children can provide increased resources necessary for improving children's wellbeing (315). Children's self-esteem may be influenced by current climate of test results, grades and rewards for achievement. School may aim to enhance 'institutional cultural capital' and be forced to neglect emotional well-being (316).

8.31 An analysis of the British National Child Development Study (317) shows that during middle childhood children spend less time at home and more time at school and with their peers. During this time the quality of their teachers and other students becomes a major contributor to their development. The period from about 10-16 years of age encompasses the transition from childhood to adolescence (317).

8.32 Messages from school can be undermined (316) eg standards of cleanliness may be lower at school than at home, the standard of school food may contradict messages to eat healthily and the street can buy goods cheaper from these multiples than the shopkeeper can from the wholesalers.

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messages to take exercise and take care on the roads may be weakened by teachers who drive and also on occasion pose a threat to children.

8.33 Wilson (318) writes that families who live in deprived neighbourhoods may have routines that are detrimental to the development of skills associated with school and work. Parents who feel that they do not have control over their own lives may lack the planning or organisational skills which help children achieve in school or employment.

8.34 Education is associated with lower crime helping to socialise young people to remain in school (37,311). People with higher educational qualifications tend to be healthier and have a lower take of social benefits (312).

Crime

8.35 Keithley and Robinson note that both the Acheson Report (14) and the most recent British Crime Survey (319) cite evidence that the risk of being a victim of crime, including violent crime, is higher among poorer than among richer sections of society. However, they also note that people caught and prosecuted for criminal offences are more likely to come from disadvantaged backgrounds (320).

8.36 Residential turnover: researchers find that residential mobility is associated with high levels of crime and victimization (321). Residential mobility has one of the largest positive effects on violent victimization of any neighbourhood characteristic, larger than poverty or racial composition (322). Poverty contributes to criminality only in transient communities characterised by rapid population turnover.

8.37 Robinson et al (323) conducted a feasibility study which looked at the relation between crime and health and health services. We provide their findings below.

8.38 The impact of crime on physical health - Violent crime may result in temporary or permanent disability and, in some cases, death. People who have experienced crime-related trauma may also have a poorer perception of their physical health, greater limitations on physical functioning and more chronic medical conditions. Individuals who have been victims of physical violence have also been shown to have higher rates of cigarette smoking, alcohol and drug abuse, risky sexual behaviour and eating disorders (323).

8.39 The impact of crime on psychological health - There is widespread acceptance that the victims of crime often suffer severe psychological distress and subsequent mental health problems. Data from general population studies in the U.S. clearly indicate that crime events are associated with high rates of Post-Traumatic Stress Disorder (PTSD). Secondary victims, such as close relations, witnesses of crime and communities experiencing violence, may also suffer from the psychological affects of crime (323).

8.40 Health and the fear of crime - The fear of crime can alter people's lifestyles and may affect them in ways that lessen their quality of life and impact upon their physical and psychological health. For example, people in fear of crime may be less likely to use public places and withdraw from social life and avoid going out, especially at night. Fear of crime may also lead to psychological health effects, such as stress, depression and sleeping difficulties (323). Crime Concerns (324) looked at the impact of fear of crime has on people's health: they describe fear of crime as a subjective and emotional response which depends on the individual and the time and place. Age, gender, environmental cues and familiarity with people and places are all cited as factors. A drop in crime is not always accompanied by a drop in the fear of crime so sustained reduction in local levels of reported crime may have a more direct effect than national reductions.

8.41 Crime results in physical and psychological injury which can require emergency treatment and long-term intervention (325). Theft and burglary can materially affect living standards and psychological effects for the victims. Fear of crime can lead to a wide range of psychological disorders and self-limitation mobility (326). Researchers found that residents of poor neighbourhoods have higher fear, are more afraid of being assaulted, injured and victimised, having their home broken into and afraid to go out on the street (326).

8.42 A range of long-term health effects are associated with victimisation. Increased rates of cigarette-smoking, alcohol and other substance abuse, health care neglect, risky sexual behaviours and eating disorders are all associated with physical and sexual assault (in source 324, p6).

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8.42 A range of long-term health effects are associated with victimisation. Increased rates of cigarette-smoking, alcohol and other substance abuse, health care neglect, risky sexual behaviours and eating disorders are all associated with physical and sexual assault (in source 324, p6).
8.43 Young people face high levels of victimisation and also greater socialisation into fear having grown up in an era in which crime influences parental control (327). This has resulted in far fewer children exploring the outside world. The consequences of which are that children have less environmental knowledge, competence and confidence.

8.44 The cost and impacts of crime on health services - Crime can place a considerable burden on health services and may be a factor in the increasing cost of health care. Crime-related trauma has been shown to be linked to an increase in the demand for both physical and psychological health care. The safety of health care staff is also a critical concern. In 1998/99, a survey of sickness absence, accidents and violence in NHS trusts found that there were on average nearly 13 violent incidents per month in NHS trusts. 64% of these incidents were against nursing staff (323).

8.45 In some cases, the causes of crime may also be health related. In this respect, it is important to put crime in the context of drug misuse, unemployment, truancy and other aspects of social exclusion. Research has shown that there is a strong link between these issues and increased levels of anti-social and criminal behaviour, including domestic violence, assault, fires and other crimes. It is thought that up to three-quarters of certain crimes are drug related. In the early 1990s, Greater Manchester Police estimated that, in Manchester alone, the annual cost of crime associated with just 1,000 heroin users was £88m. Up to two-thirds of burglaries and violent crime may be committed under the influence of alcohol (323).
9. Appendices

Appendix 1 Health and urban development

9.1 Do the places where people live make a difference to their health? The empirical examination of area-level influences on health represents a relatively recent phenomenon, made possible by the introduction of multi-level analytical methods into public health and epidemiology (328). Based on the accumulated multi-level evidence, there is now broad consensus that living in deprived (urban) neighbourhoods increases the risks of poor health outcomes, even after controlling for individual characteristics, such as socioeconomic position (328,329).

9.2 The individual outcomes examined in these studies have ranged from health-related behaviours, such as physical activity (330), smoking prevalence and diet (331); to biological markers of cardiovascular disease risk, such as body mass index (332,333) and systolic blood pressure (333); and ultimately, to major health endpoints, including all-cause mortality (334), heart disease incidence and mortality (335-338), and self-rated health (339,340).

9.3 In contrast to the extensive range of health endpoints that have been examined, the characterisation of neighbourhood-level variables in the same studies remains somewhat limited. A major problem with the empirical evidence is that the majority of studies so far have focused on a single dimension of neighbourhood structure - the prevalence of economic deprivation - in relation to health outcomes.

9.4 We have a limited understanding of what it is about the urban environment and neighbourhoods that leads to various health outcomes. It is therefore necessary to unpack the observed association the neighbourhood and health into its component pathways and mechanism (328,341). Such an understanding provides an important step toward developing interventions to improve population health (341,342). A good place to begin to think about how health may be affected by the proposed development is to distinguish between different dimensions of the urban environment (343). Broadly speaking, three dimensions may be distinguished:

• the service environment (ie, access to, and quality of, neighbourhood services and amenities)
• the physical environment (eg, air pollution, traffic patterns, housing stocks),
• the social environment, which refers broadly to the social norms and values shared by members of social groups, as well as the quality, content, and volume of interpersonal interactions within urban communities.

9.5 Huxley et al considered the impact of an urban regeneration project on mental health (344). A longitudinal study was made with 22-month follow-up in a Single Regeneration Budget area, and matched control area in South Manchester. A total of 1,344 subjects responded to a postal questionnaire survey. The authors found that mental health showed no improvement over time. Health satisfaction declined slightly, GP use did not change. The study shows that the urban regeneration programme may have had little impact as it failed to address the concerns of local residents and failed to remove restricted opportunities, which appeared to be the key factor.

9.6 Box 15 shows how health, in particular cardiovascular health, may be affected by the development of the urban environment and how the determinants of health operate to have an impact on health.
The extent to which individuals walk as part of their daily lives may be affected by:
- availability of pavements and bike lanes,
- design of public spaces,
- features of urban form (such as building design and setback),
- land use mix,
- density of population and activities,
- patterns of street connectivity, and
- the aesthetic quality of the areas.

Neighbourhood aesthetic quality (e.g., the presence of green spaces, interesting features, and pleasant surroundings) may also be related to the experience of stress or the ability to recover after exposure to stressors. Features of the local environment such as availability and cost of healthy foods and tobacco products as well as food and tobacco advertising may affect dietary patterns and smoking habits. Noise levels may be associated with cardiovascular risk through the effects on sleep disturbance and possibly stress. Air pollution may be related to a variety of biological factors that influence either the development or clinical manifestation of cardiovascular disease (345).

Features of the social environment may also be relevant. Safety and violence as well as levels of social support, cohesion and social capital may be related to the experience of stress and the development of psychosocial factors for cardiovascular disease. Social norms regarding acceptable behaviours may arise or be reinforced in the context of neighbourhoods. The physical environment also influences the aesthetic quality of the areas.

Pathways linking residential environment to cardiovascular risk are shown in Box 15. Both physical and social features of neighbourhoods may be operating: participation in sports and other leisure-time physical activity (345) can be influenced by:
- accessibility of recreational facilities (including both public and private resources),
- the presence of pavements and bike lanes,
- transportation, and the design of public spaces.

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and social environments are likely to influence each other. For example, features of street connectivity and urban design may enhance or detract from social interactions among neighbors and may influence social cohesion as well as safety and violence. Physical features of neighbourhoods may contribute to the development of social norms regarding appropriate behaviours. For example, the presence of pavements may influence the likelihood of walking and jogging in the area, and seeing others walk or jog may influence the likelihood that a given person will walk or jog. Reciprocal pathways are also likely to be present. For example, greater prevalence of bicycling to work may create advocacy for changes in physical environments more conducive to cycling (such as bike lanes or traffic calming techniques).
Appendix 2 Types of evidence
This text is adapted from Health impact assessment for regeneration projects: vol III (346).

9.11 The strongest evidence for the study of factors influencing health in populations often comes from longitudinal data for individuals collected over time. This type of information can show the extent to which changes in 'determinants of health' are followed by changes in a person's health.

9.12 This type of study is, however, difficult and expensive. Not all the relevant research has yet been carried out. To make the most of the available evidence, we therefore also refer to other good examples of studies which may be for aggregated populations or cross sectional in time.

9.13 Quite a lot of evidence from longitudinal studies relates to the health impact of negative change in health determinants, such as experience of poor housing or unemployment. There is a relative lack of research on what happens to people's health when the determinants of health improve. This is important for HIA in regeneration, since the expected changes to determinants of health will in many cases be positive.

9.14 The studies fall into several broad categories
- individual or ecological
- cross-sectional or longitudinal
- with, or without, a comparison group

Ecological studies

9.15 Ecological studies compare sets of population data from the same geographical area. They show variation in whole populations but the data are not associated with individual people so it is difficult to know whether variation in health determinants are associated with health difference at the level of individuals.

Studies of individuals

9.16 Studies of individuals, on the other hand, can show the links between determinants of health and health of the individual person more clearly.

Cross sectional studies

9.17 Cross sectional studies give a picture at one moment in time. They show whether risk factors and poor health co-exist but cannot show conclusively whether the relationship is causal eg people with poor health may also live in bad housing. It may be that people who are already in poor health end up in poor housing because of low incomes and other factors. Also poor health might be caused by other factors than poor housing, for example those living in poor housing may also be unemployed, or working in hazardous conditions, or they may have a poor diet.

Longitudinal studies

9.18 Cohort, or longitudinal, studies follow a group through time and can show changes in individual health. They may show more clearly, for example, whether worsening health follows from a period of unemployment, or whether people already in poor health are more likely to subsequently become unemployed. They are expensive and the power of the study can be weakened if a large number of participants leave the study, or if the follow up period is too short.

Case-control studies

9.19 Case-control studies investigate the association between a certain factor and a particular outcome. A typical study might look at the association between damp housing and the prevalence of respiratory diseases. The cases would be a group of individuals identified as being in damp housing. They would be compared with, the controls, individuals who do not live in damp conditions but are similar to the cases in every respect, for example other housing variables, income and socioeconomic status (347).

9.20 Case-control studies are however vulnerable to misclassification, and selection and recall bias. The choice of appropriate controls is also very important. Case control studies are best for studying large effects where it is clear that the results are not an artefact of the design. They are
not suitable if the causal links between health and the risks to health are complex eg poor health can be a risk factor for, and it can also cause, unemployment.
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Violent Behavior

Donald Acheson

International Symposium Report

The contribution of human and social capital to sustained economic growth and well-being:


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The health and social care sector must play a full and active role across the growth areas identified in the Sustainable Communities Plan.

This is part of a suite of materials funded by the ODPM to promote flexible and effective partnership working. The other materials are available on www.mksm.nhs.uk and include

- a spatial planning checklist
- key elements of the spatial planning system
- planning for access – how to integrate accessibility into masterplans

Key messages
• Spatial planning brings together all policies that have a bearing on development and the use of land. This includes providing for physical and social infrastructures.
• NHS organisations can promote sustainability through their own policies on waste, transport, investment in staff and capital and purchase of goods and services.
• The health and social care sector needs to look to the long-term and identify the land-use implications of changing patterns of care and of projected changes in the size and profile of populations.
• The health and social care sector needs to engage with colleagues in the planning system, bringing their expertise to the dialogue about sustainability and contributing to ensuring the quality of regeneration and new development from early conceptual stages through to service provision.
• The assessment and appraisal processes provide key opportunities for addressing health-related issues. Health impact assessment should be carried out within the plan-making process.
• The health and social care sector should play a full part, with others, in ensuring that all its stakeholders are engaged in the planning process and able to contribute meaningfully at each stage.
• All those with an interest in health and sustainability will want to ensure that: green spaces, public transport and community facilities are high quality, easily available and well located; services are provided seamlessly across communities; and green spaces and the built environment are designed with accessibility in mind.

‘The Spatial Planning Checklist provides a sound basis for taking a more holistic and integrated approach to planning’
Jane Hamilton, Milton Keynes Partnership

‘This is a worthwhile and valuable document, in which many key messages and actions have linkages to the Countryside Agency’s own remit.’
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