SUSTAINING HEALTH THROUGH HOUSING

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Peter Molyneux
Verity Kemp
Adam Coutts

AUTHOR STATEMENTS

Peter Molyneux is an independent Health and Regeneration Consultant. He has undertaken numerous projects at the interface between health, housing and regeneration and is expert in multi-agency working and partnership development. He has a particular interest in how improvements in the living environment can improve peoples' health. He is a Non-Executive Director of Southwark Primary Care Trust where he chairs the Audit Committee. He is Chair of the Older Persons' Advisory Committee for the Housing Associations Charitable Trust. He has served on a number of advisory bodies including the Joseph Rowntree Foundation 'Lifetime Homes' Group, the London 'Leading for Health Programme' and the Health Sub-Committee of the Energy Savings Trust.

Verity Kemp is an independent health planning and policy consultant specialising in strategic planning and organisational development. She has undertaken numerous projects including, on behalf of the Department of Health, project managing the national review of intensive care, and producing the report Comprehensive Critical Care and managing a high level review of practice placements for a workforce development confederation and project managing its GP recruitment and retention programme. She is the author of numerous good practice guides and briefings most recently for Homelessness Link on the links between Primary Care Practitioner and homelessness agencies.

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1 INTRODUCTION

Healthy and Efficient: Delivering healthy, sustainable neighbourhoods

1.1 This report seeks to challenge the assumption that rehousing is automatically an effective health intervention and that residential change, in and of itself, can alleviate suffering, cure illness, enhance access to care or enhance quality of life[1]. Rehousing from temporary to permanent housing or from an overcrowded to a less overcrowded situation is likely to improve someone's health[2]. However, rehousing or housing improvements will only improve peoples' health if there is a proper consideration of the available evidence, what we have learnt from observation and tenant and resident priorities and perceptions[3].

1.2 The massive increase in house building presaged in Housings Better Future[4] and the drive for greater efficiency has led to a concern that there will be a lowering of quality in, what some commentators have referred to as the "dash for trash". Meanwhile, in Housing Market Renewal Areas there is a concern that those on the margins of the housing market will be displaced and what social and support networks they do have will be fractured.

1.3 The drive towards greater efficiency is often assumed to lead to a lowering of quality. In this environment the drive to make, say, homes accessible and adaptable for people with a range of mobility problems (or indeed who need to wield a pushchair) is seen as being in direct conflict with efficiency.

1.4 By taking i) a whole-life cost approach to the development and management of new homes, ii) ensuring that we know who will live in them and how they will want to live, and iii) by learning from experience and from the evidence there shouldn't be any added cost to added value.

Background to the Project

1.5 In order to address some of these issues, the Housing Corporation commissioned the Health & Housing Network to carry out a best practice and innovation project, *Sustaining Health Through Housing*. The aim of the project was to encourage a more ambitious approach to the achievement of health and well-being through the development of sustainable housing and neighbourhoods. Its key objectives were to:

i) develop a network of champions and support the network through e-mail contact, events and published material;
ii) encourage the effective implementation of the Corporation's sustainable regeneration and sustainable development strategies and as well as the take-up of Corporation funded tools;
iii) encourage the mainstream application of learning from Housing Corporation innovation projects on sustainability and health;
iv) develop a better understanding of the mechanisms and relationships needed to promote the sustainability of people, neighbourhoods and property at a local level and the delivery of health and well-being;
v) disseminate the learning from the study.

1.6 The outputs from the project were to:

i) develop a web-based network of health champions in partnership with the Health Development Agency and the UK Public Health Association;
ii) hold **seven learning events** were held for practitioners to develop continuous improvement cycles to test out new approaches or services;
iii) produce a review of the available **evidence** supporting the link between health, housing and sustainability in co-operation with Queen Mary University of London. This is targeted at housing practitioners wishing to promote health and well-being in the development and evaluation of renewal projects;
iii) three site specific **case studies** with RSLs to examine how they could develop integrated approaches to sustainability and health and well-being through three site specific case studies. PDSA methodology was used to develop the cases and to assist in the evaluation of the outcomes.

Purpose of this Report

1.7 This document has been prepared as part of a programme of work funded by the Housing Corporation. It forms part of an overall programme designed to help RSL's play their full part in promoting healthy and sustainable neighbourhoods. The purpose of this document is to develop an understanding amongst practitioners of the ways in which housing and housing change, link to the wider determinants of health.

1.8 It is intended to assist stakeholders in identifying opportunities for health improvement. In particular it is intended to assist:

- Tenants and residents working on redevelopment or transfer proposals;
- Those commissioning or undertaking Environmental Impact Assessments, Health Impact Assessments and / or Sustainability Appraisals;
- Organisations and partnerships involved in the development, refurbishment and management of neighbourhoods.

Structure of the Report

1.9 The report is divided into 8 sections. These are:

1 Health, Housing and Sustainability
The changing role of housing providers in delivering health and well-being and this can best be addressed through a consideration of housing, health and sustainability.

2 Delivering Healthy, Sustainable Neighbourhoods
A summary of the findings from the seven round-table discussions and three case studies.

3 A Question of Evidence
An analysis of the available evidence on the impact of homelessness or poor housing on peoples' health, the impact on health of improvements to the physical condition of the homes in which they live, and the impact of neighbourhood effects peoples' health and their ability to make healthy choices.

4 Health and Sustainability - Summary of Regulations and Good practice
A summary of housing interventions that are designed to contribute to health and sustainability currently embedded in legislation, regulation and good practice.

2 DELIVERING HEALTHY SUSTAINABLE NEIGHBOURHOODS

"I want a cooler, cleverer, healthier Britain" Jamie Oliver

2.1 In the nineteenth century the main threats to human health, in Britain, were from infectious diseases caused by poor nutrition, overcrowding, pollution and poor sanitation. The early pioneers of public health saw the provision of good quality housing as a key weapon in tackling the underlying causes of ill-health.

2.2 This led to an acceptance that rehousing was an effective health intervention and that residential change, in and of itself, could alleviate suffering, cure illness, enhance access to care or enhance quality of life. This approach follows from the belief that risk factors can be managed through the systematic specification of particular improvements.

2.3 In the succeeding one hundred years, social housing providers and housing associations in particular have played a significant role in preventing ill-health by providing better quality housing and by responding to the demands for greater independence by people with a range of support needs.

2.4 In the twenty first century the health challenges we face are different but just as serious. Mental health, neurological disease, coronary heart disease, cancer and diabetes are the main threats to health in this century. With the possible exception of mental health problems these are not usually diseases associated with poor housing conditions. Nonetheless, the quality of someone's housing and the quality of the neighbourhood in which the live does have a significant impact on their ability to make the choices necessary to avoid some of these diseases and can have a direct impact on their ability to cope with them.

Housing, health and sustainability

2.5 Good health plays a central role in achieving sustainable growth[5]. Patterns of behaviour that promote economic, social and environmental sustainability also have health benefits and measures to improve health (especially amongst the poor who are more prone to ill-health) also contribute to sustainable development[6].

2.6 The Egan Review [7] defined a sustainable community as one which will "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 is backed up by seven components (Figure 1), which constitute the 'common goal'.

Figure 1 : Components of Sustainable Communities

Source : [7].

2.7 The Egan Review makes no explicit link between sustainability and health. However, as we can see, the social model of health[8] (Figure 2) - which shows how people's health is affected by different factors including housing, employment, transport, social support, crime and community safety and education - has many similarities with the diagram in Figure 1[9]. Issues within the different components often overlap with each other. For example, noise or air quality can be symptoms of transport and of housing.

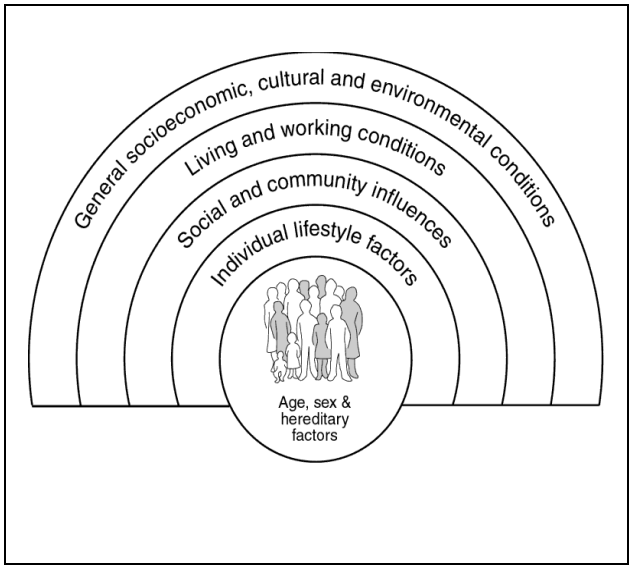
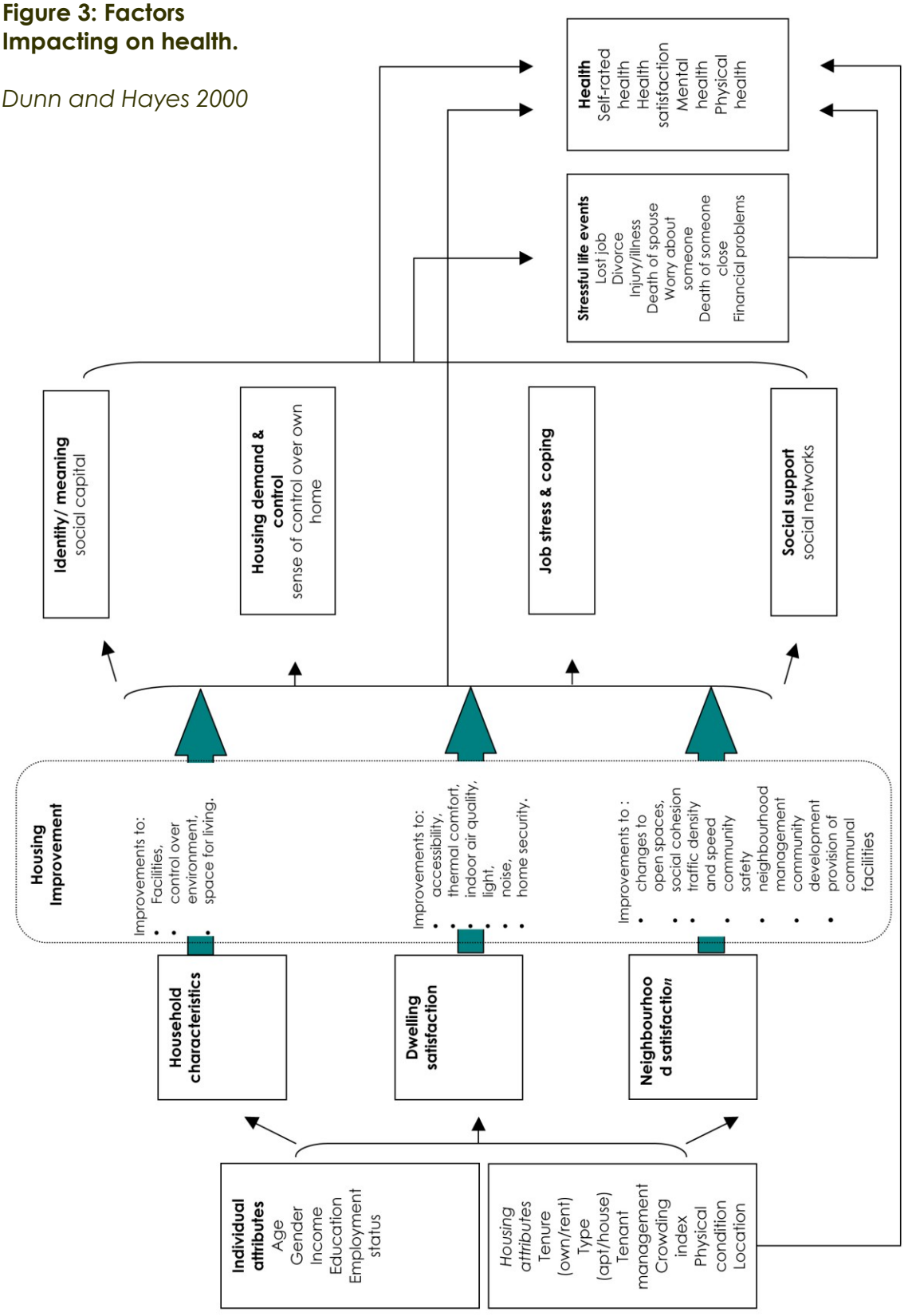


Figure 2 Determinants of health

Source : Whitehead and Dahlgren (1991)

Figure 3: Factors Impacting on health.

Dunn and Hayes 2000



2.8 With the proposed development of new housing (in the growth areas, housing market renewal areas and elsewhere) [10], it remains largely unclear what types of household will be living in these new properties and the likely demographic of the resulting neighbourhoods. There is also a concern that with the drive for large numbers of new homes there will an insufficient focus on quality and the services needed to support the new communities.

2.9 It will be 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. It is not always clear which of the determinants of health has a direct causal link with housing and which are merely indicators of other variables, about the mechanisms by which they operate and about how the various factors such as age, or tenure or income interact with each other. Figure 3 shows the complexity of the interrelationship between different factors. A key question is to what extent interventions in peoples housing status, the quality of the housing in which they live and their neighbourhood environment impact on their health[11].

2.10 Housing redevelopment and regeneration can result in a better quality of life for the people who live there. We have shown that there is a growing body of evidence from research and innovative projects that demonstrate what works[12]. In this section we will draw to together what we can learn from the available evidence, from the review of good practice and from observing the case studies.

Minimising the Impact of Poor Housing

Housing Health and Safety Rating

2.11 The Housing Health and Safety Rating (HHSRS) is built on the principle that a dwelling, including the structure, the means of access, any associated out-buildings and garden, yard and / or other amenity space, should provide a safe and healthy environment for the occupants and any visitors. To satisfy this principle a dwelling should be free from unnecessary and avoidable hazards and where hazards are necessary or unavoidable, they should be made as safe as reasonably possible. The purpose of the rating, therefore, is not to remove all hazards but to rate the severity of hazards distinguishing between those, on the one hand, where there is a small chance of relatively minor harm and those where there is an imminent risk of major harm or death[13].

2.12 The HHSRS is a structured way of assessing and reflecting how safe and healthy a dwelling is. It clearly reaffirms that health and housing are inextricably linked[14]. It provides a mechanism by which residents, environmental health practitioners and community health practitioners such as Health Visitors to work together to improve the housing conditions of those who experience the worst housing - and the worst health.

Decent Homes

2.13 The Government is committed to every home in the country being a Decent Home by 2010. A Decent Home is one that meets the current statutory minimum standard for housing, is in a reasonable state of repair, has reasonably modern facilities and provides a reasonable degree of thermal comfort.

Decent Homes

A Decent Home is one which is wind and weather tight, warm and has modern facilities. It reflects what social landlords spend their money on. To set a national target a common definition has been adopted so that everyone can work toward the same goal.

A Decent Home meets the following four criteria:

It meets the current statutory minimum standard for housing:

Dwellings below this standard are those defined as unfit under Section 604 of the Housing Act 1985 (as amended by the Local Government and Housing Act 1989).

It is in a reasonable state of repair:

Dwellings which fail to meet this criterion are those where either:

- one or more of the key building components are old and , because of their condition, need replacing or major repair; or
- two or more of the other building components are old and, because of their condition, need replacing or major repair.

It has reasonably modern facilities:

Dwellings which fail to meet this criterion are those which lack three or more of the following:

- a reasonably modern kitchen (20 years old or less);
- a kitchen with adequate space and layout;
- a reasonably modern bathroom (30 years old or less)
- an appropriately located WC and bathroom;
- there is adequate insulation against external noise;
- adequate size and layout of common areas for blocks of flats.

A home lacking two or less of the above is still classed as decent therefore it is not necessary to modernise kitchens and bathrooms if a home passes the remaining criteria.

It provides a reasonable degree of thermal comfort:

This criterion requires dwellings to have both effective insulation and efficient heating.

Source: [15]

2.14 Landlords are not expected to carry out only work which contributes to making homes decent. They may carry out preventive building work, environmental and security works and may also wish to consider which Lifetime Homes Standards are appropriate - Lifetime Homes Standards are a series of sixteen design features that ensure that a flat or house offers the accessibility and design features that make the home flexible enough to respond to changing needs[16].

2.15 The spending review 2002 extended the decent homes target to the private sector with the focus on reducing the proportion of vulnerable households living in non-decent homes. The English House Condition Survey[17] estimated that nearly 1.2 million vulnerable households in the private sector were living in a non-decent home. The Decent Home Target Implementation Plan aims to have 65% of vulnerable households in the private sector in decent homes by 2006, 70% by 2010 and 75% by 2020. This includes steps that would make the home more accessible.

2.16 Delivering Decent Homes should be seen as part of the wider goals of regeneration making the links to improving health and education outcomes, reducing health inequalities, renewing failing housing markets, tackling poverty and improving public service delivery and the standard of living for vulnerable people and disadvantaged groups.

2.17 To ensure that homes are decent and healthy consideration should be given:

- Ensuring that all homes – whether new build or refurbished – should comply with Lifetime Homes Standards;
- Be designed or adapted to minimise accidents;
- Make people feel safe in their homes and the surrounding neighbourhood;
- To provide good insulation from cold and noise;
- To specify materials that are non-toxic and non-polluting;
- To ensure good ventilation;
- Affordable heating generated from sustainable sources.

Housing with Support

2.18 There is an increased emphasis on promoting independence and housing choice for people in vulnerable groups. Identifying ways in which housing developments and housing services can prevent or delay the need for costly or intensive services, that improve quality of life and act as a platform for civic engagement and renewal. Modernising Social Services[18], and the National Service Frameworks – particularly for older people[19] – acknowledge the

contribution of housing agencies to preventing delayed transfers of care by ensuring that people receive the equipment, repairs, adaptations and improvements their housing may need in a timely way.

Improving Neighbourhood Quality

The Neighbourhood and the Individual

2.19 Whilst people want better housing, better healthcare and better schools, it is their immediate neighbourhood that has the biggest impact on their relationship to their friends, their family and their neighbours as well as their own self-esteem and sense of health and well-being[10].

2.20 The Commission for Architecture and the Built Environment state "the concept of 'neighbourhood' describes the physical organisation of uses in and between buildings and spaces"[20]. Above all, "whatever the official definition used, the people who live in a neighbourhood generally know which neighbourhood is theirs – where it starts and where it ends"[121] Whilst, definitions vary there are a number key elements that consistently emerge in all of them. These are:

- Geographical space;
- Housing type and tenure;
- Administrative area;
- Common interest and/or beliefs;
- Social networks.

2.21 This focus on neighbourhoods, in all parts of public policy, has led to a debate about the resilience of neighbourhoods, and, specifically their capacity to respond to diversity, fragmentation and changing needs. Neighbourhoods are both complex and adaptive places. They are not static social organisms but networks of individuals and organisations that need to embrace difference and nurture it. High performing neighbourhoods are, by definition, ones in which trust in institutions is developed and confidence in their ability to deliver restored[22].

Why is neighbourhood quality important to health?

2.22 The physical condition of the neighbourhood is important if it is to respond to the changing needs of the community, to maintain a neighbourhood's distinctive identity, and safeguard and enhance some of the essential elements of community life that may contribute to a safer and fairer society[23].

2.23 Lifestyles and the ability to make healthy choices are influenced by the quality of the built environment and are linked to levels of obesity, coronary heart disease, cancer and diabetes. Poorly designed neighbourhoods can expose residents to the detrimental effects of pollution or toxins or to increased risk of accidents[11].

2.24 What people see when they open their front door has a profound impact on their health[24]. Children who have access to or sight of the natural environment have higher levels of attention than those who do not. Access to green space can contribute to health and well-being, social inclusion, community development and culture. Ease of walking, opportunities for activity, access to a green and pleasant environment and the aesthetic qualities of the neighbourhood is associated with increased levels of physical activity. Awareness of facilities and satisfaction with facilities also leads to greater physical activity[25].

2.25 The corrosive effect of crime and fear of crime, combined with economic disadvantage and a poor physical environment have a major impact on the quality of people's lives and their health[26]. As part of this, trust, tolerance and a sense of attachment to the neighbourhood are strongly related to health. This means that although where you live matters for your health it is your social environment that matters most. As Marmot says, "for those of low social status, health is made worse by living in a poor area. There is a kind of double jeopardy[27].

2.26 90% of the public's interaction with the health service is in the community sector. Increasingly the emphasis will be on the delivery of health care closer to home and in the neighbourhood environment. CABE considers that the quality of this environment can contribute to health at different phases:

- *Prevention* - by providing opportunities for exercise, promoting personal safety and reducing stress.
- *Intervention* – by ensuring that all healthcare buildings are designed around the needs of the patient and the staff, as an integral part of the therapeutic effort.
- *Recovery* – by producing quality of environments that assist and accelerate healing.

2.27 Delivering healthy, 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 infra structure.

What would a healthy neighbourhood look like?

2.28 Most individuals could easily describe the relative benefits of living in a good neighbourhood rather than a bad one and the impact it would have on their mental and physical health. Indeed, many people will tolerate non-decent housing if it is in a decent neighbourhood. The Housing Health and Safety Rating System (see above) is based on detailed evidence of the impact of housing on health. Much of this evidence relates to neighbourhood conditions. Professor Tim Blackman has argued that there is an argument for introducing a "Decent Neighbourhoods Standard"[2]. It would be possible, he argues, to develop a site survey (that is similar to a house condition survey[28] that would look at the age of the housing, the number of dwellings and type

of access, the provision of gardens and green space, use of public space, the amount of derelict land, security and the accessibility of shops and services. A range of existing indicators concerning air pollution, environmental cleanliness could be adopted.

2.29 This proposal would be a natural extension to the explosion of interest in neighbourhood or area effects on health. Many people in public and not-for-profit agencies will be charged with measuring and/or monitoring the effect of the application of various policies and the use of resources on the health of people in particular neighbourhoods[29]. As such a Decent Neighbourhoods Standard could be a minimum standard that triggers action in consultation with residents - probably in the context of existing renewal and regeneration programmes[28].

Governance

2.30 Effective sustainable development requires communities to be engaged in developing the vision for their areas. Local governance currently takes place through a shifting network of agencies[30]. The legitimacy of this network is absolutely paramount. Transparency, accountability and openness to scrutiny are as important in community participation as they are in conventional forms of organisational governance if they are to inspire trust[31]. In these emerging forms of governance political legitimacy comes from a range of sources such as the ability to mobilise people, experience and insight[32].

2.31 One of the key problems is that despite the recognition that local people have a very good understanding of what has a negative and positive impact on their health and well-being, many decisions have already been made at the pre-consultation stage and appear to be sown up.

2.32 Too often problems identified by residents are often met with well-established and unimaginative responses by members of the different professions involved. As one community member said, "residents know they're on to something when the Local Authority or Regeneration Company says 'what you have to understand is'" They then went on to say, "It's really difficult to get beyond their "standardised" solutions and to get a proper understanding of why residents consider something to be a problem".

2.33 A different approach was taken by Women 20:20. In order to express ideas in a way that is manageable and understandable they worked on four different futures scenarios. They then added to the work of the focus groups a literature search, interviews with key 'experts', and advisory group and a web-site. They ensured that all ideas were incorporated and that as ideas were developed the group monitored them and fed-back on progress to check that it matched up and that nothing had been missed out [33].

2.34 In order to bring all parties with an interest in the final outcome of any set of proposals together to develop a more integrated approach NHS Estates has, together with the Princes Foundation, been using Enquiry by Design. This, brings together key organisations and stakeholders in a carefully facilitated

workshop. Workshop leadership, technical support, planning and urban design expertise were available to ensure that workshop participants were aware of relevant site constraints. By bringing all stakeholders together in this way they are able to assemble a strategic development that has been agreed and which at the end of the EbD process can be carried forward towards implementation and delivery.

2.35 These approaches recognises that people rarely behave "according to plan" and that decisions taken in one place will lead to unforseen actions elsewhere. Two individuals presented with the same data may draw very different conclusions from it. This 'diagnostic uncertainty', as it would be called in the medical sphere, is common and diagnostic agreement between clinicians is understood as a necessary part of the process. This is no less true in other areas such as housing or regeneration.

2.36 Newton's 'clockwork universe' in which big problems can be broken into their constituent parts, analysed and solved by rational deduction has strongly influenced both the practice of medicine and the leadership of organisations. Much current organisational thinking is based on the assumption that intricate planning provides the best way of making progress involving as it does planning, specifying in great detail and then consistently implementing he same detail across the board[34].

2.37 This type of thinking fails to take advantage of the natural creativity embedded in any group and fails to allow for the inevitable unpredictability of events. New conceptual frameworks that incorporate a dynamic, emergent, creative and intuitive view of the world must replace traditional "Reduce and resolve" approaches to planning and service design. A more creative way of moving towards a difficult goal is to develop a good enough vision and some simple rules[35]. These simple rules (or in some examples minimum specifications) typically include:

- Direction pointing – vision, purpose or objectives or strategic outcomes;
- Absolute boundaries – may be geographical area or a timeframe;
- Resources and permissions – the amount of time someone may spend without question or the budget.

2.38 Ultimately, the only way to know exactly what is needed in a particular area or what will happen is to observe it : it is not a question of better understanding of the agents of better models or of better analysis but of ensuring a proper compact between different types of expert and proper exploration of different scenarios and a recognition of the need to be adaptable and to respond as things change. .

Conclusion

2.39 There is a need for a new relationship between professionals and community members. Problems identified by residents are often met with 'standardised' responses by professionals which makes it difficult to establish a proper understanding of why something is important and find sustainable solutions. Heath gain depends on all 'rationalities' being acknowledged. New

frameworks that acknowledge that such systems are complex and adaptive must replace traditional "Reduce and resolve" approaches to planning and service design. Ultimately, it is not a question of better understanding of the agents, of better models or of better analysis. Instead a proper compact between different types of expert and local community members with both engaged in exploring different scenarios and a recognition of the need to be adaptable and to respond as things change is required. Only then will those who 'know best' have a useful and fulfilling involvement in strategies to deliver health gain.

3 CASE STUDIES

CASE STUDY 3.1
DESIGNING AND IMPLEMENTING HOMES FOR HEALTHY LIVING
Old Ford Housing Association

Purpose of the Project

Tower Hamlets PCT Public Health Team and Old Ford Housing Association undertook a project to identify ways in which accident prevention measures could be delivered through mainstream activity:

- install evidence based interventions to reduce home based accidents in 300 rented homes in Bow East and Bow West in Tower Hamlets in east London;
- explore how research evidence can be applied by practitioners (in more than one sector);
- explore the feasibility of producing a set of local standards for new and refurbished housing and seek their implementation.

Applying the Evidence Base

The project identified research on accident prevention interventions related to housing design. This showed that:

- The use of stair-gates, outlet covers, cupboard latches and poison stickers shows some reduction (10%) in accidents provided that it is supported by advice and provided that it is installed for people;
- The installation of fire alarms with supporting educational material is shown to be effective;
- The provision of cupboard locks shows some benefit although greater awareness of poisonous household products and their disposal may also be a factor;
- The fitting of hand-rails, grab bars, and non-slip stripping reduces falls amongst older people. Grab rails are least likely to be removed at a later date.

For older people the following menu of possible pieces of equipment or adaptations were offered i) bath mats, ii) smoke alarms, iii) reaching aids, iv) anti scald plugs, v) hand rails/grab rails and vi) chain locks / peep holes. For children the following menu was agreed i) safety gates, ii) finger trap guards, iii) socket covers, iv) cupboard locks, v) door jammers, and vi) window locks.

Monitoring Data

The project ran from May 2003 until February 2004 attracting a total of 183 referrals to the scheme. 75 of the referrals were children under 5 or 41%. 104 of the referrals were from people over 60 or 57%. 68 or 91% of the households with children went on to receive a Home Safety Assessment whilst 82 or 79% of the older people went on to

receive a Home Safety Assessment. All the households with children over 5 were determined through the Home Safety Assessment to be in need of equipment. 79 of the households with people over 60 were shown to be in need of equipment. 3 households with older people were determined to have no need for equipment.

FINDINGS

Findings from Stakeholders Interviews

Prior to this project, housing had not been aware of the public health evidence base and public health were not aware of the evidence underlying the Building Regulations and guidance operated by the housing sector. How research transfers into practice is a major concern for all sectors. This is especially true where expenditure in one area produces cost savings in another. Respondents felt that this project had been successful in encouraging and facilitating this transfer.

There was some concern expressed both at the inception of the project and as it moved forward that this was 'another short term project'. This impacted both on the project's ability to get sign-up from over-stretched health professionals and in recruiting a project manager. As a result there was a tension between the need to meet the expectations created amongst local people, to deliver a service within a tight time frame and the need to ensure that learning from the project was being captured and acted upon.

All stakeholders appreciated that the assessment and referral processes had been kept as simple as possible and that the at the equipment packages being offered were kept as standard as possible whilst ensuring that they are appropriate for the types of property into which they were going. This helped with managing the supply of equipment and prevented delays between assessment and installation.

Respondents appreciated the quality of the equipment being installed. There was some discussion about which was the better stair gate. The evidence base said that pressure mounted stair gates should not be used at the top of a flight of stairs. Yet some clients preferred the pressure mounted version and there was then a conflict between a top-down evidence based solution that could well be rejected and a bottom-up client centred approach that was more likely to be adopted.

Several respondents felt there was a need for more education at school and in nursery groups. Whilst young mothers were acknowledged to be a group prone to anxiety there was a recognition that many were not likely to get information or support from their parents and needed this information to come from elsewhere.

Some respondents felt, that given the success of the scheme, any future scheme could also use additional referral routes such as faith groups and that a useful area for research might be to understand how safety was addressed in different communities.

Respondents identified a many advantages of this scheme over more traditional models. These can be summarised as:

- the ease of accessing the service through one central point for referrals;
- the fact that people were able to self-refer and did not need to be referred by a professional;
- that there was a personal assessment that led to a tailored response;
- that the assessment was accompanied by the provision of advice on accident prevention;
- that the equipment is free to those that need it;
- that the equipment is installed for people which reduces the scope for error.

Findings from Interviews with Users

A series of interviews were held with a random sample of beneficiaries. A structured interview was used and there were twelve respondents amongst the older people within the project and thirteen respondents who were the parents or carers of children under 5. An analysis of the responses is set out below.

Interviewees were asked what their first response would be if there was an accident in the home. There was no significant difference between the older people and the parents as to where they would go. Eleven people said that they would contact their GP. Nine people said that they would call an ambulance. Two said that they would go to A&E and three said that they would contact friends or relatives.

"If you can keep this project going, you will save lives" - local resident.

Amongst the older people who were interviewed, the grab-rail and the bath-mat received the most positive comments. Amongst the parents or carers, the stair-gate received the most positive comments, followed by the cupboard / drawer locks and the coiled cable. Some respondents found that the stair-gate was difficult to keep in position.

"people will really benefit, even a grab-rail will make it easier for someone to get round" – resident.

All respondents said that the equipment had made them feel more confident and had reduced the potential for accidents in the home. Amongst the older people grab-rails and stair rails were the items that gave most confidence. Amongst the parents and carers it was the stair / kitchen gates, socket covers and cupboard locks that people felt had had the biggest impact.

"I am a child-minder and it's helped me to make a safer environment for the children in my care" – local resident.

Both parents and carers felt that they were now more aware of the potential hazards and the potential causes of home accidents. Perhaps more importantly, it had helped them to clarify what they should do to prevent them. Many had referred friends and relatives to the scheme.

There were a number of suggestions that tenants and residents made on how the scheme could be made more effective. They can be summarised as:-

- When designing stair cases and banisters, consideration should be given to the ease with which a stair gate could be fitted at a later date if required;
- Showers could be installed as standard;
- Balconies need to be designed with child safety in mind;
- Windows that only open a certain distance should be installed as standard;
- Front doors should not need to be locked manually;
- Wider kitchen work surfaces would make it easier to keep hazardous equipment away from edges.

OUTCOMES

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CASE STUDY 3.2
A HOME LIKE BUCKINGHAM PALACE
Market Estate in Islington : Southern Housing Group

BACKGROUND

The Market Estate is located in Islington North London. Built in 1967/68 it comprises 6 blocks totalling 271 homes. The general condition of the estate is rundown, a condition that has been cumulative reflecting years of poor management. Next to the estate is Caledonian Park which is regularly used by both residents of the estate and people in the surrounding area. In 2000 the London Borough of Islington began the process of stock transfer to an RSL.

In 2001 the London Borough of Islington commissioned a Health Impact Assessment from Islington Primary Care Trust. The intention in commissioning this was to inform the process of stock transfer and to I) identify the potential health impacts on health and well-being. Of the proposal to redevelop simultaneously the Market Estate and the Park and ii) identify ways in which it is possible to protect and enhance health and well-being for all sections of the community from the simultaneous regeneration of the Market Estate and Caledonian Park. This reported in February 2002.

In February 2005 the estate transferred from Islington Council to Southern Housing Group after a successful ballot held last year where 88% of residents voted in favour of Southern Housing Group's proposals. Over the next six years £42 million will be spent on redeveloping the estate and the adjacent Caledonian Park, which will see the Market Estate become a place that residents can be proud to live in. A total of 359 homes will be built for rent, shared ownership and outright sale. Residents will also benefit from significant investment in community development initiatives.

PURPOSE

The purpose of this case study is to look at the extent to which the Health Impact Assessment influenced the housing proposals and the steps Southern Housing Group have taken to improve the health and well-being of the residents of the estate.

An Appreciative Inquiry was carried out into how issues of health and sustainability had been addressed by Southern Housing Group in developing the offer to residents of the Market Estate. By using a balanced score card approach it would establish how the work being carried out on the Market Estate could be managed in a way that promotes health and well-being. The objectives of the work were to:-

i) look at the period up to the ballot and identify what the blocks and drivers were to increased specification;
ii) to review the recommendations of the HIA and design a framework for developing this work;
iii) given that the process is housing management led, establish priorities in terms of the quality of the housing and the Built Environment, governance, and services – primarily housing management services.

The Health Impact Assessment

The HIA looked at the demographics of the existing population and baseline health data. Much of the work focussed on the future of the park which was a hot issue and became a proxy for faultiness between the residents of the estate and the those, mainly owner occupiers who lived in the neighbouring areas.

30% of residents are over 60, 30% are women between 24 and 40 who head households with young children and 10% are from the Turkish Community. There are also a significant number of single men in their 50's. Mortality rates for coronary heart disease are 60% over the average for Islington and mortality rates for Cancer are 70% over the average for Islington.

In terms of housing recommendations. There were a number of issues that came through the consultation with tenants and the review of the available evidence. These can be summarised as:

i) that homes should have good space standards;
ii) there should be effective sound proofing and noise insulation;
iii) to provide water efficiency measures;
iv) that homes should be energy efficient and inexpensive to run;
v) steps should be taken to reduce levels of accidents in the home and in the area;
vi) all homes should be built to Lifetime Homes Standards;
vii) to provide communal areas that are safe for residents and there was a need for community facilities to be located on the site;

There was a concern that these recommendations needed further definition if they were going to encourage bidders to aim for higher standards of housing quality and neighbourhood design.

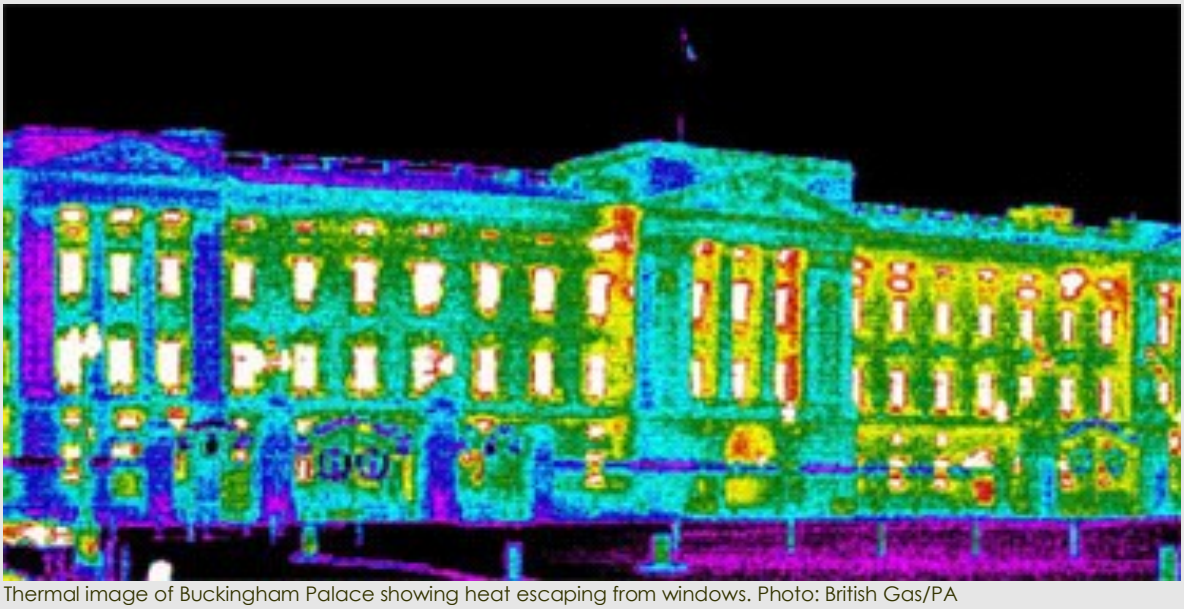
The Process

SHG decided to adopt a housing management led process. The ideas behind this was to enable a fuller consideration of housing management issues in the development process. By co-producing the estate with those who were designing it, those who would have to manage it and those who would live there it was felt that the best outcome would be achieved. By looking at a twenty year lifecycle it would also be possible to introduce innovations that would either reduce costs for the association or for the tenants.

The local authority used the findings of the HIA to inform the assessment of the bids from two competing housing associations to take over the estate. However, the design brief that was prepared by LBI and agreed with tenants was not particularly influenced by the HIA but rather was the result of a political process balancing the needs and views of different groupings.

SHG felt constrained by decisions that had already been made. This was exacerbated by tenants and residents saying that they did not feel fully informed about the proposals. Tenants and residents had misconceptions about the role of SHG and some mistrust because they saw them as an agent of the local authority with in whom they had little trust.

In one of the early tenant consultation meetings a tenant said that she wanted "a home like Buckingham Palace". Whilst the palace may offer advantages in terms of space, location and access to green space, the picture in Figure 1 shows that there are some areas where it falls down. SHG undertook a very comprehensive consultation with tenants and put effort into making sure that they understood the designs and how they would affect them. They ran a session with the Civic Trust and tried to show Tenants and residents what parker-Morris plus 10% would look like and put furniture in the drawings by the architects so that tenants could see how the new homes would look.



Thermal image of Buckingham Palace showing heat escaping from windows. Photo: British Gas/PA

This image, taken with a £40,000 thermal imaging camera by IRT Dundee, reveals how much heat is lost from the draughty windows of the royal household on a daily basis. The areas that glow white and red show where the most extreme heat loss takes place and reveal that much more could be done to save energy at the palace.

A significant achievement is the consensus that now exists around the park. The park is the largest single area of green space in the borough and, hence, is important as resource for the estate and the wider area. The reconfiguration of the park to make it safer, encourage better access for estate residents and to maximise the contribution it can make to the adoption of healthy lifestyles.

The high Turnout has meant that expectations are high and SHG will need to work hard to maintain the trust that has been built up. There is a concern about staff turn over. Can SHG continue to offer committed people with good communication skills who can sustain relationships. This could lead to an increase in management costs. There has also been such a strong drive to demolish the Market Estate that it is now difficult to manage the expectation that all problems will disappear.

SHG has recognised the need to maintain relationships with other stakeholders and to ensure that they are committed to helping with the ongoing sustainability of the estate. As part of this they have undertaken :

i) a base-line of health and social care needs and levels of vulnerability;
ii established the head line issues and the best response that can put on the ground – by SHG or others;
iii) developed a Health and Social Care Plan that maximises SHG's positive impact on individual tenants, leaseholders, the Market Estate and the wider area.

FINDINGS

- The Health Impact Assessment was useful in terms of bringing all stakeholders to the table and providing a different lens through which housing concerns of the residents and the competing interests of the park users could be investigated;
- The recommendations of the Health Impact Assessment needed further mediation of they were to drive quality of housing and neighbourhood settings;
- Need to use different processes that bring issues such as quality of life and sustainability to the fore – as a housing management issue and as a business issue;
- A 'new urbanist' approach could have looked at better integration between park and estate;
- a housing management led process has allowed more of a focus on demography in terms of an ageing population and increasing levels of young children.

4 A QUESTION OF EVIDENCE

"We are to look upon propositions collected by general induction from phenomena as accurately or very true, notwithstanding any contrary hypotheses that may be imagined, till such time as other phenomena occur, by which they may either be made more accurate, or liable to exceptions"

Isaac Newton, Principia Mathematica, Rule 1V, 1687.

Introduction

4.1 The factors that influence the quality of someone's health are many and varied. They include:

- Natural biological factors, such as age, gender and ethnicity;
- Behaviour and lifestyles, such as smoking and alcohol consumption, diet and physical exercise;
- The physical and social environment, including the home;
- The workplace and the wider environment; and
- Access to healthcare.

Figure 4: Factors that influence health status and health differentials?

FACTORS INFLUENCING HEALTH STATUS

Natural, biological variation – natural and biological factors such as age, gender and ethnicity have an important influence on health status. They cannot usually be changed and so result in health inequalities rather than in inequities. However, inequities may result where these factors combine with others to cause multiple disadvantage, for example, where a deterioration in health because of age is coupled with downward social mobility involving loss of income and a poorer standard of living.

Behaviour and lifestyles – The complex interactions between individuals' behaviours and lifestyles and the extent to which they are a matter of choice are not fully understood. What is clear is that the risk factors associated with behaviours and lifestyles are unevenly distributed between social classes. People's ability to live healthily will be affected by their living environment, their stress levels, their income, the availability of "healthy foods" and, related to all of these, their self-esteem. Their ability to take on board "health messages" must be set against the more pressing social and environmental problems.

The physical and social environment – The place where we live is perhaps one of the most important influences on our health and well being. We all need not just a roof over our heads but a home e that is warm, dry, safe and free form infestation (WHO, 1993).

The wider social environment is important too in terms of crime and community safety leisure and recreational facilities, transport and access to shops and health services and access to social networks. It is also becoming apparent that social cohesion is crucial to quality of life and that it may be even more important that the direct effects of absolute material living standards[36].

The health manifestations of homelessness, poor quality housing and the wider urban environment have been set out in a number of reviews [37].

Access to health care – Health care is clearly not the only, or even the most important determinant of health but the health service does have a role to play in ameliorating the effects of other health determinants by treating its symptoms and ensuring a smooth transition between health care and social services where appropriate. It is commonly accepted that an equitable health service should ensure equal access and provision for equal need and a high quality of service that is available to all who can benefit form it.

The evidence suggests that this is not the case, with differential rates of uptake being recorded by different social and ethnic groups. Lower levels of provision, particularly of primary care, in the areas that most need them and an unequal distribution of the quality of care according to geography and social class.

4.2 The standard of someone's housing has long been used as an indicator of health and health inequalities[38]. However, there is less evidence to show what happens to peoples' health when the quality of housing is improved. Whilst it is relatively easy to show that people who live in poor quality housing are also likely to be in poor health - with associated high use of health, social care and support services, it is not as easy to demonstrate that if the quality of housing is improved, there will be a concomitant and measurable improvement in standards of health.

4.3 As Kawachi says, "to ensure the successful translation of knowledge into action, we must remain cognisant of the full range of mechanisms by which neighbourhood environments – physical and psychosocial can influence health"[39]. This report acknowledges the vast amount of work carried out establishing the ways in which poor housing affects physical and psychological health. For the purpose of this report we have sought to unpack the evidence presented in these studies. However, there are many other factors or mechanisms exist alongside any direct causal links between the two. For example, someone living in poor housing may endure many other negative circumstances which means that assessing a particular factor in isolation such as housing is very difficult.

4.4 Until recently, research on health and housing did not include the role of 'place', of social capital and the social environment of neighbourhoods[39]. Increasingly, there is research that looks at the physical and psychological aspects of the neighbourhood in which a house is located, i.e., the neighbourhood. This research divides the neighbourhood into three domains:

- the physical environment (pollution, traffic and housing stock);
- service environment (schools, community services and police);
- social environment (social capital, collective socialisation and social disorganisation).

4.5 All three features of the neighbourhood are linked to numerous health outcomes such as asthma, patterns of physical activity, mental health and sexually transmitted diseases. Peoples' homes are set within the wider area which are themselves set within areas. Neighbourhood characteristics do not arise in a vacuum but are shaped by economic forces, political decisions, migration[40]. Even if the house itself is health promoting, i.e., the physical features and internal environment embodied in windows, heating, and lighting are improved, the outside social and physical environment may confound and moderate these health gains particularly if the social environment is threatening and people feel that they are forced to remain indoors due to fear of being victimised[41].

4.6 There are three basic levels at which health and housing interface:-

- **People : housing, health and other social inequalities**
  The impact that street homelessness, living in temporary accommodation, living in overcrowded accommodation or substandard housing has on peoples' health;
- **Property : impact on health of the physical condition of the dwelling**
  The extent to which improvements to the accessibility, adaptability, thermal comfort, indoor air quality and safety can improve health and improve independence for older people or people who experience some sort of disability.
- **Place : the impact on health of neighbourhood effects.**
  The extent to which someone's home is set within a wider physical and social environment which is attractive, safe with good services and the potential to foster good relationships.

4.7 In the following sections we will examine the available evidence under each of these three headings and explore the implications for planners, developers and providers of services.

5 PEOPLE
Housing, Health and Other Social Inequalities

5.1 In this section we look at the inequalities in health that flow from either being homeless or from living in poor housing conditions. We explore a number of potential risk factors and then go on to look at a range of other social inequalities and their impact on a person's health.

5.2 Those who sleep rough experience the worst health inequalities but there are also negative health impacts associated with living in hostels or temporary accommodation[26]. Rates of chronic illness among those homeless people have been found to be 2.5 times that of people in the general population[337] Homeless children are more prone to disturbed sleep, over activity, bed wetting and higher rates of accidents and infectious disease.

5.3 Homeless people are more likely to experience difficulties accessing mainstream health care services. They are likely to access service through A&E and are more likely to experience periods of re-admission to hospital with longer stays. There is very little information on the needs of homeless people from BME communities but what evidence there is suggests that they are more likely to experience periods of homelessness and more severe health outcomes.

5.4 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[37]. Figure 5 shows some of the key direct and indirect relationships (as reported by the Health Development Agency in 2004). Improving people's housing may reduce health inequality. For example, improving housing quality to tackle cold and dampness, improve indoor air quality and increase.

Figure 5. Evidence on the health impact of poor housing

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

5.5 The impacts on health are complex and adaptive[344]. 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.

5.6 **Error! Reference source not found.** brings together a summary of housing risks where there is evidence of a range of health impacts at a population level. Risk based approaches lies with the belief that policies can be designed to change risk factors systematically. From this it follows that health outcomes can be changed in a predictable manner. This would explain the attempts to specify the relationship between particular housing conditions (damp, cold and mould) and clusters of occupants ill health (asthma, coughs). Direct causal links are notoriously difficult to demonstrate due to the complexity of the housing-health environment. The problem is that traditional risk factor approaches are unable to deal with these complexities

5.7 Considering social capital in health inequalities takes the emphasis away from individual risk factors and turns attention to a range of social and psychosocial processes. Social capital is used as an umbrella term for concepts such as social interaction and participation and trust and cohesion: it covers all the social variables that are known to have positive social effects including health benefits. Here, 'capital' refers to the accumulation of physical and psychosocial resources that influence changes in health across the life course[54].

5.8 Hence, social exclusion[55] can focus attention on the ways in which housing is seen within a more complex understanding of social structures and relations such as socio-economic status, race, ethnicity and gender. Good housing needs to satisfy a number of functions if people are to feel a sense of well-being[56]. These are:

Shelter	Housing should be available, affordable, structurally sound and compatible with mental and physical health;
Housekeeping:	The costs and efforts of housekeeping should be within the limits of the householder's resources;
Accommodation	Spaces and facilities in terms of their size, division, arrangement and equipment must be suitable for a full range of domestic needs;
Connection:	There must be appropriate connections to other households and places of employment and service. Site and occupancy conditions should create opportunities for co-operation;

Meaning :	The character, appearance and conditions of use reflect the values of the resident. It should foster a sense of belonging, attachment and advocacy;
Recreation :	The housing must provide residents with the opportunity to relax and rest.

Tables showing the evidence of the impact of homelessness and poor housing on people

Author	Aspect of housing	Health outcome/effects	Study Design
57	People who are rough sleepers or in temporary accommodation	• the food which is available in day centres and soup runs is dependent on what has been donated • 'opportunistic eating' is a way of life for people who use daycentres and soup runs • lack of empowerment for individuals moving into settled accommodation • majority of people using day centres and soup-runs do not meet current dietary recommendations • women's diet worse than men's for both macro- and micro-nutrients	Sample population represents11% of total potential population accessing the places of contact 348 males and 75 females(n=423) Age range 15-76, Median 34years of age
37	Homelessness	• rates of chronic illness among homeless people have been found to be 2.5 times that of people in the general population	
58	Homelessness – ethnic minorities	• low rates of GP registration • low rates of GP registration among black people and low levels of satisfaction with GP and primary care services	

Author	Aspect of housing r	Health outcomes	Process
37	• homelessness – refugees and asylum seekers	• multiplicity of health and social problems	• separation of families • adjusting to new and alien surroundings • coping with trauma of past events
59	• homelessness – refugees and asylum seekers	• prevalence of common physical and mental health problems is relatively high	• experienced traumas which precipitated flight, or while fleeing, to host country
60	• homelessness – rough sleepers	• prevalence of following health problems three times as high as in general population – chronic chest conditions – breathing problems – frequent headaches – musculoskeletal problems – difficulties in seeing	• n/a

60	• homelessness – temporary accommodation	• prevalence of following health problems twice as high as in general population – chronic chest conditions – breathing problems – frequent headaches – musculoskeletal problems – difficulties in seeing	• n/a
61	• homelessness – temporary accommodation	• high rates of accidents reported for children	• lack of space and cooking apparatus eg kettles at floor level
61	• homelessness – temporary accommodation	• relatively high rates of gastroenteritis	• poor, or absent, kitchen facilities mean that people have to rely on food from cafes and take-aways
61	• homelessness – temporary accommodation	• relatively high rates of – stress – skin disorders – chest infection	• normal child development impaired through lack of space for safe play
• 62	Building dampness and respiratory symptoms in young adults	▪ 74 subjects with water damage and visible signs of mould had significantly more attacks of breathlessness both when resting and after effort compared to subjects reporting no water damage or molds. ▪ Long-term cough was also more common in this group	▪ In 1993, as a part of the European Community Respiratory Health Survey stage II, subjects were invited to participate in a detailed interview-led questionnaire, spirometry, methacholine challenge and measurement of total and specific IgE. ▪ 1853 of the 2084 selected subjects participated in this study (88.9%). ▪ One hundred and thirty-six (7.4%) subjects reported water damage in their homes in the last year and 318 (17.3%) subjects reported visible molds during the same period. ▪ Seventy-four (4%) subjects reported both water damage and visible molds in the last year.
• 63	▪ Housing characteristics and children's respiratory health ▪ It does not state spefiic characteristics?	▪ Respiratory allergy and eye irritation increased in association with traffic on street adjacent to the apartment ▪ Found positive association with all health conditions and	▪ Health and housing questionnaire administered to parents of 5951 elementary school children in 9 Russian cities ▪ Covered information on child's respiratory and

		two indicators of cigarette exposure –lifetime exposure and maternal smoking during pregnancy. ▪ Reported moisture (water damage) and presence of molds onsurfaces had strongest and most consistent association with health outcomes	medical history, home characteristics, social status of the family and allergies. ▪ Health outcomes include: Asthma, current wheeze, bronchitus, respiratory allergy, eye irritation
• [64]	Home dampness and asthma, allergic rhinitis, allergic conjunctivitis, atopic dermatitis, common colds, and bacterial respiratory infections	▪ Visible mould or damp stains or water damage was reported by 15.0% of the respondents. ▪ Positive association between home dampness and current asthma, allergic rhinitis, and atopic dermatitis, as well as common colds > or =4 times per year and other respiratory infections, but not between home dampness and allergic conjunctivitis. ▪ Strongest association found between exposure to visible mould and asthma and common colds ▪ Risk of current asthma in damp homes highest among subjects with heredity susceptibility.	▪ Questionnaire survey of 10 667 Finnish first year university students aged 18-25 years. The dampness categories analysed were visible mould and visible mould or damp stains or water damage during the last year
[65]	Exposure to mite, cockroach, and cat allergen in inner-city children	▪ Each allergen level correlated significantly between rooms in individual homes. Mite and cat allergen levels were frequently below the detection limit. ▪ Cockroach allergen concentrations in the child's bedroom were related to the prevalence of positive skin test responses to cockroach allergen extract among the children. ▪ Positive skin test responses to cockroach allergen were seen in 15% of children exposed to bedroom dust with a Bla g 1 concentration below the level of detection compared with a rate of 32% in bedrooms with Bla g 1 levels of 1 to 2 U/g and 40% to 44% among those in rooms with 4 U/g or greater ▪ The relationship between exposure and positive skin test responses was stronger amongst children with a herediatary susceptibility ▪ The strongest relationship between exposure and sensitization was seen in the bedroom	• sample of 500 children was selected from the 1528 children enrolled in the National Cooperative Inner City Asthma Study. • Children were selected who had a sample of home dust and valid skin test responses performed with a MultiTest skin test device. • samples of home dust were collected from the floor and furniture in the kitchen, bedroom, and television/living room and were assayed for Der p 1, Der f 1, Bla g 1, and Fel d 1 allergens
• [42]	▪ poor housing ▪ General ill health	▪ Found evidence that the impact of overcrowding upon respiratory health is mixed –	▪ Data drawn from the National Child Development Study (NCDS), longitudinal study

	▪ Respiratory diseases	… In childhood to age 11 it is associated with an increased risk of experiencing infectious and respiratory diseases … In adulthood it is only linked with respiratory disease ▪ Association between housing deprivation and general ill health demonstrates that it may play a role in increasing the likelihood of experiencing severe or moderate ill health in adulthood. ▪ From a longitudinal analysis it was found that the experience of multiple housing deprivation led to a 25% greater risk of disability or severe ill health across the life-course. ▪ Poor current housing conditions in adulthood are associated with greater likelihood of ill health ▪ BUT living in non deprived housing conditions is more likely to be associated with ill health amongst those who have experienced housing deprivation earlier in life than those who have not.	▪ Deprived housing measured using a housing deprivation index developed from the 1965 sweep of the NCDS ▪ This includes: housing difficulties recorded by health visitors not having sole access to hot water -overcrowding (1+/room) -lacking or having to share an indoor toilet -not having sole access to a bath -living in non-self contained accommodation (caravan) -not having sole access to a cooker -not having sole access to a garden -living in a flat
[66]	▪ Damp housing ▪ Asthma	▪ Asthmatic subjects reported dampness in their current dwellings more frequently than control subjects. ▪ The surveyor confirmed dampness in 58 of 90 (64%) dwellings of asthmatic subjects compared with 54 of 132 (41%) dwellings of control subjects ▪ This association persisted after controlling for socioeconomic and other confounding variables ▪ The severity of asthma was found to correlate statistically with measures of total dampness and mould growth ▪ Patients living in homes with confirmed areas of dampness had greater evidence of airflow obstruction than those living in dry homes	▪ 102 subjects with diagnosed asthma ▪ 196 age and sex matched controls were interviewed; 222 (75%) then agreed to have their dwelling surveyed for dampness.
[67]	▪ Damp and mould growth ▪ General health	▪ Adult respondents living in damp and mouldy dwellings were likely to report more symptoms overall, including nausea and vomiting, blocked nose, breathlessness, backache, fainting, and bad nerves, than respondents in dry dwellings. ▪ Children living in damp and mouldy dwellings had a greater prevalence of respiratory symptoms (wheeze, sore throat, runny nose) and headaches and fever compared with those living in dry dwellings.	▪ Cross-sectional study of random sample of households containing children; separate and independent assessments of housing conditions (by surveyor) and health (structured interview by trained researcher). ▪ Subjects' homes (in selected areas of public housing in Glasgow, Edinburgh, and London). ▪ Adult respondents (94% women) and 1169

		▪ The mean number of symptoms was higher in damp and mouldy houses and positively associated with increasing severity of dampness and mould (dose response relation). ▪ All these differences persisted after controlling for possible confounding factors such as household income, cigarette smoking, unemployment, and overcrowding.	children living in 597 households. ▪ Specific health symptoms and general evaluation of health among respondents and children over two weeks before interview; and score on general health questionnaire (only respondents)
[68]	Associations between housing characteristics related to dampness, mould exposure, and house dust mite levels	▪ Fitted carpets and rugs in the bedroom were related to fewer asthma symptoms and bronchial responsiveness ▪ This effect was consistent across centres and more pronounced among house dust mite-sensitised individuals. ▪ Reported mould exposure in the last year was associated with asthma symptoms and bronchial responsiveness ▪ In centres with a higher prevalence of asthma, the prevalence of reported indoor mould exposure was also high. ▪ Reported mould exposure was highest in older houses with recent water damage. ▪ conclude that indoor mould growth has an adverse effect on adult asthma.	▪ associations between housing characteristics related to dampness, mould exposure, and house dust mite levels and adult asthma ▪ data from 38 study centres from the European Community Respiratory Health ▪ Data covered the home, heating and ventilation systems, double glazing, floor covers, recent water damage, and mould exposure were obtained by means of an interviewer-led questionnaire.
• [69]	Home environment on the risk of severe asthma during adolescence.	▪ Independent associations with severe wheeze were seen for non-feather bedding, especially foam pillows and the ownership of furry pets now and at birth ▪ Parental smoking, use of gas for cooking, age of mattress, and mould growth in the child's bedroom were not significantly associated with wheezing. ▪ The bedroom arrangements of one quarter of teenagers with troublesome asthma in Sheffield had been altered because of the child's allergy or chest problem. ▪ Quarter of these families had avoided pets or removed them from the home because of allergy ▪ two thirds of asthmatic children were exposed to furry pets	▪ Questionnaire based case-control study drawn from a cross sectional survey of allergic diseases among secondary school pupils in Sheffield in 1991. ▪ 763 children whose parents had reported that over the previous 12 months they had suffered either 12 or more wheezing attacks or a speech limiting attack of wheeze. A further 763 children were frequency matched for age and school class to act as controls. Analysis was restricted to 486 affected children and 475 others born between 1975 and 1980 who had lived at their present address for more than three years. ▪ The study questionnaire may have failed to detect the avoidance or removal of feather

		in their home, an exposure which almost doubled their risk of troublesome symptoms ▪ Alterations to the bedroom involved the use of non-feather bedding, by 95% of severely wheezy children. ▪ Exposure to synthetic pillows was associated with a two to threefold increase in risk of severe wheezing, even after allowance for selective avoidance of allergens by the families of allergic or asthmatic children ▪ Avoidance of feather bedding is unlikely to benefit children with asthma, and there may be a unidentified hazard associated with use of synthetic pillows	bedding by allergic families or there is some undetermined hazard related to foam pillows. Synthetic bedding and furry pets were both widespread in this population and may represent remediable causes of childhood asthma.
70	▪ Home environment and childhood respiratory disease	▪ wheeze reported more often in non-metropolitan areas and in association with active smoking, passive smoking, the presence of a furry pet, bottled gas, paraffin, and other unusual heating fuels; ▪ Current smoking, previous smoking, and passive smoking accounted for 10.4%, 6.8%, and 6.5%, of wheezing in the past 12 months, ▪ furry pets accounted for 5.0%. ▪ Cough and phlegm were associated with active and passive smoking and with the fuels; ▪ associations were found for rhinitis, but were less consistent for rhinitis occurring in spring and summer. ▪ Gas cooking showed little association with respiratory symptoms.	▪ A survey of respiratory symptoms in children aged 12-14 years was conducted throughout Great Britain as part of the International Study of Asthma and Allergies in Childhood (ISAAC). ▪ Information was obtained on certain aspects of the home environment in order to assess their importance as risk factors.
71	▪ lifetime history of household moves and childhood asthma	▪ Among 8-9 year old children in Croydon 66% of those with asthma or wheeze in the past year had moved since birth, compared with of their classmates with no history of asthma or wheeze. ▪ moving house is unlikely to pose a substantial risk of initiating or exacerbating childhood asthma	▪ two case-control studies and one cohort study of British children.

6 PROPERTY: The impact on health of physical conditions

6.1 This section looks at the impact that the physical condition of someone's home has the their health and the extent that improving the condition of someone's home - in the broadest sense - may improve their health and well-being.

6.2 There is a lively debate about the standard to which housing needs to be developed in order to improve health. To date work in this areas has focused on five key areas:

- accessibility,
- indoor air quality,
- thermal comfort,
- noise,
- safety.

In this section of the report we will look at these each in turn.

Accessibility

6.3 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.

6.6 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.

6.7 A recent study by the Northern Ireland Housing Executive showed that were negligible additional costs associated with the implementation of Lifetime Homes. This study showed that the additional cost per dwelling of full implementation of Lifetime Homes Standards was between £441 and £255 per dwelling. This would reduce depending on the scale of the development and the extent to which Lifetime Homes was adopted cross the house building industry[72].

Thermal comfort

6.8 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.

6.9 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. For every ten deaths which occur in summer, more than 14 occur in winter[73]. 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[74]. Respiratory disease pathways are more complex but 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[75].

6.10 Excess winter mortality is not just caused by cold homes but by ineffective preparation for the cold both inside and outside. A large European study has indicated an approximately equal contribution of outdoor cold conditions to excess winter deaths[76]. 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[77].

6.11 Cold, damp homes encourage the spread of mould. Mould thrives in the organic materials in walls and cavities such as plaster, wallpaper and 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[75]. Damp and mould are linked in adults to a range of symptoms including nausea, breathlessness, backache, fainting and bad nerves. In children, symptoms are worse and include vomiting, wheeze, irritability, fever and poor appetite. Respiratory problems are more pronounced where mould is prevalent as well as damp[67].

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[78]. They are also implicated in eczema, dermatitis and perennial rhinitis[79]. Very low humidity levels can lead to dehydration, headaches, dry throat and eye irritation.

Indoor air quality

6.12 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.

6.13 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.

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

6.14 **Airborne particles** created by road traffic and industry are a significant outdoor pollutant. Approximately 60-75% of outdoor Particles (**fine or respirable** particles < 2.5 μm) enter indoors[80]. Indoor sources of respirable particles include smoking and cooking. **Coarse or inhalable particles** (> 2.5 μm) indoors include particles generated by indoor human activities and allergenic bioaerosols, such as **microbes**, **pollen**, **mould** and **house dust mite** faeces[81]. 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[67].

6.15 **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[67]. **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[44].

6.16 **Carbon monoxide (CO) & Nitrogen dioxide (NO_2)** are combustion related gases. The major indoor source of the build up of CO and NO_2 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. The main health impact of high levels of NO_2 is that it may increase the sensitivity of children to respiratory illness[78].

6.17 **Radon** is a naturally occurring radioactive gas, which is given off from rocks and soil. Radon has carcinogenic 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.

6.18 **Volatile organic compounds** (VOCs) are a large group of organic chemicals, including organochlorines, 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 Phthalates widely used as a plasticiser in plastics such as **PVC.**

6.19 **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. Phthalates 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.

6.20 **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 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[78]. It is important that current levels do not rise as some individuals are particularly sensitive.

6.21 **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 **VOC**s. Most shades of synthetic paint contain titanium dioxide white pigment which can cause respiratory problems and skin irritation.

6.22 **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[82]. Although there is little evidence of their impacts within homes, certain PAHs (especially Benzene) are known to be carcinogens, and may enter the dwelling from car exhaust fumes, say, from an integral garage.

6.23 **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

6.24 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[83]. 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.

6.25 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[84].

6.26 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 disrupted. Noise is especially disturbing at night when background noise levels are lower and sleep can be disturbed by relatively quiet sounds[85].

6.27 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[86]. 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.

6.28 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[87].

6.29 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[88].

6.30 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.

6.31 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.

6.32 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[88].

Safety

6.33 There are 2.6 million home accidents in the UK each year that result in a visit to the Accident and Emergency department and a similar number that result in treatment by a GP. There are over 3,000 accidents a year that result in death. The trend in the number of accidents is consistently falling and may fall by 30% from 3,381 in 1996 to 2,400 in 2010. Over 50% of deaths result from falls. Of the remaining deaths 17% result from poisoning, 13% from burns and 5% from choking [89].

6.34 The trend in non-fatal accidents is upward and is expected to rise from 2.6 million in 1996 to 3 million in 2010 which would represent a rise of 20%. Again, falls are responsible for over 40% of non-fatal accidents. Cutting and striking account for a further 30%, poisoning for 18% and then burns at 13%.

6.35 Accidents are, for the most part, evenly distributed across the age range. There has been a slight fall in the number of accidents amongst small children and a slight increase for those involving older people. Small children are the most vulnerable to accidents, whereas, accidents amongst the over 75's are more serious.

6.36 Injuries: the design of homes in injury prevention is widely acknowledged[90]. Designs of poor housing which increase the risk of injury are[91]:

- exposed heat sources;
- unprotected upper level windows;
- slippery surfaces; and
- poorly designed stairs with inadequate lighting.

6.37 In 1996, the Child Accident Prevention Trust said that "most deaths are preventable, and injuries can be reduced through a mixture of environmental, engineering and educational interventions"[92]. 11% of accidents occurring to children were the result of unsafe architectural features[93]. These could be reduced by the introduction of L shaped stairs and good lighting[94].

6.38 There are a number of studies looking at which interventions are most effective in preventing injury and accidents – and in reducing the inequalities associated with them. All of these studies recognise the interaction between the behaviour of people and the type of environment that may increase the risk of an accident or injury. However, there is some evidence that environmental changes and modifications are more effective than attempts to change behaviour. These changes can be summarised as:

- Safety equipment such as stair-gates, outlet covers, cupboard latches and poison stickers;
- installation of fire alarms with supporting educational material is shown to be effective;
- hand-rails, grab bars, and non-slip stripping.

Construction

6.39 There are 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.

6.40 Construction workers face multiple and varied threats to safety[95]. 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[96]. A study of construction workers in the United States found that:

- injury experience varied widely among the types of construction work;
- workers building elevators and conduits and installing glass, metal, or steel were at particularly high risk of both LWT (lost-work-time) and non-LWT injury;
- median days lost by injured workers was highest (202 days) for driving/trucking;
- median days lost for most types of work was much greater than previously reported for construction: 40 days or more for 18 of the 25 types of work analysed;
- workers compensation payment rates reflect both number and severity of injuries and were generally not significantly different from expected losses. They were, however, significantly higher than expected for driving/trucking, metal/steel installation[95].

6.41 Construction materials can pose threats to the health of builders and to family members: lead paint is a potent source of risk for children[97]. Sources of chemical hazard from building materials include solid materials used in construction e.g. treated timber; liquid substances e.g. water from the public supply could be contaminated with hydrocarbons 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.

6.42 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[97].

Noise

6.43 Noise pollution is an environmental concern in cities. Noise, defined as unwanted sound[98] 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[99] found a single study which looked at the health effects of noise from construction sites: this was a study in which 94 students in a hall of residence which was next to a construction site were interviewed. The construction site was for a three-storey, 41,000ft^2 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 end of the residence hall closest to the site 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 found the construction noise highly unpleasant. Students living closest to the construction site 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

6.44 Dust is ubiquitous at construction sites and exposure can occur during all construction activities from excavation to the final sweeping before the building is complete. Dust sources associated with construction processes can be subdivided into two groups [100]:

- 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 travelling over unpaved surfaces and the transport and handling of dry loose materials using loaders, excavators and lorries.

6.45 Dust emissions vary substantially from day-to-day depending on the level of activity and the prevailing weather [101]. There are currently no UK statutory standards or limits appropriate for the assessment of deposited dust. An annual deposition rate of 200mg/m^2/day [100] 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.

6.46 Yung [102] 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 [103].

6.47 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 [104]. 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.

6.48 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 [105] 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 a s inter-subject variability, gender, age, physique and disease
- personal exposure relative to area sampling concentrations

6.49 Box 9 describes the ways in which particulate matter can affect health. Yung [102] 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.

6.50 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 [106].

6.51 Yung[102] 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' [107].
- 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 [108]. 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 [102]suggests that this may be applicable to dust perception and annoyance.

Property: Tables showing evidence of the impact on people of housing conditions

REF	ASPECT OF HOUSING AND HEALTH	IMPACTS –HEALTH/SOCIAL	STUDY DESIGN
109	Health benefits associated with marginal energy usage reductions.	▪ Insulation retrofits would save 800 TBTU (8 × 10 14 British Thermal Units)) per year across 46 million homes, resulting in 3,100 fewer tons of PM 2.5 ,100,000 fewer tons of NOx,and 190,000 fewer tons of SO 2 per year. ▪ These emission reductions are associated with outcomes including 240 fewer deaths, 6,500 fewer asthma attacks,and 110,000 fewer restricted activity days per year. ▪ state level health benefits per unit energy savings vary by an order of magnitude, illustrating that multiple factors (including population patterns and energy sources) influence health benefit estimates. ▪ health benefits correspond to $1.3 billion per year in externalities averted compared with $5.9 billion per year in economic savings.	▪ modeled energy savings with a regression model that extrapolated findings from an energy simulation program. ▪ reductions of fine particulate matter emissions and particle precursors were quantified using fuel-specific emission factors and marginal electricity analyses. Estimates of population exposure per unit emissions,varying by location and source type,were extrapolated from past dispersion model runs.Concentration-response functions for morbidity and mortality from PM 2.5 were derived from the epidemiological literature, economic values assigned to health outcomes based on willingness to pay studies.
110	Indoor air quality of two new blocks of flats	▪ The levels of indoor air pollutants in the case building were, in general, lower than those in the control building. ▪ Asthmatic occupants reported that their symptoms had decreased during the occupancy in the case building. ▪ Showed that high IAQ is possible to reach by careful design, proper materials and equipment and on high-quality construction with reasonable additional costs. ▪ Good IAQ can also be maintained during the occupancy, if sufficient information on factors affecting IAQ and guidance on proper use and care of equipment are available for occupants.	▪ Main indoor air factors measured ▪ temperature, relative humidity CO, CO2, ammonia, total volatile organic compounds, total suspended particles, fungal spores, bacteria and cat, dog house dust mite allergens were measured in six apartments of both the buildings on five occasions during the 3-year occupancy. ▪ questionnaire to evaluate symptoms of the occupants and their satisfaction with their home environment was conducted in connection with indoor air quality (IAQ) measurements ▪ Case building (SEEcolumn 1) was built for people with respiratory diseases by following the instructions of the Finnish Classification of Indoor Climate, Construction

REF	ASPECT OF HOUSING AND HEALTH	IMPACTS –HEALTH/SOCIAL	STUDY DESIGN
			and Finishing Materials, while the control building was built using conventional building technology ▪ one flat was built according to the Finnish Classification of Indoor Climate, Construction and Finishing Materials. The other acted as a control.
111	Indoor air quality and building design [see above for details of design]	▪ Levels of indoor air impurities in the case building were initially lower and they remained on a lower level during the occupancy than those in the control building mainly because of the use of low-emitting materials and a higher ventilation rate. ▪ In the case building, the 1-week ventilation period reduced the TVOC levels approximately by 50%. ▪ Study proved that good indoor air quality can be achieved by careful design, choice of proper materials and equipment, and on high-quality construction.	▪ Two seven-storied blocks of flats were investigated: one was built in the conventional way (control building) and the other by following the instructions of the Finnish Classification of Indoor Climate, Construction and Finishing Materials [see case building specifications above ▪ Indoor air parameters were measured in one apartment on each floor of both buildings before occupants moved in and after a 5-month occupancy. ▪ ventilation system was kept at a high capacity in the case building for one week after its completion before occupants moved in the building. ▪ in case building, the most demanding class S1 target levels for the room temperature, RH, CO_2, formaldehyde, and the total suspended particles were already achieved before the occupants moved in the building and the target levels for CO, TVOC and ammonia were reached 5 months later.
112	Provision of air filters, industrial cleaning and mattress covers to families with at least one member with asthma.	▪ Insulation of exposed steam pipes did not lower temperature. ▪ Cockroach, mouse and pet antigen levels were variable and frequently high in settled dust. ▪ Viable fungal spore levels were variable and high in some apartments.	▪ Part of a urban re-development demonstration project ▪ Nine families of a public housing development in Boston (USA) enrolled in pilot asthma intervention

REF	ASPECT OF HOUSING AND HEALTH	IMPACTS –HEALTH/SOCIAL	STUDY DESIGN
		▪ Dust-mite allergen levels were below the level of concern. Industrial cleaning led to transient reduction in mouse and cockroach antigen burden. ▪ Mattress and pillow covers lowered dust-mite antigen in bedrooms, but not living rooms. ▪ Nitrogen dioxide (NO2) levels exceeded ambient concentrations due to use of gas stoves ▪ Concentrations of particulate matter with aerodynamic diameter <2.5 microm (PM 2.5) were above ambient levels because of smoking. ▪ Air filtering systems did not reduce PM levels. Several volatile organic compounds (VOCs) were above adverse risk concentrations	program **Interventions** ▪ air filters, industrial cleaning and mattress covers to each apartment. Indoor temperature was high and relative humidity low during winter. ▪ designed to gather environmental data and generate hypotheses about the relative importance of different contaminants and the viability of interventions ▪ electronic polarization system consisted of an electrically charged glass fiber/activated charcoal filter, between two screens. The unit's removal efficiency was estimated at 80% (coarse particles). ▪ clean room filtration system consisted of wall-to-ceiling mounted units operating at 300 cfm. The units were equipped with a HEPA-filter and an ozone lamp followed by an activated charcoal filter. System designed to draw in room air at floor level and discharge filtered air at ceiling level. Two or three units were installed in each apartment. ▪ For the clean room filtration system, we replaced the prefilter (40% efficiency standard size furnace filter 12 × 12 × 1 in., $2/filter) at 3-month intervals. ▪ electronic polarization systems, vacuumed the filter every month with a HEPA vacuum cleaner, and replaced the filter every 2 months with a manufacturer-supplied filter. ▪ industrial cleaning machine applied an atomized water-based solution at 200 psi and was designed to extract the residues, leaving little liquid in fabric, upholstery, and carpeting. It was used on floors, upholstered furniture, rugs, walls, windowsills, windows,

REF	ASPECT OF HOUSING AND HEALTH	IMPACTS –HEALTH/SOCIAL	STUDY DESIGN
			interior of kitchen cabinets, and pantries. ▪ Attempt was made to clean stairwells; however, the stairwells remained clean for only a period of hours, and the effort required on stairwells was considerable. In addition, cracks in walls of apartments were repaired and cockroach nests were physically eradicated without use of pesticide.
113	Indoor air quality (IAQ)	▪ Found that IAQ in an unventilated house during combustion heater use was poor due to lack of fresh air. ▪ When using a heater, natural ventilation should be used to dilute air contaminants emitted from the heater. ▪ Concentration of carbon dioxide at about 1000 ppm and a comfortable temperature of 20 degrees C could be maintained by applying natural ventilation of about 0.12 m2 during the use of an unvented kerosene space heater. ▪ To properly evaluate the IAQ and factors that may decrease combustion materials emitted from heaters, ventilation also depends on the number of the occupants and the wind velocity. ▪ use of a steamer is also important to provide optimum humidity levels without elevating the respirable dust concentration above the acceptable limit.	▪ study was done by using a house exposure model ▪ People spend most of their time inside buildings, especially the elderly and children, increasing their exposure to indoor air contaminants. Combustion materials emitted from combustion space heating appliances in housing during the winter may become a serious problem to health, since sources of ventilation are usually left closed to obtain a comfortable temperature level
114	Installation of highly insulated windows and central heating systems on indoor climate, and mite-allergen and mold spore concentrations Poorly insulated windows (heat transmission coefficient [HTC] k=2.5-3.0 W/[m^2*K]) were replaced by highly insulated windows (HTC k=1.5-1.7 W/[m^2*K]).	▪ The air-exchange rate decreased from mean 0.73 to 0.52 per hour. ▪ Temperature (mean 13.4 vs 17.5 degrees and absolute humidity (mean 4.6 g vs 6.2 g H2O/kg air, increased. ▪ Relative humidity remained nearly unchanged (mean 47.6 vs 49.1%). Der f 1 concentrations on carpets (geometric mean 0.65 vs 1.28 microg/g dust, and mattresses (geometric mean 1.56 vs 2.40 microg/g, increased. ▪ suggest that the installation of insulated windows and central heating systems is associated with an increase of Der f 1 concentrations in carpet and mattress dust and of A. fumigatus in carpet dust in apartment bedrooms.	▪ bedrooms of 98 apartments were examined before and 7 months (mean) after installation of insulated windows and central heating systems. ▪ The air-exchange rate, temperature, and humidity were measured. ▪ In settled dust on carpets and mattresses, the number of colony-forming mold spores and the Der f 1 concentration were determined. ▪ The inhabitants completed a

REF	ASPECT OF HOUSING AND HEALTH	IMPACTS –HEALTH/SOCIAL	STUDY DESIGN
			questionnaire about their lifestyles and housing conditions
115	Ventilation rate in houses with different ventilation systemssuch as mechanical ventiliatin, natural ventilation and improved natural ventiliation Indoor air humidity, domestic mite allergen levels and volatile organic compounds (VOC).	▪ None of the 23 houses with an ACH >/= 0.5 had an absolute indoor humidity (AIH) of 7 g/kg air or more, compared with 10 of the 36 houses with an ACH < 0.5 ▪ In none of the 23 houses with an ACH >/= 0.5 were concentrations of mite allergen exceeding 2 microg/g of dust found, compared with six of the 36 houses (17%) with an ACH below 0.5 ▪ 10 of the 34 houses with a total VOC exceeding 200 microg/m3 had mite allergen in mattress dust exceeding 0.5 microg/g, compared with one of the 22 houses with VOC < 200 microg/m3. ▪ Modern, highly insulated, one-storey single-dwelling houses in cold temperate regions, mechanical ventilation increases the possibility of reaching an ACH of >/= 5 which protects against indoor humidity levels contributing to mite survival as well as high levels of indoor air pollutants in winter.	▪ Measurements were performed regarding ventilation rate, indoor temperature, air humidity, mattress mite allergen concentrations using enzyme-linked immunosorbent assay and total indoor VOC in 59 similarly constructed one-storey single-dwelling houses. ▪ In 22 of the houses, a mechanical supply and exhaust ventilation were installed after construction. ▪ In the houses with the originally designed natural ventilation, ducts for outlet air were drawn from kitchen, bathroom, toilet and laundry. ▪ Inlet air was taken through the windows and through leakage of the external wall construction. ▪ Houses retrofitted with mechanical supply and exhaust ventilation, fans were connected to new ducts for supply air to each bedroom and to the living room and original exhaust ducts. The fans were running continuously.
116	Window pane condensation and indoor vapour as markers of defective air change rate, high indoor humidity and high mite allergen concentration in mattress dust?	▪ All houses with high humidity and high mite allergen concentrations were positive for the two indicators (high sensitivity), but with a specificity of only 50% so that half of the houses with reported condensation and high vapour contribution turned out to be low pollution houses with adequate high ventilation levels. ▪ absence of window pane condensation on double-glazed windows and low indoor vapour contribution (< 3 g/m3) during the	▪ Actual ventilation rate, indoor temperature, air humidity (AIH/RH) and concentrations of mite allergen were measured in 59 houses and compared with received outdoor temperatures and air humidity. ▪ Indoor vapour contribution defined as the difference between the indoor and the

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		winter are markers of a dwelling without high indoor air humidity and without high mite allergen concentrations in mattress dust in houses in a cold temperate climate with subzero outdoor temperatures	outdoor vapour concentration was calculated. ▪ Sensitivity, specificity, predictive values and accuracy were calculated for window pane condensation and high vapour contribution (≥ 3 g/m^3), as indicators of defective ventilation (< 0.5 ACH), high indoor humidity (≥ 7 g/kg and ≥ 45% RH) and high mite allergen concentration in mattress dust (≥ 2 μg/g).
117	Ventilation in homes infested by house-dust mites (HDM)	▪ Elevated concentrations of HDM allergen in mattress and floor dust were associated with the difference in absolute humidity between indoor and outdoor air, and with low air-change rates of the home, particularly the bedroom. ▪ No correlation found between concentration of TVOC or formaldehyde in bedroom air and HDM allergen concentration. ▪ In regions with cold winter climate, the air-change rate of the home and the infiltration of outdoor air into the bedroom appear to be important for the infestation of HDM.	▪ Thirty single-family homes with either high (> or = 2000 ng/g) or low (< or = 1000 ng/g) house-dust mite (HDM) allergen levels in mattress dust examined for ventilation, thermal climate, and air quality (formaldehyde and total volatile organic compounds (TVOC).
80,118	Intensive particle monitoring study was conducted in homes in the Boston, Massachusetts (National Research Council, Board on Environmental Studies and Toxicology)	▪ Sources such as cooking, cleaning and movement of people contributed significantly both to indoor concentrations (indoor-outdoor ratios varied between 2 and 33) and to altered indoor particle size distributions. ▪ Cooking, including broiling/baking, toasting, and barbecuing contributed to particulate matter with physical diameters between 0.02 and 0.5 microm [PM((0.02-0.5))], with volume median diameters of between 0.13 and 0.25 microm. ▪ Sources of particulate matter with aerodynamic diameters between 0.7 and 10 microm [PM((0.7-10))] included sauteing, cleaning (vacuuming, dusting, and sweeping), and movement of people, with volume median diameters of between 3 and 4.3 microm. ▪ Frying was associated with particles from both PM((0.02-0.5)) and PM((0.7-10)).	▪ continuous particle size and mass concentration data were collected in four single-family homes, with each home monitored for one or two 6-day periods. Additionally, housing activity and air exchange rate data were collected. Cooking, cleaning, and the movement of people were identified as the most important indoor particle sources in these homes

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		▪ Air exchange rates ranged between 0.12 and 24.3 exchanges/hr and had significant impact on indoor particle levels and size distributions. Low air exchange rates (< 1 exchange/hr) resulted in longer air residence times and more time for particle concentrations from indoor sources to increase. When air exchange rates were higher (> 1 exchange/hr), the impact of indoor sources was less pronounced, as indoor particle concentrations tracked outdoor levels more closely.	
119	Asthma symptoms, building characteristicsdoes not say, and indoor concentration of volatile organic compounds (VOCs) in dwellings.	▪ Symptoms related to asthma were more common in dwellings with house dust mites, and visible signs of dampness or microbial growth in the building. ▪ Significant relations found between nocturnal breathlessness and presence of wall to wall carpets, indoor concentration of CO2, formaldehyde, and VOCs. ▪ formaldehyde concentration exceeded the Swedish limit value for dwellings (100 micrograms/m3) in one building, and CO2 exceeded the recommended limit value of 1000 ppm in 26% of the dwellings, showing insufficient outdoor air supply. ▪ Bronchial hyperresponsiveness was related to indoor concentration of limonene, the most prevalent terpene. ▪ results suggest that indoor VOCs and formaldehyde may cause asthma-like symptoms. ▪ Need to increase the outdoor air supply in many dwelling, ▪ Wall to wall carpeting and dampness in the building should be avoided. ▪ Improved indoor environment can be achieved by selecting building materials, building construction, and indoor activities on the principle that the emission of volatile organic compounds should be as low as reasonably achievable, to minimise symptoms related to asthma due to indoor air pollution	▪ Data from European Community respiratory health survey ▪ The study comprised 88 subjects, aged 20-45 years, from the general population in Uppsala, a mid-Swedish urban community, selected by stratified random sampling. ▪ Room temperature, air humidity, respirable dust, carbon dioxide (CO2), VOCs, formaldehyde, and house dust mites were measured in the homes of the subjects. ▪ They underwent a structured interview, spirometry, peak expiratory flow (PEF) measurements at home, methacholine provocation test for bronchial hyperresponsiveness, and skin prick tests. ▪ serum concentration of eosinophilic cationic protein (S-ECP), blood eosinophil count, and total immunoglobulin E (S-IgE) were measured.
120	Indoor air quality research project was conducted in a new private house built in January 1997 to investigate changes in formaldehyde	▪ The concentrations exceeded the Japanese Government's guideline value of 0.08 ppm in 34 of the 42 (81.0%). ▪ Day to day variation in the formaldehyde concentration was found to be substantial ▪	▪ An concentrations during an 11-month period from April 1997 to February 1998. ▪ Indoor and outdoor concentrations of volatile organic compounds (VOCs) and nitrogen dioxide were

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		▪ Results suggests that indoor formaldehyde concentrations remain high until 7 months after the completion of construction. ▪ Positive correlations between the formaldehyde concentrations in the living room and the kitchen and personal exposure levels to formaldehyde, the result indicating a direct influence of the home environment. ▪ Formaldehyde concentration in the living room positively correlated with the room temperature. Natural ventilation by opening windows was found to be effective for decreasing the concentration of formaldehyde in the indoor air. ▪ Indoor VOC concentrations decreased rapidly after the completion of construction except for that of toluene, which was higher than the outdoor concentration even after 7 months. ▪ Indoor concentrations of all of the VOCs were found to be almost the same as those outdoor at the 13 month time point. ▪ Data suggest that personal exposure levels to formaldehyde and nitrogen dioxide are high in newly constructed private homes in Japan. ▪ To avoid prolonged exposure to high concentrations of indoor air pollutants it is important to use building materials with low formaldehyde emissions..	also measured in August 1997 and February 1998. ▪ Indoor formaldehyde concentrations were measured 14 times (48 hrs sampling for each measurement) for 28 days in the living room, a bedroom and the kitchen in April '97.
[121]	Prevalence of childhood asthma in low-income, inner-city.	▪ Significant positive associations between housing deterioration and allergen levels in kitchens, after adjusting for income and ethnicity, with independent effects of residential stability. ▪ Bedroom allergen levels were associated with housing instability and ethnicity. ▪ Findings demonstrate that indoor household allergen levels are related to degree of household disrepair, after adjusting for individual family attributes,	▪ Investigated levels of cockroach allergens (Bla g 2) in a sample of 132 Dominican or African American low-income households with young children in northern Manhattan in New York City (40% were receiving public assistance) to determine whether the distribution of allergens is a function of housing deterioration. ▪ Deterioration measured by presence and number of physical housing problems (holes in the ceilings and walls, water damage, etc.). More than 50% of the sample had two or more types of housing dilapidation, and 67% of the sample reported

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			cockroach sightings in their homes. ▪ Samples of dust were collected from kitchen and bedroom surfaces. We hypothesized that the greater the dilapidation, the higher the allergen levels, independent of income, sociocultural factors, and pest-control methods.
122	Ambient dust lead levels and demolition of blocks of older lead-containing row houses	▪ Geometric mean (GM) lead dust-fall rate increased by > 40-fold during demolition to 410 micro g Pb/m2/hr (2,700 micro g Pb/m2 per typical work day) and by > 6-fold during debris removal to 61 micro g Pb/m2/hr (440 micro g Pb/m2 per typical work day). ▪ Lead concentrations in dust fall also increased during demolition (GM, 2,600 mg/kg) and debris removal (GM, 1,500 mg/kg) compared with baseline (GM, 950 mg/kg). ▪ daily lead dust fall during demolition exceeded the U.S. EPA floor standard by 6-fold on average and as much as 81-fold on an individual sample basis. ▪ Dust fall is a public health concern because it settles on surfaces and becomes a pathway of ambient lead exposure and a potential pathway of residential exposure via tracking and blowing of exterior dust.	▪ Present results based on dust-fall samples collected from fixed locations within 10 m of three demolition sites ▪ Study conducted in Baltimore, Maryland (USA).
123	Measured concentrations of of 54 volatile organic compounds (VOCs) and ventilation rates in four new manufactured houses over 2-9.5 months following installation of new fixtures and fittings and in seven new site-built houses 1-2 months after completion.	▪ Formaldehyde concentrations were below or near 50 ppb with a geometric mean value for all houses of 40 ppb. ▪ Major sources included plywood flooring, latex paint and sheet vinyl flooring. ▪ Ratios of emission rates at the low and high ventilation rates decreased with decreasing compound volatility. ▪ Changes in VOC emission rates in the manufactured houses over 2-9.5 months after installation varied by compound. Only several compounds showed a consistent decrease in emission rate over this period.	▪ Houses were in four projects located in hot-humid and mixed-humid climates. ▪ They were finished and operational, but unoccupied. ▪ Ventilation rates ranged from 0.14-0.78 h-1. ▪ Several of the site-built houses had ventilation rates below the ASHRAE recommended value. ▪ In both manufactured and site-built houses, the predominant airborne compounds were alpha-pinene, formaldehyde, hexanal, and acetic acid.
124	Use of gas and electricity and	▪ High concentrations of particles are	▪ Experiments with gas

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	health hazards in poorly ventilated kitchens	generated by gas combustion, by frying, and by cooking of fatty foods. ▪ Electric rings and grills may also generate particles from their surfaces. ▪ In experiments where gas burning was the most important source of particles, most particles were in the size range 15-40 nm. ▪ When bacon was fried on the gas or electric rings the particles were of larger diameter, in the size range 50-100 nm. ▪ Substantial concentrations of NO(X) were generated during cooking on gas; four rings for 15 minutes produced 5 minute peaks of about 1000 ppb nitrogen dioxide and about 2000 ppb nitric oxide. ▪ Cooking in a poorly ventilated kitchen may give rise to potentially toxic concentrations of numbers of particles. Very high concentrations of oxides of nitrogen may also be generated by gas cooking, and with no extraction and poor ventilation, may reach concentrations at which adverse health effects may be expected. Although respiratory effects of exposure to NO(x) might be anticipated, recent epidemiology suggests that cardiac effects cannot be excluded, and further investigation of this is desirable.	and electric rings, grills, and ovens were used to compare different cooking procedures. ▪ Nitrogen oxides (NO(x)) were measured by a chemiluminescent ML9841A NO(x) analyser. A TSI 3934 scanning mobility particle sizer was used to measure average number concentration and size distribution of aerosols in the size range 10-500 nm.
125	Major sources of volatile compounds in a typically constructed, new manufactured house and evaluate several source reduction practices.	▪ Several cabinetry materials, passage doors, and the plywood subfloor were the predominant sources of formaldehyde and other aldehydes. ▪ plywood subfloor was the predominant terpene source. ▪ Four emission barriers applied to plywood were shown to reduce emission factors for formaldehyde, hexanal, and other aldehydes ▪ wood products with a urea-formaldehyde resin system should be avoided as they have substantially higher emissions of formaldehyde ▪ Applied vinyl was found to be an effective coating for substantially reducing the emissions of formaldehyde and other aldehydes from the PB case and the MDF cabinet doors.This suggests cabinet cases should be constructed with fully coated materials,such as PB with vinyl on both sides. ▪ Vinyl coated passage doors were	▪ Specimens of materials used within the house were collected. These were individually pre-conditioned for 19 +/- 4 days, and tested for emissions of formaldehyde and other target compounds using small-scale chambers.

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		shown to have substantially lower formaldehyde emissions than the standard doors. Applied finnish materials for cabinets and doors other than vinyl may also reduce emissions. ▪ laminate has been shown to be an effective emission barrier. ▪ Laminate backing sheet applied to the undersides of the PB countertops,a common construction practice ▪ The installation of a carpet cushion with an integral spill barrier or a sheet barrier material over a plywood sub .oor may be partially effective for controlling aldehyde emissions	
126	Presence of plastic wall materials in the home and respiratory health in children.	▪ lower respiratory tract symptoms-persistent wheezing cough and phlegm were strongly related to the presence of plastic wall materials, whereas upper respiratory symptoms were not. ▪ risk of asthma and pneumonia was also increased in children exposed to such materials. ▪ Emissions from plastic materials indoors may have adverse effects on the lower respiratory tracts of small children.	▪ population-based cross-sectional study involved 2568 Finnish children aged 1 to 7 years
127	Sick building syndrome and symptoms and type of heating and ventilation system, energy saving, and reconstruction in older dwellings.	▪ Subjects in buildings with a mechanical ventilation system had less ocular and nasal symptoms. ▪ Heat pumps were associated with an increase of all symptoms ▪ Heating by electric radiators, and wood heating was associated with an increase of most symptoms. ▪ Buildings with more than one sealing, i.e., window exchange, sealing of window frames, insulation of the roof/attic and phasade insulation had increase in some symptoms and decrease in others BUT significant increase in at least one sick building syndrome symptom ▪ Prevalence of apartments with at least one sign of building dampness was highest in buildings with wood heating and heat pump BUT lower in buildings with oil heating, district heating and electric radiators ▪ Electric radiators were asssociated with an increase in most types of symptoms. ▪ Electric radiators may generate ultra fine particles but dust pyrolysis at hot	▪ In Stockholm, 4815 inhabitants in 231 multi-family buildings built before 1961 were randomly selected, of whom 3241 participated (77%). Symptoms and personal factors were assessed by a postal questionnaire. Independent information on building characteristics, and energy saving measures was gathered from the building owners. ▪ In total, 48% lived in buildings that had gone through at least one type of reconstruction or energy saving remedies during the latest 10 years, including exchange of heating or ventilation system, and sealing measures (exchange of windows, sealing of window frames, roof/attic insulation, and phasade insulation).

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		electric wires in radiators ▪ Major reconstruction of the interior, direct heated electric radiators, wood heating, and multiple sealing of buildings were associated with an increase of some symptoms. ▪ MAIN RISK FACTOR for symptoms was lack of mechanical ventilation system and major reconstrcution of building with new materials. ▪ Study supports the view that mechanical ventilation in older dwellings is beneficial from a health point of view.	
128	Symptoms of Sick Building Syndrome and reports of building dampness and odors.	▪ In total, 22% reported at least 1 sign of dampness, and 32% reported odor in the dwelling. ▪ Condensation on windows, high air humidity in the bathroom, moldy odor, and water leakage were reported from 6.8%, 8.8%, 5.7%, and 13% of the dwellings. ▪ A combination of odor and signs of high humidity was related to an increased occurrence of all symptoms ▪ Similar findings were observed for a combination of odors and a history of water leakage in the past 5 yr ▪ Symptoms increased with the number of signs of dampness. ▪ dampness in dwellings, with emissions of odorous compounds, are associated with an increase in symptoms consistent with Sick Building Syndrome	▪ Two hundred thirty-one multifamily buildings built prior to 1961 in Stockholm, Sweden, contained a total of 4,815 dwellings. ▪ The authors selected these buildings for study by stratified random sampling. Occupants answered a postal questionnaire that assessed weekly symptoms, personal factors, population density in each apartment, water leakage in the preceding 5 yr, different types of odors, and signs of high indoor air humidity. ▪ The response rate was 77%. Independent information on building characteristics was gathered from the building owners and the central building register in Stockholm.
129	investigated the efficiency of	▪ statistically significant difference in	▪ Four types of materials

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	different covering materials against house dust mites and their allergens.	allergen permeability among four types of coverings ▪ In terms of the impermeability to mites and their allergens, plastic- and polyurethane-coated covers were observed to be the best, followed by non-woven, woven and cotton-based bed sheets. ▪ regular cotton-based bed sheet allows a significant amount of leakage of mite allergens. ▪ woven and non-woven material are efficient barriers against mite allergen in terms of impermeability. ▪ with regard to mite colonization, non-woven covers have the drawback of mites being able to penetrate and colonize within the fabric fibers. ▪ Woven covers are therefore recommended because of their major advantages of not allowing the colonization of mites within the fabric, being easy to clean, and comfortable.	including (1) plastic cover, (2) polyurethane-coated cover, (3) non-woven covers, (4) tightly woven microfiber covers and a regular cotton bed sheet (as a control) were evaluated using three methods: (i) heat escape method, (ii) Siriraj chamber method and stereomicroscopy, scanning electron microscopy and (iii) enzyme-linked immunosorbent assay (ELISA).
130	Levels of mite (Der p I and Der f I) allergen in dust from bedrooms, living rooms, kitchens, and bathrooms Asthma	▪ allergen levels were related to home characteristics -absolute indoor humidity (AIH), relative humidity (RH), and air changes per hour (ach). ▪ Mite allergen was detected in 62% of the homes. Levels of Der p I varied between < 16 ng and 50 micrograms/g dust, and Der f I between < 16 ng and 73 micrograms/g dust. ▪ Mite allergen levels were higher in homes with dampness problems, in homes with a smoker, and in homes without a basement. ▪ Homes with high absolute humidity (> or = 7 g/kg) or relative humidity (> or = 45%) and poor ventilation (< 0.5 ach) contained higher levels of mite allergens than homes with lower humidity and better ventilation. ▪ High levels of house-dust mite allergen in a temperate climate where mites are not ubiquitous are associated with dampness problems in homes and with tobacco smoking. ▪ data confirm and extend previous findings that high AIH and RH and poor ventilation increase the risk of mite infestation in homes. ▪ Recommend that it is necessary to control indoor humidity and ventilation levels, to avoid high mite allergen exposure in a temperate climate. Shows that mite allergen levels below the suggested threshold level (2 micrograms/g dust) are associated with mite sensitivity in children with perennial symptoms of asthma.	• Sample 130 homes of asthmatic children in three climatic zones of Sweden. Bedroom dust samples included the child's mattress, carpets, floors, and other plain surfaces. Living-room dust samples were taken from sofas and other furniture, carpets, floors, and other plain surfaces.

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131,132	Role of ventilation rate in homes in the development of bronchial obstruction during the first 2 years of life.	▪ Risk of bronchial obstruction was not directly associated with the ventilation rate in liters per second and per person (ventilation rate quartiles: 6.9, 11.5 and 17.6 l/s,p [liter/second and person]) in the homes. ▪ bronchial obstruction was higher in the low air change group than in the high air change group owing to exposure to environmental tobacco smoke, dampness problems and the presence of textile wall paper and plasticizer-containing surfaces. ▪ Results are consistent with the hypothesis that low ventilation rates strengthen the effects of indoor air pollutants.	▪ Matched case-control study based on a cohort of 3,754 newborns in Oslo in 1992-93 that was followed for 2 years ▪ Case series comprised 172 children with bronchial obstruction, and the control series was one-to-one matched for date of birth. ▪ Ventilation rate and other building characteristics were measured/collected in home visits, and questionnaires were used to obtain additional information.
133	Dampness problems and house dust mite exposure in the development of bronchial obstruction in early life	▪ Dampness problems were confirmed in the homes of 27% of the cases and 14% of the controls. ▪ conditional logistic regression analysis controlling for potential confounders, confirming dampness problems increased the risk of bronchial obstruction ▪ Exposure to D. pteronyssinus allergens > 2 microg/g dust increased the risk of bronchial obstruction ▪ Residential dampness problems in Oslo dwellings seem to increase symptoms and signs of bronchial obstruction in young children, apparently without increasing their exposure to house dust mites.	▪ Cohort of 3,754 children born in Oslo during 1992 and 1993 was followed for 2 yr. ▪ Bronchial obstruction was defined as two or more episodes with symptoms and signs of obstruction or one lasting 1 mo or more. ▪ A matched case-control study was carried out in 251 cases of bronchial obstruction (response rate: 98%) and their 251 paired controls. ▪ Information on home dampness problem(s), house dust mite exposure, and potential confounders was collected during home visits and by questionnaires.
134	House dust mite allergen variations within and between homes and household characteristics floor level, window condensation, visible damp or mould), ventilation (e.g. presence of double glazing, extractor fans, airing habits),	▪ 25% of living room floor and mattress, and over 30% of bedroom floor samples had Der p 1 concentrations greater than 10 microg/g. ▪ Household characteristics associated with Der p 1 concentrations in both living room and bedroom were floor level, extractor fan in the kitchen, and age of carpet ▪ Living room Der p 1 concentrations were also associated with gas oven/hob, window condensation, open fires, vacuum cleaner type, smokers in the house and age of	▪ Information on indoor environment was obtained from 158 adults aged 20-44. ▪ Dust samples were collected from their living room floor, bedroom floor and mattress. ▪ Concentrations of Der p 1, the major allergen from the house dust mite Dermatophagoides pteronyssinus, were

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		house. ▪ Bedroom Der p 1 concentrations were also associated with use of blankets and wash temperature of bedding. ▪ Mattress Der p 1 concentrations were associated with window condensation, concrete bedroom floor and age of mattress.	measured by monoclonal antibody immunoassay. ▪
135	Effects of changing residential characteristics on allergen and fungal levels.	▪ found that the floor Der p 1 levels decreased from 1996 to 1998 in the homes of participants who moved to an attached home, moved their bedrooms to the first floor, removed fitted carpet or central heating. ▪ mattresses greater than 5 years old resulted in an increase in bed Der p 1 levels ▪ occasional vacuuming may be a simple alternative to mattress encasement for people with house dust mite allergy ▪ Replacing or vacuuming the mattress more than twice per year reduced levels of Der p 1 in the bed. ▪ Ergosterol levels were reduced by removing visible mould and fitted carpet. ▪ suggested that attached dwellings or multifamily buildings are better ventilated, due to higher air exchange rates, than freestanding homes and therefore drier and less humid ▪ previous research suggests that stumps and wooden flooring expose the indoor environment directly to underground moisture, while a concrete slab floor generally has a layer of plastic insulation between the slab and the ground, providing some protection. ▪ importance of ground moisture is further highlighted by the finding of a substantial increase in Der p 1 levels in houses when the subject's bedroom moved to the ground floor and conversely a decrease when it moved to the first floor	▪ Subjects participants in the European Community Respiratory Health Survey (ECRHS) in Melbourne. ▪ In 1996, 485 subjects participated in a follow-up study, which involved both home and laboratory visits. ▪ Dust and air samples were collected from participants' bedrooms and a validated residential questionnaire was administered. In 1998, 360 participants underwent further follow-up. ▪ House dust mite (Der p 1) and cat allergens (Fel d 1) and ergosterol were measured in dust. ▪ first study of investigating longitudinal changes in residential characteristics as predictors of longitudinal changes in both allergen and fungal levels

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48	▪ Bedroom dust ▪ Asthma	▪ Of the children, 36.8 percent were allergic to cockroach allergen, 34.9 percent to dust-mite allergen, and 22.7 percent to cat allergen. ▪ Among the children's bedrooms, 50.2 percent had high levels of cockroach allergen in dust, 9.7 percent had high levels of dust-mite allergen, and 12.6 percent had high levels of cat allergen ▪ found that children who were both allergic to cockroach allergen and exposed to high levels of this allergen had 0.37 hospitalization a year, as compared with 0.11 for the other children ▪ had significantly more days of wheezing, missed school days, and nights with lost sleep, and their parents or other care givers were awakened during the night and changed their daytime plans because of the child's asthma significantly more frequently.	▪ asthma-related health problems amongst children in inner-city areas -allergen in bedroom dust ▪ 476 children with asthma (age, four to nine years) from eight inner-city areas in the United States. ▪ Immediate hypersensitivity to cockroach, house-dust-mite, and cat allergens was measured by skin testing..
49	Prevalence of mouse sensitivity and its relationship to mouse allergen exposure and disease activity in inner-city children with asthma	▪ Children whose homes had mouse allergen levels above the median (1.60 microg/g) in the kitchen had a significantly higher rate of mouse sensitisation ▪ The relationship among mouse allergen exposure, sensitisation, and any measures of asthma morbidity was not statistically significant. ▪ Mouse allergen may be an important indoor allergen in inner-city children with asthma, with exposure and contributing to mouse sensitisation	▪ A subset of 499 subjects from the National Cooperative Inner-City Asthma Study had dust samples adequate for mouse allergen analysis, as well as valid puncture skin test (PST) results. ▪ Data were analyzed to relate mouse allergen exposure and other risk factors to mouse sensitisation and asthma morbidity

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126	PVC materials (plasticized polyvinyl chloride) Bronchial obstruction in young children	▪ children with bronchial obstruction were more likely to have PVC flooring and textile wall materials in their homes than were children without bronchial obstruction. ▪ Evaluated that the plasticizers used in PVC materials as a potential cause of bronchial obstruction and found that the risk of bronchial obstruction increased in relation to the amount of plasticizer-emitting materials in the home. ▪ This study provides new evidence of the role of PVC and textile wall materials in the development of bronchial obstruction in young children	▪ The study was a matched pair case-control study based on a cohort of 3754 newborns in Oslo in 1992 and 1993 who were followed up for 2 years. The case group consisted of 251 children with bronchial obstruction; the control group was matched one-to-one for date of birth. ▪ Plasticized polyvinyl chloride (PVC) materials are presently among the most frequently used wall and floor covering materials in homes because they provide inexpensive, easy-to-clean surfaces that are especially practical in kitchens, bathrooms, and children's playrooms and bedrooms. ▪ PVC materials are potential emission sources of chemicals used as plasticizers, viscosity modifiers, and stabilizers, and these emissions are usually long-lasting ▪ The home environment has changed considerably during the past 3 decades because of rapid change in building technology, as well as in the type of materials used in interior decoration, furniture, and textiles. Some of the new surface materials are potential emitters of chemical compounds and particulates with allergenic properties. Little is known about whether exposure to these indoor air pollutants in the home environment contributes to bronchial obstruction and asthma.
136	Indoor air Association between the respiratory health of young children and home dampness and moulds	▪ Moulds were reported in 32.4%, flooding in 24.1%, and moisture in 14.1% of the homes. ▪ Prevalence of all respiratory symptoms were consistently higher in homes with reported moulds or dampness	A total of 17,962 parents or guardians of schoolchildren received a questionnaire, and 14,948 (83.2%) questionnaires were returned

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137	Review article of dampness in buildings and health Reviews studies of: 1) self-reported dampness and self reported health 2) self reported dampness and clinical examination 3) objective signs of dampness and self-reported health effects 4) objective signs of dampness and clinical examinations of health effects.	▪ Review shows that dampness in buildings increases the risk for health effects in airways –coughs and lesser extent asthma. ▪ Association between dampness and symptoms such as headaches, tiredness and airway infections. ▪ Concludes that the evidence for a causal association between dampness and health effects is strong. ▪ There is no indication that living in a damp building improves health! ▪ Dampness is sometimes associated with mite growth that influences mite sensitisation and allergic disease. ▪ Airborne moulds and bacteria have been shown to increase the risk for symptoms. ▪ BUT the authors suggest that it is not known which humidity related agents in indoor air cause health effects.	▪ Conducted literature search of 590 peer reviewed articles ▪ 477 articles were excluded as they were reviews, case studies, studies of occupational exposure or studies on mites. Of the 113 reviewed 52 were removed as they were deemed to be non-informative or inconclusive
138	▪ Household formaldehyde	▪ median indoor formaldehyde level was 15.8 microg/ m3(12.6ppb), with a maximum of 139 microg/m3 (111 ppb). ▪ Severe allergic sensitization was demonstrated with increasing formaldehyde exposure. ▪ **BUT**, no significant increase in the adjusted risk of asthma or respiratory symptoms with formaldehyde exposure. However, among children suffering from respiratory symptoms, more frequent symptoms were noted in those exposed to higher formaldehyde levels. ▪ Low-level exposure to indoor formaldehyde may increase the risk of allergic sensitization to common aeroallergens in children.	▪ 148 children 7-14 years of age were included in the study, 53 of whom were asthmatic. Formaldehyde measures on four occasions between March 1994 and February 1995 with passive samplesrespiratory questionnaire was completed, and skin prick tests were performed
139	▪ domestic levels of formaldehyde	▪ no effect of formaldehyde levels measured in homes on spirometric variables. ▪ eNO levels were significantly elevated in children living in homes with average formaldehyde levels $\geqslant$ 50 ppb. ▪ Exhaled NO levels (geometric mean) were 15.5 ppb (95% CI: 10.5 to 22.9 ppb) for children from homes with formaldehyde concentrations $\geqslant$ 50 ppb compared with 8.7 ppb (7.9 to 9.6) for children from homes with formaldehyde concentrations < 50 ppb ($p < 0.05$). ▪ results suggest that exposure to formaldehyde in homes may invoke a subclinical inflammatory response in the airways of healthy children.	▪ measured exhaled nitric oxide (eNO) in 224 healthy children 6 to 13 yr of age (116 girls) and monitored formaldehyde levels in their homes. ▪ Formaldehyde was monitored using a passive sampling technique. ▪ Exhaled NO was measured directly into a fast response chemiluminescence nitric oxide analyzer. The children undertook a lung function (spirometry) test

REF	ASPECT OF HOUSING AND HEALTH	IMPACTS –HEALTH/SOCIAL	STUDY DESIGN
140	▪ asthma and emissions from newly painted indoor surface	▪ asthma prevalence increased among subjects with domestic exposure to newly painted surfaces , particularly newly painted wood and kitchen painting ▪ Blood eosinophil concentrations were significantly elevated among subjects living in newly painted dwellings. ▪ significantly increased prevalence of symptoms related to asthma, but not BHR, was observed in relation to workplace expo- sure to newly painted surfaces. The indoor concentration of aliphatic compounds (C_8-C_{11}), butanols, and 2,2,4-trimethyl 1,3-pentanediol diisobutyrate (TXIB) was significantly elevated in newly painted dwellings. ▪ total indoor VOC was about 100rwg/m^3 higher in dwellings painted in the last year. ▪ significant increase in formaldehyde concentration was observed in dwellings with newly painted wood details. ▪ results indicate that exposure to chemical emissions from indoor paint is related to asthma, and that some VOCs may cause inflammatory reactions in the airways. ▪ To improve asthma management, and to counteract the increasing frequency of asthma, the significance of the indoor environment should not be neglected. ▪ study suggests that the contri- bution of emissions from paint to indoor concentrations of formaldehyde and VOCs should be as low as possible.	▪ study is part of the worldwide European Community Respiratory Health Survey, possible relations between asthma and emissions from newly painted indoor surfaces. ▪ 562 participants answered a self-administered questionnaire, on symptoms and indoor exposures, including indoor painting, during the last 12 months. ▪ underwent a structured interview, spirometry, peak flow measurements at home (PEF), methacholine provocation test for bronchial hyper-responsiveness (BHR), and skin prick tests. In addition, serum concentration of eosinophilic cationic protein (S-ECP), blood eosinophil count (B-EOS), and total immunoglobulin E (S-IgE) were measured. ▪ Current asthma defined as a combination of BHR and at least one asthma-related symptom (wheezing and attacks of breathlessness

REF	ASPECT OF HOUSING AND HEALTH	IMPACTS –HEALTH/SOCIAL	STUDY DESIGN
141	▪ indoor exposure to volatile organic compounds (VOCs), including formaldehyde and respiratory health	▪ risk of wheezing illness was significantly increased only in relation to damp and was unrelated to the other exposures measured. ▪ Among cases, formaldehyde and damp were associated with more frequent nocturnal symptoms ▪ no effect of total volatile organic compounds, nitrogen dioxide, or cotinine. ▪ Domestic volatile organic compounds are not a major determinant of risk or severity of childhood wheezing illness, though formaldehyde may increase symptom severity. ▪ Indoor damp increases both the risk and severity of childhood wheezing illness.	▪ Total volatile organic compounds, formaldehyde, nitrogen dioxide, damp (on a four category scale of % wood moisture equivalent), and environmental tobacco smoke (from salivary cotinine) were measured objectively in the homes of 193 children with persistent wheezing illness and 223 controls aged 9-11 years in Nottingham, UK.
142	▪ indoor fungi and asthma	▪ Significant seasonal variations were observed in viable airborne fungi, ergosterol levels in the floor dust and PFV. ▪ PFV correlated significantly with symptom scores and the dose of reliever medication. ▪ PFV significantly associated with smoking and visible mould. ▪ association between visible mould and PFV was independent of season, smoking and the dose of reliever medication. ▪ no association between total fungi, specific fungi or ergosterol and PFV. Der p 1 levels had no significant influence on asthma, even in HDM-sensitized individuals.	▪ Thirty-five young adults with current asthma and sensitization to fungi visited four times over 1 year. ▪ At each visit a questionnaire was administered and samples of dust and air were collected. ▪ Participants also recorded information on symptoms, peak expiratory flows (PEF) and medication use. ▪ Dust samples were analysed for house dust mite allergen (Der p 1) and total fungal biomass (ergosterol). ▪ Seasonal variation in allergen levels and significant independent effects of fungal levels on peak flow variability (PFV) were identified by repeated measures analysis of variance. ▪

REF	ASPECT OF HOUSING AND HEALTH	IMPACTS –HEALTH/SOCIAL	STUDY DESIGN
143	▪ house moves and certain housing conditions as risk factors for the development of childhood asthma.	▪ There was a non-significant association between early house moves and the subsequent development of asthma. ▪ No association found with heating methods, except for ducted-air heating which, because of the small numbers involved could have occurred by chance. ▪ None of the other factors studied affecting indoor air showed an association ▪ Heating methods or other factors likely to affect the indoor air quality in early life were not useful predictors of subsequent asthma in children.	▪ case-control study of asthmatic and non-atopic children aged 4-16 years. ▪ One hundred children with confirmed asthma in a group general practice of 11000 patients in Plymouth, U.K. ▪ Main outcome measures: House moves and main heating methods, prior to the age of onset of asthma in cases and controls.
134	▪ asthmatics ▪ house dust mites and exposed to mite allergen in their mattresses ▪ Use of protective mattress covers.	▪ Der p 1 concentrations in the active and placebo groups at the end of the trial were not significantly different. ▪ No effect on peak flow or asthma symptoms in a simple comparison of the treatment and placebo groups. ▪ In this group of patients, mite allergen avoidance in the bed by the use of allergen-impermeable bedding alone cannot be recommended as an effective way of relieving asthma symptoms.	▪ Patients were randomized into a placebo-controlled trial of the use of allergen-impermeable bed covers for 12 months, without any other form of mite-reduction measures. ▪ Asthmatic adults were selected from general practices and asthma clinics in south-east London. ▪ Serum IgE to mite allergens and allergen content of mattress dust samples were measured. ▪ Those with >0.70 kU/L mite-specific IgE and >2 microg/g Der p 1 were randomized into active or placebo treatments. ▪ Information collected on allergic symptoms and medication use and quarterly peak flow diaries were kept throughout the trial. ▪ Dog or cat allergic patients were excluded if they had a pet at home to which they were sensitized.

REF	ASPECT OF HOUSING AND HEALTH	IMPACTS –HEALTH/SOCIAL	STUDY DESIGN
144	▪ -impermeable bed covers	▪ The concentration of Der p1 in mattress dust was significantly lower in the active-intervention group at 6 months but not at 12 months ▪ Mean morning peak expiratory flow rate improved significantly in both groups ▪ BUT after 6 months there was no significant difference between the groups in the peak expiratory flow rate. ▪ Allergen-impermeable covers, as a single intervention for the avoidance of exposure to dust-mite allergen, seem clinically ineffective in adults with asthma	▪ double-blind, randomized, placebo-controlled study of allergen-impermeable bed covers involving 1122 adults with asthma. ▪ Main outcomes -mean morning peak expiratory flow rate over a four-week period during the run-in phase and at six months and the proportion of patients who discontinued inhaled corticosteroid therapy as part of a phased-reduction program during months 7 through 12. Der p1 was measured in mattress dust in a 10 percent random subsample of homes at entry and at 6 and 12 months

PROPERTY: Tables showing the of evidence the impact on health of improvements to the material condition of the dwelling

REF	ASPECT OF HOUSING ASPECT OF HEALTH	IMPACTS –HEALTH / SOCIAL	STUDY DESIGN
145	▪ housing tenure and type	▪ study found that mutual residence by itself does not bring people together ▪ however … presence of home owners helps to alleviate the stigma associated with residence in a deprived estate … at micro level a small spatial distance between houses of different tenure is a factor in encouraging casual contact ▪ home owners can make a contribution to transforming deprived communities ▪ change may be slow and outcomes uncertain depending on the spatial and social contexts in which such policies are operationalised ▪ introduction of owner-occupation makes little difference to renters social networks	▪ measure the potential of owner-occupiers to influence social networks, and thus social inclusion, among housing estate residents ▪ sampling criteria: renters and owners should be living on the same streets and not physically separated by main roads, open spaces or other barriers ▪ residents completed diaries which described their movement outside their homes for a period of seven consecutive days ▪ thirty-eight households (27 owners and 11 renters, 49 individuals in total) on three Scottish estates … tenants and owner-occupiers ▪ in-depth interviews to supplement the diaries

REF	ASPECT OF HOUSING ASPECT OF HEALTH	IMPACTS –HEALTH / SOCIAL	STUDY DESIGN
58	Rehousing psychosocial health ▪ Nottingham Health Profile	health problems were not solved immediately by being rehoused: the following problems continued ▪ self-reported … chest-related, breathing problems, gastric problems ▪ injuries ▪ psychosocial health	▪ Tower Hamlets (London) ▪ 47 Bangladeshi & 26 Somali women and men giving access to … ▪ 73 recently re-housed families and 390 people ▪ two questionnaires administered three and twelve months after resettlement questionnaire sent to GPs ▪ the properties the families moved from, and into, were in a poor state of structural repair especially in PLA[ϕ] ▪ 72% faced financial difficulties in moving to new home – 57% needed a loan ▪ high levels of household mobility ▪ racism "… continuum of poor housing, repeated enforced mobility, and thus worsening health … continue[s] unless there is effective intervention at some stage in the process ▪ 40% reported that the most useful help at resettlement would be financial assistance in moving, furnishing and decorating new home ▪ delays in assessment and receipt of housing benefit and difficulties in applying for and receiving benefits to which they are entitled ▪ detrimental effect on children's schooling (45% of households had children who had missed periods of schooling due to homelessness) detrimental effect on access to primary care and for children reduced access to developmental, medical and dental checks

[ϕ] PLA: private leased accommodation

REF	ASPECT OF HOUSING ASPECT OF HEALTH	IMPACTS –HEALTH / SOCIAL	STUDY DESIGN
146	installation of heating system	elimination of dampness and mould prevented a further deterioration rather than bringing about an improvement ▪ general deterioration in all children's symptomatic health over the year ▪ symptoms associated with mould/dampness decreased or stayed the same in households with new heating but showed a marked increase in households which had had no improvement (McNemar test $p<0.05$) ▪ households with the new scheme reported increase in aches and pains, sore throat, persistent cough, tiredness and temper tantrums ▪ improvements in housing conditions may increase resistance to illness but may be insufficient to produce health gain ▪ isolated improvements to housing are insufficient to ameliorate symptoms in areas of multiple disadvantage	▪ interviews conducted in residents homes prior to installation of heating system (time 1), approximately 6 months later (time 2) and approximately 12 months after first interview (time 3) ▪ Examined ▪ wheezing ▪ sore throat. persistent cough ▪ runny nose ▪ headaches ▪ poor appetite ▪ tiredness ▪ aches and pains ▪ diarrhoea ▪ vomiting ▪ fever/high temperature ▪ temper tantrums ▪ irritability ▪ earache ▪ feeling down ▪ longitudinal study to evaluate the effects of an improved heating system on the symptoms of children living in a peripheral housing estate ▪ cohort of 251 children from an original sample of 977 households
147	Refurbishment housing renewa psycho-social health	the population living in Holly Street before the renewal was different to that after the renewal. The new population reported ▪ improved psychosocial health ▪ less fear of crime less damp	▪ unpublished study before and after refurbishment of estate ▪ this study is not a longitudinal study of the same population … the people who were moved out were not followed up … thus before and after comparisons do not show individual health impact
148	▪ Examines changes in environmental housing quality. ▪ Self rated health	▪ An improvement in perceived environmental housing quality was conducive to an increase in the wellbeing of movers ▪ Gain in self-rated health was strongly predicted by an improved satisfaction with indicators related to: ▪ environmental housing quality measured as location of building ▪ perceived air quality ▪ to the apartment itself –its suitability ▪ relationship with neighbours ▪ Noise from neighbours	▪ Cross sectional telephone survey. ▪ Random sample of 3870 aged between 18-70 in North Western region of Switzerland. ▪ Measured associations between changes in satisfaction with 40 housing quality indicators and improvement in self rated health

REF	ASPECT OF HOUSING ASPECT OF HEALTH	IMPACTS –HEALTH / SOCIAL	STUDY DESIGN
149	Housing refurbishment ▪ Improvements of ventilation, insulation, draught proofing and heating control ▪ Self rated health ▪ SF36 questionnaire	▪ Significant improvements occurred in the environmental conditions in all the dwellings. ▪ The National Home Energy Rating (NHER) increased by an average of 2.1 on a 10 point scale. Energy efficiency improved ▪ Number of houses suffering from fuel poverty reduced ▪ Perceived health of occupants as measured by the SF36 improved by average of 10% ▪ The effectiveness of the lungs of four asthmatics tested improved by an average of 20% on peak flow readings. Substantial reduction in the number of dust mites collected in living rooms and bedrooms Installation of ▪ Low energy lights ▪ Cavity wall insulation ▪ Loft hatch modification ▪ Kitchen fan ▪ Bathroom fan ¾ MVHR (Mechanical Ventilation with heat recovery) ▪ installing central heating alone can lead to other problems if the occupants cannot afford to the house to adequate internal temperatures. It may actually increase dust mite growth	▪ Intervention study of seven dwellings in Nottingham. ▪ Budget for each house: £8500 ▪ Alterations were made to the temperature, relative humidity, health, dust mite numbers, ventilation and insulation ▪ Improvements were measured before their introduction and one year later ▪ Data based on the Nottingham Energy, Health and Housing study (91)

REF	ASPECT OF HOUSING ASPECT OF HEALTH	IMPACTS –HEALTH / SOCIAL	STUDY DESIGN
150	housing renewal personal control over the process of renewal housing renewal ▪ replacing doors and windows ▪ rewiring ▪ remodelling the kitchen and bathroom ▪ complete redecoration ▪ install or replace central heating	▪ stress related health problems which were talked about in qualitative interviews in some cases the process of housing renewal was stressful and damaging to health while in others it was enjoyable and rewarding the following outcomes were reported ▪ stress related conditions ... aggravation of psoriasis ... tension in inter-family relationships ... nervousness ... weight loss also positive outcomes *eg* ... happiness ... excitement ▪ people who were able to establish perceived control over what was happening had a more positive experience ▪ also depended on how much control the individual wanted and, crucially, its negotiability opportunity to effect a change in one aspect of life, such as the home environment means that it can be seen as possible in another through raised self-esteem and confidence ▪ personal control over the process of housing renewal was very important ▪ different from the generally accepted passive role of the tenant ▪ there is a potential for conflict if tenants have greater control ... home improvement may be harder to manage and to administer ... capital programmes may be more difficult to plan ▪ nature of the tenant/landlord relationship in the social rented sector is very important ways to maximise benefits of housing renewal for tenants ... offer choice of contractor from an approved list ... encourage direct relationship with those carrying out the work ... involve tenants in the details of the renewal ... consider whether or not the work has to be carried out during the tenancy or why it must be done at a particular time … especially important for elderly residents	▪ local authority peripheral estate which was undergoing renewal through Estate Action ▪ focus on one phase where 110 homes were about to undergo refurbishment with, in some cases, the residents remaining in their home ▪ survey of more than half involved - before and after – gave descriptive information ▪ main focus on in-depth interviews creating interpretative biographies with 16 of survey respondents

REF	ASPECT OF HOUSING ASPECT OF HEALTH	IMPACTS –HEALTH / SOCIAL	STUDY DESIGN
151	▪ Renovation and repair ▪ Lead poisoning as measured by elevated blood lead levels (BLLs)	▪ Risk for excess lead exposure is increased by home renovation/repair involving – interior paint preparation or reported dispersal of dust	Case control study: ▪ 106 case children whose homes had under gone repair over the last 6 months ▪ 159 control children ▪ Study area: New York City
152	▪ Refurbishment ▪ community regeneration ▪ Mental health measured using the Hospital Anxiety and Depression Scale (HADS) ▪ Self-esteem – Rosenberg	▪ Reduced anxiety and depression after one year ▪ Self-esteem rose slightly ▪ Greater participation in residents association meetings and improved neighbourliness	▪ Cross sectional and prospective data. ▪ Interviewed 55 residents before and one year after regeneration
153	▪ Refurbishment, ▪ Neighbourhood renewal, security and safety improvements ▪ Self-reported health, mental health and respiratory conditions	▪ Adult ratings of general health status decreased. ▪ chronic respiratory conditions increased ▪ Self reported mental health problems decreased as well as trouble with nerves. ▪ The longitudinal and cross sectional evidence point to the physical improvements in the area having independent beneficial effects on mental health. ▪ Smoking rates decreased ▪ The effect of physical improvements may have improved social support. There is evidence that housing estate improvements may lead to more sociable and civil neighbourhoods (95) ▪ Improved adult mental health but may be due to perception of the area as safe	▪ Prospective uncontrolled study in Newcastle ▪ Interviews with 488/791 households before and after (5 years) intervention ▪ 98 households re-interviewed 5 years afterwards.
154	▪ Rehousing ▪ Housing improvements ▪ Prospective uncontrolled study ▪ Interviewed residents before and 1-4 years afterwards ▪ Sample size: 70 individuals	▪ Illness episodes increased by 56% (flu epidemic made a large contribution) ▪ Reductions in aches and pains, asthmatic and bronchia symptoms, stress and depression. ▪ Reduction in health service use: GP, and prescriptions ▪ Increased feelings of safety, sense of community. ▪ Significant reductions in concerns about criminal activity and behaviour of youths	▪ Self reported illness episodes Use of health services and prescriptions
155	▪ Rehousing ▪ Psychological wellbeing – measured using the Psychiatric Epidemiological Research Instrument (PERI)	▪ Reduced psychological distress at first follow up. ▪ After 3 years psychological health scores significantly different from pre intervention average but not post move.	▪ Prospective uncontrolled study ▪ Interviews with 23 women before, 5 months, 2 years and 3 years after

REF	ASPECT OF HOUSING ASPECT OF HEALTH	IMPACTS –HEALTH / SOCIAL	STUDY DESIGN
38	▪ Central heating installation ▪ Asthma amongst children ▪ Days off school	▪ Respiratory symptoms reduced. ▪ School aged children had less days off ▪ Demonstrable improvement in houses and indoor environment ▪ No general health gain attributable to housing improvement ▪ No change in prevalence of risk factors ▪ Asthma prevalence reduced, but severity unchanged ▪ Self-reported asthma prevalence in those aged under 18 years declined from 24% at baseline to 14% at the end of the study. Frequency of asthma symptoms reported in the month before each survey also reduced. ▪ The difference between those living in improved and unimproved houses at the end of the first year was not significant. ▪ Severity, as estimated by BTS asthma steps, remained unchanged in those continuing to report asthma. The study demonstrates the feasibility of evaluating the health effects of housing improvements. ▪ Bedroom and living room temperatures improved after renovation (central heating and insulation), but only bedroom temperatures showed a significant difference between improved and unimproved houses at the end of the first year	▪ Prospective study in Cornwall UK with control group. ▪ Watcombe Housing Project –Torbay – **CONTINUING IMPACT ASSESSMENT** ▪ Measurements taken before intervention and three months afterwards amongst 72 children ▪ Torbay Council agreed to improve the houses over a two year period. ▪ Of the 142 houses on the estate, 119 agreed to randomisation, which was carried out at a public meeting; 50 houses were selected for improvement in the first year. ▪ Measurements of the indoor environment, general and respiratory health were taken at baseline and annually for the next two years in all houses and for all occupants. ▪ At baseline, there were 480 people living in 119 houses. The population profile was young, with 58% aged 20 and under and 10% aged 50 and over.

REF	ASPECT OF HOUSING ASPECT OF HEALTH	IMPACTS –HEALTH / SOCIAL	STUDY DESIGN
156	▪ Improvements to the energy efficiency of tower blocks ▪ Included replacement of underfloor electric heating system ▪ Improved thermal insulation –each tower block was encased in mineral wool insulation material with an outer skin of rainscreen cladding ▪ Measures were designed to increase the dew point values so that condensation would not develop ▪ Health status measured using the SF36	▪ Residents of the improved housing had higher SF36 scores (more healthy) on 2 of 2 of the 8 dimensions –physical role and energy and vitality ▪ No significant differences were reported on physical functioning, emotional role, social function, mental health, pain or general perception	▪ Retrospective study of residents after housing renewal (135/140) with control group
157	▪ Window replacement ▪ Self reported health	▪ Symptoms such as joint pains, headaches, neck and back pain significantly reduced	
158	▪ housing conditions improved –new beds and major refurbishment ▪ Reports of need for home and hospital care ▪ Change in daily activities	▪ 34% became more active after improvements ▪ Workloads of carers declined and respondents reported increases in activity levels ▪ Decreased need for home care associated with less risk of hospitalisation ▪ Alterations to building entrances and walkways were associated with improvements in daily activities	▪ Retrospective study of 375 residents conducted 6-24 months after intervention in Tokyo, Japan ▪ No control group
159	▪ Rehousing ▪ area based regeneration ▪ self reported health service usage ▪ Experiences of fear of crime and violence	▪ Retrospective cross sectional study of 160 households 6-12 months after intervention	▪ Reported decreased GP visits. Frequent users reduced ▪ Significant reductions in fear of crime, feelings isolation. ▪ Increased participation in local community

REF	ASPECT OF HOUSING ASPECT OF HEALTH	IMPACTS –HEALTH / SOCIAL	STUDY DESIGN
160	medical priority rehousing self-reported health ▪ mental illness ▪ depression ▪ learning difficulties, ▪ metabolic disorders, skin diseases and ▪ diseases of the intestine, kidney, liver and bladder	▪ rehousing can precipitate mental illness ▪ mental illness and depression are the two conditions most likely to have undergone a change … over 2/3 of people experiencing these conditions reported a change and the majority reported an improvement (no measures of significance given) ▪ respondents felt that relocation had least effect on learning difficulties, metabolic disorders, skin diseases and diseases of the intestine, kidney, liver and bladder ▪ rehousing can improve health and welfare ▪ also possible that staying put can be as bad for health as moving ▪ psychological distress associated with residential change especially where prompted by reasons beyond the mover's control … ▪ movers were allowed choice over location of new property and were able to secure better access to close relatives for their social support network	
161	▪ Medical priority rehousing	▪ Amongst the rehoused there was a reduction in anxiety and depression	▪ Prospective observational study with control group in Salford, UK. ▪ Interviewed 28 individuals before, 6-8 weeks and 52 weeks after intervention

REF	ASPECT OF HOUSING ASPECT OF HEALTH	IMPACTS –HEALTH / SOCIAL	STUDY DESIGN
155	▪ Housing quality & relocation ▪ Cognitive functioning	▪ Children who experienced the most marked improvement in natural features or restorative characteristics of their home tended to have more ability to direct their attention ▪ Exposure to the natural environment directly or through a window is cognitively, psychologically and physically beneficial Possible explanation provided by Kaplan and Kaplan (110) who suggest 4 elements needed for recovery of direct attentional fatigue and restoration of attentional capacity ▪ 1) *Fascination*-present in environments that draw attention effortlessly. Allows the neural inhibitory mechanism to rest ▪ 2) *Being away*-experience of taking a short holiday from daily hassles –gazing out of the window or walk in woods ▪ 3) *Extent*-depth or scope of the experience ▪ 4) *Compatibility*-the 'fit' between the environment and the individuals' purposes	▪ Housing quality in terms of nature surrounding it –naturalness and relocation to a 'greener' environment ▪ 17 children of low income families of a self help housing programme ▪ Families given help to construct and purchase new home ▪ Longitudinal design –housing quality and cognitive functioning measured premove and postmove ▪ Naturalness measured using an objective housing scale measure developed by Evans *et al* (108) ▪ Cognitive functioning measured using the Attention Deficit Disorders Evaluation Scale (ADDES) (109) ▪ In general, research has found that children who live in high rise housing tend to exhibit more behavioural problems, restricted play and poorer physical health than children living in low rise or single family housing (111,112)
162	Housing quality in terms of ▪ Structural quality ▪ Privacy ▪ Indoor climatic conditions ▪ Hazards - stairs ▪ Cleanliness and clutter ▪ Neighbourhood quality in terms of incivilities such as vandalism ▪ Psychological distress	○ In the cross sectional comparison of low and middle income white rural inhabitants they found better quality housing was related to lower psychological distress ○ In the longitudinal study low income African American and white women residing in urban areas were assessed before and after moving to better quality housing ○ Result: changes in housing quality predicted post location psychological distress scores, i.e., improved/worsening in degree of housing quality contributed to either an increase/decrease in mental health depending upon whether there was an improvement or worsening in terms of housing quality.. ○ **Possible mechanism:** individuals chronically exposed to residential crowding and noise tend to suffer from strained interpersonal relationships, diminished motivation and loss of control.	▪ Cross sectional rural sample of 207 women with at least one child at home ▪ Low to middle income families ▪ Longitudinal urban sample of 31 predominately African American women who were relocated into a residence financed with the Habitat for Humanity ▪ Psychological distress was measured using the Demoralization Index of the Psychiatric Epidemiology Research Instrument (PERI) (113)

REF	ASPECT OF HOUSING ASPECT OF HEALTH	IMPACTS –HEALTH / SOCIAL	STUDY DESIGN
163	▪ Housing tenure ▪ Housing stressors: overcrowding, dampness, hazards, problems with heating the home ▪ Local neighbourhood environment (amenities, crime, neighbourliness, area reputation and satisfaction)	▪ Found that housing stressors independently predicted limiting long standing illness ▪ Area assessment and housing type independently contributed to anxiety ▪ Housing stressors, housing type (public rented sector) and area assessment contributed to depression Possible mechanisms ▪ environment, presence of damp and mould may lead to depression through worries about health of household members and embarrassment or shame of the conditions in which they live. ▪ Public rented sector tenants report higher levels of incivilities such as vandalism, loitering youths, litter and graffiti which have been linked to the fear of crime and the promotion of anxiety ▪ Low income is associated with housing stressors and may make it more difficult for individuals to deal with them.	▪ General self-rated health ▪ Anxiety and depression (HAD Scale) ▪ Data is from the West of Scotland Twenty-07 Survey: Health in the Community ▪ It is a longitudinal study exploring the processes producing social patterning in health by social class, gender, age, area of residence, marital status and ethnicity ▪ Anxiety and depression measured using the Hospital Anxiety and Depression Scale
164	▪ perceptions of the local environment, neighbourhood quality, cohesion and standard of living ▪ Self-reported health ▪ Mental Health Questionnaire-GHQ-12 ▪ Examines the extent to which residents of socially contrasting neighbourhoods in one city differ in their perceptions of the local environment, neighbourhood quality, cohesion and standard of living in relation to others	▪ Reported neighbourhood problems and perceptions of neighbourhood cohesion were significantly associated with health outcomes especially total number of symptoms reported in the last month and for mental health scores ▪ Incidence of neighbourhood problems was more strongly correlated with health outcomes than perceived neighbourhood cohesion ▪ Psychological sense of community is associated with health outcomes. ▪ Perceived neighbourhood cohesion was highest amongst those who viewed their standard of living as about the same as others and lowest who felt themselves to be better off than their neighbours.	▪ Data is from the West of Scotland Twenty-07 Survey: Health in the Community ▪ Two study areas are: north west city of Glasgow (The West End and Garscadden) middle class area ▪ And south west city (Mosspark and Greater Pollock) deprived area ▪ Neighbourhood problems such as vandalism, litter and rubbish, reputation of the neighbourhood ▪ Neighbourhood cohesion: attraction to neighbourhood, neighbouring and psychological sense of community ▪ Neighbourhoods are arenas in which individuals make social comparisons which can affect their sense of well-being ▪ Length of residence is associated up to 15 years is associated with a stronger sense of neighbouring ▪ Sense of neighbouring is associated with GHQ-12 scores

REF	ASPECT OF HOUSING ASPECT OF HEALTH	IMPACTS –HEALTH / SOCIAL	STUDY DESIGN
56	▪ socio-economic status – tenure and car ownership ▪ Self reported health ▪ how does owning home and a car may promote health?	▪ Eight health measures were significantly associated with housing tenure and car access. ▪ Housing tenure and car access were related to (self-esteem, mastery and ontological security) ▪ home and car ownership were also found to have physical and psychological health promoting benefits. ▪ These included access to amenities protection from such problems as damp and cold housing, noisy or abusive neighbours, and threats to personal safety, the inconvenience and insecurity of public transport. ▪ housing tenure and car access were more strongly associated with health and psycho-social assets among men than women, ▪ housing tenure was more strongly associated with health among single than cohabiting people. ▪ Car access was not a significant predictor of health for women, but was for men. Men with access to more expensive cars had the highest self-esteem and mastery scores, and better health. ▪ research suggests that public renting and public transport, have health-damaging effects through both physical and psycho-social pathways. ▪ Policies that reduce these effects - for example, by improving the physical structure of public housing and the perceived threats to personal safety on public transport - may help to reduce inequalities in health. Possible mechanisms: ▪ authors highlight the role of ontological security - the practical and psycho-social benefits of home ownership and access to cars. ▪ owning a home and a car provide a greater sense of personal security and protection from physical and personal threats, and a sense of doing well in life. ▪ BUT social renting and use of public transport were seen to have some advantages, such as: lower costs and fewer personal responsibilities; BUT the negative features were that they provided poor quality dwellings or erratic and dirty public transport which were seen to be stressful, inconvenient and health damaging.	▪ how relying on public housing and public transport might be health damaging ▪ Postal survey of a representative sample of 2,000 working-age adults in the Central Clydeside ▪ in-depth interviews with a sub-sample of around 80 respondents. ▪ Eight self-reported measures of physical and mental health, including self-rated health, limiting longstanding illness, number of symptoms, depression and anxiety subscales of the Hospital Anxiety and Depression Scale (HADS) and number of General Practice visits in the last 12 months

REF	ASPECT OF HOUSING ASPECT OF HEALTH	IMPACTS –HEALTH / SOCIAL	STUDY DESIGN
	▪	▪	▪
165	▪ Lead paint removal	▪ After the uncontrolled removal of lead-based paint, interior dust lead levels ranged from 390 to 27,600 micro g Pb/ft(2) (on floors and windowsills) and bare soil lead levels ranged from 360 ppm in the yard to 3,900 ppm along the foundation to 130,000 ppm in the child's play area, well above applicable U.S. Department of Housing and Urban Development/U.S. Environmental Protection Agency standards. ▪ Hard costs of decontamination were over $195,000, which exceeds the incremental cost of incorporating lead-safe work practices into repainting. ▪ Case report highlights the need to incorporate lead-safe work practices into routine repainting, remodeling, and other renovation and maintenance jobs that may disturb lead-based paint.	▪ Costs of decontamination after uncontained power sanding was used to remove paint down to bare wood from approximately 3,000 ft(2) of exterior siding on a large, well-maintained 75-year-old house in a middle-income neighborhood
166	▪ Cost-effective interventions that minimize lead-based paint hazards.	▪ cleaning intervention significantly reduced dust lead loadings on floors, windowsills, and window troughs immediately following the work. ▪ BUT reductions did not persist at six months and one year post-intervention. ▪ Six months and one year post-intervention dust lead loadings are not significantly different from the pre-intervention loadings on either bare floors or windowsills. ▪ Window trough lead loadings declined over 50 percent from pre-intervention to one year post-intervention, the loadings rebounded markedly from the geometric mean at clearance of 101 microgram/ft(2) to 5500 microgram/ft(2) at 6 months and 5790 microgram/ft(2) at one-year post-intervention. ▪ Results demonstrate that a single professional cleaning of dust and debris without addressing potential sources of lead dust (such as deteriorated lead-based paint) or repeating the cleaning are unlikely to result in significant and sustained reductions in dust lead loadings.	▪ Professional cleaning of lead-contaminated dust and debris was conducted in 37 housing units with deteriorated lead-based paint and dust lead hazards. ▪ Study units are a subset of a larger cohort of the nearly 3500 housing units enrolled in the Evaluation of the HUD Lead-Based Paint Hazard Control Grant Program. ▪ Dust lead loading measurements were taken prior to cleaning, immediately after cleaning (i.e., clearance), and six months, one, two, and three years post-intervention.

7 PLACE:

The impact of neighbourhood effects on peoples' health

Health and urban development

7.1 The places where people live make a difference to their health. The study of neighbourhood effects on peoples' health is a relatively recent development. There is now broad consensus that living in deprived (urban) neighbourhoods increases the risks of poor health outcomes[167]. Neighbourhood quality has been shown to effect:

- Someone's ability to adopt health promoting behaviours e.g. physical activity [168], smoking prevalence and diet[169];
- Biological indicators of cardiovascular disease risk e.g. body mass index[5] and systolic blood pressure [170];
- major health killers e.g. mortality [171], heart disease incidence and mortality [172] and self-rated health [173].

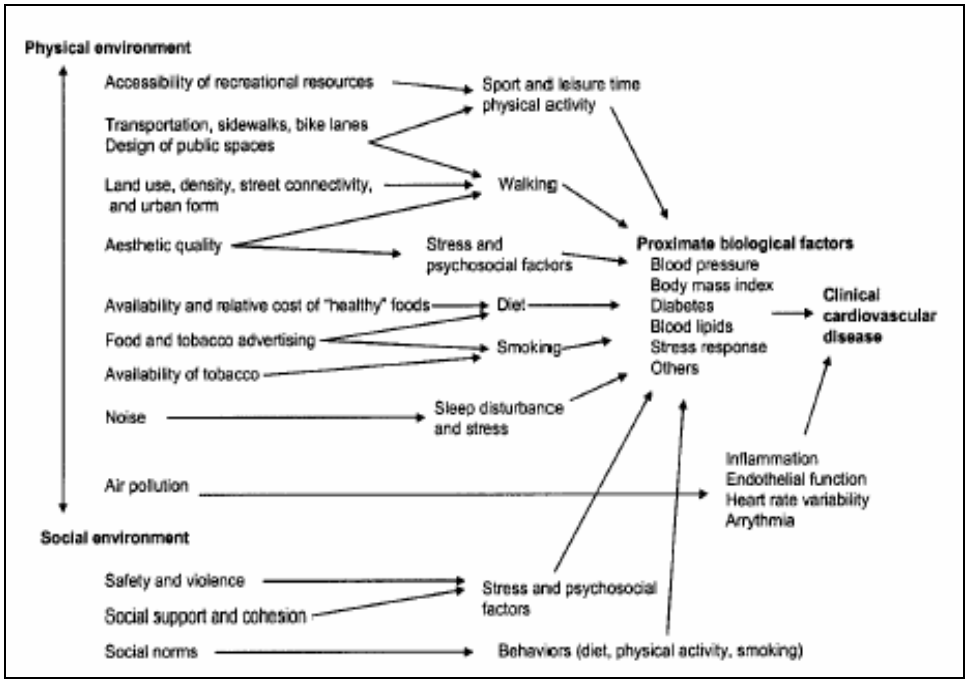
7.2 We have only a limited understanding of what it is about the urban environment and neighbourhoods that leads to different health outcomes[56] .

In order to understand which interventions improve population health it is important to distinguish between different aspects of the urban environment [174]. Broadly speaking there are three aspects that is important to distinguish between:

- the service environment (e.g. access to, and quality of, services and amenities);
- the physical environment (e.g., air quality, traffic levels);
- the social environment (e.g. the quality, content, and volume of interactions between people).

UYSERVICE ENVIRONMENT

Table XX : Link Between Neighbourhood Design and Heart Disease



Source : [175]

7.3 Figure XXX shows the different ways in which the design and quality of the neighbourhood environment are related to levels of cardiovascular risk. This shows how a number of physical and social features of neighbourhoods affect the extent to which people participate in sports and other leisure-time physical activity[175]. From this we can see that these are influenced by:

- the design of public spaces and accessibility of recreational facilities and awareness of these facilities;
- the presence of pavements and bike lanes,
- patterns of street connectivity and access to transportation;
- the aesthetic quality of the area.

7.4 So, the accessibility of facilities, opportunities for activity, and aesthetic qualities of the area are important factors in whether adults take part in physical activity[176]. The proximity of a park or beach, a cycle path, or shops can lead to higher levels of exercise or recreation[177]. Also, awareness of facilities, satisfaction with facilities, and the perception that the area offers opportunities to be physically active encourage greater physical activity [178]. For older people access to local facilities, pleasant scenery and seeing other people exercise is important to whether or not they participate in physical activity [179].

PHYSICAL ENVIRONMENT

7.5 A pedestrian centred approach to design including pavements, street lighting, and planted strips encourage people to walk and cycle and discourage the use of motor vehicles[180]. There is also less travel by car and more non motorised travel (such as walking and cycling) in neighbourhoods characterised by a mix of land uses, high density, and pedestrian-friendly designs[181].

7.6 At the same time, the lack of physical activity amongst poor urban children is associated with their activity levels and their limited access to safe recreation areas in the neighbourhoods they lived in[182]. A perception that the neighbourhood was unsafe or that there were high levels of social disorder were a key factor in there being lower levels of physical activity than in other areas.

7.7 A common way of improving perceptions of safety is the installation of lighting and CCTV cameras. However, lighting, the installation of CCTV and certain architectural designs can increase the fear of crime levels[183]. Precisely targeted increases in street lighting can reduce crime levels. CCTV can be effective in reducing crime and fear of crime[184] but this is mostly property crime, for personal crime, public order offences, and fear of crime the results are more mixed [185]. The majority of people express support for CCTV installation as they think it will make them feel safer. However, respondents in a survey 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.

7.8 Residents living in relatively barren environments are more likely to be aggressive and violent than residents in greener areas [186] [187]. Run down, noisy, high rise living conditions discourage older people from social interaction. Settings which encourage older people to develop social ties with neighbours include features such as access to transport and safe public spaces. The greener a building's surroundings the fewer crimes are reported [188]. However, dense vegetation has been linked to the fear of crime [189].

Social Environment

7.9 A starting point for understanding how the social environment affects health is to distinguish between social processes that are 'bad' for health (pathogenic) versus those that promote health (salutogenic),). There are a number of theories that seek to understand the ways in which community resilience is measured and 'social glue' is strengthened or dissolved. These include social disorganisation, social isolation, behavioural contagion, collective socialization and social capital. For the purposes of this report we will look simply at social capital.

7.10 The concept of social capital broadly refers to 'the resources available to individuals and groups through social connections'[54]. 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.

7.11 In one sense, the concept of social capital is not new[54]. Extensive research in community psychology has identified related constructs such as 'the psychological sense of community' [190], 'neighbouring', as well as 'community competence' [191] [192], which share much in common with the core dimensions of social capital.

7.12 There is no one set of indicators to measure social capital. Most studies have used some combination of measures of trust, perceived reciprocity, and social participation, aggregated to the community (or other group) level. However, *other proxy measures have also been* used, including volunteerism, community attachment, and electoral participation[193].

Box 1 Bonding, bridging and linking social capital

Bonding social capital is characterised by strong bonds within groups (eg ethnic groups) or families etc.

Bridging social capital captures a range of less strong bonds, which are more outward looking between and
across groups, friends or businesses.

Linking social capital recognises the importance of positive connections between those with differing levels
of power or status

Source : [194]

7.13 An important distinction is between the 'bonding', 'bridging', and 'linking' forms of social capital [195].

Box 1 shows how bonding social capital refers 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 those who are unlike each other yet are more or less equal in terms of their status and power' and which help individuals get on [196] [197]. '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'[195]. To date, few studies have attempted to distinguish between the bonding/bridging/linking forms of social capital, mainly due to the difficulty of measuring bridging or linking social capital.

Linking social capital to health

7.14 There are several ways through which social capital may influence individual health outcomes. At the community level social capital may enhance the health of residents through two processes:

i) collective efficacy - the ability of communities to undertake collective action to introduce local smoke-free ordinances, or to lobby against the closure of local clinics;
ii) collective socialisation - informal social control over deviant health behaviours, such as underage smoking and drinking [167] [198].

7.15 Strong attachments to community increase the likelihood that indicators of health problems, like missing a community meeting or leaving milk on the doorstep will receive attention [199]. An example of this is how during the 1995 Chicago heat wave, (during which hundreds of elderly residents died of heatexhaustion) [41]. 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 successful at protecting vulnerable residents against the risk of death.

7.16 Social capital is not always associated with better health outcomes [193] Individuals living in a 'high social capital' context may experience negative impacts [200]. For instance individuals may be constantly called upon to provide social support to members of their bonding networks. Additionally, there may be pressures to conform to certain rules and expectations within a community which do not allow freedom of individual expression. A UK study[201] found that neighbourhoods in which close family bonding ties were predominant tended to be less tolerant of diversity [202]and could blame particular groups for any problems.

7.17 In neighbourhood renewal and regeneration, the 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.

7.18 [203] examined the physical redevelopment of Diggs Town in Norfolk, Virginia USA. This is a public housing project comprising of low-rise moderate density developments which consists of households with low socio-economic status. The area is characterised by high ethnic density and high crime. Physical changes to streetscapes, the quality of the housing stock and the use of 'defensible space' to form boundaries between private and public spaces can reduce any stigma associated with the area, and result in a greater sense of trust, reciprocity and voluntarism.

PLACE: Evidence showing the impact of neighbourhood effects on peoples' health

REF	ASPECT OF ENVIRONMNET ASPECT OF HEALTH	IMPACTS	STUDY DESIGN
204	▪ Fear of crime and the built environment	▪ In both cities they found that it is the social nature of the different places which provokes fear including the reputation of places as dangerous and safe ▪ Women in Edinburgh responded negatively to the idea of designing out fear due to the higher levels of violence in Scotland and the greater familiarity with the idea of designing out fear. ▪ Fear shapes the understanding, perception and use of space and place. ▪ This study found that important life changes such as moving house were likely to have influenced feelings of security	▪ Qualitative study examining women's fear of violent attack in Edinburgh and Helsinki ▪ 389 questionnaires in Edinburgh and Helsinki data were based on 666 households from the Safety of Finns Survey
205	▪ Community violence ▪ Post Traumatic Stress Disorder (PTSD) Measured using the Checklist of Children's Distress Symptoms	▪ Found that exposure to community violence contributed to PTSD symptomatology by creating disturbances within multiple contexts surrounding the child. ▪ Exposure to community violence was related to ▪ decreased child perceptions of neighbourhood safety and increased family conflict ▪ and greater family conflict. ▪ In dangerous environments child rearing practices may become more authoritarian and restrictive altering parent child interactions, disturbing family communication resulting in conflict ▪ Witnessing violence and being victimized are related to PTSD ▪ Exposure to community violence effects child adaptation through its influence on the multiple contexts surrounding the child. It can act as a potentiating factor for disturbances within the child as well as within the family ▪ findings are consistent with models of traumatic stress which argue that when events call basic assumptions about the safety and controllability of everyday life into question feelings of helplessness and hopelessness will emerge	▪ Data were collected from 70 African American children living in and around an inner city public housing development ▪ Participants were 32 males and 38 females aged 10-15 years old ▪ Exposure to community violence (ETV) ▪ children's frequency of knowing of, witnessing or being victimised by community violence ▪ Identifying the mechanisms through which exposure to community violence leads to PTSD symptoms

REF	ASPECT OF ENVIRONMNET ASPECT OF HEALTH	IMPACTS	STUDY DESIGN
206	▪ Neighbourhood disorder ▪ Community stressors: … anti-social behaviour of residents, … perceived threats to self and property, and … community values. ▪ Self-rated health ▪ Psychological distress:	Neighbourhood problem scores were: ... greater in lower- than higher-status socioeconomic neighbourhoods; ... positively associated with individual deprivation; ... negatively correlated with social capital; and ... associated with poor self-rated health, psychological distress and impaired physical functioning	▪ measured using the 12-item General Health Questionnaire (GHQ) {Goldberg D, 1972 69 /id}. ▪ Physical functioning: measured using the Short Form-36 Health Survey (SF-36) ▪ Cross-sectional Questionnaire survey including 10-item neighbourhood problems scale and measures of self-reported health, health behaviours and social capital. ▪ Completed by 419 residents of 18 higher socioeconomic status neighbourhoods and 235 residents of 19 lower socioeconomic neighbourhoods

REF	ASPECT OF ENVIRONMNET ASPECT OF HEALTH	IMPACTS	STUDY DESIGN
[25]	▪ Neighbourhood disorder/ stability (perceived) and psychological distress.	▪ Neighbourhood stability is associated with psychological well-being only in economically advantaged neighbourhoods. ▪ Found residential stability is associated with high levels of distress in high poverty neighbourhoods ▪ Affluent neighbourhoods stability is associated with low levels of distress ▪ Neighbourhood stability is positively associated with the presence of social ties among neighbours in both poor and non poor neighbourhoods. ▪ Stability benefits social integration. ▪ Neighbourhood stability enhances psychological well-being in affluent neighbourhoods but in poor neighbourhoods the opposite is true ▪ Living in a poor, stable neighbourhood is associated with distress partly because these neighbourhoods have high levels of disorder associated with poverty but lack the advantages that stability provides in affluent neighbourhoods for reducing disorder. ▪ In poor neighbourhoods residents live with drug and alcohol use on the streets, teenagers hanging around, abandoned buildings, crime, graffiti and vandalism. ▪ Even though most residents do not suffer victimization they experience it through visible signs and cues that social control is absent. ▪ These stressors take their toll in feelings of distress. ▪ Disorder raises levels of fear and in tandem reduces the perception that the person is in control of their life. Result: feelings of powerlessness to escape the situation ▪ Cohesiveness Perspective: ▪ stability is good for well-being or communities and residents. ▪ Low residential turnover increases social integration, i.e., the likelihood that neighbours will know each other, share values and norms and be able to exercise informal social control. ▪ Mobility increases the chances that neighbours are strangers, reduces the ability of neighbours to form social relationships and impairs the ability of neighbours to work ▪ Researchers find that residential mobility is associated with high levels of crime and victimization ▪ Residential mobility has one of the largest positive effects on violent victimization of any neighbourhood characteristic, larger than poverty or racial composition. ▪ Poverty contributes to criminality only in transient communities characterised by rapid population turnover.	▪ Use data from the 1995 cross-sectional survey of Community, Crime and Health-Illinois-USA ▪ Neighbourhood disorder/stability measured using the Ross-Mirowsky 15-item scale ▪ Depression-measured using a 7-item scale of the Center for Epidemiological Studies Depression Scale (151). ▪ Anxiety-measured by 3 items: (1) worry a lot about little things (2) felt tense or anxious (3) felt restless. ▪ Distress scale is a combination of the depression and anxiety scales. ▪ Neighbourhood disorder refers to visible cues indicating the breakdown of social order as perceived by residents:; ... referred to: ; ... graffti; ... noise; ... vandalism; ... derelict buildings; ... alcohol and drug use in the community; ... people hanging around; ... crime; ... trouble with neighbours; ... cleanliness of the neighbourhood; ... neighbours taking care of houses/flats; ... neighbourhood safety; ... people watching out for each other; ... police presence in the neighbourhood; and ... trust
[207] cited in [208]	▪ Fear of crime and vulnerability	▪ Demonstrates that poor people may feel less safe than others. ▪ Gender was found to be the most significant factor influencing whether people were more likely to feel unsafe. ▪ Old age and poverty were significant for women. ▪ Ability to defend oneself from attack and low income were particularly notable in shaping the experience of feeling unsafe for men. ▪ older people living in circumstances of multiple deprivation were seven times more likely to feel unsafe in comparison to the less deprived older person	▪ Analysis of the 1994 British Crime Survey which involves interviews with 14,500 people aged 16+

REF	ASPECT OF ENVIRONMNET ASPECT OF HEALTH	IMPACTS	STUDY DESIGN
185	▪ Closed circuit television ▪ Examines the fear of crime levels experienced by local residents to Glasgow city centre both before and after installation of CCTV	▪ Found majority support for the CCTV installation. They thought it would make them feel safer. ▪ However, when actual as opposed to prospective feelings of safety are compared over time there was no improvement after installation. ▪ CCTV did not make people feel safer. Respondents 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	▪ Questionnaire survey over three years –1994, 1995 and 1996. ▪ 3074 participants.
209	▪ Neighbourhood disorder and trust.	▪ People who report living in neighbourhoods with high levels of crime, vandalism, graffiti, danger, noise, and drugs are more mistrusting. ▪ The sense of powerlessness, which is common in such neighbourhoods, amplifies the effect of neighborhood disorder on mistrust ▪ Perceived neighborhood disorder where disadvantaged individuals live, influences mistrust directly and indirectly by increasing residents' perceptions of powerlessness which in turn amplify disorder's effect on mistrust.	Community, Crime, and Health data, a 1995 survey of a representative sample of 2,482 Illinois residents with linked data on neighbourhoods
210	▪ Relationship between crime, the environment and Mental fatigue includes: irritability, inattentiveness and decreased control over impulses –each are well established precursors to violence	▪ Examined the crime rate of a large housing development in Chicago ▪ Found that the greener a building's surroundings were the fewer crimes (property and violent) reported. ▪ Perceived neighborhood disorder where disadvantaged individuals live, influences mistrust directly and indirectly by increasing residents' perceptions of powerlessness which in turn amplify disorder's effect on mistrust. ▪ Dense vegetation has been linked to the fear of crime, lower perceived security (160) ▪ View distance is an important factor as vegetation blocks views. ▪ Provides potential cover for criminal activity. ▪ Well maintained vegetation outside a home may serve as a cure to care. ▪ Vegetation may mitigate crime by reducing mental fatigue. ▪ Mental fatigue may lead to increased outbursts of anger and violence. ▪ Mental fatigue symptoms are: irritability, inattentiveness and decreased control over impulses –each are well established precursors to violence	

REF	ASPECT OF ENVIRONMNET ASPECT OF HEALTH	IMPACTS	STUDY DESIGN
211	▪ Links between nature, aggression and violence.	▪ Levels of aggression were compared for 145 urban public housing residents in Chicago. ▪ 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 aggression ▪ Residents living in buildings without trees and grass have reported more procrastination in dealing with their problems. They felt their problems were more severe and less solvable than residents living in greener environments ▪ Findings suggest that public housing environments may be configured to enhance residents' psychological resources for coping with poverty	▪ Mental fatigue symptoms: irritability, inattentiveness and decreased control over impulses –each are well established precursors to violence ▪ Attentional Performance: ▪ Measured by: mood and stress
212	▪ Physical environment –green space ▪ Social integration with neighbours (possible link to social capital)	▪ Use of green outdoor common spaces predicted the strength of neighbourhood social ties and sense of community	▪ 91 elderly residents (62-91 years old) of a inner city Chicago public housing association ▪
213	▪ Neighbourhood violence and collective efficacy	▪ Showed that collective efficacy is negatively associated with neighbourhood violence ▪ Associations of concentrated disadvantage and residential instability with violence are mediated by collective efficacy. ▪ Neighbourhood community ties are very important for the elderly. Linked to life satisfaction and as demonstrated by risk of mortality. ▪ Run down, noisy, high rise living conditions discourage the elderly from social interaction – these settings are have been labeled sociofugal ▪ Settings which encourage older adults to develop social ties with neighbours are known as sociopetal –access to transient and safe public spaces ▪ Study suggests that the use of trees near elderly people's homes may be an inexpensive way to enhance their social integration. ▪ Caring for their local environment may also enhance their health	▪ Need to consider encouraging communities to mobilize against violence through self-help strategies for informal social control, reinforced through partnerships with agencies of formal social control (community policing) ▪ Collective efficacy: social cohesion among neighbours combined with their willingness to intervene on behalf of the common good. ▪ Uses data from the Project on Human Development in Chicago Neighbourhoods 1995 –8782 residents of 343 neighbourhoods in Chicago.

REF	ASPECT OF ENVIRONMNET ASPECT OF HEALTH	IMPACTS	STUDY DESIGN
214	▪ Social capital and crime.	▪ Strongest correlates of violent crime (robbery, homicide and assault) were interpersonal trust and the proportion of female headed households. ▪ Violent crimes were consistently associated with relative deprivation (income inequality) and low social capital. ▪ Burglary was associated with deprivation and low social capital. ▪ Areas with high crime rates tended to exhibit higher mortality rates from all causes suggesting that crime and population health share the same social origins. ▪ Crime is a mirror of the quality of the social environment. ▪ Greater income equality is related to lower crime rates and better health outcomes in general due to: reduces the social divisions and improves social cohesion ▪ Highly visible inequalities in the form of material wealth causes resentment, frustration, hopelessness and alienation creating distrust. ▪ Distrust breeds less cohesive communities. ▪ High rates of crime may be due to the loss of social buffers, i.e., informal and formal networks of organisations –churches, business and neighbourhood groups. As well as the social norms concerning labour force participation and educational attainment.	▪ Crime: measured by homicide rates, rape, robbery, assault, burglary and motor vehicle theft. ▪ Used data from the General Social Surveys to measure interpersonal trust. ▪ It is a nationally (USA) representative sample of adults over 18

REF	ASPECT OF ENVIRONMNET ASPECT OF HEALTH	IMPACTS	STUDY DESIGN
215	▪ Neighbourhood violence and local institutions	▪ Presence of retail establishments and libraries is not associated with rates of violence. ▪ Due to: lack sufficient breadth and power of social influence to reduce crime. ▪ Institutions may provide positive resources for communities but these do not in turn alter the conditions (residential mobility, housing and school quality and business location) ▪ Found that a greater presence of recreation centres does reduce crime in the most economically disadvantaged areas. ▪ Need to prevent development of bars and drinking establishments. ▪ Public housing does not significantly influence crime. ▪ Ludwig, Duncan and Hirschfield (1999) demonstrate that moving seriously deprived families to low poverty neighbourhoods reduces teen involvement in violent crime but increases property crime [216] ▪ Social disorganization theory-high rates of deprivation are said to reduce informal control mechanisms which in turn lead to increased crime and violence. ▪ Local social ties often predict crime but do not necessarily explain the relationship between poverty and criminal behaviour. ▪ Public housing is a part of the institutional fabric of poor neighbourhoods. ▪ Wilson argues that disadvantage in neighbourhoods creates a distinct social milieu characterised by social isolation. ▪ Disadvantage communities have difficulties in sustaining basic community institutions that socialize residents together to provide informal methods of control (168) ▪ Communities lack strong and viable institutions have fewer role models. ▪ When local organisations that link individuals to each other and to the broader political context are absent, commitments to mainstream values are less likely to be encouraged, socialisation to conformity is undermined and indirect social control is undermined. ▪ Local institutions also provide organized activities which structure individual's time. ▪ Families, neighbours and other groups have fewer contexts in which to form networks that foster direct control. ▪ Institutions: recreation centres, libraries, banks and retail stores : provide activities to structure time and where people can meet, promote and facilitate sharing of common values. Also provide jobs.	▪ Rates of total and individual violent crimes are examined for 177 census tracts in Columbus, Ohio for 1990. ▪ Institutions: libraries, community centres, banks, retail outlet, bars and pubs
217	▪ Fear of crime ▪ Neighbourhood incivilities –abandoned vehicles, litter, noise, tramps, prostitution.	▪ Incivilities: low level breaches of community standards that signal the erosion of accepted norms and values. ▪ Found social and physical incivilities are significantly correlated with perceptions of crime risk. ▪ Incivilities were related to fear but less strongly. ▪ Social and physical incivilities play a role in generating feelings of fear but the role is modest and is mediated through perceptions of crime risk.	▪ National data set (USA) USED which samples 1101 randomly selected adults

REF	ASPECT OF ENVIRONMNET ASPECT OF HEALTH	IMPACTS	STUDY DESIGN
218	▪ Health impacts of the fear of crime in residential tower blocks	▪ Residents live in similar tower blocks where security had been improved with 'access and control' measures such as intercoms and CCTV ▪ People who were not satisfied with their housing in general were more likely to perceive an increase in crime and report greater stress. ▪ Those dissatisfied with their heating reported more stress ▪ Enhanced security measures did increase the residents' feelings of safety. ▪ BUT turning tower blocks into fortresses will increase the residents' alienation from the neighbourhood. ▪ Two thirds of the respondents felt unsafe walking out alone after dark in the area. This was highly correlated with poor mental health on the SF36 after adjusting for age and gender. ▪ Residents who felt safe out alone displayed better mental and social wellbeing. Findings suggest that measures to improve security should focus on the home and neighbourhood ▪ Linkages between housing estate design and feelings of security are well documented by Jane Jacobs[219]and Oscar Newman[220] in the USA and COLEMAN, POYNER AND WEBB in the UK[221]	▪ Psychological health measured using the SF36-Medical Outcomes Survey Short Form 36 ▪ Sample of 407 adults living in 21 tower blocks – Liverpool ▪ Cross sectional analysis of baseline data of residents' attitudes prior to their move to new accommodation.
11	▪ Investigating relationship between housing, socioeconomic status and self-reported general and mental health ▪ Empirical study of the social and economic dimensions of housing –demand, control, material (affordability, dwelling type), meaningful (pride in dwelling, home as a refuge)	▪ Self rated health was associated with housing tenure, housing demand, and housing control after controlling for age, gender and education ▪ Mental health was associated with housing tenure, housing control, demand and neighbour friendliness ▪ The effects of housing did not contribute to health as strongly as self-assessed stress and social support ▪ Respondents were likely to report fair/poor health if they could not stand to be at home sometimes; felt their housework was a strain or reported that they did not have any one who could help them if they needed it. ▪ Influence of housing demand and control variables superceded a well known correlate of health status –educational attainment. ▪ Findings lend support to the hypothesis that features of the domestic environment – control and demands are significant predictors of self reported general and mental health status. ▪ Housing is a concrete manifestation of socioeconomic status which is important in the development of explanations for the social production of health inequalities ▪ It is the largest capital asset that most people will ever own so the value of the house may provide a good indication of the households wealth	▪ Self reported health Self reported frequency of feeling downhearted an blue –Rand Mental Health Index [222] ▪ Cross sectional telephone survey administered to a random sample of 650 households

REF	ASPECT OF ENVIRONMNET ASPECT OF HEALTH	IMPACTS	STUDY DESIGN
223	▪ Design of the built environment and depression	▪ Found statistically significant associations between 5 measures of the built environment and the prevalence of depression ▪ People who were identified as cases of depression were more likely to be living in housing areas characterised by: Newer properties with deck access but few private gardens Shared public recreational spaces Instances of graffiti ▪ Found associations between ratings researcher-defined housing areas and residents' satisfaction ▪ They suggest that it is possible to rate the characteristics of the built environment in urban setting independent of residents' subjective perceptions ▪ There is a lack of empirical research on the effects of specific features of the built environment on health ▪ Except: [224] ▪ They rated several aspects of the built environment –housing form, density, accessibility, entrance type and position, and control over the buffer zone between private and public variables Result: compared with non-depressed controls, depressed women were significantly more likely to be living in blocks with raised walkways than in brick houses or tower blocks.	▪ Study conducted prior to evaluation of the effects of an urban regeneration programme on the mental health of residents –electoral ward in North London. ▪ Physical environment measured using the Built Environment Site Survey Checklist (BESSC) ▪ Depression measured using the Center for Epidemiological Studies Depression Scale (CES-D)

REF	ASPECT OF ENVIRONMNET ASPECT OF HEALTH	IMPACTS	STUDY DESIGN
225	▪ Residential crowding ▪ Environmental design-	▪ Found that for terraced and multiple family houses overcrowding was associated with diminished child psychological health ▪ Children in single family dwellings demonstrated better psychological health ▪ Household crowding was correlated with behavioural disturbance at school for those living in multiple family dwellings only. ▪ As density increases modest decreases occur in the child's psychological health ▪ Children living in multiple family dwellings react more strongly to high density conditions ▪ Housing design can help people cope with undesirable psychosocial conditions or acerbate their negative effects. ▪ High density living can be tolerated when children live in smaller dwellings, detached units, when they have a room of their own or at least a place space where they can be alone –this prevents uncontrollable social interaction. ▪ Type of housing unity not floor level was important in terms of main effects ▪ Internal residential density has been found to be associated with increased family conflict and diminished parental responsiveness to children [226] ▪ Family dynamics alter in crowded homes and affect children's mental health ▪ Multiple dwelling units make it difficult for children and parents to regulate social interaction. In combination with a high internal density this may lead to social withdrawal causing poor mental health ▪ Conclude that the taller and larger a multiple dwelling the greater the adverse effects of residential crowding ▪ Major underlying psychological processes that accounts for some of the negative effects of crowding is the loss of control over interpersonal interaction. ▪ ▪ Found that pre-school children in crowded homes displayed delayed cognitive development ▪ The inaccessibility of external play spaces is believed to lead to young children being stuck at home with more intra-family conflict and greater social isolation from friends – creates a social overload [152,227] ▪ There is a positive association between housing density (overcrowding) and psychological ill health.	▪ Cross sectional study ▪ 1280 letters sent to children in the Inn Valley of Tyrol, Austria –response rate 79.5% ▪ single family, terraced housing, and multiple unit dwellings ▪ Child mental health measured using (KINDL) (181) and questionnaire given to children's teacher measuring classroom behaviour

REF	ASPECT OF ENVIRONMNET ASPECT OF HEALTH	IMPACTS	STUDY DESIGN
228	▪ Housing quality (structural, privacy, indoor climate, hazards, cleanliness and clutter and children's resources) ▪ First study to document a relationship between children's psychological health and housing quality.	▪ Children living in lower quality housing, independent of household income displayed greater symptoms of psychological distress. ▪ Housing quality also affects aspects of children's motivation. They found that children in poor quality housing were less likely to participate in age specific challenge puzzle ▪ Motivation is also associated with residential density ▪ Housing quality influences overt behavior and learned helplessness (loss of control) ▪ Chronic exposure to aversive housing conditions that are unchangeable may lead to the sense that the individual cannot alter their surroundings. ▪ Demands of living in poor housing and dealing with hassles associated with the house may lead to parents becoming frustrated and irritable hence poor parenting ▪ Children may also be ashamed of their housing amongst peers ▪ Findings support those of [229] that children in poor quality housing experience more punitive parenting and perform badly at school Family size nor ration of adults to children do not predict psychological well being amongst children (184)	▪ 277 children in grades 3 to 5 recruited from public schools ▪ 5 rural counties of New York state ▪ Cross sectional study ▪ Socioemotional health measured with the Children's Behavior Questionnaire
230	▪ Benefits of windows and view from the home ▪ View includes: vegetation and built elements ▪ Psychological well-being ▪ Residential satisfaction	▪ Frequency of checking the sky played a small role in explaining participants' sense of Effective Functioning and satisfaction ▪ Outdoor activities were important to effective functioning such as: ▪ Individuals who spent time outdoors –going to the park or jogging said they felt positive ▪ Involvement in gardening activities enhanced neighbourhood satisfaction ▪ Seeing built structures –streets, other buildings and parking areas had no effect on well being ▪ Busy streets had a negative effect on neighbourhood satisfaction Nature in the window was a strong predictor of well being (effective functioning) and residential satisfaction	▪ Study conducted in 6 apartment communities in Ann Arbor Michigan –low-medium rent area ▪ Wellbeing measured in terms of effective functioning scale. (being at rest and calm) as opposed to distracted (fatigued attention) They looked at four domains of 'view' 1) seeing the sky-checking the weather 2) nature based activities -gardening 3) seeing built elements 4) views of nature –trees and gardens
231	▪ Relationship between boarded-up housing and rates of gonorrhea and premature mortality	▪ Boarded-up housing remained a predictor of gonorrhea rates, all-cause premature mortality, and premature mortality due to malignant neoplasms, diabetes, homicide, and suicide after control for sociodemographic factors. ▪ Boarded-up housing may be related to mortality risk because of its potential adverse impact on social relationships and opportunities to engage in healthful behaviors. ▪ Neighborhood physical conditions should be considered as a potential global factor influencing health and well-being.	Ecological study of 107 US cities, developed several models predicting rates of gonorrhea and premature death before age 65 from all causes and from specific causes, controlling for race, poverty, education, population change, and health insurance coverage

REF	ASPECT OF ENVIRONMNET ASPECT OF HEALTH	IMPACTS	STUDY DESIGN
54	▪ Neighborhood characteristics social capital ▪ Mortality	▪ Neighborhood social capital-as measured by reciprocity, trust, and civic participation-was associated with lower neighborhood death rates, after adjustment for neighborhood material deprivation. ▪ Higher levels of neighborhood social capital were associated with lower neighborhood 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 Blacks. ▪ No association between social capital and cancer mortality	• Cross-sectional study design which linked counts of death for persons 45-64 years by race and sex to neighborhood indicators of social capital and poverty for 342 Chicago neighbourhoods in the USA, we tested the ecological association between neighborhood-level social capital and mortality rates, taking advantage of the community survey data collected as part of the Project on Human Development in Chicago Neighbourhoods
232	▪ Role neighborhood structural characteristics--including concentrated disadvantage, residential instability, and immigrant concentration-- collective efficacy in promoting physical health among neighborhood residents. ▪	▪ Neighborhood socioeconomic disadvantage is not significantly related to self-rated physical health when individual level demographic and health background are controlled. ▪ Individuals residing in neighbourhoods with higher levels of collective efficacy report better overall health. ▪ Socioeconomic disadvantage and collective efficacy condition the positive effects of individual level education on physical health.	▪ Data from the 1990 census, the 1994 Project on Human Development in Chicago Neighbourhoods Community Survey, and the 1991-2000 Metropolitan Chicago Information Center-Metro Survey,
231,233	▪ Neighbourhood incivilities -broken windows ▪ Sexually transmitted diseases	▪ Broken windows index explained more of the variance in gonorrhea rates than did a poverty index measuring income, unemployment, and low education. ▪ High-poverty neighbourhoods, block groups with high broken windows scores had significantly higher gonorrhea rates than block groups with low broken windows scores ▪ The association of deteriorated physical conditions of local neighbourhoods with gonorrhea rates, independent of poverty, merits an intervention trial to test whether the environment has a causal role in influencing high-risk sexual behaviors.	▪ Assessed 55 block groups by rating housing and street conditions. ▪ Mapped all cases of gonorrhea between 1994 and 1996 and calculated aggregated case rates by block group. We obtained public school inspection reports and assigned findings to the block groups served by the neighborhood schools. ▪ "broken windows" index measured housing quality, abandoned cars, graffiti, trash, and public school deterioration. Using data from the 1990 census and 1995 updates,
234	▪ Neighbourhood residence ▪ Mental health outcomes	▪ Parents who moved to low-poverty neighbourhoods reported significantly less distress than parents who remained in high-poverty neighbourhoods. ▪ Boys who moved to less poor neighbourhoods reported significantly fewer anxious/depressive and dependency problems than did boys who stayed in public housing. ▪ Study provides experimental evidence of neighborhood income effects on mental health.	▪ Moving to Opportunity is a randomized, controlled trial in which families from public housing in high-poverty neighbourhoods were moved into private housing in near-poor or nonpoor neighbourhoods, with a subset remaining in public housing. ▪ 3-year follow-up of the New York site, 550 families were reinterviewed.

REF	ASPECT OF ENVIRONMNET ASPECT OF HEALTH	IMPACTS	STUDY DESIGN
235	▪ Neighbourhood social processes ▪ Well being of individual residents	▪ Association between how well a parent knew her neighbors and the presence of child behaviour problems differed depending on the degree of economic impoverishment of the neighborhood. ▪ Wealthy neighbourhoods, children whose parent reported knowing few of the neighbourrs had higher levels of internalizing problems such as anxiety and depression compared to those who knew many of their neighbors. ▪ Poor neighbourhoods, children whose parent reported knowing few of the neighbors had lower levels of internalizing problems compared to those who knew many of their neighbors	▪ Attachment to community, an indicator of social capital, in a sample of African American parents, and the presence of behavior problems in their preschool children. ▪ Participants were recruited from a socioeconomically diverse set of neighbourhoods. Attachment to community was assessed using a multi-item scale comprised of two subscales, general sense of community and how well one knew one's neighbors
236	▪ Residential noise noise from installations such as ventilation and air-conditioning systems ▪	▪ Proportion of persons who reported that they were very or extremely annoyed indoors from noise from installations was more than twice as high as for traffic noise. ▪ Installation noise affected respondents' willingness to have their windows open and to sleep with an open window. ▪ High disturbance of installation noises found indicates the importance of also regulating the noise exposure on the "quiet side" of buildings	▪ residents exposed to traffic noise on one side of the building and to low frequency noise from installations on the other side of the building. ▪ general living environment questionnaire delivered to a randomly selected person in each household. ▪ In total 41 respondents answered the questionnaire ▪ Noise from installations was measured indoors in a bedroom facing the courtyard in a selection of apartments and outdoors in the yard. 24h traffic noise outdoor and indoor levels were calculated.
237	▪ children's perception of noise exposure ▪ perceived risk of and attitudes towards noise pollution; ▪ coping strategies; ▪ annoyance response	▪ children in the focus groups reported being most affected by neighbours' noise and road traffic noise, ▪ children exposed to aircraft noise were most affected by aircraft noise. ▪ Impact of noise pollution on everyday activities (e.g. schoolwork, homework and playing) was larger for the children exposed to high levels of aircraft noise compared with the low noise exposed children and focus group samples. ▪ Coping strategies that children employed to combat noise exposure in their lives was dependent on the amount of control they had over the noise source. ▪ Emotional response of children describing the annoyance reaction to noise was consistent with adult reactions	▪ Quantitative research consistently demonstrate that children are a high risk group, vulnerable to the adverse effects of noise exposure, especially effects on cognitive performance, motivation and annoyance ▪ The Millennium Conference Study involved focus group interviews with an international sample (n=36) unselected by exposure. The West London Schools Study involved individual interviews, conducted with a purposively selected sample (n=18) exposed to aircraft noise

REF	ASPECT OF ENVIRONMNET ASPECT OF HEALTH	IMPACTS	STUDY DESIGN
238	▪ Ambient noise levels (highway, rail, road) and multiple mental health indices of school children	▪ Noise exposure was significantly associated in both samples with classroom adjustment ratings. ▪ Child self reported mental health was significantly linked to ambient noise only in children with a history of early biological risk (low birth weight and preterm birth). ▪ Exposure to ambient noise was associated with small decrements in children's mental health and poorer classroom behaviour. ▪ Correlation between mental health and ambient noise is larger in children with early biological risk.	▪ Two stage design strategy (representative sample and extreme sample) two cross sectional samples (n=1280; n=123) of primary school children (age 8-11) ▪ Individual exposure to noise at home was linked with two indices of mental health (self reporting by the child on a standard scale and rating by the teacher of classroom adjustment on a standard scale).
239	▪ Ambient noise and children's stress levels	▪ Children in the noisier areas had elevated resting systolic blood pressure and 8-h, overnight urinary cortisol. ▪ Children from noisier neighbourhoods also evidenced elevated heart rate reactivity to a discrete stressor (reading test) in the laboratory and rated themselves higher in perceived stress symptoms on a standardized index. ▪ Girls had diminished motivation in a standardized behavioral protocol.	▪ Little is known about the nonauditory consequences of typical, day-to-day noise exposure among young children ▪ Multimethodological indices of stress among children living under 50 dB or above 60 dB (A-weighted, day-night average sound levels) in small towns and villages in Austria. ▪ Major noise sources were local road and rail traffic. ▪ Two samples were comparable in parental education, housing characteristics, family size, marital status, and body mass index, and index of body fat.
240	▪ Road traffic noise and children's health	▪ The excretion of cortisol and its metabolites in the first half of the night was significantly correlated to L(Cmax) (co-variables: age, sex, and the day of the week) as well as to impaired sleep, memory and ability to concentrate. ▪ Cortisol excretion in the second half of the night was not correlated to the noise level ▪ Children under long-term road traffic noise exposure during the night had an increased risk of chronic stress hormone regulation disturbances. ▪ Disturbances were significantly correlated to L(Cmax) and findings of allergy and/or asthma bronchial. ▪ Long-term low frequency noise exposure with Lmax < 55 dB(A) during the night resulted in chronic increases of children's excretion of free cortisol in the first half of the night and in serious disturbances of the circadian rhythm of cortisol.	▪ 56 children age 7 - 10 had a medical check-up ▪ Children's excretion of free cortisol was measured by HPLC in two urine samples collected at 1 p.m. and in the morning. ▪ Children lived either at a busy road with 24 h lorry traffic or in quiet areas. ▪ Atthe side of the road the noise level was registered during five nights. ▪ In bedrooms representative measurements of the short-term maximal sound level (L(Amax) and L(Cmax)) and of the frequency spectrum were taken ▪ During the night on average every 2 minutes a lorry with L(max) > 80 dB(A) passed by the houses

REF	ASPECT OF ENVIRONMNET ASPECT OF HEALTH	IMPACTS	STUDY DESIGN
241	▪ Traffic noise ▪ Sleep disturbance	▪ REM sleep decreased abruptly as soon as the sound pressure level exceeded 44 dBA. ▪ With increasing noise, sleep was assessed as increasingly worse. ▪ Noise-induced sleep disturbances were not related to sex. ▪ Equivalent sound pressure level measured for high-density road traffic seems to be a valuable predictor for subjective sleep disturbances as long as the maximum levels do not exceed it by more than 8-10 dBA.	• Eighteen female and 18 male students (21-30 years) slept in the lab during 12 consecutive nights each, where a high-density road traffic noise was played back with four intensities
242	▪ Traffic noise ▪ Sleep disturbance	▪ noise-sensitive people have a greater risk of being annoyed by other sounds (aeroplanes, neighbours, work) as well, and they have less appreciation of their living environment. ▪ Noise-sensitivity is more strongly represented amongst persons with a higher socio-economic status. ▪ Annoyance and sleep disturbance are greater amongst people who keep their windows closed at the exposed side of their home.	▪ 3445 persons living in Amsterdam (1507 male and 1938 female), aged 41-43 years, participated in an investigation in which the relationship was studied between the (measured) road traffic noise in front of the houses in which the participants lived, and the (reported) resulting annoyance and sleep disturbance.
243	▪ Residential noise ▪ Self-rated health	▪ No detrimental relations among objective noise levels, health, and sleep could be shown. ▪ BUT strong correlations between the subjective noise responses of annoyance and sensitivity and health complaints. ▪ Only women revealed a relationship between poor sleep quality and sensitivity. ▪ Stronger relationship among noise sensitivity, health complaints, and poor sleep quality for women than for men could be explained by the degree of exposure to noise as evidenced by their longer residence and greater time spent at home.	▪ Forty-seven women and 35 men living beside a street with moderate to heavy traffic took part. ▪ Answered questions on health complaints, usual sleep patterns, sleep the actual week of testing, their subjective responses to noise, psychosocial relations, anxiety, stressful life events, type A behavior, and attitudinal factors that could explain their responses to noise.
88	▪ Noise exposure ▪ Psychological morbidity	▪ Found that traffic noise exposure levels were strongly associated with annoyance to noise. ▪ Noise-sensitive men were more likely to be highly annoyed by noise exposure than less noise-sensitive men. There was no direct association between noise exposure level and psychological morbidity but there were provocative interactions with noise sensitivity.	▪ Data from population-based Caerphilly Collaborative Survey of 2398 men from Caerphilly, South Wales

REF	ASPECT OF ENVIRONMNET ASPECT OF HEALTH	IMPACTS	STUDY DESIGN
244	▪ Traffic stress ▪ Health	▪ Perceived traffic stress is associated with both general health status and depression in multivariate multilevel models, such that persons reporting traffic stress had lower health status and more depressive symptoms. ▪ There is an interaction between vehicular burden and traffic stress for both health outcomes. ▪ Persons who lived in areas with greater vehicular burden and who reported the most traffic stress also had the lowest health status and greatest depressive symptoms. ▪ Findings suggest that traffic stress may represent an important factor that influences the well-being of urban populations, and that studies which examine factors at only one level (either individual level only or ecological level only) may underestimate the effect of the social environment.	▪ Data from the Chinese American psychiatric epidemiologic study (*N*=1503) are linked to data from the 1990 Census in the United States. ▪ Hierarchical linear modeling was used to analyze the cross-sectional relationship between traffic stress, neighbourhood conditions, depression and health status.
245	▪ Traffic noise ▪ Stress hormones	▪ Found significant associations between traffic volume and noradrenaline concentrations in urine were found with exposure of the bedroom (not the living room), ▪ Iindicates a higher chronic physiological arousal in noise-exposed subjects as compared to less exposed. ▪ Subjective measures of disturbance due to traffic noise were positively correlated with the noradrenaline level. ▪ BUT only found in subjects where closing the window could not reduce the perceived disturbance, which points to the effectiveness of individual coping mechanisms	▪ Nocturnal excretion of catecholamines in urine was studied in 30–45-year-old women whose bedroom and/or living room were facing streets of varying traffic volume. ▪ Traffic volume of the streets was used as an indicator of noise exposure; adrenaline and noradrenaline concentrations were assessed as indicators of the outcome of the physiological stress
246	▪ Traffic noise as a psychosocial stressor	▪ non-significant odds ratios for IHD incidence ranging from 0.9 to 1.4 were found for the highly noise annoyed/disturbed subjects when compared with the less annoyed/disturbed subjects, over the six year follow up period. ▪ BUT this relation was strongly modified by the prevalence of pre-existing chronic diseases. ▪ Individuals free of any chronic disease at the beginning of the follow up, significant odds ratios between 1.7 and 3.0 were seen. ▪ Subgroup with chronic diseases no such noise effects were seen. This surprising result of no effect in the group of people with a potential risk, due to pre-existing health problems, may be because of the dilution of the true effect due to recall bias. ▪ Annoyance and disturbance due to road traffic noise is associated with a higher incidence of IHD. Prevalence of disease can be an important effect modifier of the relation between noise annoyance and health outcomes.	▪ Prospective cohort study, of the association between annoyance and disturbances due to road traffic noise and the incidence of ischaemic heart disease (IHD) was studied in 3950 middle aged men
247	▪ Traffic noise ▪ Cardiovascular disease	▪ The available literature provides no epidemiological evidence of a relationship between noise exposure and mean blood pressure readings in adults ▪ Noise-related increases in blood pressure are consistently seen in children. ▪ There is little evidence that exposure to high traffic noise levels is associated with an increased risk of hypertension. ▪ Ischaemic heart disease there is some evidence in the literature of an increased risk in subjects who live in noisy areas with outdoor noise levels of greater than 65-70 dBA.	▪ Epidemiological review of current literature

8 SUMMARISING THE REGULATIONS:

STANDARDS FOR HEALTHY, SUSTAINABLE HOUSING

8.1 There have been many attempts to design in issues that are health promoting into housing standards. The Building Regulations and, for housing associations, the Housing Corporation Scheme Standards have been reviewed on a regular basis to drive up standards.

8.2 There are also a number of standards that have been developed to promote the prevention of negative health impacts - such as accidents - and to promote positive health impacts - such as accessibility, adaptability and visistability for people with mobility problems. Many of these are developed as part of good practice, as part of a voluntary code or as part of an accreditation system.

8.3 As part of this programme it was decided to pull together a set of these standards and to try and establish a set of standards for healthy, sustainable housing. This work was carried out in co-operation with the Newcastle Health and Housing Group. What follows is an adapted version of these standards. The standards that have been included are:

Organisation	**Abbreviation**
Housing Health & Safety Rating System	HHSRS
Scheme Development Standards	SDS
Sustainability Works	SW
Decent Homes Standard	DHS
Building Regulations	BR
Housing Quality Indicators	HQI
Joseph Rowntree Foundation Lifetime Homes	JRF

Scottish Housing Quality Standard	SHQS
National Housing Strategy for Wales	NHSW
Housing Design Handbook	BRE
Secure by Design	SbD
Child Accident Prevention Trust	CAPT

Standard	Detail	Reference	New build (N) or Refurbishment
1.			
1.1	Mechanical extractor fans in kitchen (preferably cooker hood) and bathroom. Use heat recovery units if possible	BR; Local	N / R
1.2	Draughtproof internal kitchen and bathroom doors	Local	R
1.3	Self-closers to kitchen and bathroom doors	Local	R
1.4	Heat recovery ventilation units in bedrooms of asthma sufferers	Local	R
1.5	Short-term loan of de-humidifiers where condensation is a sever problem	Local	R
1.6	Trickle vents in all new sealed-unit glazing	BR	N / R
1.7	Acoustic vents fitted instead or 1.6 where external noise is a problem	Local	N / R
1.8	CO alarms hard-wired in rooms with fuel-burning appliance – supply battery powered alarms where this would cause unacceptable disturbance	SW; Local; JRF	N / R
1.9	National Air Quality Objectives to inform location of new housing	Local	N
1.10	Ventilation moved to back of property when adjacent to main road	Local	N / R
1.11	Organic paints, stains and varnishes used on all internal surfaces	SW	N / R
1.12	All glues, chipboard and MDF should be free of formaldehyde	SW	N / R
1.13	Boron-based timber treatments to be used internally	SW	N / R
1.14	Dpc should be physical barrier or low-solvent treatment	Local	N / R
1.15	Provide householders with information to explain the use of their heating system, need for controlled ventilation, use of their ventilation system, use of smoke and CO alarms and asbestos – when it should be removed and when left in situ	Local; BR	N / R
2.			
2.1	Full house central heating capable of achieving WHO recommended temperatures and a higher living room temperature of 23C for vulnerable groups	DHS; Local; SDS; SHQS	N / R

Standard	Detail	Reference	New build (N) or Refurbishment
2.2	Fit A-rated boilers	Local	R
2.3	Fit easy to operate programmer, room thermostat, TRVs and hot water thermostat	HQI; SDS; BR	R
2.4	Fully insulate – 250mm loft insulation, insulate wall cavities, 50mm drylining of solid walls. Foam-insulated hot water tanks and insulate primary pipes	Local	R
2.5	Properties to achieve SAP70 minimum and provide affordable warmth (adequate heat for <10% of income)	HQI; SDS; SW	R
2.6	Energy advice readily accessible, free of charge with an option of home visits	Local	N / R
3.			
3.1	Allow sufficient space for the separation of different activities	HHSRS; BRE	N / R
3.2	Kitchens and bathrooms in good condition	DHS; SHQS	R
3.3	Adequate and suitable food storage facilities and preparation areas	HHSRS; BRE; SHQS	N / R
3.4	Cooking facilities at an appropriate height and position for use by the occupant	HHSRS; BRE	N / R
3.5	Each WC should have a wash hand basin	HHSRS	N / R
3.6	Houses of 3 bedrooms or more should be equipped with a second, adequately located WC	SHQS	N / R
3.7	Maximise daylight – windows planned on more than one side of each room and increase daylight over BS by: Kitchen 2x Living rooms 1.5x	SW; BRE	N / R

Standard	Detail	Reference	New build (N) or Refurbishment
	Bedrooms 1x		
3.8	Provide alternatives to carpeting (linoleum, floorboards etc) for people with allergies	SW	N / R
3.9	Provide broadband connections to facilitate use of online facilities and smart technology developments	JRF	N / R
3.10	Communal facilities designed into new and existing developments	Local	N / R
4.			
4.1	Strive for DHS for all grant work and house swaps	DHS	R
4.2	New windows and doors should meet Secure By Design Standards	SbD	N / R
4.3	New windows to have wooden frames – advantages to be explained to tenants and adequate maintenance schedule put in place	SW	R
4.4	Internal arrangement to avoid changes of level	Local	N / R
4.5	All materials should be sustainable with a minimum lifetime of 30 years	Local	R
5.			
5.1	All water pipes to be lead-free from the main and throughout the property	SHQS	R
5.2	External lead water pipes should be replaced when environmental improvements are taking place	Local	R
5.3	Assess whether lead paint is present in the property – if so, remove safely	HHSRS	R
6.			
6.1	Maximum noise levels from external sources of 35dB(A) in living rooms and 30dB(A) in bedrooms at night	Local	R
6.2	Carry out noise survey prior to installation of new windows – fit triple glazing where required to meet noise standard	Local; SDS; HQI	R
6.3	Acoustic vents fitted in preference to trickle vents in noisy situations	Local	N / R
7.			

Standard	Detail	Reference	New build (N) or Refurbishment
7.1	**Falls**		
7.1.1	Slip resistant floors in 'wet' areas	HQI; BRE	N / R
7.1.2	Slip resistant baths with handles / grip rails at suitable height	HHSRS; BRE	N / R
7.1.3	Restrictors on upper floor casement windows	HQI	N / R
7.1.4	Stairs, halls and corridors to be well lit - use low energy lighting to reduce shadows	SDS; BRE	N / R
7.1.5	Fixed, continuous handrail on both sides of all staircases, including single steps	HHSRS; BRE	N / R
7.2	**Accident Prevention**		
7.2.1	Security storage for harmful substances including lockable cupboard for medicines	HQI; CAPT; SDS	N / R
7.2.2	Laminated (safety) glass on internal doors and any single-glazed entrance level window	HQI; CAPT; BRE	N / R
7.2.3	Ensure all windows can be safely operated	SDS	N / R
7.2.4	Low surface temperature radiators	SDS	N / R
7.2.5	Mixer taps where no hot water thermostat present	Local	R
7.3	**Fire Safety**		
7.3.1	Hard-wired smoke alarm on every floor (battery operated when wiring defective)	HQI; SDS; SHQS; CAPT	R
7.3.2	Fire blankets in kitchen	CAPT	N / R
7.3.3	Installation of domestic sprinkler system	Local	N / R
7.4	**General**		
7.4.1	Sufficient natural light to enable domestic tasks to be carried out without eyestrain during daylight hours	HHSRS	N / R
7.4.2	Where asbestos is left in situ it should be clearly labelled	Local	R

Standard	Detail	Reference	New build (N) or Refurbishment
7.4.3	Loft spaces between properties should be divided to prevent fire spread and intruder access	Local	R
7.4.4	Care Alarms should be available for all older people, people with disabilities or those who have suffered domestic violence or racial harassment	Local	N / R
7.5	**Child Safety**		
7.5.1	Affordable (subsidised) provision throughout the City of: • Stairgates • Safety catches on upper floor windows • Fireguards • Safety glass for low level doors and windows • Socket covers • Safety catches on kitchen cupboards	CAPT; HHSRS	N / R
7.6	**Smart Technology**		
7.6.1	Following assessment, consider installation of: • Fall detectors • Automatic temperature control for hot water • Automatic lighting with movement detectors • Lights linked to fire and intruder alarms • Temperature, light level and movement detectors	JRF	N / R
7.7	**Communal Areas**		
7.7.1	Consider installation of safety glass, handrails and lifts in communal areas	Local	N / R
7.8	**Advice & Information**		

Standard	Detail	Reference	New build (N) or Refurbishment
7.8.1	Provide advice and assistance to householders to reduce accidents	Local	N / R
7.8.2	A risk assessment in the home should be linked to practical help with small jobs which are common causes of accidents e.g. help to move furniture, removing trip hazards	Local	N / R
7.8.3	Advice should ensure there are suitable routes for escape from fire and that householders have made their escape plans	Local	N / R
7.8.4	The 'Bottle in the Fridge' scheme should be promoted so that emergency services have basic details about the householder	Local	N / R
8.			
8.1	Follow Secure By Design Standards for house and locality	SbD; SDS; HHSRS; NHSW	N / R
8.2	Adapt key-operated locks for people with limited dexterity	Local	N / R
8.3	Entryphones to be at a suitable height for wheelchair users	Local	N / R
8.4	Entryphone handsets should be portable rather than wall-mounted	Local	N / R
8.5	Fit intruder alarms for vulnerable people, including older people, disabled and people who have suffered domestic violence or racial harassment	Local	N / R
8.6	Consider video camera at entrance and remote control door opening for groups in 8.5	JRF; BRE	N / R
8.7	All voids to be adequately secured	Local	R
9.			
9.1	All new social and private housing to meet JRF Lifetime Homes Standards	JRF; NHSW (social)	N

Standard	Detail	Reference	New build (N) or Refurbishment
9.2	All refurbishment to aspire to JRF Lifetime Homes Standards as far as possible	JRF	R
9.3	**Bathroom / WC**		
9.3.1	Entry level WC	JRF; Local; HQI	N / R
9.3.2	Walls in bathrooms and WCs designed to take support aids	SDS	N
9.3.3	Level access showers where space allows (always retain baths). Non-slip flooring and side seat.	SDS	N / R
9.3.4	Ensure seated end of bath is not under eaves	Local	R
9.4	**Access**		
9.4.1	Level or easy access to property	JRF; Local; BR (part M); BRE; HQI	N / R
9.4.2	Openings widened to allow wheelchair access	Local	R
9.4.3	New staircases suitable for stair lift	SDS	N
9.4.4	Provide fused spur for future stair lift	HQI	N / R
9.4.5	All window openings should be accessible	Local	N / R
9.5	**Facilities**		
9.5.1	Intercoms at low level and portable handsets	Local	R
9.5.2	Thermostatic control of hot water	SDS	N / R
9.5.3	Low surface temperature radiators	SDS	N / R
9.5.4	Provision of ducting to allow retrofitting of smart cabling	SDS	N
9.5.5	Window locks capable of being used by people with limited dexterity	Local	N / R
9.5.6	Additional sockets throughout house	Local	R
9.5.7	Flashing light for doorbell and telephone	JRF	N / R
9.5.8	New kitchens fitted with adjustable brackets for wall-mounted cupboards to allow easy alteration of height	Local	N / R

Standard	Detail	Reference	New build (N) or Refurbishment
9.6	**General**		
9.6.1	Designed to facilitate future internal remodelling	SDS	N
9.6.2	All handles, switches, thermostats and sockets at suitable height (900mm)	SDS; BRE	N / R
9.6.3	Cable ties to avoid trailing cables	Local	N / R
9.6.4	The provision of ducting within the property will allow the addition of smart technologies as required. Options should include motorised door and window openers, motorised curtains and blinds, lifting mechanisms for cupboards and sinks, automatic on/off for taps.	HQI; SDS; JRF	N