CENTRE FOR SUSTAINABLE ENERGY

# Fuel Poverty and Ill Health

## A Review

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# FUEL POVERTY AND ILL HEALTH – a review

## PREFACE

The following literature review was undertaken in Spring 2001 for the 'Walsall health and fuel poverty project', which is sponsored by Walsall Health Authority and npower (Health through Warmth programme). The project aims to develop a set of indicators of specific illnesses and medical conditions relating to cold and damp housing, while recognising the wider social determinants of ill health.

The review shows that it is sometimes difficult to disentangle the precise causal link between ill health and fuel poverty-related problems. Nevertheless, the project aims to develop a practical tool or 'template', based on the indicators, for guiding GPs towards identifying an underlying fuel poverty problem.

The project will work with GPs in developing the appropriate indicators. It is envisaged these will cumulatively suggest there is a fuel poverty problem. The work will aim to establish a 'balance of probabilities' for associating a range of individual health indicators with fuel poverty-related bad housing. The template itself will consist of a set of questions that will 'trigger' the GP to make a referral for an energy efficiency grant. The project will make every effort to ensure that the template can be easily integrated within the existing prescribing system.

The review suggests that the proposed system will enable GPs to play an important role in tackling some of the underlying problems that give rise to poor health. One of the aims of the monitoring element of the project hopes to provide evidence for this approach. Should the approach be successful, the project will show that GPs can play an important role in preventative health care. This in turn will help inform the new public health agenda.

## 1. INTRODUCTION

The link between ill health and poor quality housing is well established. Health improvements in Britain over the past 100 years have resulted far more from collective intervention in the environment than from the development, or even provision, of curative health care (Byrne, 1993). Improvements in housing in particular are associated with a broad range of health improvements.

It is more difficult, however, to isolate poor housing as a particular causative factor in the incidence of a specific disease or medical condition from other factors, for example deprivation in general. Nevertheless, there is a growing body of research evidence that does attempt to show causation or at the very least, association between poor housing and specific health problems. This review considers the evidence for the detrimental effect of 'fuel poverty' on health. It aims to show that low internal temperatures and the presence of dampness and/or mould are significant factors in causing a range of illnesses and diseases.

The review first gives a brief outline of the characteristics of fuel poverty, considering in particular those aspects that are linked to ill health. It goes on to discuss the methodological issues that affect our understanding of the links between fuel poverty and poor health. It then reviews current understanding of the specific associations between fuel poverty and specific illnesses and medical conditions. Finally it draws out the implications of the review for the Walsall Health and Fuel Poverty project.

## 2. FUEL POVERTY

### 2.1. Understanding fuel poverty

The term 'fuel poverty' describes the interaction between low income, poor access to fuel company services, poorly insulated housing and inefficient heating systems. While fuel poverty and poverty in general are closely related, there is a clear distinction. Whilst most people on low incomes are likely to face difficulty in paying their fuel bills, 'fuel poverty' describes the particular hardship many people on low incomes face because they live in 'hard to heat' housing or run expensive, inefficient appliances eg fridges, cookers, washing machines, lighting.

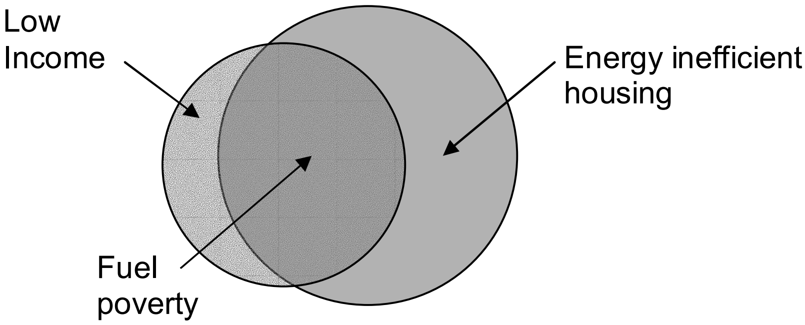
This review will focus on the particular problems relating to 'hard to heat housing', rather than inefficient appliances, since the former is directly linked to poor health. Appliance use accounts for an ever-increasing element of fuel consumption in Britain, due to rising living standards and technological advance. People with inefficient appliances will therefore incur unnecessarily high bills, which in turn can lead to mental stress. Nevertheless, most of the evidence reviewed relates to the health impact of 'hard to heat' housing. This arises from three main causes:

- inefficient or inadequate heating systems,
- thermal inefficiency eg due to poor building fabric, lack of insulation, draughty homes
- under-occupancy – households living in properties that are 'too large' for their needs.

The problem of energy inefficient housing is extensive in Britain. Only 2.7m dwellings (14% of the total) in England have a SAP rating of over 60[1] (DETR, 2000). Whilst energy inefficient housing is concentrated among people on low incomes it does extend to other groups. However, the latter have the option of paying higher fuel bills to compensate for extra heating costs or can invest in capital improvements to improve energy efficiency.

[1] SAP, or Standard Assessment Procedure, is a measure of a property's energy rating. The scale ranges from 0 to 100 and gives a measure of the annual unit heating cost of a dwelling under a standard regime, assuming a specific heating pattern and room temperature. 60 and over represents a good standard of energy efficiency.

Similarly, some people on low incomes (relatively few in number) live in well-designed energy efficient housing. For this group, fuel bills may be sufficiently low to allow reasonable comfort levels without excessive worries over the size of fuel bills. The relationship between general poverty, fuel poverty and energy inefficiency can be illustrated as follows (NRFC, 2000):




'Fuel poor' households typically respond to 'hard to heat' housing in two ways:

1. They cut back on fuel use to try and maintain manageable fuel bills. This leads to cold homes and damp and/or mould growth – key determinants of poor health.
2. They run up high fuel bills to try and maintain adequate levels of warmth. This contributes to general indebtedness or the need to cut back on other essential items such as food and clothing. This can also have health consequences, for example depression.

In reality, most fuel poor households adopt both forms of coping strategy ie they struggle with high fuel bills and ration their fuel use, thus suffering inadequate heating standards.

## 2.2. Defining fuel poverty

The widely accepted definition of a 'fuel poor household' is one which needs to spend more than 10% of its income to heat its home to an adequate standard of warmth: 21$^{o}$C in the living room and 18$^{o}$C in other occupied rooms. This definition brings together the income and housing elements of fuel poverty. However, it does not encompass non-heating requirements and there are different views on how income should be defined. The 1996 English House Condition Survey estimates that between 4.3m and 6.9m households in England live in fuel poverty. The variation occurs according to whether housing costs are included or excluded within the income element.

The definition relates directly to health because the specified temperatures refer to WHO assessments of internal temperature levels required to safeguard health (World Health Organisation, 1990). The Government has accepted the health case for maintaining adequate warmth. It specifies four heating regimes that cover the heating requirements of different types of household (DETR, 2000):

**Table 1: Specification of heating regimes**

| **Regime** | **Temp of heated rooms** | | **Extent of heating** | **Duration of heating** |
|---|---|---|---|---|
| | Living rooms | Other rooms | | |
| Minimum | 18°C | 16°C | Partial – 50% other rooms | All day – 16 hrs |
| Partial | 21°C | 18°C | Partial – 50% other rooms | All day – 16 hrs |
| Standard | 21°C | 18°C | Full house | Morning and evening – 9 hrs |
| Full | 21°C | 18°C | Full house | All day – 16 hrs |

The minimum standard reflects the minimum temperatures required for safeguarding health in healthy adults. The ‘partial’ and ‘full’ regimes reflect the heating requirements of households likely to be housebound during winter. The partial specification was developed for ‘under-occupied’ housing. Over a quarter of all households and over a half of single older households are considered to only require partial heating because they occupy relatively large homes and have several spare rooms (DETR, 2000).

However, many households require all day heating because they are liable to be at home all day eg older retired households, the long-term sick, unemployed people, families with young children. This illustrates another dimension of fuel poverty, namely that certain groups are intrinsically more vulnerable to fuel poverty because their circumstances mean they cannot benefit from the ‘free heat’ provided in the workplace or education establishment.

The fuel required to maintain the heating regimes described in Table 1 can be calculated from a technical modeling exercise that takes into account such factors as building type, exposure, fuel type, heating system, size and age of property etc. The fuel poverty definition described earlier is based on the amount of fuel a household <u>needs</u> to consume to maintain adequate heating (and temperatures), rather than the amount the household <u>actually</u> consumes.

Many fuel poor households spend less than 10% of their income on fuel and put up with inadequate heating levels. For this reason, some commentators suggest that the extent of ‘underspend’ on fuel (the difference between actual and required consumption) represents a better definition of fuel poverty since it directly relates to cold internal temperatures. This in turn is likely to indicate the degree of vulnerability to ill health. Most research into the link between fuel poverty and ill health uses ‘cold homes’ or ‘damp and/or mould’ as the independent variable, rather than ‘households needing to spend 10% or more of income on fuel’.

# 3. THE CAUSES OF ILL HEALTH AND ILLNESS

## 3.1. Methodology issues

Byrne and Keithley (Burridge, 1993) refer to two broad approaches within health research:

1. The traditional medical approach of associating single causes with individual effects.
2. The public health approach of investigating causal systems, rather than single causal factors.

The public health approach tends to look at the impact of a range of causal factors, many of which are likely to be inter-related, on a community's health status. For example, a study may show the impact of a major housing improvement on aggregate health, rather than attempt to identify a single cause of an illness and then eliminate that cause.

The two approaches lead to different methodologies for investigating the link between health and housing. The medical model tends to emphasise individual behaviour as a prime cause of ill health. It uses a 'case-finding' approach in attempting to associate diagnosed conditions with specific housing issues. The public health model places more emphasis on the notion of 'general susceptibility'. It is predicated on the hypothesis that people are vulnerable to a variety of ills because of the social and economic strains under which they live. This informs the notion of 'health inequalities' (Acheson, 1999).

Hunt (Burridge, 1993) refers to three problems with the medical model:

1. Doctors may disagree considerably on the correct diagnosis eg asthma and bronchitis. Some doctors have preferences in diagnoses and diagnostic categories are subject to fads and fashions.
2. A diagnosis obviously depends on a patient first seeing a doctor. However, the decision to seek medical advice depends upon much more than the presence of a symptom. A case-finding approach will therefore under-estimate the extent of ill health in a community.
3. Medically diagnosed health is seen as a more reliable indicator than self-defined health. Yet many diagnoses are based upon reports by patients about their symptoms.

Reliance on diagnostic instruments, such as measures of respiratory function, is misplaced unless their application is rigidly controlled with respect to timing, place and observer error, both in their readings and the way they are read.

While the public health model provides a more holistic approach to combating ill health, it is difficult to disentangle the relative importance of the mix of measures the approach entails. For example, a before and after study of the health impact of a major regeneration programme may find that the community's overall health improves significantly. However, the study will not be able to determine with any degree of precision whether the improvement is due to improved housing, employment growth, income measures or improved social provision. Further, the health improvements may have arisen because of contemporary national policy initiatives, such as improved welfare benefits.

Public health research can sometimes overcome these problems by using control areas with similar characteristics to the area under investigation. However, it is difficult to identify control areas with similar characteristics to the study area and to control for all the possible causal factors.

Conversely, medical research has attempted to replicate as far as possible traditional scientific experimental methods. This includes randomised control trials, 'double blind' research techniques for eliminating observer error and renewed emphasis on evidence-based practice.

The medical model and general susceptibility model are not necessarily incompatible. This review considers studies from both traditions. It aims to show that there is considerable evidence for linking poor housing to specific health problems. It will therefore help enable the Walsall Health and Fuel Poverty project to agree a set of indicators for identifying fuel poverty-related health problems.

### 3.2. Evidence of the links between fuel poverty and ill health

Evidence for the link between fuel poverty and ill health can be divided into two broad categories: the impact of low internal temperatures ('cold homes') and the impact of dampness and/or mould growth.

### 3.3. Cold homes

The 'excess winter death rate' in Britain is one of the largest in Europe (only Ireland's is comparable). Every year, an average of 30,000 extra deaths occur during the winter months than during the summer period (Hansard, 1997). There is a general association between cold weather and increased medical conditions, principally cardio-vascular illnesses and respiratory problems. Excess winter mortality is highest among older people and lower socio-economic groups, but is not confined to these groups. The substantial decline in excess winter mortality that occurred between 1977 and 1994 is considered attributable to the growth of central heating and improved medical care (Wilkinson et al, 1998).

A review by the Chief Medical Statistician in 1985 examined the relationship between season and mortality, and concluded that about 80% of variance in winter deaths is associated with changes in temperature. He went onto estimate that 'for every degree change in the average winter temperature there is a rise or fall in the number of winter deaths by about 8,000' (Alderson, 1985).

It is estimated that of the 'excess winter deaths', a third are attributable to respiratory disease, and over half to cardiovascular disease (mainly heart attacks and strokes) (Curwen, 1991). The risk factors for cardiovascular conditions (blood pressure, cholesterol and the clotting factor fibrinogen) also vary seasonally (Khaw & Woodhouse, 1995). Arterial blood pressure in particular increases significantly after 2 hours' exposure to temperatures below 12$^{o}$C, most noticeably among older people (Collins et al, 1985).

Hypothermia is registered in fewer than 200 deaths throughout the year and thus accounts for less than 1% of excess winter death (Collins, 1983).

The explanation for the precise mechanisms that give rise to excess winter deaths is an area of continuing controversy. There is widespread agreement that temperature is the key causal factor, as illustrated by the Alderson quote above. However, there are disagreements over the relative influence of internal house temperatures and external temperatures ie 'getting cold inside' or 'getting cold outside'. The latter refers to the possibility that people do not dress up warm enough during cold weather – the 'getting cold at bus stops' argument (Keatinge, 1986).

This has important implications for an appropriate policy response. If internal temperatures are the main determinant, there are direct implications for heating, insulation and building standards. If outdoor temperatures are more important, more emphasis needs to be placed on prevention and individual behaviour.

The review includes some of the latest research findings on this issue. It suggests that both factors are relevant. The Eurowinter study of excess winter death rates suggests that there are a number of contributory factors in explaining the relative differences between excess winter death rates in different countries (see Appendix). In brief, it appears that excess winter deaths in countries with colder climates than Britain's are lower because the thermal efficiency standards of houses are higher and because people dress up warmer when going outside. Whilst Greece does not have as high an excess winter death rate as Britain's, it is higher than other countries with colder climates. Again it appears this may be due to people not protecting themselves adequately, both indoors and outside, against cold temperatures.

The Collins review summarises the medical evidence on respiratory illness (see Appendix). It is widely accepted that cold, damp housing is unhealthy, but the relative effects of cold, damp and mouldy living conditions are difficult to disentangle as they are co-related. Consequently, the different importance of mould and dust mites in causing asthma cannot be identified (although see Howieson study in the Appendix).

Collins suggests that there is a greater increase in winter mortality from respiratory disease than from circulatory (coronary). Respiratory health is more related to indoor temperatures and cardiovascular health to outdoor cold. Older people need warmer temperatures because they are less active but have colder homes. However, it is very difficult to show a definitive link between home temperatures and specific health outcomes, just as it is nearly impossible to identify the exact thermal conditions of the home after someone has died.

Goodwin reviews the evidence for linking cold temperatures and circulatory illness among older people (see Appendix). The review suggests a link between cold internal temperatures and cold external temperatures. It introduces the notion of 'cold stress'. This arises when the shock of a cold morning might cause too much cardiovascular strain, particularly if leaving a cold dwelling. Goodwin's review suggests that cold stress might be lessened if the effect of external cold is mediated by warm indoor temperatures ie older people are at less risk from circulatory disease from 'cold stress' if they live in a warm home.

Accidents in the home, which can have fatal outcome, are also more common in winter. Their incidence is related to the effects of lowering body temperature on mental functioning or to cold-induced impairments of movement or sensation. Finger strength and manual dexterity have been shown to decrease progressively as indoor temperatures fall from 24$^{o}$C to 6$^{o}$C (Raw et al, 2001).

## 3.4. Relationship between home temperatures and health impact

Table 2 below summarises the evidence for the health impact of different internal temperatures, plus recommended standards. The levels are not absolute – people vary widely in their needs. It should not be assumed that ill health will inevitably result from failure to meet these criteria. The recommended levels are set on the basis that meeting them will normally protect against the adverse health effects of cold indoors conditions (adapted from EAS, 1998 and Raw et al, 2001).

| Temp. | Effect | Recommendation |
|---|---|---|
| 21 | Comfortable temperature for population, including older people, in living rooms | Recommended by British Geriatrics Society |
| 18 | Minimum temperature for population as a whole – little health risk, although older and sedentary people may feel cold | Parker Morris standard for living rooms |
| 16 | 16-12$^{o}$C – respiratory problems become more common, some cardiovascular risk | |

| | | |
|---|---|---|
| 13 | | Parker Morris standard for kitchens |
| 12 | Exposure between 12 and 9°C for more than 2 hours causes core body temperatures to drop, blood pressure to rise and increased risk of cardiovascular strain | |
| 5 | Significant increase in the risk of hypothermia | |

### 3.5. Damp and mould

There is considerable evidence on the association between dampness and ill health. Damp is often linked to cold buildings but not always. Viruses which give rise to infections are more common in damp houses (Hatch et al, 1979). Bacteria also thrive in moist conditions, although there is little research relating to their presence in domestic dwellings (Morris quoted in Hunt, 1993).

However, a certain level of dampness may be beneficial. Henwood, quoting the Building Research Establishment, refers to evidence that upper respiratory tract illness increases when indoor relative humidity is low (Henwood, 1997; Raw & Hamilton, 1995). There is also a greater likelihood of infection transmission in low humidities because of the increased survival of airbourne micro-organisms.

Most health effects in Britain are associated with high levels of humidity, rather than low. This is due to the strong association between high humidity and mould and dust mites. High relative humidity leads to condensation on cold surfaces, which in turn encourages the growth of mould. Mould is less likely to be found in conditions of penetrating or rising damp since the salts that emerge with the moisture tend to inhibit its growth. Condensation, on the other hand, contains relatively pure water which is highly conducive to the growth and proliferation of fungal spores. These live off the organic material on walls and in cavities, such as plaster, wallpaper and wallpaper paste. Once present, mould spreads easily to carpets, furniture and clothing (Hunt, 1993).

Mould growth is less common in homes which have better insulation, cavity walls, good ventilation and air circulation, good heating which is actually used to keep the home warm, no use of unflued combustion appliances and a generally good state of repair. It is therefore less common in newer homes (Raw et al, 2001).

Mould is linked with a range of allergies, infections, toxic reactions, some cancers and psychological symptoms. Mould spores require a relative humidity of 70% or more to grow. However the level of fungal spores which represents a risk to health is uncertain. There also appears to be some relationship to the level of susceptibility of the individual.

The Platt study represents a major survey into the relationship between damp, mould growth and sympomatic ill health (see Appendix). The study is widely accepted as providing conclusive evidence that damp and mould do have an adverse impact, with the level of illnesses positively associated with increasing severity of dampness (dose response relation). Symptoms typically include nausea, breathlessness, backache, fainting and bad nerves among adults and respiratory symptoms (wheeze, sore throat, runny nose), headaches, fever, vomiting among children. These effects were independent of income, smoking, unemployment, cooking and washing facilities or the presence of pets.

**Mental health**

It is likely that cold, damp housing also has an impact on mental health, although it is difficult to disentangle the detrimental impact of this factor from general deprivation. The Khamano study (see Appendix) suggests poor housing does lead to depression, particularly due to worries over fuel bills, feelings of 'helplessness' about being unable to improve their housing conditions and worries over more direct health problems eg diabetes.

To give some indication of the scale of fuel debt, Citizens Advice Bureaux throughout Britain dealt with 97,000 utility debt problems in 2000 (personal communication). This represented 10% of all debt problems presented to CABx. Of course, many people with debt problems seek advice from other providers (eg local authorities) and many do not seek advice at all. For example, several large creditors estimate that between 12 and 20% of people defaulting on loans actually involved an advice centre, despite the fact that loan defaults represent a particularly serious form of indebtedness.

Nevertheless, there is likely to be a strong correlation between indebtedness relating to fuel poverty and mental stress. Henwood refers to research evidence that shows the positive impact of improved housing on psychological distress. (Henwood, 1997; see also Project review Appendix). Raw et al also refers to the psychological effects arising from the constant sight of fungal growth, the sometimes unpleasant smell and the difficulty of getting rid of mould, although these have not bee quantified (Raw et al, 2001). Raw also refers to the stigma of being unclean, arising from mould, and that this in itself causes depression and stress.

**Dust mites**

Dust mites are a major contributor to asthma, due to their ability to trigger Type I allergic reactions (immediate hypersensitivity). Dust mites flourish in 40% or more humidity and at temperatures of between 17 and 32$^{o}$C (Korsgaard, 1979). The growth of dust mites is also related to the age, cleaning and use of soft furnishings. For example allergen levels in mattress dust have been found to be higher in homes where the child's bedroom was reported to be damp, increasing with the age of the mattress (van der Lustgraff, 1978). Problems arise when dust mite debris, particularly faecal pellets, act as allergens. They are generally present at higher levels during autumn.

There is growing evidence that house dust mites can cause asthma, although it is not possible to define the levels of allergen that are associated with clinical disease (Raw et al, 2001). Both current and past exposure may be relevant, particularly exposure in infancy. It is not clear what proportion of asthma in Britain is partly or wholly attributable to dust mites. However Raw argues that even if the proportion is small (eg 5% extra cases), it could represent a substantial burden of disease, because asthma is one of the most common chronic diseases. It affects at least one in ten children and one in twenty adults. Even a weak causal link could thus generate many thousands of extra cases.

House dust mites are also implicated in perennial rhinitis and eczema (Carswell & Thompson, 1987; Howarth et al, 1897). The Howarth study reported that the severity of atopic eczema could be greatly reduced by effective house dust mite avoidance, suggesting the association may be causal.

There is growing concern that some aspects of improved energy efficiency, particularly the growth of central heating and insulation measures, might be exacerbating the problem. This is because such measures increase humidity, unless they are accompanied with ventilation measures. The Howieson study aims to provide conclusive evidence that poor ventilation (often resulting from insulation measures etc), coupled with increased use of fitted carpets and other soft furnishings, is responsible for the asthma 'pandemic' sweeping the country (see Appendix). Certainly, dust mites do not survive below relative humidities of 45% at room temperature (Raw et al, 2001).

The Energy Action Scotland study provides some initial evidence that asthma rates are lower in cold, draughty homes (see Appendix). However, the Somerville study suggests that asthma rates declined among asthmatic children in Cornwall, following the installation of central heating systems (see Appendix).

## 4. SUMMARY

Cold environmental conditions are associated with increased deaths from heart attacks, strokes and respiratory illnesses, particularly among older people. A proportion of the excess winter deaths, particularly those due to respiratory disease, can be attributed to cold indoor conditions. Cardiovascular disease may be more linked to cold external temperatures. However, cold stress may also play an important role. This occurs when the shock of a cold morning might cause too much cardiovascular strain, particularly if leaving a cold dwelling. Thus the impact of cold stress is reduced if people live in a warm home.

While the relative influence of cold external and cold internal temperatures on health is still open to question, there is general agreement that the population, particularly older people, should protect themselves more adequately against both. This implies education to dress up warmer when going outside in cold conditions <u>and</u> improved heating, insulation and building standards.

Damp and mould growth are strongly associated with nausea, breathlessness, backache, fainting and bad nerves among adults and respiratory symptoms (wheeze, sore throat, runny nose), headaches, fever, vomiting among children. Condensation causing high relative humidity is the main culprit, rather than rising or penetrative damp. Damp is also associated with stress and depression, although this area is less well researched.

Dust mites also flourish in houses with high relative humidity and poor ventilation. Energy efficiency measures, particularly insulation, can exacerbate the problem unless accompanied by ventilation measures. Soft furnishings and fitted carpets also contribute to the growth of mite colonies, unless regularly cleaned. Mites are regarded as a major contributor to asthma, particularly among children.

Dust mites may also contribute to perennial rhinitis and atopic eczema.

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## Appendix 1 – health research summary

| Study | Issue | Study method | Main results | Conclusion |
|---|---|---|---|---|
| Platt, S et al (1989) | To examine the relation between damp and mould growth and symptomatic ill health. | • Cross-sectional study of random sample of households containing children<br>• Separate and independent assessments of housing conditions (by surveyor) and health (structured interviews)<br>• Adult households (94% women) and 1169 children in 597 households<br>• Public housing in Glasgow, Edinburgh & London | • Damp found in 31% of dwellings and mould growth in 46%.<br>• Adult respondents living in damp and mouldy dwellings were likely to report more symptoms overall, including nausea, breathlessness, backache, fainting and bad nerves, than respondents in dry dwellings.<br>• Children in damp dwellings had a greater prevalence of vomiting, wheeze, irritability, fever and poor appetite under damp conditions than those in non-damp dwellings<br>• Children in mouldy dwellings had a greater prevalence of respiratory symptoms (wheeze, sore throat, runny nose), headaches and fever than those in non-mouldy dwellings.<br>• The mean number of symptoms was higher in damp and mouldy houses and positively associated with increasing severity of dampness mould (dose response relation).<br>• All differences persisted after controlling for household income, cigarette smoking, unemployment and overcrowding. | Damp and mouldy living conditions have an adverse effect on symptomatic health, particularly among children. |
| Howieson et al (2001) | To evaluate strategies for reducing indoor water vapour pressures, allergen reservoirs and dust mite activity within energy efficient and inefficient dwellings and measure any effects on the respiratory health of asthmatics | • Intervention study using a triple blind, placebo controlled protocol<br>• 3 phases – only 1st phase largely complete<br>• Phase I investigated the impact of allergen avoidance tehcniques plus Mechanical Heat Recovery Ventilation (MHRV) to reduce water vapour pressures and inhibit re-colonisation (of dust mites)<br>• 68 asthmatics in 45 dwellings in N. Lanarkshire over 2 year period.<br>• Cohort split into 2 active groups and 1 control group | • Initial findings suggest some improvements in lung function, although findings still have to be correlated with any changes in drug use<br>• This suggests that allergen avoidance measures plus MHRV can reduce allergen reservoirs which in turn may have a significant effect on asthmatics' lung function.<br>• Full report available in summer 2001<br>• Phase I will feed into Phase II of the study – this will aim to identify and compare changes in allergen reservoirs, hygrothermal conditions and respiratory function of an active and control cohort of around 40 asthmatics per group. | The research aims to establish whether ventilation and allergen avoidance measures should be made integral to energy efficiency measures to ensure respiratory health of asthmatics is improved. |

| Study | Issue | Study method | Main results | Conclusion |
|---|---|---|---|---|
| Eurowinter Group (1997) | To assess whether increases in mortality per 1°C fall in temperature differ in various European regions and to relate any differences to usual winter climate and measures to protect against cold | • Percentage increases in deaths per day per 1°C fall in temperature below 18°C (indices of cold-related mortality) were estimated by linear modelling.<br>• Through use of surveys, protective factors were adjusted by regression to 7°C outdoor temperature.<br>• Cause-specific data gathered from 1998 –1992 were analysed by multiple regression for men and women aged 50-59 and 65-74 in N. Finland, S. Finland, Baden-Wuttemburg, the Netherlands, London and N. Italy (24 groups) and for 1992 data in Athens and Palermo. | • The percentage increases in all-cause mortality per 1°C fall in temperature were greater in warmer regions than colder.<br>• At an outdoor temperature of 7°C, the mean living-room temperature was 19.2°C in Athens and 21.7°C in S. Finland – 13% and 72% of people in these regions, respectively, wore hats when outdoors at 7°C.<br>• Multiple regression analyses showed that high indices of cold-related mortality (all causes and respiratory) were associated with high mean winter temperatures, low living-room temperatures, limited bedroom heating, low proportions of people wearing hats, gloves and coats and inactivity and shivering when outdoors at 7°C<br>• Data was standardised for sex and age in the 6 regions with full data. | Mortality increased to a greater extent with a given fall of temperature in regions with warm winters, in populations with cooler homes, and among people who wore fewer clothes and were less active indoors. |
| Collins, K (2000) | To review evidence on the respective contributions of indoor and outdoor cold to seasonal respiratory and cardiovascular disease and mortality. | Review of recent laboratory and epidemiological studies into:<br>• relationship between ambient temperatures, cold-related respiratory illnesses, cold housing and respiratory health<br>• the extent to which respiratory disease is a component of excess winter mortality. | • Though of different intensity, outdoor and indoor cold temperatures both have the potential for promoting respiratory illnesses in the presence of respiratory pathogens.<br>• Severely cold outdoor temperatures may directly affect the natural defences of the respiratory system.<br>• Cold dwellings can have indirect effects through conditioning the humidity of the indoor environment and infectivity of micro-organisms.<br>• Dust mites are commonly associated with warm, damp homes, whereas mould is with cold and damp.<br>• Whilst many UK homes are damp and/or cold, it is methodologically difficult to disentangle the different importance of mould and dust mites in causing asthma and to show a definitive link between home temperatures and specific health outcomes.<br>• It is difficult to interpret the causes of excess winter mortality due to the blurring of the distinction between respiratory and cardiovascular deaths.<br>• Recent epidemiological studies show direct associations between a reduction in mortality indices and increased protective measures against the cold. | |

| Study | Issue | Study method | Main results | Conclusion |
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| Goodwin, J (2000) | To review the relationship between cold stress and health of older people, with particular reference to circulatory disease. | • Review of relative contribution of indoor and outdoor temperatures and physical activity in circulatory illness among older people.<br>• Review of causes of excess winter mortality. | • Hypothermia represents a minor cause of excess winter mortality.<br>• Respiratory disease accounts for half of excess cold-related deaths with ischaemic heart disease and cerebrovascular disease accounting for the remainder.<br>• Inadequately protected exposure to outside cold contributes to winter mortality.<br>• However, indoor temperatures play an important role in mitigating the effects of winter cold on older people.<br>• Cold stress may explain the link between the relative contribution of outside and indoor temperatures.<br>• The shock of cold mornings can cause excessive cardiovascular strain, particularly if leaving a cold dwelling. The effect is less if leaving a warm dwelling.<br>• Older people experience increased blood pressure and heart rate in winter compared to summer at precisely the times of day (early morning and early evening) that correspond to the times of greatest risk of the acute onset of thrombotic disease.<br>• Physical activity and fitness generally have beneficial health outcomes – however the above suggests that older people should avoid vigorous activity at certain times of the day, particularly in winter, and they should moderate outdoor excursions into the cold. | |
| Somerville, M et al (2000) | To evaluate the use of NHS money to improve health by improving housing conditions | • Pilot study assessing health outcomes before and after housing conditions were improved.<br>• Intervention involved installation of central heating (funded by Health Authority) in the homes of asthmatic children.<br>• 72 children with previously diagnosed asthma living in 59 damp houses in Cornwall | • Energy efficiency improved by a mean of 2.1 on the NHER scale.<br>• Initially 92% of children's bedrooms were unheated and 61% were damp. Following improvements, the proportions were 14% and 21% respectively.<br>• All respiratory symptoms were significantly reduced after intervention; the greatest reduction was seen in nocturnal cough from a median score of 3 (most nights) to 1 (on one or several nights) in the previous month.<br>• School age children lost significantly less time from school for asthma in the previous 3 moths but not for other reasons.<br>• Lack of a control group menat that effects of age, season and biased reporting could not be eliminated. | Housing improvements appear to have a positive impact on children's health, particularly respiratory problems. Further work is under way to substantiate these findings. |

| Study | Issue | Study method | Main results | Conclusion |
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| Khanom, L (2000) | To assess the health impact of energy efficiency improvements on households suffering fuel poverty in public sector houses in Tower Hamlets (initial results from ongoing study) | • Structured questionnaires and 2 in-depth interviews on people's perceptions and understanding of relationship between home heating practices, consumption of fuel and self-reported ill- health in the household<br>• Random sample of public sector Housing Benefit recipients within Tower Hamlets<br>• 89 respondents (out of a sample of 188) in first stage.<br>• 24 respondents in 1st in-depth interview (all households in fuel poverty within sample).<br>• Weaknesses in data include small sample, reliance on self-reporting of symptoms, lack of control group and only taken from 1st stage of research. | • Most respondents had difficulty paying their fuel bills. Most paid their bills quarterly – leading to financial difficulties at particular times of the year.<br>• 23 (of 89) households reported wallpaper peeling off the walls which they had difficulty affording to re-decorate.<br>• 11 of these households reported mould growth causing regular damage to clothes and furniture.<br>• 67% of sample (89) reported depression; 63%, regular headaches; 57%, coughing; 47%, aches and pains.<br>• 68% reported their children suffering fever; 51% of children, sore throat; 40%, wheezing; 31% skin irritability; 18%, vomiting.<br>• Most of these respondents felt their children's health problems were related to lack of warmth in the home.<br>• Adults reporting depression stated this was due to worrying about other severe illnesses such as diabetes, asthma and long-term illnesses or problems at home and with their children.<br>• Depression was strongly correlated with poor housing conditions – many also claimed this was due to 'helplessness' at not being able to do anything to improve their living conditions.<br>• Vomiting in children was strongly correlated with mould on walls in the home. | Initial results suggest a strong relationship between poor housing conditions and certain health conditions, particularly depression and vomiting in children; depression is related to worries over fuel bills and a feeling of helplessness in not being able to improve their housing conditions. |

| Study | Issue | Study method | Main results | Conclusion |
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| Green et al (2000) | To establish the strength and significance of any relationship between improved energy efficiency in 4 tower blocks in Sheffield and health status of the tower blocks' residents. | • Cross-sectional survey of 135 residents of improved blocks and matched sample of 140 residents of 'unimproved' blocks to assess the impact of energy efficiency improvements on damp and mouldy conditions and the warmth, comfort and health status of residents.<br>• Most potential compounding factors were recognised and accounted for, apart from higher proportion of unemployed people and larger families in unimproved blocks.<br>• Improvements included replacement of underfloor electric heating with gas-fired district heating, improved thermal insulation (each tower block was encased in mineral wool insulation with an outer skin of rainscreen cladding) and improved ventilation measures.<br>• Average expenditure: £29,000 per unit. | The following significant differences were found between improved and non-improved blocks:<br>• Room temperatures in improved blocks were substantially higher, whilst fuel consumption levels in improved and unimproved blocks were roughly the same.<br>• Residents responded to energy efficiency improvements by increasing warmth and comfort rather than reducing consumption.<br>• Damp and mould in improved blocks was virtually eliminated, compared to 40% of unimproved blocks suffering damp or mould in one or more rooms.<br>• Residents of improved blocks had higher mean scores on all 8 dimensions of SF-36, indicating better health, than residents of unimproved blocks, with the exception of 'general health perceptions' (which were roughly the same).<br>• The mean scores for residents of improved blocks on SF-36 were also higher than the City average, despite the fact that average incomes were well below the City average.<br>• With respect to specific health dimensions within SF-36, there were significant differences between the mean scores for physical role at 1% level and between energy/vitality and emotional role at 5% level. | Capital investment in 4 Sheffield tower blocks had a dramatic impact on the lives of their residents. Housing investment can break the vicious circle of low incomes, poor housing and poor health. However, results have to be qualified because of difficulties in obtaining a good match between the two groups of residents cf forthcoming longitudinal study of housing investment and health in Liverpool. |

| Study | Issue | Study method | Main results | Conclusion |
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| Energy Action Scotland (1999) | To examine whether there is an identifiable link between poor housing, fuel poverty and heatlh status and to estimate the likely scale of additional costs to the NHS. | • Two stage study based on 2 GP surgeries in Glasgow:1 serving a large public sector housing estate; the other a more mixed and varied constituency.<br>• 1st stage involved self completion survey by 440 patients awaiting consultation (questionnaires were delivered after a period of cold weather).<br>• 2nd stage involved detailed questionnaires of 95 households (199 people) reporting symptoms known to be associated with damp or cold living conditions; 72 of these also had energy audits.<br>• Sample was not representative, due to self-selection nature. For example, patients were of poorer health than population of Scotland as a whole and were twice as likely to present themselves to GPs. | **Phase I (444 respondents)**<br>• 40% of respondents reporting problems with condensation damp, mould and draughts went to their doctor 10 times a year (average for all respondents was 6.1 and for Scotland, 3.1).<br>• 72% of those who had central heating (and used it) had either not visited their doctor or had been less than 3 times during the previous year.<br>• 27% of those without central heating had been to their doctor 10 or more times in the previous year. This compared to a figure of 9% for those with central heating.<br>• Cost to NHS of extra presentations to GPs resulting from dampness estimated at £263 per person per annum.<br>**Phase II (95 households, 199 people, 72 energy audits)**<br>• 60% reported that a member of their household had visited their GP on 10+ occasions over previous year.<br>• 37% of households included someone who had been admitted to hospital over previous year.<br>• 26% of households included someone with asthma and 39% reported family members with a long-term illness.<br>• 57% reported one or more health problem associated with dampness.<br>• The level of asthma was 1.6 times higher in households that reported dampness, than in households without dampness. For children, 19% were reported as having asthma as were 8% of adults (national figures, 14% and 4% respectively).<br>• Respondents living in dwellings reported as being cold and draughty, rather than damp, were significantly less likely to report a member of the household with asthma.<br>• Children who were absent from school for more than a week in the previous year lived in dwellings which reported twice as much dampness problems as those where children had been off for one week or less. | Despite the small sample size, poor health status in children appears to be convincingly associated with dampness.<br>The rate of asthma was above the national average, although incidence was much lower in houses that were cold and draughty.<br>Investment in housing renewal may be cost effective, given the recurring additional costs to the NHS of poor housing. |

| Study | Issue | Study method | Main results | Conclusion |
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| Critchley R et al (2000) | To demonstrate the sort of modifications suitable for existing social housing to improve the health of asthmatics | • Before and after study of the impact of heating, ventilation and insulation modifications on health, energy use, comfort and dust mite rates.<br>• 7 Council homes occupied by at least one asthmatic.<br>• Level of funding prevented more representative sample size. | • Perceived health, as measured by SF-36, improved by 12%; effectiveness of lungs of 4 asthmatics improved by mean of 20%; medication or symptoms reduced for 3 out of the 4 asthmatics where this was recorded<br>• Dust mite rates reduced to insignificant levels, probably due to relative humidity being reduced to below 50%<br>• NHER ratings increased on average by 2.1<br>• Poor standard of installation of ventilation systems<br>• Successful installation of heating and ventilation improvements requires a 6 stage process including tailored surveys of measures required, energy survey (eg NHER), consultation with occupants over suitable measures, detailed specifications of measures and close supervision of installation<br>• SF-36 was appropriate for assessing adult health but not child | Improved housing conditions can improve health, particularly for asthma sufferers providing measures are properly planned and executed. New HEES may raise moisture levels, leading to increased dust mite rates and risk of asthma, since ventilation is not included in the package. |
| Ambrose, P (2000) | To assess and if possible measure the improvements in health of a sample of the population who have been re-housed, or had their existing accommodation improved, as part of SRB | • Before (1996) and after (2000) survey of random sample of 525 households to assess self-reported health status and perspectives on related issues eg access to health care, fear of crime, satisfaction with housing and other services<br>• Comparator household survey conducted in area of improved housing in Paddington in 1996.<br>• Survey of local service providers in fields of housing, health, education, policing etc to ascertain views on the relationship between health standards and housing conditions and broader effects of SRB intervention. | • The second sample surveyed in 2000 was only half the size of the original sample – however the 2nd sample showed very similar demographic, benefit dependence and other characteristics to the 1st. Health improvements were therefore taken as 'real'.<br>• The incidence of illness episodes was higher, although fewer of them resulted in a visit to the GP or medication.<br>• The average length of illness episodes was much shorter, and very few people said they felt ill all the time<br>• The rate of illness days/person/day fell from 0.37 to 0.05, whilst the pattern of main symptoms remained the same.<br>• There was a high level of satisfaction with the new housing and estates generally.<br>• Damp and cold conditions were much less prevalent but still affected around 1/3 of the population.<br>• The research also contextualises the results within the broader picture of health inequalities within Stepney and London and suggests these limit the potential benefit of area-based initiatives such as SRB | The SRB housing renewal programme has contributed to a considerable imorvement in the health of residents within the SRB area. However health gain is only confined to a very limited area unless more fundamental changes are made to benefit and fiscal regimes. |

## Appendix 2 Summary of health projects

| Project/ Partners | Time frame/Funding | Aims and Objectives | Core activities | Evaluation |
|---|---|---|---|---|
| **HECA Action for improved health and housing**<br>Telford & Wrekin Council<br>Shropshire Health Authority<br>Telford EEAC | Started 1997<br>£50,000 - HECA Action<br>£8,200 - joint finance<br>£5,300 - Council's Home Repairs Assistance Grants | To work with local health professionals and GPs to increase awareness of energy efficiency and associated health benefits by<br>• Providing training for GPs and health professionals about energy efficiency<br>• Developing an energy efficiency information pack for health professionals<br>• Enabling health professionals to encourage patients to be energy efficient at home, including help with referrals for installation of measures | • GPs not included in training - primary care teams considered better placed to identify patients in need of improved energy efficiency<br>• Energy/health information pack for GPs and health care workers developed to help assess risk from cold homes. These were widely disseminated in health outlets.<br>• A simple referral form was developed by Council and piloted in 2 primary health teams<br>• Model exhibition on health and energy efficiency toured GP surgeries | • No monitoring of impact on number of visits to GP surgeries<br>• Difficulty in getting GP involvement<br>• Involvement of Community Health Trust might have helped ensure training was included in health workers' training schedules |
| **Energy Action for Health**<br>Doncaster MBC<br>Doncaster NHS Healthcare Trust | Started 1997<br>£172,000 from HECA Action (for other work as well) | To improve the health of local people through provision of energy advice, improved awareness and increased referrals for grant aid by<br>• Enabling health visitors to identify households in need of grant aid (generally the fuel poor)<br>• Developing an existing energy efficiency data base of households to identify priority 'fuel poor' groups<br>• Holding energy advice surgeries for members of the public in GP surgeries | • A manual was developed for health visitors attending training and a separate manual for receptionists at GP surgeries<br>• Publicity materials were produced, including thermometers promoting the scheme<br>• Energy advice surgeries held in 40 GP practices<br>• Patients referred for either HEES grant or local authority HRA grant<br>• HEES referrals increased by 15% as result of scheme | • Training well received by health visitors, although shortened to ensure not too burdensome<br>• Important to provide refresher training<br>• No monitoring of impact on health, although research planned to correlate energy rating data with hospital admissions<br>• Difficulty of obtaining short term results on health gain<br>• Ongoing consultation and tailoring of scheme essential<br>• Feedback to health professionals helps ensure ongoing involvement |

| **Project/ Partners** | **Time frame/Funding** | **Aims and Objectives** | **Core activities** | **Evaluation** |
|---|---|---|---|---|
| Energetic Homes<br>Leicestershire Health Authority<br>Midlands Asthma & Allergies Research Association<br>Hospitals<br>De Montfort University | Started 1997<br>£32,000 – HECA Action<br>£300,000 ERDF Article X for energy efficiency grants in 14 wards (half of City)<br>Funding fully subscribed by 1999 – team ceased taking referrals after this date | To reduce the incidence of asthma by improving the energy efficiency and ventilation of asthmatics' homes by:<br>• Conducting a methodologically robust study on the links between housing and asthma<br>• Offering grant aid to asthmatic households who have been referred by their doctor | • Extensive promotion of scheme by Health Authority to GPs in 14 wards<br>• GPs sent pro-forma to asthmatic patients<br>• 'Open days' in renewal offices on asthma and preventative measures<br>• Allergen avoidance advice given to people receiving grant aid<br>• Patients contribute 50% towards cost of works, or 25% if on Benefits<br>• Package includes standard insulation work plus heat recovery fans. | • Response from GPs varied considerably<br>• Original research project abandoned because HECA Action timetable did not fit in with timescale of BMA Ethics Commiittee – this reduced credibility of scheme with some GPs<br>• Some GPs did not consider this approach 'primary care' and charged for referrals.<br>• GPs in hospital clinics were more committed than GPs in surgeries<br>• Client contribution represented a considerable barrier to take up. |

| **Project/ Partners** | **Time frame/Funding** | **Aims and Objectives** | **Core activities** | **Evaluation** |
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| SNUG and healthy homes<br>Birmingham CC<br>Family Health Services<br>Birmingham Health Authority<br>Home Improvement Agencies | Started 1995<br>£150,000 for SNUG and £150,000 for 'Healthy homes' (from Health Authority) | Each project aims to improve the health of older people in the Ladywood (SNUG) and Hodge Hill (Healthy homes) areas of Birmingham by:<br>• Improving the homes of frail older people at risk of hospitalisation<br>• Improving links between the local authority and GPs<br>• Involving Home Improvement Agencies in technical support<br>• Providing welfare rights advice to maximise benefit take up. | • Eligible households on low incomes are referred by their GP or para-medic for a grant of up to £1500 in Ladywood or £2,500 in Hodge Hill to carry out works that will reduce likelihood of hospitalisation, or an amelioration of their condition in the case of chronic illness<br>• GPs used a standard form to help identify eligible households, where works could be prescribed as an alternative to medicine or treatment (see Appendix).<br>• Referrals are recorded by the Council and passed to a Care & Repair Agency to inspect the home and produce a work specification<br>• The Agency also provides welfare rights advice at the time of inspection.<br>• GPs carry out a clinical review several months after the home improvements undertaken to assess impact on patients' health<br>• Marketing involved GP seminars, including Continued Professional Development credits, canvassing of GPs by FHSA practice support teams and publicity in the medical press and radio. | • After slow start, a high proportion of GPs became involved<br>• Poor response from health visitors<br>• Better response from GPs in Ladywood than Hodge Hill possibly because more single practitioners in Hodge Hill – problem was overcome by identifying cases and then asking for GP approval<br>• Some monitoring of health impact |