The 'Secure Warm Modern' programme in Nottingham

Decent Homes impact study: Health and wellbeing

Nottingham City Homes

Secure ◆ Warm ◆ Modern

Nottingham Trent University

Knowledge Transfer Partnerships

NHS Nottingham City

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Nottingham City Homes

Amanda Schofield, Director of Strategy and Partnerships
Mark Johnson, Director of Property Services
Steve Hale, Assistant Director of Asset Management
Dan Lucas, Strategy Development Officer
Steve Edlin, Head of Service – Capital Programme

Nottingham Business School

Professor Alistair Mutch
Dr Néstor Valero-Silva
Dr John Buglear

NHS Nottingham City

Dr Peter Cansfield, Deputy Director of Public Health
Andrew Hall, Head of Partnerships and Health Improvement
Dr Abigail Dutton

KTP Adviser

Philippa Ryan

Housing Investment Impact Analyst (KTP Associate)

Alice Jones
alice.jones@nottinghamcityhomes.org.uk

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www.nottinghamcityhomes.org.uk/improving_your_home/secure_warm_modern/impact_study.aspx

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Executive summary

Social inequalities and health

The inequalities in health seen in the UK – in terms of mortality, life expectancy or health status – are closely related to disparities in social and economic circumstances.

In Nottingham, those living in the wealthiest neighbourhoods live on average 10 years longer than those from the most deprived neighbourhoods.

Tackling inequality in health is now one of the primary objectives for the NHS, but the core argument of the Marmot Review (2010) is that *"Action on health inequalities requires action across all the social determinants of health… Action taken by the Department of Health and the NHS alone will not reduce health inequalities."* [1]

Some of the poorest health outcomes in Nottingham are seen in estates with a high proportion of social housing. This is because of the way social housing is prioritised for the most disadvantaged, including those with medical needs.

As a result, many of the Nottingham City Homes estates are in areas scoring amongst the worst 10 percent in England on the national health indices. Because of this, NCH is committed to its role helping improve the health of our tenants.

Housing is one of the factors that determines health outcomes. Evidence shows that poor housing leads to poor health. Poor housing quality, including cold, damp and insecure conditions, has a negative impact on both physical and mental health.

The Secure, Warm, Modern programme in Nottingham

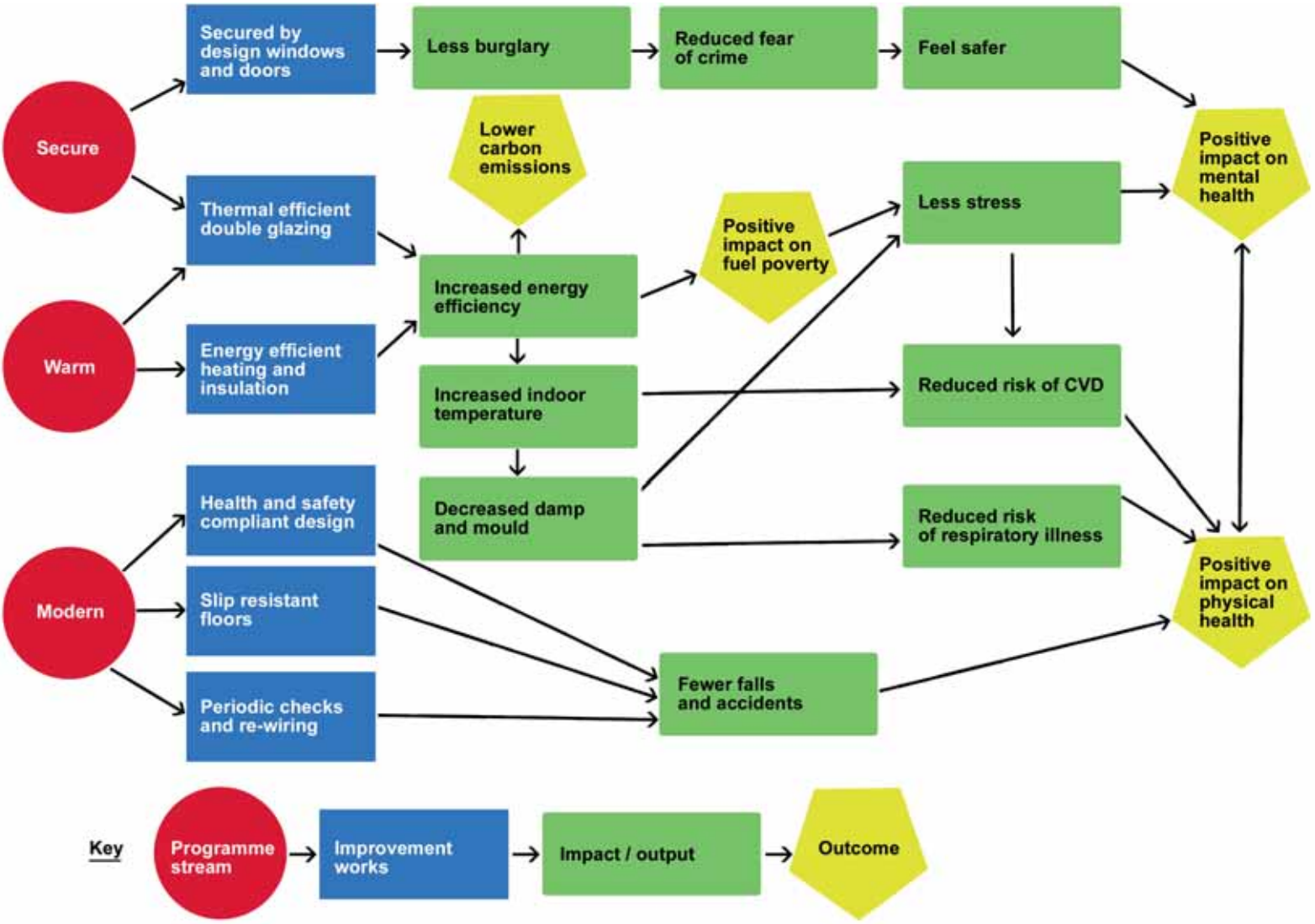
Nottingham City Homes' Secure, Warm, Modern programme aims to bring Nottingham's 28,500 council homes up to and above the national Decent Homes standard. The work began in 2008, with a total planned investment of £187 million between 2008 and 2015, delivered under the following streams:

- Nottingham Secure – replacing all single-glazed windows with 'Secured by Design' double-glazed units in around 15,300 properties
- Warmth for Nottingham – improving heating systems for 19,700 properties
- Modern Living – making internal improvements including new kitchens for 17,000 homes and new bathrooms in 12,700 homes.

NCH wanted to understand what the impact of this significant investment in the quality of council housing. In partnership with Nottingham Trent University and Nottingham City NHS, a Health Impact Assessment has been carried out to understand the health impact of the Secure, Warm, Modern programme.

Health impact map

The health impact map was developed to show the anticipated causal mechanisms and expected health outcomes as a result of the housing improvements carried out under the Secure, Warm, Modern programme:



The evidence for the HIA was gathered through:

- A review of previous studies relating to the health impact of housing
- Analysis of local demographic and hospital admissions data for relevant health conditions
- Modelling of the health impacts of removing identified health and safety hazards
- Interviews with NCH tenants and local health professionals.

Impact on physical health

Cardio-vascular disease

Cold temperatures cause raised blood pressure and increased viscosity, and has been shown to cause hypertension, ischemic heart disease and strokes.

Around a third of all Excess Winter Deaths are caused by cardio-vascular disease.

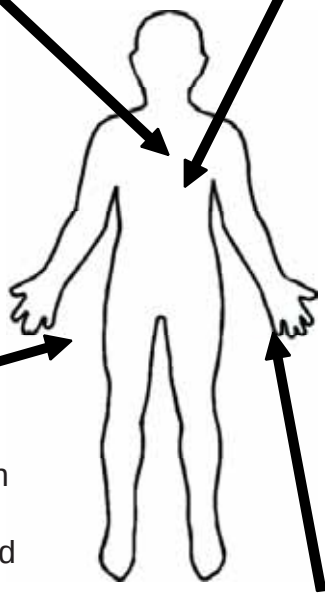
Respiratory illness

At temperatures below 16^{o}C resistance to respiratory infections is reduced.

Cold conditions also impair lung function and can trigger bronchoconstriction in asthma and COPD.

Damp and mouldy conditions can also cause asthma symptoms and contribute to respiratory infections.

Respiratory disease accounts for over a third of all Excess Winter Deaths.



Falls and accidents

45 percent of people aged 80 and over are at risk of falling, and between 10-25 percent will sustain a serious injury as a result. Hazards for trips and falls in the home are a causal factor.

Over 2 million injuries from accidents occur in the home each year. Fatal accidents are more common in the winter, as cold reduces body temperature and so mental function, dexterity, strength and sensation.

Joints and mobility

Cold conditions are thought to worsen pain associated with arthritis and rheumatism.

Estimated improvements in physical health after Secure, Warm, Modern:

- The World Health Organization found that children living in homes with low quality heating systems showed double prevalence for respiratory problems. By improving heating systems, SWM is therefore estimated to have reduced 1,039 cases of respiratory illness in children living in NCH properties

- NCH identified 235 serious fall hazards in NCH properties prior to SWM; by removing these hazards, it is estimated that this has avoided 12 hospital admissions a year

- NCH identified over 2,000 hazards that could cause accidents, such as electrical and fire hazards. By removing these hazards, it is estimated this has avoided 144 hospital admissions a year. This could save the NHS around £175,000 each year in treatment costs

- It is estimated that SWM has saved two lives a year by reducing excess cold conditions in the home through SWM. There are a total of 128 Excess Winter Deaths each year across the whole of Nottingham (2002-08).

Impact on mental health

Security and fear of crime

A lack of a sense of safety in the home can lead to anxiety and problems with nerves, whilst improvements in safety and security have lead to a significant reduction in self-reported mental health problems, for example reducing self-reporting mental health problems from 52 percent to 41 percent of adults.

Fitting 'Secured by Design' windows in NCH properties reduced burglary by 42 percent on two sample estates where the windows were fitted, compared to a 21 percent reduction city-wide over the same period.

"I had been burgled, and every night I checked everything, it was like an obsessive thing… So from the day I had my windows I felt 100 percent safe".

Damp and mould

Damp and mould may have a large negative affect on mental health. The WHO found that extensive exposure to dampness and mould increased the chance of depression by 60 percent.

NCH found that around 200 homes had severe damp and mould prior to the Decent Homes work. Based on the prevalence of depression in Nottingham and the findings from the WHO above, it is estimated that removing this damp and mould could lead to a reduction of 38 cases of depression amongst NCH tenants.

"I was just miserable, you know, because it was cold and damp and then you'd have to be putting on loads of clothing and things like that, you know, it was like miserable and gloomy I should say."

Excess cold and fuel poverty

Nottingham City 2011 Joint Strategic Needs Assessment on adult mental health reported that those with cold homes or experiencing fuel poverty have a four-fold increased risk of depression or anxiety. NCH found that over 5,000 homes were suffering from excess cold prior to the Decent Homes work; it is estimated that remedying this excess cold (and potential fuel poverty) could lead to a reduction of around 1,400 cases of depression amongst NCH tenants. This could save the NHS almost £200,000 in treatment costs.

The Energy Savings Trust estimates that fitting double-glazed windows can save between £95 and £223 a year, and upgrading the central heating to an A-rated boiler could save £225 a year in fuel cost. Across all NCH tenants that have received new windows or boilers, this amounts to a potential collective saving of £3.5m a year on fuel bills.

"You'd have to put more money in just to keep it warm… so obviously you're trying to save as much as you can, so that was a big hole in my pocket… The [gas payment] reduced down from £30 to £15, so I just top up every week and it has saved me a lot of money"

Conclusions and recommendations

There is a clear social gradient in health in Nottingham, with those living in the most deprived areas having worse outcomes across a number of health conditions and overall life expectancy. Housing conditions are one of the multiple factors of deprivation that can impact negatively on health outcomes.

Addressing housing conditions alone has a moderate impact in improving the health of adults, due to the complexity of the multiple causes of ill-health. However, the cumulative and long-term effect may well be significant; for example, addressing housing conditions has a more significant impact on children, thus potentially resulting in a life-time of savings in terms of health costs.

A number of national studies have calculated the cost implications of poor housing that falls on the NHS as treatment costs; these estimates range from £1.5 billion to £2.5 billion a year. In this research, a small number of examples were selected for which a measurable change and cost impact for the NHS in Nottingham could be calculated; the costs saved as result of addressing serious hazards in the home, reducing asthma in children, and relieving depression from damp and mould, excess cold and fuel poverty total almost £700,000. Just this small number of examples account for 1 percent of Nottingham City PCT's cost of provision for 2010/11 (totaling £56.5m). In addition, the improvements made to the NCH properties will make a long-term difference to these homes (for example, the anticipated life-span of a new boiler is 15 years) and so the health benefits will accumulate over this time.

The core recommendations, and a number of examples of how this could be applied based on the evidence outlined throughout the HIA, are as follows:

1. Maximise opportunities to continue to lever in health benefits through improvements to the quality of council housing stock, through NCH's Asset Management Strategy. Examples include:
   - Supporting the neighbourhood renewal project to build 500 'lifetime homes' and minimise the negative wellbeing impact of the moving process
   - Building cost-effective health and safety features into ongoing asset management programmes, e.g., hard-wired smoke detectors, thermostatic mixer valves.

2. Develop understanding and integrate delivery of public health outcomes through wider services such as housing, by engaging with the Health and Wellbeing Board and Clinical Commissioning Groups. For example:
   - Contributing to local strategies, such as the Joint Strategic Needs Assessment (JSNA) and Joint Health and Wellbeing Strategy (JHWS)
   - Engaging with GPs and Clinical Commissioning Groups through information sharing and building relationships at a neighbourhood level.

3. Consider how NCH's engagement with tenants through existing services could potentially complement or support public health initiatives. Examples include:
   - Facilitating tenants' engagement with public health services, such as smoking cessation, weight loss, Occupational Therapists, etc
   - Supporting the continued delivery of the Nottingham On Call telecare alarm service.

1. Introduction

Nottingham City Homes, in partnership with Nottingham Trent University, are conducting a two-year impact study on the wider social benefits of the Decent Homes programme, known in Nottingham as the Secure Warm Modern (SWM) programme. The research investigates the impact of this significant investment in Nottingham's council housing properties on social outcomes such as crime, energy efficiency and fuel poverty, and on the local economy and employment. This report focuses on the impact of the SWM programme on the health and wellbeing of council tenants in Nottingham.

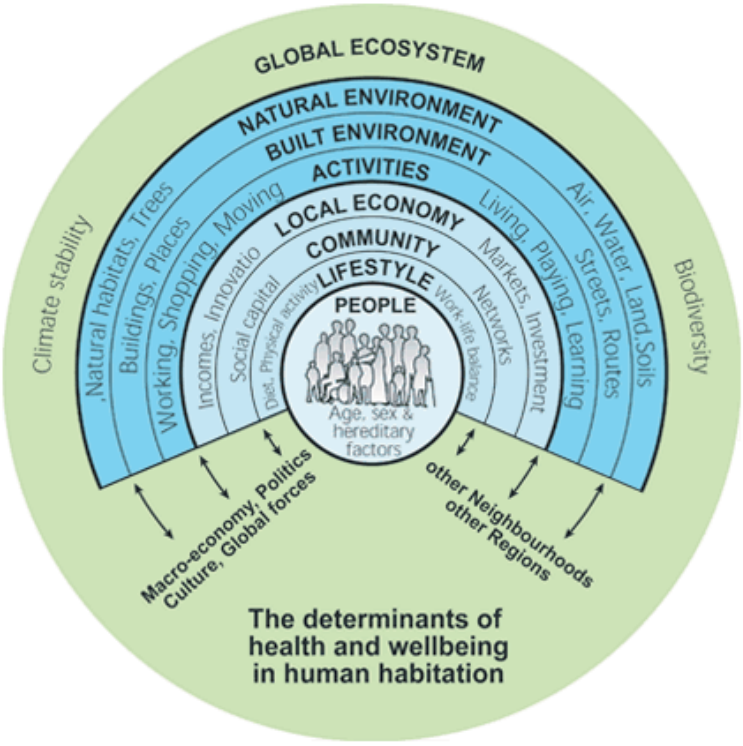
This health impact report has been produced in partnership with the Directorate of Health Equality at Nottingham City NHS. It shows the important relationship between housing and health; it is therefore an initial platform from which to shape ongoing partnerships between housing providers and health service providers. Furthermore, it acts as a guide to future investment decisions that will ensure that housing services are able to contribute to reducing health inequalities in Nottingham.

1.1. Social determinants of health inequalities

Marmot's (2010) Strategic Review of Health Inequalities highlighted that the inequalities in health seen in the UK – in terms of mortality, life expectancy or health status – are closely related to disparities in social and economic circumstances. Those living in the richest neighbourhoods in England live, on average, seven years longer than those living in the poorest neighbourhoods in England. The difference in disability-free life expectancy is even greater at seventeen years.[2]

The Marmot Review emphasises the importance of a wider model of health, including the impact of socio-economic factors (Figure 1). It shows that there is a graded relationship between the level of deprivation, in terms of education, employment and working environment, and housing and neighbourhood conditions, and health outcomes; Marmot refers to this as the 'social gradient in health'. The central message is therefore that: "Taking action to reduce inequalities in health does not require a separate health agenda, but action across the whole of society" [3]

Figure 1: Model of the wider social determinants of health (Dahlgren and Whitehead, 1991)



The recognition of the issue of health inequality in the UK is not new; following the Acheson Independent Inquiry into Inequalities in Health in 1998, the then government pledged to reduce the inequality gap (measured by infant mortality and life expectancy) by 10 percent between 1997 and 2010. However, a recent report by Sheffield and Bristol Universities[4] showed that the health gap between those from deprived areas and those from the most well-off areas is increasing, despite government interventions. Tackling health inequalities has become a core policy objective for the NHS, and is an important feature of plans set out for the Health Service under the recent white paper.[5]

In its Outcomes Framework the NHS states:
Tackling health inequalities and promoting equality is central if the NHS is to deliver health outcomes that are among the best in the world. The social gradient in many health outcomes for people in disadvantaged groups and areas is a major driver of England's poor health outcomes in comparison to other similar countries.[6]

However, the Government has also been receptive to the message of the Marmot Review, that an approach is required that addresses all social inequalities as a route to reducing inequality in health. The Minister for Public Health, Anne Milton, stated that: *"We need a new approach to improve the health of the poorest, fastest. One that works across government to include factors that affect health that lie outside the NHS, such as poverty, housing, education and the environment."*. [7]

Health inequalities in Nottingham

In Nottingham, health inequalities are even greater than the national average, with a difference in life expectancy of ten years between the most deprived and the most affluent areas within the city (Figure 2).

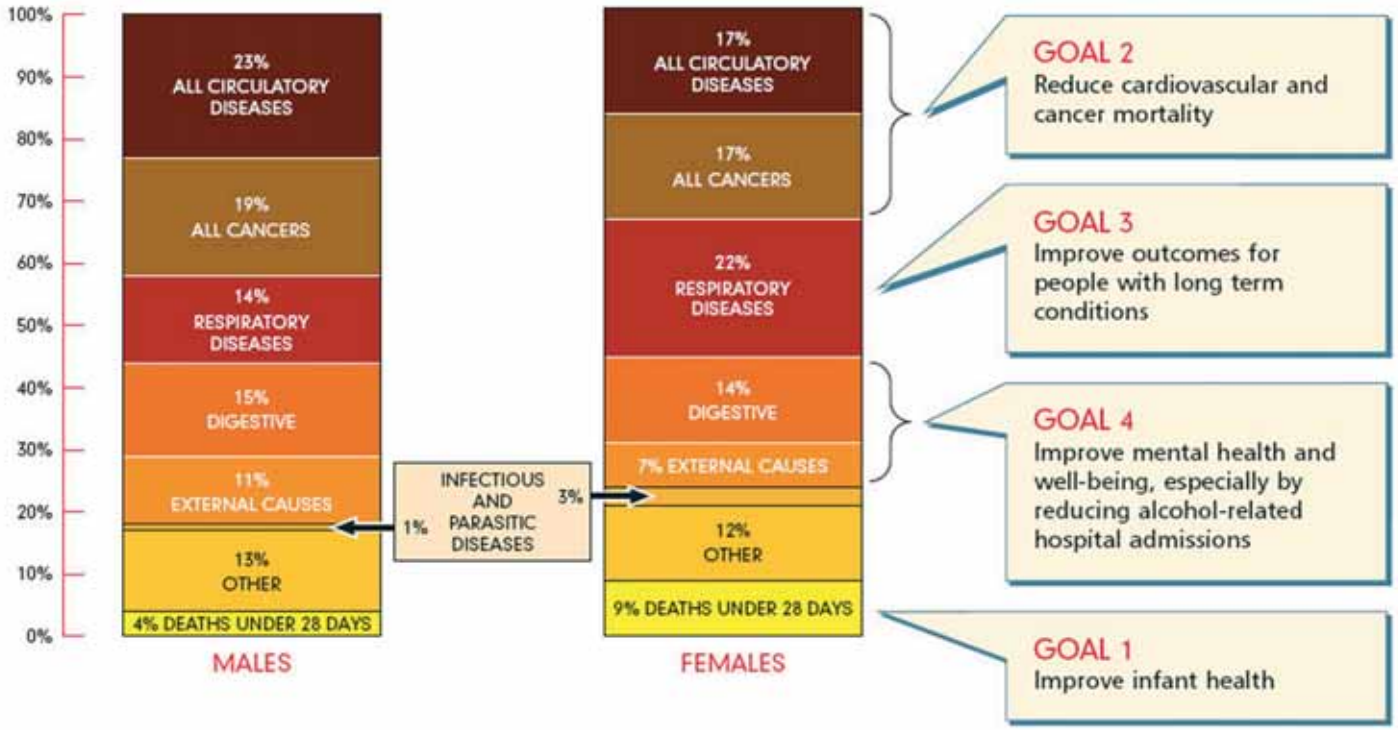
Figure 2: Life expectancies across Nottingham wards (Source: Nottingham City PCT)

Catching the tram and bus through the health inequalities across the city - where a few miles down the road can mean a significant changes in years of life expectancy.

The figures against each 'stop' show average life expectancy at birth for males in Nottingham living in that city ward area. The average across the city is 73.5, compared with the English national average of 76.9, the worst average city rate in England of 72.5 and the best rate of 82.2.

Nottingham City NHS's plan for addressing these inequalities is set out in its World Class Commissioning: Five-Year Strategy 2009/10-2013/14 document. This identifies the health conditions that contribute to differences in life expectancy (Figure 3), and therefore towards the relevant goals for reducing inequality.

Figure 3: Causes of health inequalities in Nottingham (NHS's World Class Commissioning)

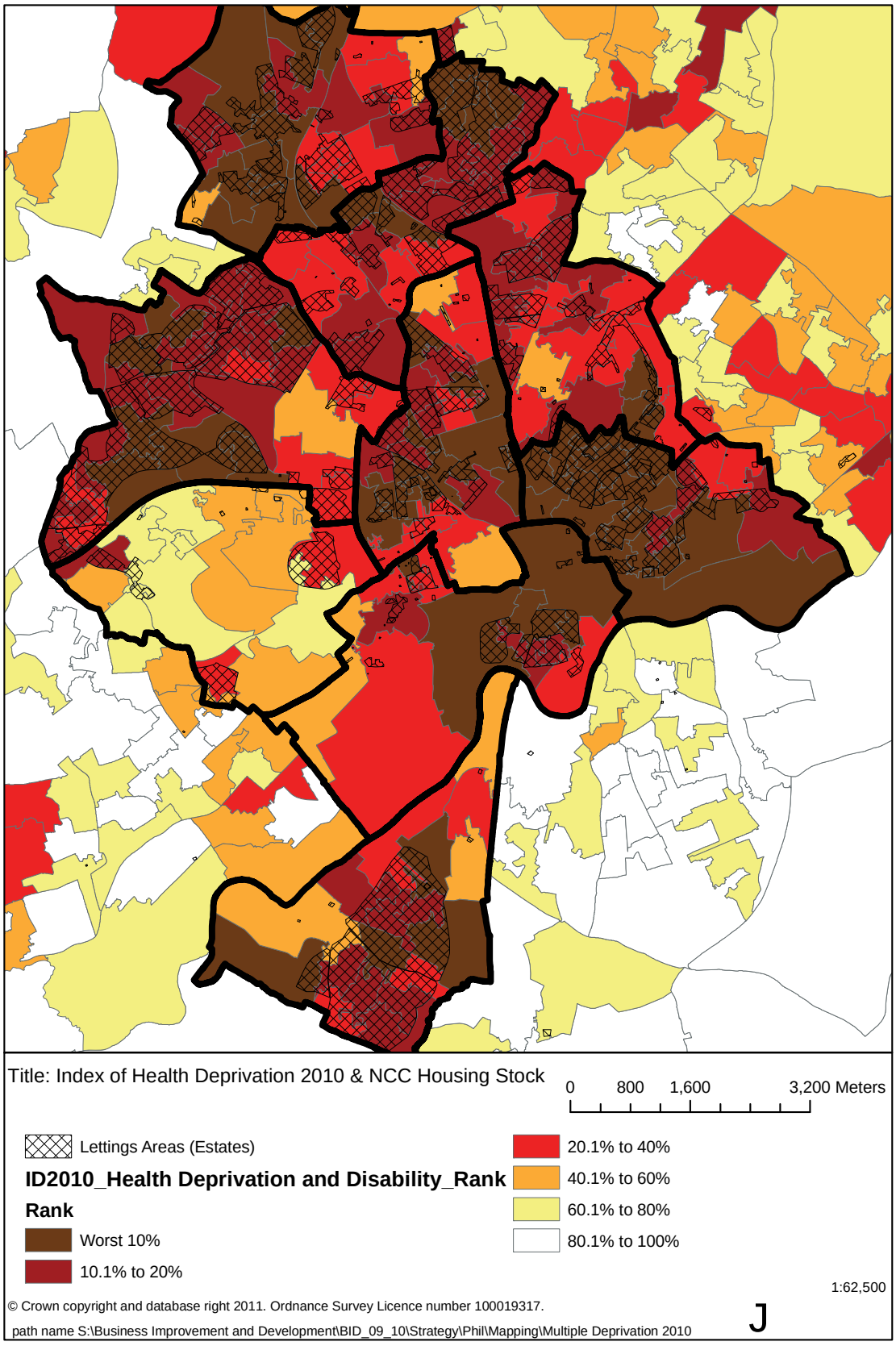


The social gradient in health can be clearly seen in Nottingham, with those living in social housing amongst the worst off. Occupants of NCH housing are likely to be affected by many of the social determinants of health identified in the Marmot Review, such as low educational attainment, unemployment and low incomes, which have a negative impact on the health outcomes of these tenants. The areas that are managed by NCH cover some of the most deprived areas in Nottingham (and indeed in England), across all of the Indices of Multiple Deprivation including income, employment, education and skills, crime and disorder, and health and disability.[i]

For example, currently 67 percent of NCH tenants meet the criteria for and receive Housing Benefit, which is specifically to support those on the lowest incomes and includes those who are unemployed. The correlation with poor health outcomes is also clearly seen; many of the NCH estates are in areas scoring amongst the worst 10 percent in England on the health indices (Figure 4). The ward with the lowest life expectancy in Nottingham is Bilborough ward, in which 41 percent of the properties are council houses; this is compared to Wollaton ward, where only 14 percent of properties are council housing and which has the longest life expectancy, with Wollaton residents living on average 10 years longer than those in nearby Bilborough.

i. The Index of Multiple Deprivation (IMD), produced by the Department for Communities and Local Government, measures seven dimensions of deprivation for every Lower Super Output Area (LSOA) in England and provides an overall index score and ranking.

Figure 4: Index of Health Deprivation (2010) and NCH estates



This relationship between council housing, deprivation and poor health is partly explained by the allocations system for council housing, which prioritises those most in need according to set criteria. In particular, the allocations system prioritises those who have no other housing options (who are therefore deemed to be 'statutory homeless'), and also those with medical housing needs (including on the grounds of disability or ill-health, or those ready for discharge from hospital whose current home is inappropriate).

The high demand for council housing means that individuals with these priority needs are likely to be awarded housing before those with a less immediate financial or health need. Therefore, the allocation system is likely to create a concentration of the most deprived, in terms of income and health, living in council housing.

In addition to socio-economic factors, there are a number of lifestyle factors that contribute to poor health in Nottingham, particularly among social housing tenants. Nottingham City NHS's Five-Year Strategy World-Class Commissioning identifies smoking, poor diet, low physical activity and heavy drinking as significant causes of poor health outcomes in Nottingham, particularly identified with those living in social housing.[8]

The impact of housing conditions on health

Another implication of this wider model of health is that housing and neighbourhood conditions have a direct impact on health and wellbeing (Figure 1). Therefore, NCH's housing management may have a direct implication for health outcomes, as a result of the conditions of both the houses and the neighbourhoods in which our tenants live.

The present report investigates more closely the impact of this second area: the impact on health outcomes of improvements in housing conditions as a result of the SWM programme. However, these findings are always in the context of the social gradient of health described above, in which many NCH tenants are already disadvantaged by the wider socio-economic determinants of health, as well as by lifestyle factors.

1.2. The Secure Warm Modern (SWM) programme

Nottingham City Homes' (NCH) SWM programme aims to bring Nottingham's 28,500 council homes up to and above the national Decent Homes standard.[9] The work began in 2008, with a total planned investment of £186 million between 2008 and 2015.

The programme reflects tenants' priorities for the investment, and is therefore delivered under the following streams of work:

- Nottingham Secure – replacing all single-glazed windows with 'Secured by Design' double-glazed units in around 15,300 properties
- Warmth for Nottingham - improving heating systems for 19,700 properties and topping up loft insulation
- Modern Living - making internal improvements including new kitchens for 17,000 homes and new bathrooms in 12,700 homes.

The programme also aims to ensure that electrical wiring, external doors and loft insulation are adequate to meet the Decent Homes standard.

In addition, if a tenant identifies and indicates that they may have special requirements, a referral is made to an Occupational Therapist (OT), who then assesses the property and the needs of the tenant. The OT then recommends any special aids and adaptations required, which are undertaken alongside the SWM work. This has identified over 500 special adaptations, such as specifically adapting bathrooms or replacing baths with a wet-room, to be made over the course of the programme.

The SWM programme is now well under way. Between April 2008 – September 2011:

- 15,000 properties have had their windows upgraded and 3,000 doors have been replaced
- 9,500 heating systems have been upgraded, and 2,500 lofts topped up with insulation
- 8,000 kitchens and 6,400 bathrooms have been replaced
- 284 aids and adaptations have been made to properties.

Individual properties may have had some or all of these improvements. This is determined by a survey carried out on each property, which identifies what is required to bring the property up to the 'Nottingham Plus' Decent Homes standard. Each house is assessed against the Housing Health and Safety Rating System (HHSRS), designed to identify and then ensure that any potential health and safety hazards within homes are avoided. A 'hazard' is defined as any risk of harm to the health or safety of an actual or potential occupier that is attributable to the condition of the dwelling.

The HHSRS identifies 29 possible hazards, categorised in four groups: Physiological, Psychological, Infection, and Accidents.[10] Each hazard is given a score based on the likelihood and severity of harm resulting from a particular hazard; those scoring above a certain level are classified as 'category 1' hazards, and are required to be addressed under the Decent Homes programme.

2. Housing and Health – uncovering the evidence

The research was undertaken along the lines of a Health Impact Assessment (HIA), as presented by the World Health Organisation (WHO) and the NHS in the UK.[11] The stages of the HIA are:

Screening: assessing the potential for the programme to affect the population's health.

Scoping: setting out the foundations for the appraisal, including the potential health impacts.

Appraisal: gathering the evidence, both quantitative and qualitative.

Making recommendations: including reporting findings, and further engagement with stakeholders to influence future decisions.

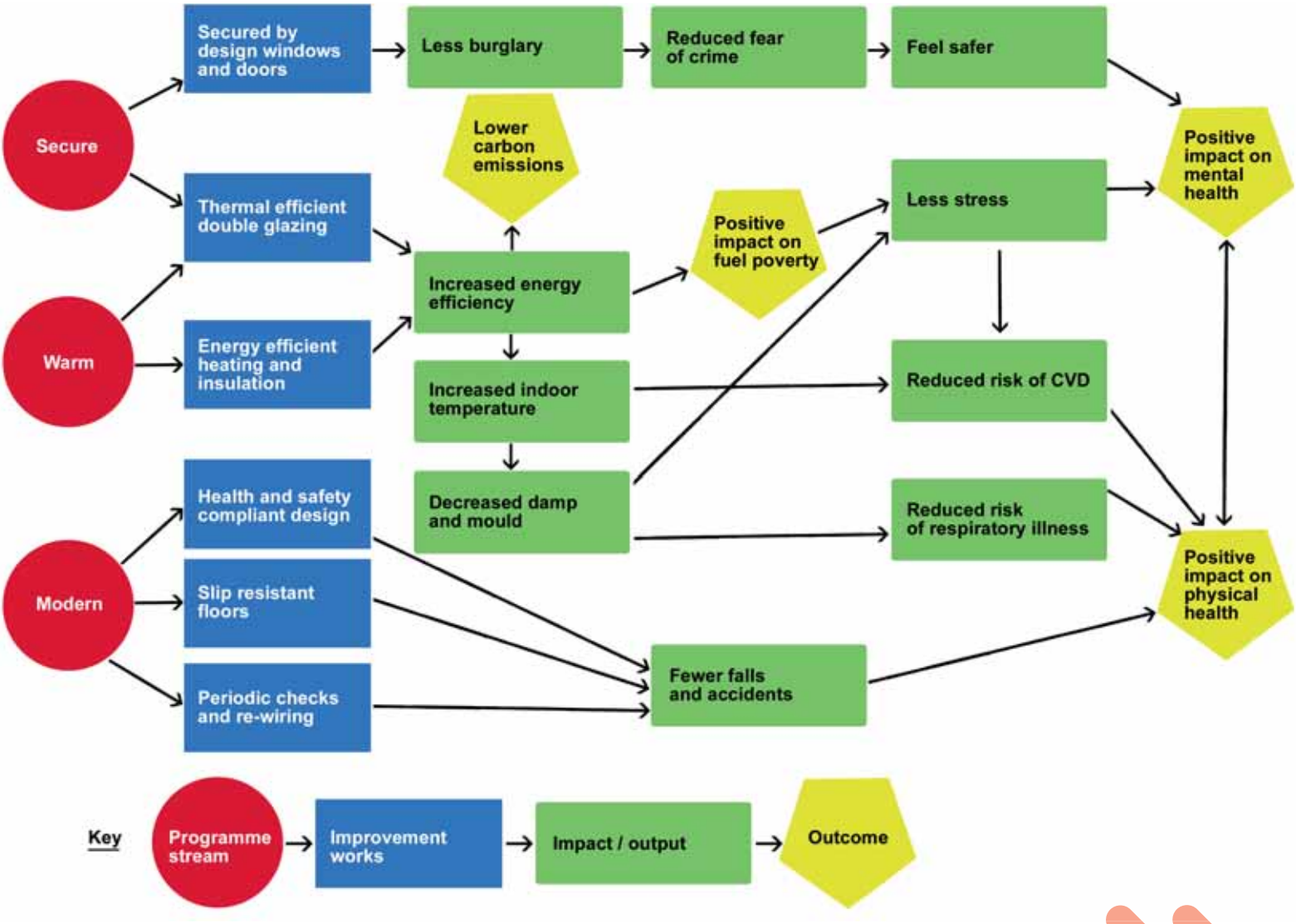
Ongoing monitoring and evalution: to measure changes / improvements.

2.1. The health impact map

The screening stage identified that there was a large body of literature relating to the impact of housing on the population's health. This was further explored in the scoping stage, during which a health impact map was developed showing the anticipated causal mechanisms and expected health outcomes as a result of the housing improvements carried out under the SWM programme (Figure 5). This was developed from the initial review of the literature, where the relationship between housing and health is well recognised; there is a growing body of evidence supporting this relationship and the different mechanisms through which housing and the broader built environment affect health.

This impact map forms the basis of the appraisal stage, setting out the health outcomes and indicators further investigated during the evidence collection stage.

Figure 5: SWM health impact map



2.2. Appraisal methods

The appraisal has been carried out concurrently with the housing improvement programme, with three years of the SWM work having been completed and a further three years remaining. This provides a sample of properties that have had work completed, against a sample which have not yet had any improvements. It also allows any findings from the HIA to influence the remaining programme delivery.

However, there are a number of methodological difficulties in isolating the impact on health of the housing improvements:

- As outlined above, the relationship between health and housing is complex and there are many confounding variables involved. Poor housing conditions often co-exist with other forms of deprivation, such as poor education, unemployment, ill health, etc., making it difficult to isolate and assess the impact of housing alone on health

- Health impacts following housing improvement can sometimes take time to unfold, making the true effect of housing improvement impossible to assess in the short to medium terms. For example poor health in adulthood may be a result of poor housing conditions in childhood[12]

- The sample of properties available to compare outcomes either before/after the work or between intervention/control groups is limited by the time the programme has been running and the number of properties that have received the work. The small sample size makes it difficult to find statistically significant differences.

In light of this, the appraisal aims mainly to characterise and, where possible, quantify the health impact of the SWM programme. It therefore includes a variety of data collection techniques in order to attempt to triangulate the findings from each to reach a more robust conclusion.

The methods for data collection included:

1. Evidence from a rapid review of the literature describing the qualitative and quantitative health impacts following housing improvements, then applied to local demographic data

2. Local data analysis to identify the extent of relevant health conditions in council housing estates,[ii] and evaluate any potential effect of housing improvements on the rate of hospital admissions/deaths, before and after comparing intervention and non-intervention areas

3. Review of data from surveys of NCH properties using the Housing Health and Safety Rating System. Further modeling provides estimations of the health benefits from addressing serious hazards through the Decent Homes programme

4. Qualitative in-depth interviews with six sets of tenants who have received the work, two local GPs, a Respiratory Consultant and a Medical Housing Referrals Officer.

ii. Local health data were identified by using NCH property postcodes or housing estate boundaries; however, this is likely to include a number of neighbouring houses of other tenures, e.g., due to 'right to buy' sales.

Appendix A gives further detail on the data collection and analysis methods used.

The findings from each of the methods above are brought together under the following thematic headings:

1. Impact on physical health
    - General health and wellbeing
    - Cardio-vascular disease
    - Respiratory illness
    - Excess winter deaths
    - Falls and other accidental injuries

2. Mental health impacts
    - Security and fear of crime
    - Damp and mould
    - Fuel poverty
    - The refurbishment process.

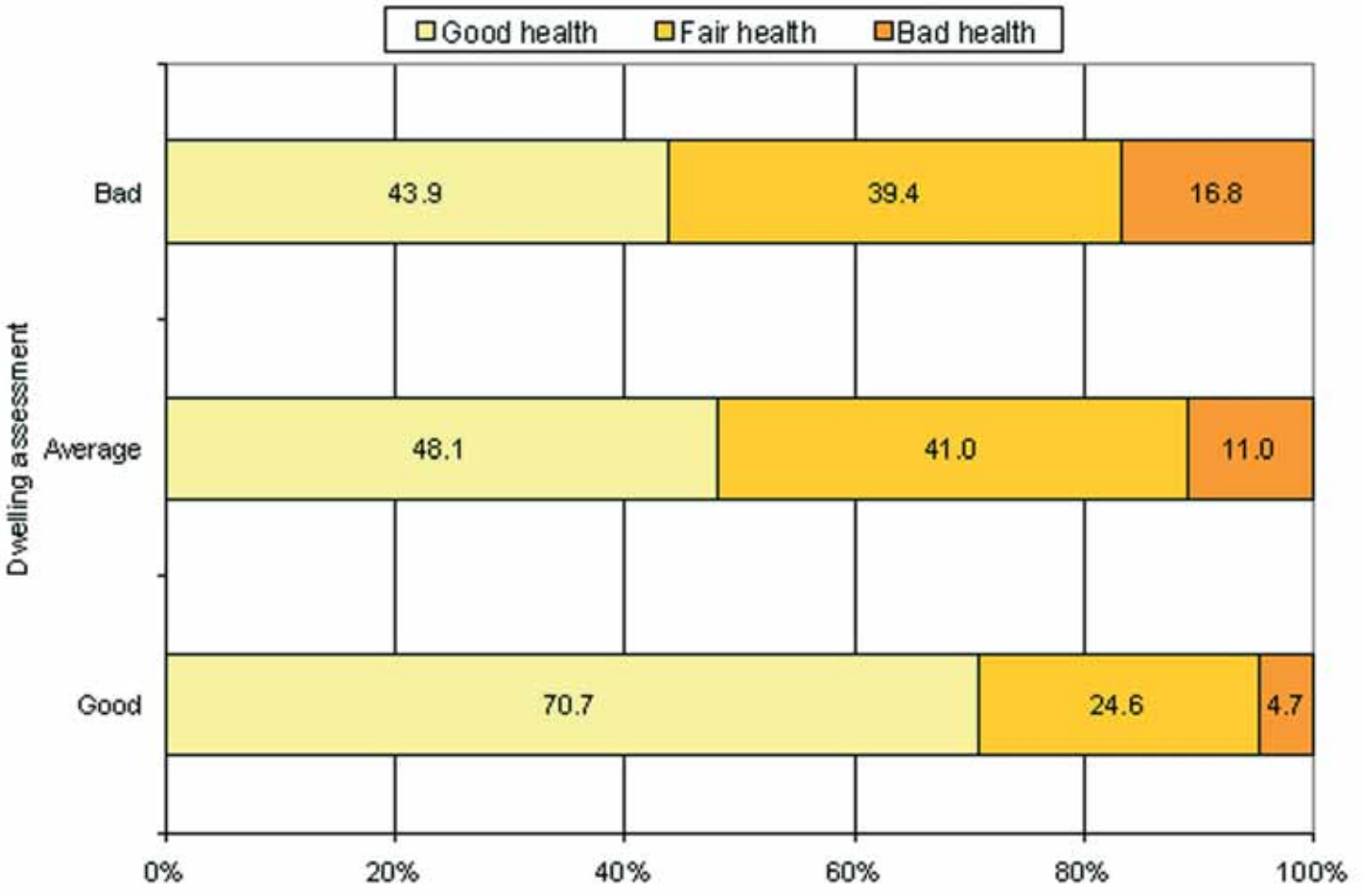
3. Findings on the health impacts of housing

3.1. Impact on physical health

General health and wellbeing

In confirmation of the wider model of health in Figure 1, the evidence suggests that housing quality and conditions are related to general evaluations of health, and resulting use of health services. This is illustrated by a large-scale study carried out by the World Health Organisation on European housing and health status in 2007, which shows that decreased dwelling quality is associated with decreased health.[13]

Figure 6: Self-reported housing conditions and health status (Source: WHO, 2007)



In this study, almost a quarter of residents living in the lowest quality dwellings reported their health status as bad or very bad, compared to 6.2 percent of residents living in good quality dwellings. In high quality dwellings the proportion of "very healthy" residents was more than three times that of residents in low-quality dwellings. This relationship is also supported by the observation made in a number of smaller studies, including other studies of social housing, which concluded that self-reported health improves with housing quality. [14, 15, 16, 17, 18]

The causal mechanisms explaining this relationship between poor housing and ill health are many and varied, and the strength of evidence also varies widely. Poor housing can affect specific conditions, such as cardio-vascular or respiratory diseases, as set out in the sections below. In addition, there are a number of more general ways that poor housing can affect health, which would result in a lower assessment of general health.

For example, cold conditions are thought to worsen pain associated with arthritis and rheumatism.[19] Damp and mould are strongly linked with symptoms such as nausea, breathlessness, backache, fainting, headaches, fever and vomiting in children. They are also linked to allergies, infections (other than respiratory), toxic reactions and some cancers, although the level of mould spores that would lead to these reactions is uncertain.[20]

During interviews with two local GPs, they identified that poor or inappropriate housing, combined with other issues relating to deprivation, has an impact on their patients' general health, and therefore on GPs' workload:

"I think within the inner city the deprivation has such an impact on health that it actually makes our workload really hard… the amount of work that we have to do to support that patient will be completely different to [someone from] a leafy suburb."

"Housing issues do have an impact, specifically if you're looking at things like large families in small accommodation… patients who are in inappropriate accommodation, perhaps because as they've got older they've stayed in the same place and can't manage the stairs… some of the housing stock where it has been quite run-down, where there's been damp… the noise impact and issues with neighbours. That has an impact on their mental health and their physical health."

The evidence on housing and health is dominated by studies showing the relationship between poor housing and poor health, while there is less extensive evidence to show the relationship between housing improvements and improved health.

Some of the different health benefits that have been reported following housing improvements include fewer mobility problems,[21] fewer aches and pains, and fewer runny noses.[22] Two individual studies and one systematic review found that housing improvements led to a reduction in GP attendances.[23] One study showed that the percentage of people having GP visits in the previous two weeks dropped from 35.6 percent to 24.6 percent. A second study showed that the number of residents attending the GP more than six times in six months dropped from 54 percent to 45 percent of a very small sample size. There is therefore some evidence of a beneficial impact of housing improvements on demand for health services.

Application to Nottingham City Homes population:
Number of children missing school

A randomised trial of housing insulation showed that an increase in indoor temperature was associated with a statistically significant reduction in the number of children missing school.[24] In both the intervention and control groups, before the interventions took place 71 percent of children had missed at least one school day in the preceding year. In the year after the home improvements had taken place, 75 percent of the control group missed some school, compared to 61 percent of the intervention group. The relative risk reduction of 14.1 percent was statistically significant.

By applying these figures to NCH's population the potential benefit of housing improvements of school days missed can be estimated.

There are currently 14,443 NCH residents aged under 18 years old. Applying the findings above, it may be expected that before the intervention 10,255 (71 percent) children will have missed at least one day of school due to illness. After the housing improvements this may reduce to 8,810 (61 percent) children. Therefore, an estimated 1,445 children who would have missed school due to illness will not do so following the improvement of their homes.

This not only reflects a potential improvement in health amongst the children; it is also encouraging, as it may benefit the education and social development of children whose absence from school had previously hindered their progress.

This evidence is supported by the findings from interviews with both tenants and health professionals. All of the tenants interviewed felt that the housing conditions prior to the improvements impacted negatively on them and made their general health or existing health conditions worse. A common issue was cold indoor temperatures, due to draughts and poor insulation (particularly from single-glazed windows) and inadequate (or too expensive to run) heating. Other issues included condensation and damp, causing mouldy conditions on the windows and walls. For some tenants, their housing quality caused them to worry: particularly about security and vulnerability to break-ins, and also about the gas fires and the possibility of accidents or carbon monoxide poisoning.

Nearly all of the tenants interviewed felt that their general health was better since they had the SWM work completed. In the majority of cases, the tenants felt that the housing conditions did not directly cause poor health, but exacerbated existing conditions. For example, a number had conditions made worse by the cold conditions, causing pain or discomfort, such as arthritis or asthma (examples can be found in each of the four case studies below). In a small number of cases, the tenants felt that housing conditions had contributed to causing illness, such as cold, damp and mouldy conditions contributing to respiratory infections such as colds or flu; since the work was completed they had had fewer or no bouts of cold or flu.

Case study 1

Jane[iii] has a disability that affects her mobility, so she lives in a bungalow where the bathroom has also been especially adapted to a wet-room. The bungalow has also had the windows replaced with double-glazing and a new central heating system fitted under the SWM programme.

Before the windows and heating were done, Jane described the bungalow as “cold, freezing. Draughty everywhere”. She could feel the cold draughts around the old single-glazed windows, and all areas of the property were cold. She used to put the gas fire on in the sitting room all the time when she was in, and stay mainly in this room as it was warm and she had to heat only the one room. Despite this, Jane found that she was paying more on fuel bills for the bungalow than when she used to live in a two-bedroom house.

Jane’s disability causes her significant pain, so she is prescribed morphine pills that she can take to control the pain. When it gets cold, this causes her limbs and body to shake, which makes her very tired as it uses up all her energy. When it was cold she would find she was taking more morphine pills to deal with the pain.

She was also concerned that the door and windows were not secure, especially as there had been a number of burglaries in the area.

When she found out the work was being done, the main feeling was “joy”. She wasn’t worried about the work, just looking forward to having it done. The windows were done in one day and the heating was done in a day and a half; she used the ‘Helping Hands’ service to help move things and give her any support needed.

Since the windows have been replaced, Jane has noticed the difference – it is now “much better”. The main difference is that it is much warmer in the whole house. For example, it is a lot less draughty and she no longer has to have the radiator on in the bedroom.

Jane feels much safer with the new door. She has also noticed that it is much quieter in the house because of the new windows, with much less noise from the traffic outside.

It has also made a difference to her health – Jane has noticed that her health has improved, as she does not experience the shakiness as much and so does not have to take as many painkillers.

Now she’s happy with the house, and likes living there.

iii. Tenants’ names have been changed in all the case studies to maintain their personal privacy

Cardio-vascular disease

There is a growing body of research linking cold temperatures with cardio-vascular disease. Mortality from ischæmic heart disease and cerebro-vascular disease together count for over a third of all excess cold-related mortality in England and Wales[25] (see Excess Winter Death section, below). When the indoor temperature is below 12ºC blood pressure and viscosity rise, both risk factors for cardio-vascular disease. For each 1ºC drop in living room temperature, there is a rise in blood pressure of 1.3mmHg.[26] Individual studies have shown some associations between poor temperature control and ischæmic heart disease and stroke,[27] and that residents in dwellings with non-tight roofs and non-tight or single-glazed windows showed an increased association with hypertension.[28]

The WHO lists the following implications of temperatures below the recommended indoor temperature:

Indoor temperature	Effect on body
18-24ºC	No risk to sedentary, healthy people
Below 16ºC	Diminished resistance to respiratory infections
Below 12ºC	Increased blood pressure and viscosity
Below 9ºC	After two or more hours, deep body temperature falls

Table 1: WHO assessment on the effect of indoor temperature on the body

As well as these direct impacts of cold homes on cardio-vascular health, there are a number of potential indirect effects as a result of deprivation that have a negative impact on cardio-vascular heath and may interact with the effects of cold housing. For example, those with poor incomes, who are unemployed or who have a lower level of education experience higher levels of stress as a product of deprivation; increased stress alone is a risk factor for cardio-vascular disease. Those living in social rented properties are more likely than average to be burgled or a victim of violent crime;[29] also, there is some evidence to support that fear of crime reduces physical exercise,[30] another risk factor for cardio-vascular disease. Lack of education, understanding or enthusiasm to engage in healthy living could also be factors contributing to the increased prevalence of cardio-vascular disease in those living in poor housing.

Local hospital admissions data for circulatory disease shows that the highest levels of admissions are in Bilborough, Bulwell, city centre (Arboretum) and Clifton North areas. Figure 7 shows admissions per 1,000 for each Lower Super Output Area (LSOA), overlaid with council housing estate boundaries. This shows that the areas with highest circulatory disease admissions coincide with areas of council housing estates.

It indicates that, as anticipated, circulatory disease is more prevalent in areas of council housing due to the social gradient in this health condition. However, the evidence on the link between temperature and cardio-vascular events suggests that it is therefore likely that housing improvements, as part of a holistic approach with health education and healthy opportunities, will contribute to an improvement in cardio-vascular health.

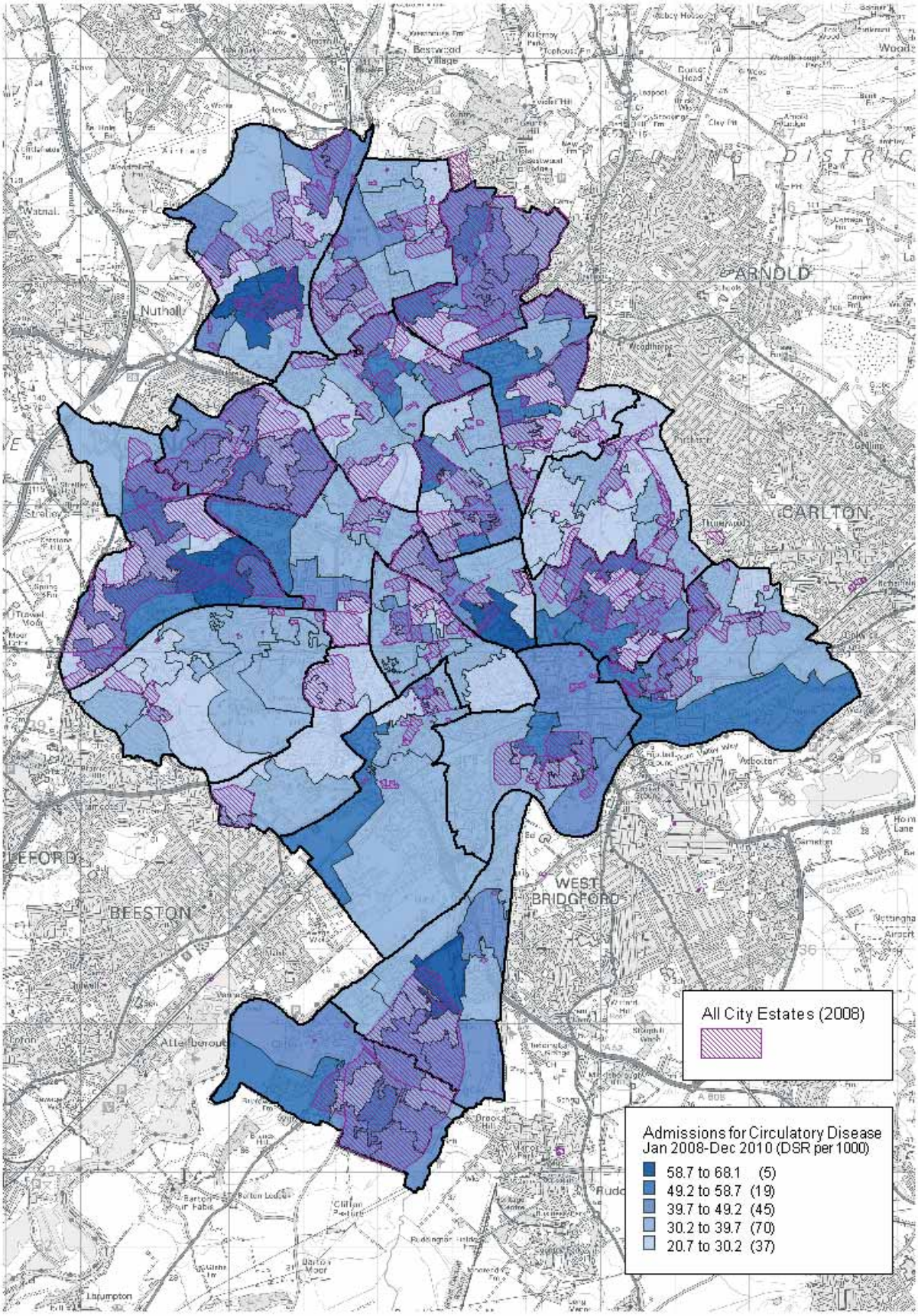


Figure 7: Circulatory disease admissions and NCH estates

Respiratory illness

The relationship between respiratory illness and housing conditions is more complex, with potential interacting effects of temperature, humidity conditions and prevalence of infections such as influenza. For example, respiratory disease accounts for over one third of all excess cold-related mortality (see section on Excess Winter Deaths, below). This is generally attributable to cross-infection from indoor crowding; the adverse effects of cold on the immune system (as shown in Table 1, below 16ºC individuals have diminished resistance to respiratory infections) and to the fact that lower temperatures assist the survival of bacterial droplets.[31, 32] However, as well as the factor of temperature, excess winter deaths from respiratory illness are affected by the prevalence of influenza strains.[33]

Cold conditions also impair lung function and can trigger broncho-constriction in asthma and Chronic Obstructive Pulmonary Disease (COPD). Damp and mouldy conditions can also cause asthma symptoms and contribute to respiratory infections;[34] mould has been found to be more prevalent in the least energy-efficient homes.

These effects were confirmed in an interview with a local Respiratory Consultant, who stated that COPD is the biggest cause of admissions in relation to respiratory conditions in Nottingham, and that the level of admissions tends to surge during cold periods. The Consultant observed that their *"Patients with COPD will actually do badly based in a very cold and very hot temperatures, winters in particular"*. The advice literature given out to patients with COPD in Nottingham includes a section that emphasises the importance of keeping warm.

The Consultant's experience also supported the evidence in the literature of a social gradient in health; he stated that *"There are huge numbers [of admissions for COPD] from Nottingham City PCT - this is one of the worst areas… It's because of deprivation and higher smoking rates, but mainly social deprivation… even if you allow for smoking the people in more deprived areas get worse COPD – and it's not clear why that is"*. This relationship is seen in the local data for respiratory disease admissions, which shows that areas with high levels of respiratory disease again tend to overlap with council housing estates. The NCH estates overlapping with the areas with the highest rates of admissions for respiratory disease are Old Highbury Vale, Bilborough, Beechdale, and Bulwell Hall (Figure 8).

Improving the heating systems and the energy efficiency of homes leads to an increase in living temperatures and a decrease in the amount of time that the temperature within the home is below dangerous levels, alongside a decrease in mould and spore growth. This would suggest that improved heating and energy efficiency following housing improvements lead to a significant reduction in respiratory morbidity. A recent review of energy efficiency improvement interventions and health found a modest measurable improvement in physical health in adults.[35]

The surveys to NCH properties prior to SWM found 202 category 1 cases of damp and mould. The HHSRS model assumes the main health impact of their occurrence is respiratory disease, including asthma, coughs and wheezes, and also infections such as rhinitis, conjunctivitis and eczema. It is estimated that addressing these cases of damp and mould could have led to a reduction of 15 cases of harm, including 1.5 serious and 13.5 moderate cases. This will have an estimated cost saving to the NHS of £6,670 in the first year.

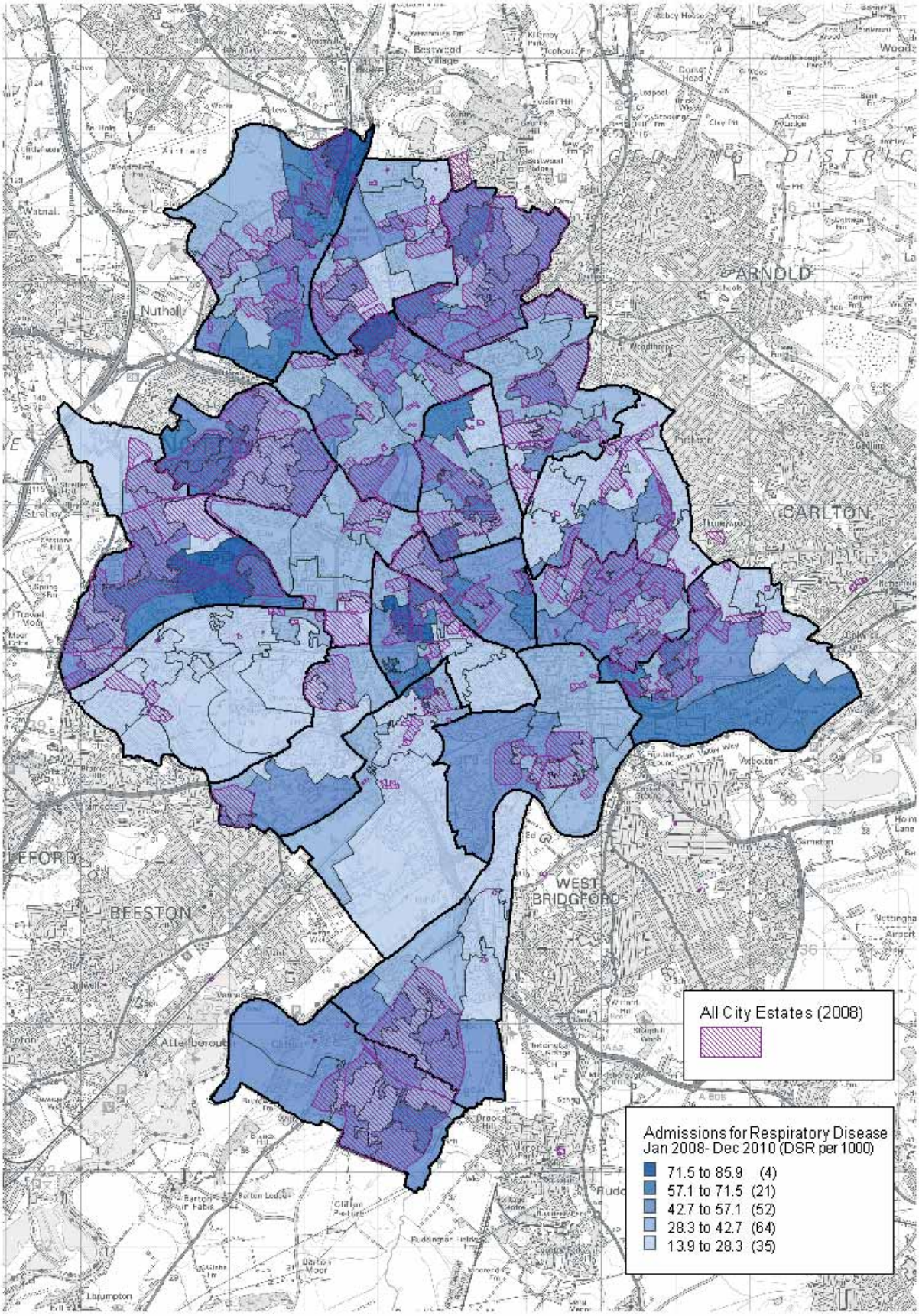


Figure 8: Respiratory disease admissions and NCH estates

Other studies found that housing improvements led to a reduction in smokers.[36, 37] Any reduction in smoking benefits not only the individual, but the whole household, the community and wider community through the reduction in demand on the NHS.

While the impact on adults' health of housing improvements is modest, a repeated finding in the literature is a significant improvement in childhood asthma following such improvements. Several studies have shown that with an improved indoor temperature and reduced mould, housing improvements have led to a reduction in asthma symptoms in children, resulting in a significant reduction in asthma-related school days missed.[38, 39, 40] SEPHO reported that home improvements decreased school sickness by 80 percent in children with asthma or recurrent respiratory infections. [41] This corresponds to the evidence given by a local GP, who found that *"we have patients who would come in saying their child perhaps is getting recurrent chest infections and things like that, and they wonder if it's linked to the damp. Sometimes patients have shown us pictures of the damp in their houses."*

Application to Nottingham City Homes population:
Prevalence of respiratory disease in children

A WHO study in 2007 found that children (aged 0-17 years) showed double prevalence for respiratory problems in homes with low-quality heating systems. This is potentially a large impact, as asthma accounts for the majority of respiratory symptoms in children. The prevalence of asthma is increasing, with the UK having one of the highest prevalences of asthma[42] and central England (which includes Nottingham) having the highest prevalence within the UK at 21 percent.[43]

Using these prevalence rates of the effect of low-quality heating on the prevalence of respiratory symptoms, it is possible to estimate the effect on NCH residents:

Around 28 percent of NCH residents (including all household members registered on NCH records) are aged under-18, accounting for 21 percent of Nottingham City's under-18-year-olds. 10,600 heating systems have been replaced, affecting around 21,200 residents, of whom 5,936 (28 percent) are likely to be under 18 years old.

Working from the WHO finding that the prevalence of childhood respiratory disease is doubled for those living in homes with low-quality heating, the prevalence among the 5,936 under 18 year olds living in NCH properties, who have had their heating systems replaced will have been twice that of the other children in Nottingham City. If the prevalence for the whole of Nottingham City is 21 percent, the prevalence in those 5,936 children is 35 percent compared to a prevalence of 17 percent in the rest of Nottingham City. Therefore, in the homes that have already had their heating systems replaced, there could have been around 2,078 children with respiratory illness. By replacing heating systems this figure could be halved, reducing 1,039 cases of respiratory disease in children.

The average treatment cost for a child with asthma is £181 according to the National Asthma Campaign;[44] therefore, these housing improvements could save the NHS £188,059.

While improving the warmth of the home has positive effects on health, there is some evidence of certain unintended negative effects from housing improvements. There are several small studies that show a worsening in respiratory symptoms and illness following housing improvements. One review suggests that warmer homes create optimal conditions for dust mites, which may then contribute to a worsening in asthma symptoms. Further studies attribute a possible worsening in respiratory symptoms to exposure to indoor painting (exposure to volatile organic compounds and hydrocarbons) causing clinically verified asthma, bronchial hyper-responsiveness and nocturnal breathlessness.[45, 46,47] However, the increase in respiratory symptoms in this case would be short-lived.

Excess winter deaths

In the UK there is greater mortality and morbidity in the winter months compared to the non-winter months. This excess winter mortality is higher in the UK than in many other European countries that experience colder winters. 'Excess Winter Deaths' (EWDs) refers to the number of deaths that occur during the winter months (December to March) over and above those that occur in the summer months:

$$\text{EWDs} = \text{Deaths in Dec-Mar} \left(\frac{\text{Deaths in previous Aug-Nov + deaths in current Apr-Jul}}{2} \right)$$

In 2009-2010 there were an estimated 25,400 EWDs in England and Wales. Only a minority of these EWDs were a direct result of the cold itself, e.g., hypothermia, or as a result of accidents on icy surfaces. The majority of EWDs are due to circulatory disease such as heart attacks and strokes, as well as respiratory disease, including influenza and pneumonia.[48]

Contrary to the social gradient seen in other health conditions, excess winter mortality is widely distributed across socio-economic groups with similar rates across both affluent and less affluent groups.[49] However, some groups are more vulnerable to EWD, primarily the elderly; over 80 percent of all EWDs in England and Wales in 2009/10 were among those aged 75 or over.[50] As a higher proportion of NCH tenants are aged 75 or over compared to the city average (10.6 percent of NCH tenants compared to 5.8 percent of the overall city population), there is therefore a higher level of risk of excess winter mortality amongst council housing tenants in Nottingham due to the age profile. In addition, those with pre-existing conditions, such as heart disease or respiratory disease, have been shown to be at increased risk of winter mortality.[51] These links could be important in tackling the issue of EWD, particularly in Nottingham City where cardio-vascular disease is the main cause of death and where rates of premature death from COPD are approximately twice that of the County.[52, 53]

A study of Excess Winter Deaths in Nottingham found that there were on average 128 EWDs each winter in Nottingham City between 2002 and 2008. This equates to 15.9 percent more deaths in the winter months compared to the non-winter months. In line with national evidence, this was predominantly among older people, with 89 percent of these EWDs occurring among people aged 65 and over. The annual variation in the rate of EWDs reflects the national average, suggesting that rates for EWDs are higher in years with colder temperatures.[54]

Vulnerability to excess winter mortality has been shown to be related to the temperature conditions inside the home. A number of studies show that poorly-insulated or low energy-efficient homes are correlated with winter respiratory disease among older people[55] and with excess winter mortality.[56]

This suggests that improvements to housing that increase energy efficiency should be included in public health strategies and interventions. The Joseph Rowntree Trust (2001) concluded that:
"The findings suggest that people in poorly heated homes are indeed more vulnerable to winter death than those living in well-heated homes. This suggests that substantial public health benefits can be expected from measures that improve the thermal efficiency of dwellings and the affordability of heating them."[57]

Application to Nottingham City Homes population:
Prevalence of mortality and morbidity from excess cold

NCH recorded 5,114 category 1 hazards for excess cold during the HHSRS surveys completed prior to the SWM programme, indicating that tenants in these properties would be more vulnerable to colder temperatures in their homes during the winter months. By addressing these hazards, through installing efficient central heating systems and double-glazed windows, it is estimated that this will have avoided one death as a result of the cold conditions, and one incident of moderate harm. This is equivalent to a cost saving of £45,793 to the NHS in the first year.

These are conservative estimates, as only properties that previously had both an inefficient heating system and single-glazed windows were included under a category 1 hazard. An additional 8,700 properties have also had single-glazed windows replaced with double-glazing, and these properties would have been likely to be just under or potentially within the category 1 hazard band. If these properties are also included as excess cold hazards, then a total of two deaths, one serious and three moderate incidents of harm have been avoided, giving a total savings cost to the NHS from removing excess cold hazards of £125,221.

Falls

All NCH properties are assessed for health and safety hazards as part of the initial survey, including hazards for trips and falls, and electrical and fire risks. Each home has an individual design for the new kitchen and bathroom, ensuring the safe positioning of amenities and appliances.[iv] Where the survey identifies special requirements, the property and tenant are in addition assessed by an Occupational Therapist, who recommends any aids and adaptations that are then undertaken as part of the SWM work.

The risk of falling increases with age, particularly in those 65 and over. Thirty-five percent of over-65s are at risk of falling each year, rising to 45 percent of people aged 80 and over. Between 10 percent and 25 percent of these fallers will sustain a serious injury. The incidence of falls is rising nationally; in Nottingham the rate of admissions for serious accidental injury is higher than the national average.[58] Applying these proportions to NCH tenants, of whom 6,811 are 65 years or older, it is therefore estimated that 2,384 NCH residents are at risk of falling each year, and between 238 and 596 of these residents would sustain a serious injury as a result of their fall.

Local admissions data for falls shows that council housing estates in Bestwood Park, Top Valley East, Radford (St Peters) and Bilborough are included in areas with the highest rates of admissions per 1,000 for falls.

Falls at home have many contributing factors, some of which are unavoidable, such as increasing age and frailty. However, many factors contributing to a fall, such as a potentially hazardous home environment, can be avoided. A number of studies have supported this by showing that hazard modification and housing improvements, such as grab rails and encouraging practices to remove objects left on stairs, does help to reduce falls.[58, 59, 60, 61, 62, 63] In addition, cold environments reduce mobility and lead to an increase in falls,[64] thus increasing energy efficiency could also have positive effects by increasing mobility.

Application to Nottingham City Homes population:
Number of fall hazards remedied and influence on number of falls

The HHSRS surveys identified 235 category 1 fall hazards in NCH properties, including those between levels, on the same level, on stairs and in the bath, affecting 226 properties and the 581 tenants living in these properties.

It is estimated remedying these hazards could have prevented 12 incidents of harm per year, including one severe, three serious and seven moderate incidents of harm. It is estimated that this could have saved the NHS £32,000 in the first year alone.

iv. For example, cookers are positioned so that they are not behind a door, and have two surfaces on either side on which to place hot objects.

Housing improvements may therefore have a role in reducing fall incidence, yet the multi-factorial causes of falls means that a wider approach is required to address the problem. For example, the World Health Organisation concluded that home assessment and modification as part of a multi-factorial programme can reduce falls in frail people; however, the assessment and modification of the home on its own appears, although feasible, ineffective in reducing falls or fall injuries among older people.[65] It is therefore positive that the SWM programme encourages the involvement of an Occupational Therapist, who is able not only to determine suitable adaptations to the home, but also works with the tenant to modify the latter's activities in order to enhance their day-to-day safety.

Accidents

In 2005, unintentional injuries accounted for nearly two percent of all deaths in England and Wales. When considering non-fatal injuries, 45 percent result from accidents in the home, totalling around 2,701,326 accidents occurring in the home each year.[66]

About 50 percent of injuries in pre-school children occur in the home.[67] Despite improvements, avoidable injuries are still the largest cause of death in children aged between 1 and 14 years; as such, they are a major public health issue in the East Midlands. During the five-year period 2001-2005, 25 percent of deaths of East Midlands residents in this age group were the result of avoidable injuries – injury and poisoning.

Avoidable injury has links with deprivation.[68] This is supported by the finding in Nottingham City's Joint Strategic Needs Assessment on avoidable injury: local authorities within the East Midlands with higher levels of childhood poverty tend to have higher hospital admission rates for accidental injury in children. Also, children whose parents have never worked, or are long-term unemployed, are thirteen times more likely to die from avoidable injury than are children of parents in higher managerial and professional occupations.

Fatal accidents in the home are more common in winter. The effect of the cold on reducing body temperature and thus mental function, dexterity, strength and sensation is thought to contribute to this.[69]

Fire is another potential cause of harm in the home. Data from Nottingham Fire and Rescue Service indicate that there were 107 casualties (i.e., persons requiring medical attention) as a result of domestic fires in 2008-2010 in Nottingham city, of which 47 were in NCH properties. This is in line with national evidence that fires, and injuries from fires, increase with levels of deprivation, and in older housing.[70] Currently, 50 percent of NCH properties are fitted with hard-wired smoke alarms, as properties that undergo electrical rewiring as part of SWM are at the same time fitted with a smoke alarm. A programme is in place to fit hard-wired smoke detectors to all remaining NCH properties by 2014. Evidence in the literature indicates that fitting smoke alarms has been shown to reduce accidents,[71, 72] with one study reporting an 80 percent reduction in the annual injury rate over a four-year period following the installation of smoke alarms.[73]

Accidents in the home are, like falls, multi-factorial. The home environment itself is one modifiable contributing factor. In light of the significance of the number of accidents at home, home improvements aiming to provide primary prevention of accidents are very important. For example, following recent research with Glasgow Housing Association, the University of Nottingham advocates that all social landlords fit thermostatic mixer valves in new bathrooms, which limit the maximum temperature of bath water and therefore reduce the number of scalds to children, the elderly and disabled.[74]

Application to Nottingham City Homes population:
Number of health and safety hazards remedied and influence on number of accidents

The HHSRS includes a number of hazards under the prevention of accidents, including electrical hazards, fire, flames and hot surfaces, collision and entrapment, position and operability of amenities, and structural collapse and falling elements.

The HHSRS data for NCH found 2,394 category 1 hazards under these headings, with the majority of potential accidents relating to flames and hot surfaces (1,226 category 1 hazards) and electrical hazards (822 category 1 hazards).

It is estimated that addressing these hazards could have reduced the incidents of harm by 144 a year, including five severe, 37 serious, and 103 moderate incidents of harm. It is estimated that this could save £175,000 in NHS treatment costs in the first year.

Case study 2

Emma and David live in a bungalow which, as well as having new windows, heating and kitchen under the SWM programme, has also been specially adapted to provide access for David's wheelchair.

Before they had the adaptations, David's access into and around the house was limited. Now, the doors have been widened, and the bathroom converted into a wheelchair-accessible wet-room. This has made a major difference in terms of the freedom he now has to move about the house: *"with this wheelchair I can go out, I can see on the path, I can go through the door… It's nice just to sit at the back door and feel you can see people and you can do what you want to do."*

David's blood-pressure medication (Warfarin) means that he is very sensitive to the cold, and he found that he used to get cold very easily and frequently. This meant that the gas fire had to be on much of the time, a cause of concern for Emma as David suffers from sleep apnoea; this could result in his falling asleep suddenly and the associated risk of his falling onto the gas fire. With the new heating system, the room can be warmed either by radiators or the electric fire. Also, Emma and David have noticed that with the double-glazed windows, the heat is retained more effectively and it is a lot less draughty. Emma found *"I don't have to worry about him actually getting too hurt like I would with the gas fire... That's a lot of help towards your health because at the end of the day you are not stressing out over it"*.

The couple also have the 'Nottingham On Call' service, which is a home safety and personal security system managed by NCH. The system provides a 24-hour telecare emergency service, linked to personal alarms and a telephone system in the home. This service has made a big difference to them: *"That's the best system I've ever known in years. That's the biggest [difference], Nottingham On Call… Because it means if he falls or anything I don't have to worry about picking my phone up, I can just ring them and they sort it out and get in touch with whoever needs to come out"*.

All the adaptations and improvements on the property have positively impacted on the couple's lives, in terms of their health and mental wellbeing: *"This place is absolute spot on… Just how I wanted it"*

3.2. Mental health impacts

From the literature it is clear that housing affects mental health. It is easy to appreciate that poor quality housing, low temperatures, damp and mouldy conditions, security concerns and overcrowding can have a negative effect on mental health. However, the literature shows that reversing any negative impacts on mental health of housing circumstances is not as simple as improving housing conditions, due to the complex nature and multi-factorial causes of mental ill health.

There are a number of studies that support the causal linkages in our health impact map between housing conditions and mental health. These studies repeatedly show that poor housing conditions such as mould, damp, cold temperatures and the perceived lack of safety (as well as occupancy issues such as overcrowding and cramped room space) damage the mental health of inhabitants.[75, 76, 77]

Security and fear of crime

A lack of a sense of safety in the home can lead to anxiety and problems with nerves, while improvements in safety and security have led to a significant reduction in self-reported mental health problems. In one study, those self-reporting mental health problems were reduced from 52 percent to 41 percent of adults following work to increase the security of the area.[78] Several other studies have shown that as home improvements are made to increase security, residents feel safer inside their homes,[79] and that this sense of safety can extend to outside the home.[80] This increased sense of safety could lead to reduced levels of stress, thus have a positive impact on mental health and possibly improve social and physical functioning.[81]

A previous strand of this Decent Homes Impact Study looked at the impact of fitting 'Secured by Design' windows to NCH estates.[82] This found that burglary was reduced by 42 percent on two sample estates where the windows were fitted, compared to a 21 percent reduction city-wide over the same period. Prior to the work, 46 percent of the tenants surveyed in that area said that burglary/theft was a 'very' or 'fairly' big problem; the year after the programme was completed, the proportion of tenants thinking this had decreased to 37 percent. This has resulted in an improvement in tenants' mental wellbeing; the proportion of tenants surveyed in the sample areas who felt a little or very unsafe in their homes alone after dark decreased from 37 percent to 31 percent.

Therefore, given the evidence that burglary has been reduced as a result of the SWM programme and that this has positively affected tenants' perception of safety in their respective area, it is anticipated that such a measure will have the same positive effect on mental health as is reported in similar studies (see case studies 3 and 4).

Damp and mould

Damp and mould may have a considerable negative effect on mental health. Baker (2001) highlights the negative psychological effects arising from the constant sight of fungal growth, the unpleasant smell sometimes associated with it, and the difficulty of getting rid of mould. There is also the associated stigma of being unclean, which may in itself cause depression and stress.[83] A large study by the WHO found that various aspects of housing were found to be associated with, and potentially reinforced or enhanced, social pathologies such as depression, isolation and anxiety; also, that extensive exposure to dampness and mould increased the chance of depression by 60 percent.

Application to Nottingham City Homes population:
Prevalence of depression affected by damp and mould

It is possible to estimate the potential effect of damp and mouldy conditions on the prevalence of depression of the Nottingham City Homes population by applying the finding of a 60 percent increased risk of depression from the WHO study.

The background prevalence of depression across England is 10.9 percent. Some general practitioners in Nottingham City have a recorded prevalence of depression as high as 21.5 percent.

According to the HHSRS records there were 202 NCH properties with a category 1 hazard for mould or damp, and 473 residents living in these homes. It is likely that the majority of NCH properties significantly affected by mould or damp are included in these results; however, it is possible that a few houses affected to a lesser degree by mould and damp are not included, making the following calculations conservative.

If the prevalence of depression in Nottingham City were equal to the national average of 10.9 percent, then by remedying the problem of mould and dampness this would reduce the number of NCH residents with depression from 52 to 32, a reduction of 20 cases.

Considering the level of deprivation in Nottingham city it is likely the prevalence of depression is higher than the national average. Since adverse housing conditions and depression are linked, it could be expected that at least some of the incidents of depression in areas with highest rates of depression would be attributable to housing conditions. Using the 21.5 percent rate of prevalence, the number of incidents of depression may have fallen from 102 to 64, avoiding 38 cases of depression.

The average direct cost to the NHS of treating depression is taken from Thomas and Morris (2000), at £142 per case.[84] Applying this to the figures above, reducing damp and mould could save the NHS between £2,845 and £5,406 in direct treatment costs for resulting mental health issues.

These simple calculations give an indication of the size of the impact of housing improvements on the mental health of the residents and suggest it is significant, even when considering the relatively small numbers of residents who have been helped: 1 in 12 tenants who previously had damp and mould would see an improvement in their mental health.

Case study 3

Lisa lives in a mid-terrace house built in the early 1930s. The single-glazed windows were replaced with double-glazing under the SWM programme, and the property is also due to be fitted with a full central heating system (replacing the current gas fire and back boiler), as well as a new kitchen and bathroom.

Lisa found that before the windows were replaced, the house was very cold and draughty. There were also problems with condensation, which had twice caused a damp black patch of mould on the living-room wall.

"Oh, it was really cold… You had to have the heat on – even sometimes even in the summertime you'd have to put the heating on just to keep it just a normal temperature… You could see the curtains just moving by themselves – I used to say "Jack Frost is on his way!" … and you could see your breath, so that's how bad it was.

"You'd have to be putting more money in just to keep it warm… so obviously you're trying to save as much as you can, so that was like a big hole in my pocket… it just used to burn a lot of money all the time having it on every week."

The cold, damp and concerns about gas and security affected the whole family:
"All of us used to have lots of colds… health-wise it was really bad I'd say – I was in bed one time for a week with my daughter had to look after me and that was just due to the cold… Because I have lower back pain anyway, so with it being cold it's like my bones couldn't get warm and I was constantly at the doctor's and on medication and things like that, so I felt it really bad.

"I think I had a little gas leak at one time, I had to go to the doctor's and what it was, it was a little gas leak… It does worry me because sometimes you'd be round there thinking 'Can I smell gas?' So it is a big worry.

"You could take the window out, so the security – when I used to go out I used to be thinking 'Oh God, I hope everything's alright.'

"I was just miserable, you know, because it was cold and damp and then you'd have to be putting on loads of clothing and things like that, you know, it was like miserable and gloomy I should say.

"When they wrote to me and said that they were going to come and do the windows I was over the moon; well I was thinking about more of the bill, saving on the electricity, gas, and more secure as well."

Just having the new windows has made a big difference both to Lisa's worries about heating costs and security and to her health conditions:
"The [gas payment] reduced down from £30 to £15, so I just top up every week and it has saved me a lot of money, I'm not just saying that, it's saved me a lot of money…. If I went out I'd know that nobody could get in there or anything, so that was a comfort as well"

"I can feel the difference, even though I know I can feel the pain but it hasn't been as bad as before I had the windows done… If it's anything to do with colds or flu I haven't been to the doctor's for that and the children haven't been to the doctor's for that"

"The gas fire's not on… we're not all in one room ...fantastic!"

Fuel poverty

Fuel poverty has also been linked to mental health. A household is said to be in fuel poverty if it needs to spend more than 10 percent of its total income on fuel to heat the home to an adequate level; 21ºC in the main living area, and 18ºC in other occupied rooms.

Nottingham City 2011 Joint Strategic Needs Assessment on adult mental health reported that those with a cold home or experiencing fuel poverty have a four-fold increased risk of depression or anxiety. This is supported by a study that found how reducing fuel poverty improved mental health through a reduction in stress.[85] In his review of fuel poverty and ill health, Baker (2001) concluded that there is likely to be a strong correlation between indebtedness relating to fuel poverty, and mental stress.[86] It is also possible that a cold home can contribute to social isolation, as people are reluctant to invite friends round to a cold house.[87]

The Decent Homes Impact Study has also analysed the effect of the SWM programme on the energy efficiency of the properties and therefore the impact on the fuel poverty of tenants.[88] This research found that the energy efficiency of the properties has increased, with resulting savings in fuel costs for the tenants. The Energy Savings Trust estimates that fitting double-glazed windows can save between £95 and £223 a year, and upgrading the central heating to an A-rated boiler could save £225 a year from fuel bills. Across all NCH tenants who have received new windows or boilers, this amounts to a potential collective saving of £3.5m a year on fuel bills.

Application to Nottingham City Homes population:
Prevalence of depression affected by excess cold and fuel poverty

Using similar methods to those above, it is possible to estimate the potential effect of excess cold on the prevalence of depression amongst the Nottingham City homes population by applying the ratio of 1:4 stated in the Nottingham JSNA.

NCH's HHSRS data shows all of the NCH properties that were affected by excess cold: a total of 5,114 homes with 8,694 residents. There may be other NCH tenants who are affected by fuel poverty yet are not included in these figures and therefore the estimates below are conservative.

If the prevalence of depression in Nottingham City were that of the national average, the number of cases of depression would be reduced from 948 to 237 through the Decent Homes programme removing the problem of excess cold, avoiding 711 cases of depression.

Using the more realistic prevalence of depression of 21.5 percent, through the Decent Homes programme the number of cases of depression would be reduced from 1,869 to 467, a reduction of 1,402 cases.

Applying the same average cost to the NHS of £142 per case for treating depression as before, this would save the NHS in Nottingham between £100,962 and £199,084 in treatment costs as a result of the SWM programme's reducing excess cold and fuel poverty.

These calculations give an indication of the size of positive health impact that would result from removing excess cold; 1 in 6 of those tenants who previously experienced excess cold would see significant improvement in mental health as a result of this programme.

Case study 4

Sheila lives in a three-bedroomed mid-terraced house, classified as a ‘hard to heat’ home because of its solid walls – this means that the house has one single solid wall and no cavity to insert wall insulation, making it very energy-inefficient. Sheila’s home was therefore fitted with internal insulation under the Community Energy Saving Programme (CESP), as well as with a new kitchen, bathroom, central heating system and double-glazed windows under the SWM programme.

Talking about the house before the work, Sheila said:
“The house has always been cold, very, very, very cold because we have only got one layer of bricks… The gas fire was old. I did have to keep [the radiators] on all the time in winter, at night and that…Sometimes I came into the house and it was cold and I didn’t want to go into a cold kitchen to prepare a meal…I tended to live more in one room just to keep the heat in that room because I was so worried about the bills… It seems with having the single-glazed windows they didn’t keep the warmth in and to me that was the most important thing, the warmth as well as the security… I had been burgled, and every night I checked everything, it was like an obsessive thing.”

Sheila has been diagnosed with the brittle-bone condition osteoporosis. Regarding her health, Sheila said:
“I got awful backache…I always felt worse in winter… If I was having trouble walking and it was hurting, I would perhaps fill a kettle and make a flask of coffee and watch television in my bedroom where it was nice and warm... And I seemed to have more coughs and colds... And I think it was depressing because it was cold and I actually used to sit on the floor with my back to the fire because I was that cold.”

Sheila underwent a six-week renovation to carry out the refurbishment works and fit the internal insulation, as well as a special adaptation to the bath to help her get in and out. This process was quite a strain, as many of the household facilities such as the cooker and washing machine were out of action for some of the time. Sheila used the ‘Helping Hands’ service from NCH to help prepare the home for the work, such as packing up areas and moving furniture.

Since the work has been completed, Sheila has noticed a big difference in her health and general wellbeing, as a result of being warmer and less worried about heating costs and security concerns:

"I love everything, everything about it…my house is lovely and warm…I used to have my bedroom radiator on all the time, I have not had it on once even in the winter, it is off 24-hours a day, turned off… I pay [my fuel bills] by direct debit monthly, I am in credit... So once we had the new windows that started to keep some heat in and it cut a lot of the noise out as well which was very good. So from the day I had my windows I felt a 100 percent safe… It makes me feel glad to get up in the morning and come down to my lovely house. I love having people round. I'm proud of it. I think if you've got a nice house it makes you happy."

The refurbishment process

It is possible that the benefits in mental health following housing improvements are proportional to the extent of the improvements themselves – the worse the state of the repair before the improvements and the better the house on completion of the improvements, the greater the impact on mental health.[89]

However, housing improvements can be intrusive and cause stress through the disruption that they cause. An example at the most extreme end of the spectrum is given in an evaluation of a regeneration project in Liverpool, in which residents had to be re-housed during the process; a report concluded that the stress associated with the redevelopment process was significantly associated with poorer mental health and in the short term acted to counterbalance the benefits of improved living conditions.[90] However, in cases more directly comparable to the situation in Nottingham, other studies found that the mental stress of the renewal process, although considerable, did not counteract the overall positive affect on general wellbeing, and suggested that the effect may prove to be increasingly positive over time once the effects and memory of the redevelopment process itself are forgotten.[91]

Stress caused by the renovation process itself is closely linked to the amount of personal control each tenant feels that they have over the redevelopment process. The original government guidelines first to describe the concept of Decent Homes and subsequent studies highlight the importance of giving residents as much awareness and control as possible over the housing improvements.[92] It is recognised the negative mental health impacts of the improvements can be limited by ensuring that the residents feel involved and, to some degree, in control of the process.[93, 94]

Tenant consultation has been an important part of Nottingham's SWM programme, with tenants able to choose among design options for new installations and consulted on the design. The 'Helping Hands' scheme provides additional support for those who need it, such as moving furniture, support during the work, etc. Ultimately, tenants are able to refuse to allow the work to be done if they feel unable to cope with the disruption; however, the refusal rate is low, at 2.2 percent. Also, tenants surveyed regarding their satisfaction with the process and works following the installation gave an average score in 2009/10 of 8.31 out of 10, indicating a high level of customer satisfaction with the process and completed works.

These findings are supported by the evidence gained from interviews with tenants and GPs. The level of stress or anxiety during the refurbishment process varies, depending on the extent of the work to be completed and the ability of the tenant to cope with the potential disruption. For example, the tenants interviewed who had their windows replaced did not find the process at all stressful, as it is completed within one day and the benefits are felt immediately. However, the more extensive works – such as kitchens, bathrooms and internal insulation – cause greater disruption to daily life and take between three and six weeks to complete.

The causes of stress identified through the interviews include: delays and faults in the installation process; lack of privacy due to workmen in the home; facilities such as cookers and washing machines being out of use; communications issues, such as missed appointments, and having to persevere before obtaining a response to a problem.

This had varying impact on the tenants; some felt able to cope, despite the difficulties, because of the positive differences that the refurbishment would deliver:
"While the majority of the horrible work was being done, and it was horrible, I kept thinking 'At the end of it you are going to have something beautiful' and that was what kept me going."

However, evidence from a local GP suggests that some tenants did find it hard to cope with:
"I've had at least two or three households of people coming in with stress, needing sleeping tablets, needing anti-depressants because they can't cope with the kitchen and bathroom... just really frazzled and disrupted by it all."

Therefore, the installation process itself can have a negative impact on the mental wellbeing of tenants, with a small number requiring additional support during the process. The evidence of high overall customer satisfaction with the SWM programme suggests that this affects a small minority; however, for those who are less well able to cope, this may have a significant, if temporary, negative impact on their wellbeing.

3.3. Appraisal summary

Firstly, this appraisal has shown that there is a clear social gradient in health in Nottingham, with those living in the most deprived areas having worse outcomes across a number of health conditions and overall life expectancy. Council housing estates tend to house the most deprived people, in terms of income and health, as a result of the allocation system, which focuses on providing housing to those most in need. Therefore, the multiple factors of deprivation faced by NCH tenants are likely to impact negatively on their health, and housing conditions are one of these many factors.

Secondly, the evidence reviewed in this appraisal – including a review of studies on housing and health, hospital admissions data for Nottingham, stock condition data from NCH and interviews with tenants and health professionals – all point towards a convincing conclusion that poor housing has a negative impact on health. Cold and damp housing can worsen pre-existing health conditions, including cardio-vascular and respiratory disease, and these particular conditions are more prevalent in areas of the city that include council housing estates.

Poor housing conditions may also be a cause of ill-health, for example, by lowering resistance to respiratory infections. There is evidence for a number of other ways in which poor housing can have an impact on health, such as causing aches and pains, infections, and mobility problems. All factors taken together, this creates a convincing picture of why those living in poor housing have generally poorer health. The impact on health outcomes and use of health services varies in severity, from more general illness treated by GPs to the worse case possible when people's lives are at risk, as demonstrated by the 128 Excess Winter Deaths that occur in Nottingham each year.

In addition to the physical health impact, there is a clear interaction between housing, on the one hand, and mental health and general wellbeing on the other. The case studies support wider evidence that suggests how issues such as cold, damp, fuel poverty and insecurity can lead to low mood, or even depression.

Again, this coincides with the more general negative effects of deprivation on mental health, as summarised by a local GP during our interviews:
"If you've been in desperate circumstances, your mental health is going to be vulnerable, and I think being somewhere that's dank and dreary will play into your tendency to have a low mood… it's not the whole story, but I think it's part of the equation."

Finally, it appears that improving housing conditions can therefore have a positive impact on both physical and mental health. A number of studies have shown that this effect is moderate in adults, which is likely to be the case given the complexity of the multiple causes of ill-health; addressing housing conditions alone will not negate the many other factors that contribute to health conditions. However, the cumulative and long-term effect may well be significant; for example, addressing housing conditions has a more significant impact on children, thus potentially resulting in a life-time of savings in terms of health costs.

A number of national studies have calculated the cost implications of poor housing that falls on the NHS as treatment costs; these estimates range from £1.5 billion to £2.5 billion a year.[95, 96]

Throughout the present appraisal, a number of examples were selected for which a measurable change and cost impact for the NHS in Nottingham could be calculated. The examples account for only a small number of the potential avenues through which housing improvements could positively impact on health and treatment costs. Even with these conservative estimates, the costs saved as result of addressing serious hazards in the home, reducing asthma in children, and relieving depression from damp and mould, excess cold and fuel poverty could total almost £700,000.

This small number of examples alone account for one percent of Nottingham City PCT's cost of provision for 2010/11 (totaling £56.5m[97]). In addition, the improvements made to the NCH properties will make a long-term difference to these homes (for example, the anticipated life-span of a new boiler is 15 years) and thus the health benefits will accumulate over this time.

4. Housing and health – taking the findings further

Following the HIA model, this section sets out some of the discussion points and recommendations for stakeholders to consider as a result of the appraisal. It reflects on how such evidence could inform both housing and health delivery, taking into account the current context of limited resources in the public sector and significant changes within the health system. This also includes more broader consideration of the wider potential impact of housing services – beyond the bricks and mortar issues of the Decent Homes programme – in addressing health inequalities.

4.1. Informing future housing investments

The evidence collected points to the ways in which future housing investments, including refurbishment programmes and new-build projects, provide an opportunity to lever in the maximum health benefits alongside NCH's aims for asset management. Clearly, ensuring that homes are as energy efficient as possible (thereby reducing cold, damp and fuel poverty) is one of the main ways of improving a range of physical health conditions, and mental health and wellbeing. The SWM programme has made an initial impact on this, improving the average energy efficiency (SAP[v]) rating from 60 to 68 points out of 100. This is estimated to save NCH tenants a cumulative total of £3.5m from their fuel bills each year. However, there are further opportunities for future energy efficiency improvements as a result of, for example, funding through the Energy Company Obligation. These have been identified in NCH's Low Carbon Roadmap, which sets out NCH's long-term plans for energy efficiency improvements for the stock to 2020.

NCH has a further opportunity to influence health outcomes through the recently announced neighbourhood renewal programme. Around 1,000 of the poorest quality council housing properties in Nottingham have been identified for decommissioning and demolition, to be replaced by around 500 new family houses. A health impact evaluation of a very similar project in Liverpool showed that there were significant positive effects from moving residents out of poor quality homes into highly energy efficient newly-built properties.[98] This raises a number of considerations for NCH in the design of the new properties and the process for achieving this, and the resulting impact on tenants' health. For example, estate and property design has implications for security (as demonstrated in the Secured by Design[99] scheme), healthy lifestyles (for example, safe routes for walking and cycling, and access to local amenities such as sports facilities and shops with healthy food options), and access to green space (which has been shown to have a positive impact on wellbeing[100]).

The 'lifetime homes' principles also help ensure that the design takes into account the long-term needs of current and future residents, to provide flexibility and adaptation to accommodate the needs of any occupants.[101] In designing the process for removing and re-housing tenants, NCH should also be aware of the potential negative effect on mental health of moving people from their homes, and how to mitigate this during the process – for example, learning from relevant case study examples such as the Liverpool Housing Action Trust programme mentioned above.

v. SAP is the Government's Standard Assessment Procedure for Energy Rating of Dwellings, where properties are scored between 1 and 100 based on energy costs associated with space heating, water heating, ventilation and lighting, minus cost savings from energy generation technologies. A score of below 30 is considered very energy inefficient, while a score of 70 or more is considered very energy efficient.

NCH's long-term plan for the management of housing quality, set out in its Asset Management Strategy, is planned in a 30-year timeframe. The strategy therefore needs to take into account future, as well as current, population needs – including health needs. For example, the issues associated with the ageing population will have an impact on the type of housing and refurbishment work needed to ensure that people can stay safely in their homes for as long as possible, to relieve the pressure on the NHS. The Asset Management Strategy will be affected by the forthcoming changes to the way that council housing is funded under the Housing Revenue Account (HRA). From April 2012, each housing organisation will directly fund all housing management costs from the rent it collects, rather than receiving a subsidy from central government. In line with the Government's localism agenda, this will give NCH greater flexibility to plan and prioritise the way in which it manages the housing stock, including the potential to take local health considerations into account.

As shown in the present report, the Decent Homes programme has provided the opportunity to deliver housing improvements on a significant scale within the social housing sector, supported by a substantial injection of funding from national government, allowing some of the worst housing conditions and their impact on residents' health to be addressed. However, the standard of housing in the private sector still remains of concern, with the highest rates of non-decency in the private rented sector (41 percent of the private-rented sector failed the Decent Homes standard in 2009) yet the highest numbers of non-decent homes in the owner-occupied sector (accounting for two-thirds of all non-decent homes).[102]

With much of this work left to do, it may be that social housing providers such as NCH are best equipped to manage such programmes in other tenures, were funding to be made available. For example, NCH has already achieved significant efficiency savings in the unit costs and delivery of their own Decent Homes programme, and has an established infrastructure to manage such a programme effectively. If the cost implications on the public purse of poor housing are taken seriously, there is a case for funding or subsidising such improvements from health or other public sector budgets in the private sector, with housing providers such as NCH well placed to deliver a cost-effective delivery option.

4.2. Informing local health strategy and delivery

The health system is currently undergoing a significant period of change, altering the way that health services are commissioned at the local level. In summary, the proposed changes are:

- Primary Care Trusts and Strategic Health Authorities will be abolished by 2013, and the responsibility for local health commissioning will instead be managed by Clinical Commissioning Groups (CCGs), led by local General Practitioners

- Responsibility for public health will move to Local Authorities, with a duty for local health improvement and reduction in health inequalities

- Health and Wellbeing Boards (HWB) will be established within the Local Authority, with the remit to improve local health and social care and reduce health inequalities. Their responsibilities will include: delivering the Joint Strategic Needs Assessment (JNSA) and Joint Health and Wellbeing Strategy (JHWS) with the aim of joining up commissioning between health, public health, social care and wider services relating to health and wellbeing; and delivering value for money.

Therefore, in the local context, the two main points of engagement between the health service and other providers of services that impact on health and wellbeing, such as housing, will be the HWB at the strategic level and CCGs at the delivery level.

Health and Wellbeing Board

Nottingham's HWB was established in October 2011, and includes a position on the Board for NCH. This provides NCH with the opportunity to inform the development of the JNSA and JHWS, to help the move towards a more integrated understanding and delivery of public health outcomes through wider services such as housing.

There are a number of ways in which NCH could contribute to the development of an integrated strategy:

- Providing the evidence of the impact of housing on health and wellbeing to support its inclusion in public health strategies (the JNSA and JHWS), for example, as provided by this HIA report

- Sharing NCH's Asset Management plans, in order both to influence and to be influenced by the public health agenda, and integrating these plans into the city's wider health strategies

- Emphasising NCH's broader role in shaping communities and places, through its wider service delivery as well as its capabilities in delivering capital programmes.

The focus of this HIA has been on the impact of physical housing improvements on health inequalities; however, NCH has a much broader role in delivering services to tenants and through its engagement with local communities. These wider roles also have a direct impact on wellbeing issues, as well as providing a channel to engage with the most health-deprived communities. For example, NCH currently delivers a number of services under the Supporting People programme, such as warden-aided sheltered housing complexes for older tenants, and the Nottingham On Call telecare alarm emergency service. There are currently around 11,000 people registered for the Nottingham On Call's personal alarm service, which includes both NCH tenants and any other local resident requiring the service (including tenants of other housing associations and private customers).

These services have an impact on health and wellbeing; a report from the Department of Communities and Local Government estimated that the £1.6 billion in housing-related support delivered through the Supporting People programme generated savings of £3.41 billion to the public purse, including £315 million of savings to the health service in a year.[103]

In light of this impact, the current cuts to the Supporting People programme (the national budget has been reduced by 11.5 percent, and in Nottingham the budget has fallen from £22.3m to £12.4m, a 45 percent cut) should be of concern to the health agenda. In the context of this and other public sector efficiency cuts, there is all the more justification for an integrated and joined-up approach in order to continue to deliver services which may be outside of direct health services, but indeed have a long-term impact on overall health outcomes and therefore resources.

In addition, NCH has established networks and means of communication with some of the most health-deprived communities in Nottingham, providing an opportunity to enhance wider public health outreach programmes. For example, the NCH tenant and leaseholder newsletter is sent every six weeks to all tenants and leaseholders and could include information about public health services and local events. Also, as part of the SWM programme, contractors hold local road-show events to demonstrate the options for kitchen design, etc., and for tenants to ask questions; these events could also have information or representatives, for example, regarding healthy eating or cookery skills. NCH is also involved in grass-root community organisations such as Tenant and Resident Associations, which could be encouraged to take part in public health initiatives. There are therefore a number of routes along which public health initiatives could be integrated into NCH's front-line service delivery.

Clinical Commissioning Groups

The route for engaging with local health commissioning will in the future be via CCGs, consisting primarily of groups of local GPs plus other local health professionals. The commissioning framework will operate on a payment-by-results basis, with GPs receiving funding according to the outcomes they deliver, including for their management of common chronic diseases such as asthma, and for the wider services they offer such as child health surveillance. GPs may therefore be financially incentivised to develop services that improve these outcomes; and this HIA provides much evidence to show that improving housing will have an impact on these outcomes.

Direct engagement between GPs and housing providers would present a number of challenges, with little precedent for this in the current system. During the interviews for this report, GPs identified issues such as that they had little contact with the social housing system, and a limited understanding of how it operates. For example, where requests for housing are made on medical grounds, this is assessed by the housing referrals team within NCH; the team has their own Medical Officers to visit, verify the issues and confirm whether re-housing is required. Although patients may request a letter of support from their GP, the GPs themselves have little involvement in the case. During an interview, a GP commented that *"[patients] think a doctor's letter… will advance them up the housing list. And I think, in common with all doctors, we don't really know if that's true or not. We don't really know how the system works. We don't know what the points mean."*

Another issue raised is the potential for GPs not to consider housing as part of the cause or solution for a health issue, or to feel that they are not equipped to deal with this: *"I don't think we advise people to say, not have carpet in their bedroom or something like that. I think we neglect that… we'll say 'Up your inhalers'"; "housing tends to sit on the outside of [the support the NHS offers] because it's not directly health… we need people to be champions for the link between housing and health because we don't have the time or energy or availability to be that for our patients".* There appears to be a concern that if wider issues are brought into the equation, this would put increased pressure on already stretched GP resources: *"You could spend all day every day just writing housing letters if you wanted to"; "It would be lovely to think that we could look holistically after our patients – to be able to represent them in regards to their housing, but there just aren't the resources and the workload we're increasingly being asked to take just doesn't allow for that."*

Therefore, engaging with GPs via the CCGs may require some of these barriers to be overcome; it is necessary to present a convincing case that housing interventions could improve the health outcomes that GPs are paid to achieve, and that engagement with the housing system would not add to the already considerable resource burden that GPs are already under. This may require supplying GPs with more information about the health impacts of housing, and also about the local housing allocations system and how this operates. The aim would be to enable GPs to feel that they can adequately understand and support any patients with housing issues, even merely by referring them to the correct service. This could be communicated through targeted written materials such as leaflets, presentations from housing services at GP network events, or facilitating contact at the local level between GP practices and local Housing Patch Managers. In a number of cases, they operate from the same joint service centre (e.g., the Mary Potter centre in Hyson Green, the Clifton Cornerstone, and new facilities in Bullwell and St Ann's).

5. Conclusion and recommendations

There is a clear social gradient in health in Nottingham, with those living in the most deprived areas having worse outcomes across a number of health conditions and overall life expectancy. Housing conditions are one of the multiple factors of deprivation that can impact negatively on health outcomes.

The evidence collected for this HIA demonstrates that there is a long-term positive health impact from improving housing conditions. Addressing housing conditions alone has a moderate immediate impact in improving the health of adults, due to the complexity of the multiple causes of ill health. However, there are greater positive impacts for the most vulnerable, including children and the elderly, and the cumulative and long-term effect is likely to be significant, resulting in a considerable cost saving to the NHS. This evidence provides the basis for future discussions between health and housing providers.

Here, we summarise the core recommendations and highlight a number of examples of how this could be applied, based on the evidence outlined throughout the HIA:

1. Maximise opportunities to continue to lever in health benefits through improvements to the quality of council housing stock, through NCH's Asset Management Strategy. Examples include:
    - Supporting the neighbourhood renewal project to build 500 'lifetime homes' and minimise the negative wellbeing impact of the moving process
    - Building cost-effective health and safety features into ongoing asset management programmes, e.g., hard-wired smoke detectors, thermostatic mixer valves.

2. Develop understanding and integrate delivery of public health outcomes through wider services such as housing, by engaging with the Health and Wellbeing Board and Clinical Commissioning Groups. For example:
    - Contributing to local strategies, such as the Joint Strategic Needs Assessment (JSNA) and Joint Health and Wellbeing Strategy (JHWS)
    - Engaging with GPs and Clinical Commissioning Groups through information sharing and building relationships at a neighbourhood level.

3. Consider how NCH's engagement with tenants through existing services could potentially complement or support public health initiatives. Examples include:
    - Facilitating tenants' engagement with public health services, such as smoking cessation, weight loss, Occupational Therapists, etc
    - Supporting the continued delivery of the Nottingham On Call telecare alarm service.

Appendix: Notes on data collection and analysis

Risk of harm and savings to the NHS based on the HHSRS model

The estimations of the number of incidents of harm avoided are modelled from the HHSRS data based on the methodology developed by BRE and University of Warwick.[104] The essential premise is to compare the number of harms that were likely to occur given the HHSRS score prior to the Decent Homes improvement works, with the number of harms likely to occur given the HHSRS score after the works.

The HHSRS score is calculated by multiplying the likelihood of a harm occurring by a spread of the expected severity of the injury should that harm occur. There are four classes of harm: Extreme, Severe, Serious and Moderate. More severe outcomes are given a higher weighting in this equation. The definitions of the types of injury under each class of harm can be found in the HHSRS Operating Guidance.

A category 1 hazard is one that is has a total Hazard Score of 1000 or more. NCH recorded a log of all category 1 hazards identified in the Nottingham stock. Using figures from the BRE report, the difference was calculated between the average HHSRS scores for properties with a category 1 hazard, with the national average scores as set out in the HHSRS Operating Guidance. This allowed the calculation of the difference in the number of Extreme, Severe, Serious, Moderate harms that would be expected before and after the Decent Homes work, for each hazard category and overall, based on the actual number and type of hazards recorded for NCH stock.

The cost savings from these avoided incidents of harm were based on the representative costs calculated in the BRE report, i.e., £50,000 for treating an extreme harm, £20,000 for a severe harm, £1,500 for a serious harm, and £100 for a moderate harm.

These costs were totalled across all the hazards and all the classes of harms, giving a total estimated cost saving to the NHS in Nottingham as a result of addressing all the category 1 hazards identified in NCH properties.

The HHSRS Operating Guidance states that the likelihood rating given as part of the overall score represents the probability of an occurrence of harm in the 12 months following the assessment. Therefore, it is assumed that addressing the causes of the harm would reduce the number of incidents of harm by the same number each year, for as long as the installation continues to be effective in addressing the hazard. The number of incidents of harm and the cost to the NHS can thus be accumulated over the years following the intervention.

Local hospital admissions data

As part of the appraisal an attempt was made to measure the difference in hospital admissions for relevant health conditions, before and after the delivery of the SWM programme. To do this, an intervention group of NCH property postcodes was selected in order for them to be compared with a control group of NCH property postcodes where the work was yet to be started. Admissions to hospital per 1,000 of the population were calculated for the year before the improvements (August 2008 to July 2009) and the year after (August 2009 to July 2010).

However, this analysis produced no results of statistical significance, and no clear pattern in changes to morbidity and mortality. For this reason, the data were not included in the final report. A number of reasons may explain this result:

- The number of properties in each group and the years for comparison (including only data from one year before and one year after) were restricted due to the concurrent nature of the HIA, with much of the SWM programme still to be completed. The small sample size increased the confidence intervals, making it less likely to find a significant result

- The results may potentially have been skewed by the fact that the year after the intervention (the only year measured for comparison) happened to be one of the coldest on record, making cold-related health admissions more likely despite housing improvements

- As concluded in the appraisal, the complex causal factors for poor health mean that removing even one of these factors (i.e., poor housing) is unlikely to result in a significant change in total numbers of actual hospital admissions. The effect is more likely to be seen in terms of self-evaluations of general health and, potentially, visits to GPs.

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Phone: 0845 330 3131
Minicom: 0115 915 7447
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