Improving housing, improving health: the potential to develop evidence based healthy housing policy

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Introduction

Poor housing has been used both as an indicator of poverty, and as a common target for interventions to improve public health and reduce health inequalities. Although housing still has a prime place on the health inequalities agenda, it is also of wider importance, since small individual health impacts have the potential to exert large effects at the population level. The relationship between health and housing seems unarguable, and the basic human need for shelter would appear to make the relationship between poor housing and poor health self evident.

In spite of, or perhaps because of, this intuitive relationship there is a notable lack of good research evidence of the health gains that result from investment in housing. Thousands of studies have investigated the health of populations and their housing conditions resulting in a body of evidence which displays consistent associations between poor health and poor housing. Despite this, there remains some uncertainty about the strength of the evidence, as demonstrated in a speech by a former British Minister for Health, "My officials tell me it’s hard to prove that better housing improves people’s health". (Frank Dobson, in a speech to the National Housing Federation in 1997).

Academics have also supported the view that current evidence cannot justify investment in housing on health grounds: suggesting rather that it should be on the basis of amenity and energy conservation.

Going beyond associations

There is no shortage of evidence per se. There have been many, possibly hundreds, of cross-sectional studies which have found statistically significant associations between poor housing conditions and poor health. Some of the main factors which have been associated with health or illness in these studies are listed in Box 1.

Addressing the housing and environmental factors associated with poor health in cross-sectional surveys may seem an obvious strategy. However, such associations alone do not provide convincing evidence that such interventions will be effective. Observational data on social influences on health are unable to demonstrate a convincing link between cause and outcome as it is difficult to control for a wide enough range of confounders. Nor are observational studies able to explain the nature or the strength of association observed or whether the damage done can be reversed. Furthermore, there are several well-known examples of potentially effective interventions identified from observational research which fail to have the desired effect in practice. Take as an example health promotion interventions such as exercise promotion. There is a clear and well-documented association, shown in many large observational epidemiological studies, between low levels of physical activity and coronary heart disease (CHD), suggesting that interventions to increase physical activity will reduce the incidence of disease. Intervention studies (e.g. community experimental studies of the effectiveness of interventions to increase physical activity) however, have not presented strong evidence that physical activity can be successfully prompted to persons who are physically inactive. Other interventions based on plausible causal relationships have had the opposite effects to those intended. For example, data from observational studies suggested that high levels of beta-carotene and vitamin A intake had a protective effect against lung cancer.
However, a subsequent large randomised trial reported that beta-carotene and Vitamin A supplementation provided no benefits and an increased relative risk of developing lung cancer was reported in the intervention group.  

Well designed experimental or quasi-experimental studies (such as “natural experiments”) provide stronger evidence of the potential for housing to generate health gains and also can help identify adverse effects. Quasi-experimental studies may not be appropriate for all aspects of housing research; but to evaluate the effects of housing improvements and determine what it is about improved housing that may improve health, they are the design of choice where randomised controlled trials are not feasible.

Obstacles to studying the health effects of housing improvements

Methodological obstacles may explain, in part, why empirical housing research has been predominantly cross-sectional. However, recent ideological shifts have led to an increasing interest from policy makers in measuring the health impacts of social interventions (such as social housing), in gathering evidence to shape policy, and in determining effective ways of improving health through policy. From a methodological perspective there are, however, many difficulties with assessing the health effects of housing interventions.

The relationship between housing and health is characterised by multi-factorial interactions, and untangling causal relationships or applying an experimental model is not straightforward. For example, within populations it is generally the more vulnerable groups, the elderly, sick, unemployed, mothers and young children, who spend the most time indoors resulting in much higher levels of exposure to potential hazards. Some factors, such as home ownership, have been associated with both improved and deteriorated health. It may be unhelpful to control for factors individually associated with increased morbidity, for example Graham explains cigarette smoking in terms of mediating the stress effects of deprivation and poor housing. It has also been suggested that poor housing can have a ‘spill-over’ effect, generating other social problems in an area. In addition, housing interventions rarely occur in isolation, and often a major refurbishment or new build initiative will be accompanied by other community regeneration activities. This may result in displacement of existing residents and thus affect the sociodemographic characteristics of an area and making ‘before and after’ comparisons problematic.

There are also pragmatic restrictions on housing research methodology. It is not usually feasible to randomly select individuals for rehousing, and it is impossible to blind groups to most changes in their housing, resulting in high levels of recall bias. There may be a considerable time delay between exposure to a housing hazard and emergence of health effect, and studies with long periods of follow-up are required to fully investigate this relationship. This involves considerable cost and commitment from the participants and the researchers, though there are a number of such studies in the UK. Furthermore, housing studies naturally focus on areas of deprivation where populations are highly mobile, levels of attrition are high and it is difficult to select a population which is relatively homogenous while being large enough to detect small changes in morbidity.

More generally the experimental approach to housing research has been criticised for being reductionist, and for ignoring the multi-factorial nature of causality in housing, deprivation and health. Instead an holistic approach which recognises varying levels of susceptibility to social conditions and the multiple interactions of these influences has been recommended. However, broad generalisations about the link between deprivation and ill health may have only a limited role in informing specific policy decisions.

Apart from methodological obstacles, political obstacles to conducting housing research may also have impeded research on the effects of housing improvement (as opposed to observational studies of housing and health) and thus have subsequently hindered informed decision making by policy makers. This lack of convincing evidence may be used by governments to absolve them of responsibility to improve housing on health grounds. Although, there is no lack of available cross-sectional evidence, the results of these studies are often conflicting and the associated uncertainty may have
stood in the way of the development of healthy housing policy.

**Reviewing the current evidence**

The volume of research literature accumulating in many areas, and the fact that the conclusions of studies are often conflicting, can present a problem to those who want to develop evidence-based practice and policy. Literature reviews can be an important aid to this information overload, and there have been several comprehensive reviews of the housing literature to date. Two of these reviews focussed on the more general literature of observed associations between poor housing and poor health as opposed to studies which attempt to look at health gains following housing improvement. Both these reviews concluded that the body of existing research does demonstrate the existence of strong associations between poor housing and health. Systematic reviews of housing related interventions, smoke alarms, and house dust mite reduction measures have also been carried out. In the absence of any comprehensive summary of the health effects of housing improvement intervention studies we recently carried out a systematic review which included all studies of rehousing and housing improvement which measured health outcomes irrespective of study design. The review methodology and study outlines from this review have been published elsewhere. We report here on the methods used in the primary studies to measure health gains and make specific research recommendations in this area.

We sought primary studies since 1887, in any language and used broad inclusion criteria so as to include all studies which had measured the health or social effects of housing improvement. This included experimental or quasi-experimental approaches, including randomised controlled trials and observational studies which used prospective or retrospective measures of health. Outcome measures were based on a social model of health, and included socio-economic changes and illness-based indicators.

Nineteen completed intervention studies were identified, the earliest dating from 1936. Three studies examined the health impacts of medical priority rehousing, 12 examined health effects of rehousing or refurbishment and renovation in the general population, and 4 assessed energy efficiency measures. Eight of the 19 studies assessed housing improvement in the context of area or community regeneration.

Fourteen ongoing UK-based studies of housing intervention studies were also identified. These are evaluating similar interventions to the completed studies. Seven of these ongoing studies are prospective and controlled. One of these is employing a randomised stepped wedge design.

**Methodological and measurement issues in existing housing evaluations**

I Retrospective studies

Five studies used a retrospective uncontrolled design. Improvements in health were reported in all of these studies. Only one study used qualitative methods. In this study of rehousing and refurbishment residents reported improved mental and physical health. The study was retrospective and there were reported difficulties with obtaining a representative sample.

A further three retrospective studies used a control group for comparison. One study of rehousing found reductions in health service use across both groups but greater reductions in the intervention group at 1 year. Another study found reductions in routine prescribing data for anxiolytic drugs following rehousing and regeneration at 2 and 7 years. However, this may have been explained by changes in population demographics following regeneration. The third study reported improved health following energy efficiency improvements. Follow up rates are unclear or are not reported for these studies.

Data from retrospective studies is limited due the introduction of recall bias. These studies are not able to report on previous health state and difficulties of blinding residents to housing changes introduce further bias. Though the studies with the control groups did attempt to account for
some of the main confounding variables such as age, socio-economic status and smoking.

II Prospective studies

Eleven prospective studies were identified, 29, 30, 32, 33, 38, 41-43, 46-48, 50, five of which had no control groups. 32, 42, 47, 50, 53 Four of the uncontrolled studies reported improvements in mental health following rehousing at 3-5 years, and one study of central heating installation reported reductions in childhood respiratory symptoms at 3 months. Two of these studies also reported increases in self-reported physical symptoms, 47, 48, 50 however follow-up rates in one of these studies was low.

Six of the prospective studies used control groups. 29, 30, 33, 34, 38, 39, 41-43, 46 Five studies selected the control group from the same population. Two of the prospective controlled studies were of rehousing from a slum area; 33, 34, 46 one of these studies found small improvements in self-reported illness episodes and mental health. 33, 34 The second study used routine data on mortality and found increases in mortality following rehousing. 46 Data on increased rent and ability to buy food following rehousing was used to explain these findings. Two studies of improved energy efficiency reported conflicting results; follow-up in both these studies was less than 33%.

The prospective controlled design provides the best quality evidence available. However, given the range of interventions covered and limitations of sample size, and poor or unclear follow-up rates it is difficult to make generalisations from these studies about the health effects of housing improvement.

III Use of control groups

Matching control groups is a useful way of controlling for area or individual factors which may change over time regardless of the intervention. Matched control groups were used in both retrospective and prospective studies identified in this review. However, even when authors report matching the control group, data on comparability of the groups should be checked. Photographs from Wamben & Piland’s (1973) 35 study for example show stark differences in baseline housing conditions between the control and intervention group. Seven studies we identified selected the control group from the same population, 33, 34, 37-39, 41, 43, 44 though in two of these studies the control groups were selected from those who did not volunteer for the intervention and this may have introduced selection bias. In addition matching for area rather than individual may not be able to control for confounders between individuals, such as age and social class.

IV Outcomes used

The type of outcome measure used to assess health impacts may provide another source of study bias. Health indicators reported by the studies ranged from self-reported illness/symptom episodes, feeling of wellbeing to validated mental and general health measures and routine data on infant and adult mortality data. Some studies also assessed the impacts of housing improvement on health service use, with reported findings including decreased GP visits, reduced likelihood of inpatient and outpatient use of health services, and reduced prescribing of hypnotic and respiratory drugs.

Broader social impacts of housing improvement were also reported in some studies including improvements in social indicators, such as perceptions of safety and social and community participation. 36, 42, 48

Four studies used routine health service data 32, 35, 46, 51, 52 ; two of these studies used linked individual routine data. In one study, routine prescription data demonstrated positive effects following housing refurbishment; however data were not linked to individuals and there were reports of changes in the population demographics. 51

Another study found increases in mortality rates which were then explained by increases in rents which in turn impinged on the households’ ability to purchase an adequate diet. This finding highlights the need for housing evaluations to be open to possible adverse effects and to encompass a broad set of explanatory variables, and to allow for enough time to pass to detect effects which may take years to emerge.

Use of routine data can be an invaluable source of information. If used at an area level it can be easy to collect and is generally regarded as an objective measure of
mortality, morbidity, service use or provision. However, as illustrated in Walker & Bradshaw’s study of routine practice prescribing data, displacement of original residents can change the population demographics of an area. This may be obscured by the use of routine aggregate data. Use of routine data which is linked to individual records produces data which is more sensitive to potential effects, however routine record linkage is labour intensive and may not always be possible.

**The current evidence base for healthy housing policy**

There have been few studies of the effectiveness of housing improvement as a measure for improving specific health measures. Existing studies have, however, reported improvements in overall self-reported physical and mental health and reductions in symptoms following housing improvement. There is some evidence of reductions in health service use, and some studies have shown improvements in broad indicators of social inclusion such as fear of crime and neighbourliness. However, because of the methodological limitations of these studies, the evidence that health and broader social improvements result from housing improvement is limited and there is nothing to inform choices by housing providers between different types of interventions. There are few large prospective controlled studies, and many studies are now quite old. A summary of effects from the higher quality studies reviewed suggests that there can be real health gains observed following housing improvement; but overall there is little robust evidence at present that housing improvement can act as an effective or cost-effective tool for the reduction of health inequalities.

This distinct lack of evidence of the positive health effects of improved housing may be surprising. One startling finding was of the adverse socio-economic effects of increased rents in new housing. It is possible that this and other unknown adverse effects minimised the potential for health gains and that these effects were not detected due to methodological or study design problems. It is important that future evaluations use a multi-disciplinary approach in order to ensure that future housing investment can at least do no harm and that the potential for health gains is maximised.

Difficulties in observing the effects of improved housing may be an inherent problem in evaluating social interventions. Social interventions such as housing are characterised by their complexity and their interactions with peripheral factors which are not well described or understood. As suggested previously, what may seem an intuitively good intervention may produce adverse effects due to unconsidered peripheral mechanisms. It is important that effectiveness of an intervention can be maximised by assessing the existence and nature of adverse effects and taking action to minimise them.

**Broadening the evidence base for healthy housing**

The most valuable study is likely to be that which collects both individual and area level data and includes subjective and objective health measures, with health interpreted broadly enough to encompass wider social impacts of housing interventions. The cost and difficulty of collecting this information makes it unlikely that any significant or robust evidence base in this area will be assembled in the near future. In the absence of evidence from intervention studies it may be necessary to develop a more inclusive evidence base.

The main methodological challenge to this lies in maximising use of existing observational evidence and integrating it with the few existing intervention studies. As the results of ongoing studies become available, estimates of the nature and size of the health impacts of housing can then be refined. Well-conducted, large scale observational studies can be used to inform intervention needs, study designs, appropriate indicators and outcomes, can help generate hypotheses and can also be used to complement data from intervention studies. Longitudinal studies have also been recommended as a useful, if expensive, study design in evaluating complex interventions such as housing. Such studies have the advantage of being able to follow residents over long periods of time a therefore eliciting possible temporal effects of poor housing and health in later life. As an example, the National Childhood Development Study (NCDS) was able to look specifically at the impact of housing on health and the temporal relationship of poor housing and poor health over the first 33
years of life. The authors conclude that poor housing does cast a shadow on health in later life and demonstrated a dose-response relationship, with multiple housing deprivation leading to greater risk of disability or severe ill health in later life. Data from the Boyd-Orr cohort also suggests that childhood housing conditions have an effect on adult health independent of the effects of socio-economic deprivation. Longitudinal data collection can be built into intervention studies but response rates over time are liable to fall.

There are other aspects of housing and health which are still poorly understood. In particular there is scope for further research into the relationship between health selection and housing conditions which investigates the direction of the relationship between health and housing. For example, some empirical work has suggested that housing careers are adversely affected by poor health. In addition, the health benefits associated with home ownership are not seen in all cases. For example, mortgage indebtedness is associated with home ownership and complicates the positive relationship between health and housing tenure. Robinson also suggests that poor health is a barrier for homeless people to re-enter into the housing system.

Housing study design: Some recommendations

Evidence of the effectiveness of interventions, or ‘what works’, needs to be derived from experimental or quasi-experimental study designs. However, some intervention study models are prone to the ecological fallacy, where aggregate data is used to explain relationships at an individual level. This assumes that the individuals within an area are a homogeneous group and as a result, variations between individuals and within an area can be missed. Investigating complex relationships which are known to be influenced by social factors requires a broader perspective, combining quantitative and qualitative methods.

Despite criticisms of reductionism, we would suggest that with careful planning of a flexible, quasi-experimental design, it is possible to elicit measures effectiveness of housing and other social interventions.

Although, there is long a tradition of this type of evaluation in the USA it has rarely been attempted in the UK. The studies in our review may be few in number, but they demonstrate that it is possible to apply these methods to housing research. Many of the ongoing studies identified are deploying a quasi-experimental methodology appropriate to eliciting causal evidence drawing on both bio-medical and social science expertise. In addition, many were collaborative efforts between housing and health agencies and academics, although it is not clear exactly what collaboration entails. Use of combined quantitative and qualitative methods is less evident.

As well as careful study design, rigorous sample selection, analysis and reporting, housing research requires intensive efforts and associated resources to ensure large enough sample sizes and successful follow-up rates. It is clear from the studies reviewed that successful follow-up of populations is possible over periods of a few years. High rates of follow-up can add considerable weight to study findings. However, achieving these over long periods of time is labour intensive and has important resource implications.

Conclusion

Despite a distinct lack of evidence from intervention studies it is encouraging to note the apparent shifts within housing research facilitated by an increased political interest in funding housing research and in issues of effectiveness.

There is, however, a lack of comparative information on the costs and effects of specific housing improvements, such as central heating or major refurbishment. Evidence on the costs and effects of housing investment is likely to be of most value to policy makers and housing providers, and would add substance to the development of policies to reduce health inequalities.

Large scale, quasi-experimental studies which investigate the wider social context of housing improvements and their comparative effectiveness and cost-effectiveness of specific improvements are now required to help contribute to a sound evidence base for healthy housing policy.
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Box 1:
Housing factors associated with health variation

Housing tenure
Outdoor temperature
Indoor air quality
Homelessness
Overcrowding
Dampness & hygrothermal growth
Housing design

Other housing related interventions associated with health variation
Relocation to different locality
Rent subsidies
Allergens & house dust mite
Home accidents prevention
Fire prevention