Housing improvement and health gain: a summary and systematic review
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Authors’ objectives
To review the evidence on the effectiveness of housing improvement as a health improvement measure.

Searching
The following sources were searched for studies published in any language: ASSIA from 1987 to 2000; CAB Health from 1973 to 2000; DHSS Data from 1983 to 2000; EMBASE from 1974 to 2000; HealthSTAR from 1975 to 2000; MEDLINE from 1966 to 2000; PAIS from 1976 to 2000; PsycINFO from 1887 to 2000; SIGLE from 1980 to 2000; Social SciSearch from 1972 to 2000; Sociological Abstracts from 1963 to 2000; the Social Sciences Citation Index from 1981 to 2000; URBADISC (ACOMPLINE) from 1970 to 2000; the Cochrane Controlled Trials Register (Issue 2, 2000); and IBSS and SPECTR for December 2000. Full details of the search strategy were reported.

In addition, the bibliographies of all reports, papers and textbooks were handsearched. Information on unpublished and ongoing studies was requested from subscribers to the Housing Studies Association Newsletter, the Health Action Zone discussion group, health authority housing departments, UK academic departments, local authorities, housing associations, the Joseph Rowntree Foundation, and delegates at an international housing conference. Several Internet sites were also searched: Scottish Poverty Information Unit; Housing Corporation Innovation and Good Practice and Research Database; the Joseph Rowntree Foundation; projects funded by the joint DH/DETR/MRC research programmes on air pollution; UK National Research Register; U.S. Department of Housing and Urban development, Office of Policy Development and Research; Regard: National Database on Social Sciences Research (UK); National Centre for Social Research (UK); OHN in Practice database; and Current Controlled Trials.

Study selection
Study designs of evaluations included in the review
Primary studies of experimental or quasi-experimental design were eligible for inclusion. Cross-sectional studies that did not investigate the effects of the housing improvement before and after the intervention were excluded. Studies graded C on the basis of the validity criteria were subsequently excluded. The included studies were prospective controlled and uncontrolled observational studies, retrospective controlled and uncontrolled studies, retrospective cross-sectional studies, and a mix of cross-sectional and prospective data collection.

Specific interventions included in the review
Studies that evaluated housing improvements were eligible for inclusion.

Housing interventions were defined as rehousing and all physical changes to housing infrastructure, such as heating installation, insulation, double-glazing and general refurbishment. Interventions to improve the indoor environment by means of furniture or indoor equipment were excluded unless the evaluation measured changes in the residents' health, and the measures were part of a package that included improvements to the house itself. Environmental studies that assessed the adverse effects of potential pollutants were excluded. The actual interventions included in the review were medical priority rehousing, rehousing or refurbishment plus relocation from a slum area or community regeneration, and energy efficiency measures. The latter included central heating installation, installation of ‘Heat with Rent’, the replacement of windows, and energy efficiency improvements to tower blocks.

Participants included in the review
The inclusion criteria were not defined a priori in terms of the participants. The participants included elderly tenants and school-age children. People were rehoused on mental health grounds, from slum areas and from socially-isolated substandard housing.

Outcomes assessed in the review
Studies that assessed outcome measures based on a social model of health, and included socioeconomic changes, well-
being changes and illness-based outcomes, were eligible. The actual outcomes included:

- mental health (Foulds and Bedford Personal Disturbance Inventory and Scales, Present State Examination, Psychiatric Epidemiological Research Instrument and Hospital Anxiety and Depression Scale);
- self-reported general health status (Nottingham Health Profile), social adjustment, morbidity, health status, respiratory conditions, asthma symptoms, time off school, symptoms, mental health, morale, life satisfaction, self-treatment;
- view of area, safety, draughts in house, neighbourhood atmosphere, neighbourhood involvement, and experiences of crime and violence;
- health service use such as physician contact, smoking health service use, prescriptions, hospital out-patient visits, need for hospital care, need for home care, and self-reported health service use;
- crude and standardised quinquennial mortality rates;
- changes in daily activities;
- self-esteem (Rosenberg Scale); and
- the health service providers' views on local area and health changes.

How were decisions on the relevance of primary studies made?
At least two reviewers independently screened all the identified abstracts.

**Assessment of study quality**
The strength of the evidence from the studies was graded using criteria developed by the NHS Centre for Reviews and Dissemination (see Other Publications of Related Interest).

The criteria for level A evidence were: a prospective study with a follow-up rate of greater than 80% and a duration of at least 6 months; either a randomised controlled trial or a controlled trial with a comparable control group; and an objective assessment of the health outcomes.

The criteria for level B evidence were: a prospective study with a control group; and a limited level of confounding, but an appropriate assessment of the health outcomes.

The criteria for level C evidence were: other study designs; prospective and retrospective studies that did not adjust for confounding factors; and studies with a biased assessment of the health outcomes.

Three reviewers assessed the validity of the studies, and any disagreements were resolved by joint discussion.

**Data extraction**
The following data were extracted by one reviewer and checked by a second: author, year of publication and location of study; study methods and duration of follow-up; the number of participants; intervention details; health and social outcomes; sample selection; whether adjustment was made for confounding factors; blinded assessment of outcomes; and main results. When data on the group of interest were not provided in the publication, the authors calculated the data where possible.

**Methods of synthesis**
How were the studies combined?
A narrative synthesis was undertaken with studies grouped by the intervention type.

How were differences between studies investigated?
Results of the review

Nineteen primary intervention studies were included. These included 11 prospective and 8 retrospective studies. Six of the prospective studies and 3 of the retrospective studies used a control group.

The quality of the identified studies was generally poor. The generalisability of the findings was limited by the small populations and the lack of control for confounding factors. Fourteen ongoing UK-based studies of housing interventions were also identified.

Medical priority housing (3 studies).

All 3 studies found improvements in self-reported physical and mental health. The only prospective study was small and no study controlled for confounding variables.

Rehousing or refurbishment plus relocation from slum area or community regeneration (11 studies).

Eight of the 11 studies included some level of area regeneration. Two of the 6 prospective controlled studies reported benefit from the intervention, including improvements in mental health. The one prospective study that controlled for confounding showed an increase in illness episode in the intervention group at 9 months, but a greater reduction in illness episodes at 18 months than the control group. The absolute difference was small (29 episodes per 1,000 people) and the rate of follow-up was not reported. The other prospective study was small and may have used a non-comparable control group.

Three studies reported adverse effects among residents who had been rehoused. These included increases in chronic respiratory conditions, reduced ratings of good health and increased mortality rates.

Energy efficiency measures (4 studies).

The studies suggested that housing interventions result in small improvements in respiratory and other symptoms. Two studies adjusted for confounding factors, but high (69%) or unreported attrition rates may limit the generalisability of the findings. Methodologically-robust prospective controlled trials provided no evidence of a reduction in the use of health services.

Authors' conclusions

There have been few studies of the effectiveness of housing improvements as a measure for improving health. In particular, there are few large prospective studies and many studies are now dated. A summary of the most methodologically-sound studies suggests that investment in housing does have the capacity to improve health. However, a number of studies of rehousing and regeneration reported adverse effects such as increased symptoms and mortality rates. In addition, the range of interventions and outcome type was wide, and some of the better studies were limited by small numbers in the final sample. Overall there is currently little robust evidence to suggest that housing improvement can act as an effective or cost-effective tool for the reduction of health inequalities.

CRD commentary

This was a well-conducted and clearly presented review. The aims of the review were stated, and the inclusion criteria were defined in terms of the study design, intervention and outcomes. The literature search was comprehensive and it is very unlikely that any relevant studies were omitted. The methods used to select the studies, to assess validity, and to extract the data were described. The quality of the included studies was assessed using predefined criteria. Relevant data, including results from the validity assessment, were tabulated. A narrative synthesis was appropriate given the differences between the studies in terms of their design, interventions and outcome measures. Attention was also drawn to the methodological limitations of the studies.

The evidence presented supports the authors' conclusions.
Implications of the review for practice and research

Practice: The authors state the following implications for housing policy makers.

Housing improvements may improve the residents' mental health and small improvements in general health may also be observed.

The associated increase in the residents' housing costs may reduce the ability of the housing improvements to improve health, and may have adverse effects.

Future investment in housing should be accompanied by rigorous evaluations of the residents' health before and after improvement.

Research: The authors state that large-scale quasi-experimental studies that recognise the role of other social factors in the context of housing improvement are required, as well as studies comparing the effectiveness and cost-effectiveness of specific housing improvements. In addition, in the absence of extensive literature on housing interventions, large-scale observational studies of housing and health should be systematically reviewed and used to contribute to the development of healthy housing policy.

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http://www.sphsu.mrc.ac.uk/unit_reports.php?rptID=20& amp;pageID=1

Other publications of related interest

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Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on
the reliability of the review and the conclusions drawn.