INTARESE Technical brief

Issue 2 NOVEMBER 2008

Integrated Assessment of Health Risks of Environmental Stressors in Europe

Housing and Health

The connections between housing and health are many and complex. The home is more than just a simple shelter. It is a place for rest and relaxation, for socialising, for privacy and for everyday living, and an essential psychological and physical necessity.

A healthy home therefore needs to have sound structure, be free of hazards, and provide adequate facilities for sleeping, personal hygiene, food preparation and storage. It should also provide an environment for comfortable relaxation, with facilities for communication and social exchange with friends, family and others.

The importance of the home in public health policy is fundamental. On average up to 90% of our time is spent indoors, with the old, very young and sick spending the greatest amount of time. Everybody is potentially exposed to health risks from the home and the range of individual vulnerabilities to the indoor environment is wide.

The future may bring increasing demands for healthy homes to provide protection from outside hazards, including extreme temperatures and air pollution. Translating those requirements into a set of measures which reflect impact on health is not straightforward.

The Housing case study is one of seven case studies that are being developed to test the INTARESE methodology. The assessment is being done in two stages: a 'first pass' aimed at evaluating the general approach, and then a 'second pass' in which the overall health impacts of different policy scenarios will be assessed.

An integrated approach to improving health through housing policies

There is an increasing need to quantify the impacts of housing policies on health, says Dr Paul Wilkinson, INTARESE's Housing case study leader and Reader at The London School of Hygiene & Tropical Medicine (LSHTM).

Dr. Paul Wilkinson

The aim of the housing case study is to assess the environmental and health impacts of housing interventions within the EU, with particular reference to energy efficiency and the indoor environment.

"Energy efficiency has a strong rationale in Europe because of its bearing on climate change, fuel poverty and energy security." says Dr Wilkinson.

Thermal insulation is widely recognized for its economic and carbon emission reduction benefits.

"However, there is much less evidence on the potential health effects of energy efficiency measures, which often are accompanied by a decrease in air-exchange rates," warns Wilkinson. "This trade-off needs also to be considered if key decision-makers are to make more informed choices".

Relevant Hazards

An important first step in any assessment of health impacts is to specify the scope and focus of the problem. In the case of housing, this phase of 'issue-framing' is especially crucial, for the range of hazards is large, and many different policies affect housing conditions.

Project co-funded by the European Commission under the Sixth Framework Programme (2002-2006)

Bridget Fenn

"We therefore had to make pragmatic decisions when determining which hazards to study." says Wilkinson.

Bridget Fenn, deputy case study leader and lecturer in epidemiology at LSHTM explains: "We started with some of the more important hazards that are of relevance at an EU policy level. In particular we looked at indoor temperatures and air quality, focusing specifically on radon gas to begin with."

Even within this relatively narrow context, relationships between housing and human health are complex. Many different factors may affect indoor temperatures and air quality, and people's exposures depend on how they behave. The initial priority was thus to establish a means of modelling health impacts, using a small number of exposure-response relationships, before extending it to take account of other exposures and health effects.

"We decided to look at mortality outcomes in the first pass assessment," says Fenn. "In particular we focused on lung cancer due to radon gas exposure and cardiovascular disease from exposure to cold."

Early results from the case study have demonstrated the potential to model changes in health risk from housing policies. They also show, however, that the true impact of policies can only be assessed if the complexity of the indoor environment is recognised.

National interests

The Housing case study is co-ordinated by the London School of Hygiene & Tropical Medicine (LSHTM). The other institutions involved in are Imperial College (IC) London, (RIVM) Netherlands, (KTL) Finland, (ASL) Italy, and the Centre Scientifique et Technique du Batiment Centre Scientifique et Technique du Batiment (CSTB) France.

Each country has its own specific interest regarding housing and health in relation to energy efficiency policy. Several protocols have been developed to look at how energy efficiency affects temperature, ventilation and indoor air quality.

For example, CSTB has a specific interest in indoor radon gas; KTL is looking at mould and damp and how they affect respiratory symptoms; ASL is particularly interested in high indoor temperatures; IC is looking at the effects of ventilation and indoor air pollution; and LSHTM is studying the effect of insulation and ventilation on indoor cold and radon gas.

In June 2008 the Housing framework was presented to a range of UK stakeholders. These included academics and representatives from the Greater London Authority, housing associations and a not-for-profit organisation providing insulation to low-income and older households in the London Borough of Waltham Forest.

The workshop concluded that the case study should focus initially on defining unknown exposure-response relationships, and demonstrate the potential for a user-friendly method of assessment. These relationships could then be further developed, and the model validated against empirical evidence. In the future, the case study could be expanded to incorporate other factors that might affect the uptake and impacts of energy efficiency measures such as human behaviour and fuel poverty as well as other morbidity outcomes including mental health.

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Health impact assessment

The housing case study has developed a model to illustrate a prospective health impact assessment (HIA) and attempts to predict the negative and positive health impacts from different housing policy options centred on thermal insulation.

Dr. Zaid Chalabi

"We developed a mathematical modelling framework to evaluate the health impacts of housing policies", says Dr Zaid Chalabi, mathematical modeller at LSHTM and contributor to the INTARESE housing case study.

The framework consists of a number of models. A central component is a set of building physics models that describe how the indoor environment of the dwellings relates to the dwelling characteristics, external environment and householder behaviour. Models are also included to estimate population exposures via different pathways such as inhalation and dermal contact as well as extent exposure levels and periods. Exposure-health response models provide the means to calculate the relative risks due to resulting changes in exposure, while life table models aggregate the health effects to give an overall estimate of life expectancy.

The framework was initially used to assess the health impact of increasing energy efficiency by improving housing insulation only. The model was parameterised using data on the existing UK housing stock.
Health impacts are, of course, only one of the criteria for assessing a housing policy. Other factors might include costs and social equity. The framework is thus designed so that it can easily be integrated into a more comprehensive evaluation of any housing policy.

Systematic HIA - the way forward

"There is a need for the systematic assessment of policies, with the aim of improving the energy efficiency of buildings. This leads to the optimization of sustainable building environmental quality and public health benefits", says Dr. Ulla Haverinen-Shaughnessy, a Senior Researcher at KTL, Finland. Her contribution to INTARESE housing is focused on issues related to indoor air quality, dampness and mould.

As a response to their cold climates, Finland and other Nordic countries already have relatively high energy efficiency requirements. For example, insulation requirements for external wall structures in the UK, France and the Netherlands have been 30- 50% less efficient than those in Sweden, Norway and Finland. In Italy, the standard is even lower - some 70% less than those in Nordic countries.

These rigorous requirements mean that indoor temperatures seldom drop below comfortable levels, and improved insulation is not likely to increase the health benefits. This was illustrated in a recent survey: only 8% of Finnish households reported that indoor temperatures were too cold for comfort in winter, whereas 29% said that they became too hot in summer.

"It has been our experience that, as insulation is increased, it is necessary to ensure good ventilation and moisture control practices," says Haverinen-Shaughnessy. "We need to avoid poor indoor air quality, dampness and mould, if we are to protect and improve human health in the home."

Ventilation and Indoor Air Pollution

The impacts of energy efficiency measures are not necessarily all beneficial. Adverse effects may arise, if reduced ventilation rates lead to increased indoor air pollution.

Sirinath Jamieson

Modelling indoor air pollution and ventilation in naturally-ventilated housing

"Indoor air pollution and thermal comfort levels are largely controlled by ventilation", says Sirinath Jamieson, a researcher at Imperial College London, who is studying the effects of ventilation on indoor air pollution. "However, it is also important to investigate where the balance is between improving these factors and increasing exposure to outdoor air pollution inside our homes."

Dr Bernard Collignan

Generally, the purpose of ventilation is to remove stale indoor air and replace it with fresh air from outside of the building. This is based on the assumption that the outdoor air is of a reasonable quality. In urban areas, this is not always true.

The aim of the work is to help assess the potential effects on indoor air quality of future housing policies. "As most housing in Europe is ventilated naturally, my study focuses on the balance between enhancing natural ventilation and the risk of bringing outdoor air pollution into the home."

Models are being developed to estimate the way in which changes in outdoor weather and air pollution affect indoor exposures to fine particles in the atmosphere. These have to take account not only of conditions outside the building, but also details of the indoor environment, such as the room height and orientation, efficiency of natural ventilation and human activity patterns.

Impact on radon exposure of policy scenarios on energy efficiency

"At CSTB we are aiming to assess the impact of energy efficiency public policies (thermal insulating) on radon exposure. More precisely, it's considered that this policy could have a negative impact on the air renewal of buildings" says Dr Bernard Collignan, a research engineer in Indoor Air Quality and Ventilation management at CSTB.

Radon typically enters buildings either from underlying radioactive rocks, or from materials used in construction. The levels of radon that then occur depend on how rapidly the air is renewed. Policies on energy efficiency which impact on the ventilation of buildings can thus have major effects on exposures to radon by causing changes in the rate of air exchange from outside.

"Our objective is to assess the number of deaths from lung cancer due to radon exposure each year." explains Collignan. "We're looking at the whole French population in homes after remediation."

"In the real and complex world, an approach to housing and health based on INTARESE's methodology will become increasingly important"

Ventilation is a complex but key issue that needs to be considered in housing health impact assessments. Given the trend for energy efficient homes and the likelihood of governments insisting that ventilation rates are reduced, INTARESE's approach will become increasingly important.

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Design: Schuttelaar & Partners, Brussels.