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Indoor pollution modelled to inform policy on home insulation

Increased insulation in homes could reduce ventilation and lead to greater exposure to indoor air pollution, a new study suggests. This, in turn, could affect health. The researchers modelled exposure to fine particles, which indicated that insulating half the homes in Greece by 2020 could lead to a 6% increase in adverse health effects. Sources of indoor air pollution should be reduced as far as possible and, failing that, sufficient airing is key, they recommend.

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Previous research on the effects of air pollution has tended to consider only the concentrations of pollutants in outdoor air. However, indoor exposure can be just as important, especially if individuals spend a large proportion of their time inside.

This study estimated exposure to fine particulate matter in Switzerland, the Czech Republic and Greece using the Exposure Simulation Modelling and Assessment Tool (ESMAT). This distinguishes between indoor environments, such as at home, at work or travelling. It includes indoor sources of pollution, such as tobacco smoke and cooking, in addition to outdoor pollution that enters the home.

The researchers modelled three scenarios for the year 2020, which assumed that 0%, 50% or 100% of buildings would be well-insulated. 'Well-insulated' homes were defined as either renovated, including mainly new windows, or newly built. It was also assumed that only new buildings would be equipped with mechanical ventilation and heat recovery systems that help remove indoor air pollution.

The researchers also took resident behaviour into account, considering whether they opened windows to air their homes – which may help lower indoor pollution. They assumed this was less likely in new buildings, as their sophisticated design reduces the need to ventilate homes this way.

Data were sourced from the EU funded HEIMTSA[1] and INTARESE[2] projects. Combining the ESMAT results with software called Expolicy (Exposure Based Assessment of Policies), the researchers calculated the health effects of increasing insulation in buildings in terms of the number of years lost due to ill health.

The study distinguished between two opposing effects caused by insulation. Firstly, insulation reduces energy demand for heating, which lowers emissions of particulate matter from fossil fuel use and reduces overall exposure. However, insulation also makes rooms air-tight, preventing the escape of indoor air pollution from smoking or cooking, which increases exposure.

The results indicated that, if half of all residential houses were well-insulated in Greece, the number of years lost to ill health would be 5.9% higher than if no houses were insulated. In Switzerland, this figure was 3.5%, whereas in the Czech Republic it was 0.5%. When it was assumed that 100% of residential homes were well-insulated, adverse health impacts were greater. However, it is important to emphasise that this level of insulation is unrealistic, and that the study only considered adverse health impacts due to air pollution. It did not consider health improvements due to better heating, which may at least partly counter the negative health impacts.

The researchers point out that their estimates do include uncertainties. They mainly used best estimates for the amount of air pollution that enters homes. These could be improved if better studies become available. Also, the results can only be interpreted on large-scale population level. For individuals, the situation might be completely different; in some cases, indoor air pollution might be very low, particularly if mechanical ventilation and heat recovery systems are installed, or if indoor sources are small. In these cases, insulation is likely to help improve health.

1. The Health and Environment Integrated Methodology and Toolbox for Scenario Assessment (HEIMTSA) was supported by the European Commission under the Sixth Framework Programme. See www.heimtsa.eu

2. Integrated Assessment of Health Risks of Environmental Stressors in Europe (INTARESE) was supported by the European Commission under the Sixth Framework Programme. See: www.intarese.org