Cutting household ventilation to improve energy efficiency

A warning about radon and lung cancer

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If global emissions of greenhouse gases continue on their present trajectory, the Intergovernmental Panel on Climate Change (IPCC) projects that the world may be more than 4°C warmer in 2100 than in 1861-80.1 To hold warming to less than 2°C on average, the level often cited as the threshold of dangerous climate change, emissions must be reduced radically. For example, the World Bank estimated that global emissions would need to be halved by 2050, and continue falling thereafter, to reach this goal.2 The prospect is daunting, but there are many opportunities for intervention. Housing is a good example, as Milner and colleagues point to one health risk: an increase in indoor radon levels in homes in which ventilation is reduced to control heat loss.

Radon is an inert gas, present in much of the Earth’s crust, which rises into buildings through cracks and fissures in the foundations. The radioactive breakdown products of radon are potent carcinogens: the US Environmental Protection Agency estimates that they cause about 21 000 deaths a year from lung cancer in the United States.3 In the United Kingdom, radon is commonly detected indoors. Although concentrations in most homes are low (fewer than 1% fall above the UK action level of 200 Bq per m3), this does not mean absence of risk: the dose-response relation between radon and lung cancer that best fits the epidemiological data is a straight line with no lower threshold. Because the bulk of the population is at the lower end of the exposure curve, this is where most of the burden of disease occurs. In the UK, 90% of radon attributable lung cancers are estimated to occur in homes with concentrations below 200 Bq per m3.4

The national housing energy efficiency strategy for England aims to cut heat loss from homes by reducing uncontrolled ventilation. If this strategy was implemented, what difference would it make to radon levels? Milner and colleagues use mathematical modelling to estimate that indoor concentrations of radon would rise on average by more than 50% if English homes were made airtight enough to meet energy efficiency targets. They also estimate an extra 4700 life years lost and up to 278 additional deaths from lung cancer annually as a result. Mechanical ventilation and heat recovery systems that extract heat from air before it is passed to the outside would limit the rise in radon levels, but these systems are relatively complex and expensive.

This is the first study that has tried to quantify the risks of energy efficiency measures caused by radon, and several points should be made about the calculations. The long lag between exposure to radon and incidence of lung cancer means the effects of tighter homes are projected to occur 20-30 years in the future. It is impossible to anticipate the changes in all relevant variables so far ahead. For instance, the calculations assume no variation in health status of the population or treatment effectiveness, although other scenarios are also plausible. Moreover, projections about lung cancer are highly sensitive to assumptions about the prevalence of smoking because the risks of radon and tobacco use combine in an additive fashion.5 Milner and colleagues’ primary model assumes no change in the prevalence of smoking in adults. But in the past 30 years the proportion of British adults who smoke has halved, and if this decline continues the radon effect will also diminish. In their sensitivity analyses, the authors estimate that if the prevalence of smoking halved again (from 21% to 10%) the number of additional deaths from lung cancer attributable to airtight homes would reduce by 44%.

Milner and colleagues do not attempt a comprehensive assessment of the health consequences of reduced ventilation. Airtight homes may increase levels of other indoor pollutants, such as second hand smoke or emissions from gas cookers and heaters, as well as potentially increasing the spread of airborne infections. Better indoor climate control has benefits too. A New Zealand trial found that children with asthma living in warmer homes had fewer episodes of wheezing, fewer visits to
the doctor, and fewer days off school.4 A full assessment of the
benefits and risks would also include the damage averted by
slowing climate change. The risks of unmitigated global
warming are uncertain, but potentially large. For instance, one
study estimates that European “mega-heatwaves,” such as the
2003 event that caused about 70 000 excess deaths, will become
5-10 times more common in the next 40 years.5

Milner and colleagues’ study reminds us that large scale
interventions may have unintended harmful consequences. But
it also points to opportunities for reducing the risks of climate
change in ways that minimise risks to health and may improve
it. In the UK, more effective insulation of homes could save
energy and warm houses without compromising the flow of
clean air. In other countries the win-win possibilities include
safer heating, cleaner cooking, and low energy cooling.

Everywhere housing can and should contribute to smart growth
strategies that improve access to services and facilities, increase
the opportunities for physical activity, improve air quality
indoors and out, and reduce dependence on fossil fuels.6

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