Health economics evaluations of radon intervention strategies in Ireland

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Introduction

A health economics evaluation was undertaken of different radon intervention strategies, which might be applied in Ireland. The aim of health economics in general is to assist decision makers in achieving the best public health outcomes from finite resources. The aim of this work was to indentify the most cost effective radon interventions in an Irish context and was undertaken in support of the development of a National Radon Control Strategy.

This evaluation was undertaken using cost-effectiveness analysis, a tool widely used by health economists. For each radon intervention considered, the analysis compares the economic cost of the intervention against the effectiveness of the measure. In this analysis the effectiveness of an intervention is measured in terms of quality adjusted life years gained (QALY) as a result of the intervention. The QALY is widely used by health economists to compare the beneficial effect per unit cost for a wide range of different health interventions (vaccination, health screening, road traffic measures, etc). The QALY has the advantage of combining in a single measure both premature mortality and morbidity/ quality of life. The cost effectiveness model used in this analysis is based on that described by Gray et al, [2009] and the World Health Organisation [WHO, 2009].

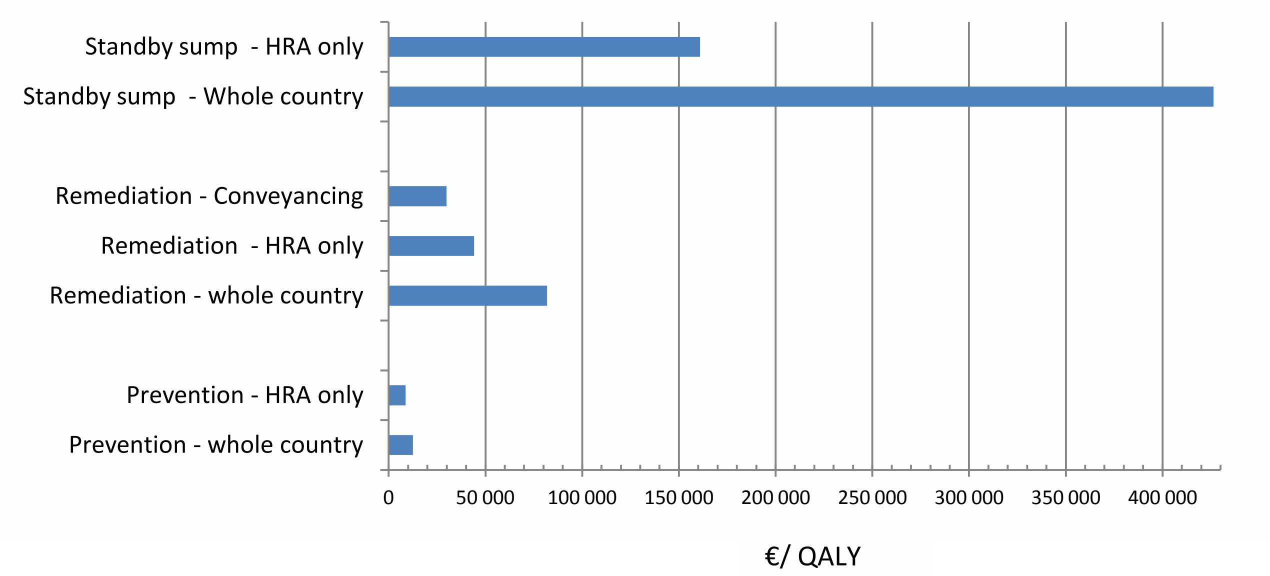
The cost-effectiveness model

The cost-effectiveness model estimates the lifetime risk of fatal lung cancer before and after preventive measures to reduce radon level using Irish demographic and cancer incidence data and the radon risk estimates obtained from the European pooling study [Darby et al. 2005, 2006]. These lifetime risks are used to calculate life years gained, which are further adjusted using age specific and sex specific normative weights to calculate QALYs gained. The model estimates the cost of each intervention, which can then be combined with the QALY values to calculate a cost effectiveness ratio (€/ QALY) for each intervention.

Direct costs incurred or saved by homeowners, government and the health service have been included. There costs include: the costs associated with education/ awareness programmes to encourage householders to test radon levels in their homes, the measurement/ survey costs associated with identifying high radon levels in existing homes, remediation of existing homes (both capital and running costs), the cost of preventive measures in new homes, the cost of standby sumps and health service costs. In common with other similar evaluations, all future costs and benefits are discounted to account both the economic value of deferred spending together with societal preference to defer costs and to enjoy the benefits as soon as possible. Discounting has been applied using the guidelines issued by the Department of Public Expenditure and Reform [DPER, 2011]

Euro per QALY values were modelled for: prevention incorporated in new homes at the time of construction, remediation (where a standby sump was not present in the house) and remediation by activation of a standby sump. For each intervention the cost effectiveness was modelled for two scenarios the first assuming the intervention was targeted at the whole country and the second that the intervention was targeted at high radon areas (HRA) only. The effect on cost effectiveness of different strategies to promote radon measurement was also modelled. The strategies considered included: public education programmes, requiring the exchange of information on radon between vendor and purchaser when a house is sold and remediation programmes undertaken by local authorities. This analysis was also be used to examine the impact of cost effectiveness on a range of other factors such as average radon level, smoking status and choice of reference level, etc. The key results are summarised in Figure 1.

Figure 1 Cost effectiveness of radon interventions

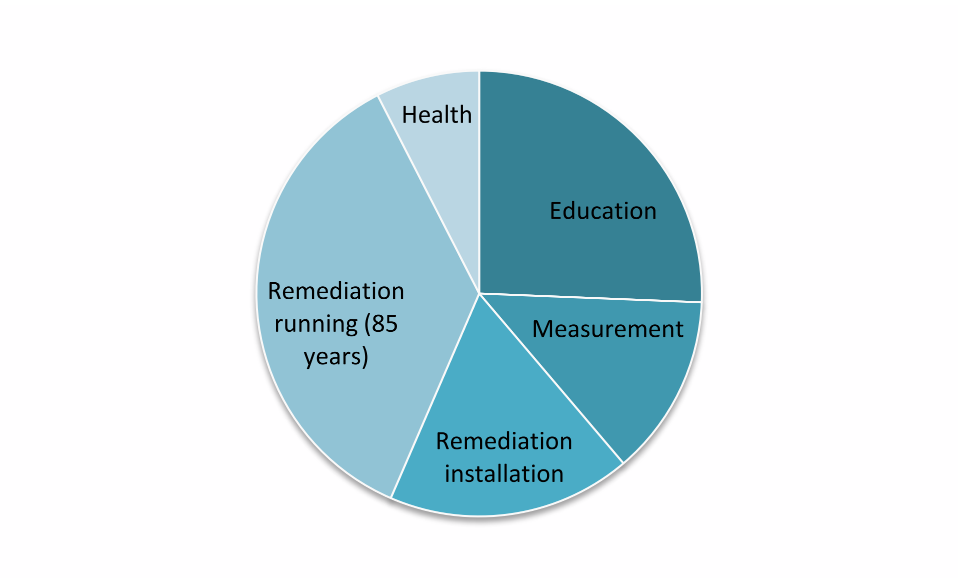


A number of clear trends emerge from this analysis. Of all of the scenarios considered radon prevention in new houses appears to be the most cost effective. Awareness raising and remediation programmes for existing houses are more likely to be cost effective in high radon areas, while as currently implemented the cost effectiveness of standby sumps appears to be poor.

The poor cost effectiveness associated with standby sumps is due primarily to the fact that only a very small proportion of houses with standby sumps are actually tested and an even smaller proportion of those remediated. Hence despite the relatively low unit cost of installing a sump in a new house, the ratio of sumps installed to house remediated is very large and hence the normalised cost is high.

For each scenario the cost per QALY gained as a result of the intervention was broken down by cost type (direct cost of the remedial measure, health service costs, education/ awareness and radon survey). This breakdown is useful is suggesting where improvements in cost effectiveness can be gained. As can be seen from Figure 2, for example, measures which improve the uptake rates of awareness programmes may have a significant impact on cost effectiveness (given the relatively high cost of education and awareness programmes when normalised to QALY gained). Similarly considering the proportion of the overall cost per QALY accounted for by running costs, the fan wattage is likely to have a significant impact on cost effectiveness.

Figure 2 – Cost per QALY for remediation in high radon areas broken down by key elements of cost.



The principal reason for the relatively low normalised cost of radon prevention when compared to remediation is that prevention is applied to all houses in the target area, while remediation is applied only to houses with radon concentrations above the National Reference Level, which in Ireland is 200 Bq/m^3. Prevention, therefore, results in an average reduction in radon concentrations across the whole housing stock, while remediation only results in a reduction in radon concentrations in houses, which initially had concentration in excess of the reference level. Because of the lognormal distribution of radon levels in houses, the majority of houses in all parts of the country have concentrations below the reference level and as a result the majority of radon attributable lung cancers are caused by exposure to radon at concentrations below the reference level.

Conclusions

A number of clear trend and general conclusions emerge from the cost effectiveness analysis, which are summarised below. It should be noted that these are based on Irish conditions (average radon level, demographics, costs etc) and so may not be exactly the same in other countries.

- In general the incorporation of prevention into new buildings at the time of construction is significantly more cost effective than identifying existing homes with high radon levels and remediating them.
- It is cost effective to include basic preventive measures in all new homes and not just those in high radon areas.
- The total costs associated with remediation of existing housing are dominated by the cost of education and testing programmes. It clear that it is expensive to find homes and to persuade owners to act. The lifetime costs associated with active remediation systems are also high. The hierarch of costs associated with remediation can be summarised as follows:

Education & testing > lifetime running > installation of remedial measure.

- The cost effectiveness of awareness & remediation programmes is significantly better in high radon areas. This points to the need for careful targeting of radon awareness campaigns.
- Cost effectiveness of awareness and remediation campaigns is dependent on test uptake and remediation rates. There is a need, therefore, to adopt strategies which improve these rates. The cost effectiveness ratio for social housing programmes, for example, tend to be relatively good because such programmes have generally close to 100% uptake. Other strategies, which may improve uptake rates, include grant aiding or subsidising either testing or remediation, linking of radon testing to conveyancing and measures to support householder decision making throughout the remediation process.
- The cost effectiveness of putting standby sumps in new houses is poor. This is the case since due to the low rate of measurement in private homes the vast majority of standby sumps installed are never used.
- Smoking status has a key influence on cost-effectiveness for all radon interventions. However, since the intervention is to the house not the person it is appropriate to base policy choices on average smoking prevalence.

Cost effectiveness analysis is a useful tool for policy makers seeking to decide between alternative policy options and was an important input into the development of a National Radon Control Strategy in Ireland. It should be noted, however, that the analysis is subject to limitations and uncertainties. These limitations and uncertainties need to be carefully understood. Cost effectiveness is primarily about efficiency but decision makers need also to take into account equity and fairness. Like all models the quality of the results will depend on the accuracy of the input parameters and the appropriateness of the assumptions made. For these reasons the results of cost effectiveness analysis, therefore, should not be used as the sole basis for decision making.

References

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