The cost-effectiveness of residential radon remediation programmes: assumptions about benefits stream profiles over time
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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
The use of residential radon remediation programmes was examined. No further details were provided.

Type of intervention
Secondary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised households located in a radon-affected area that were above the radon action level of 200 Bq/m³.

Setting
The setting was the community. The economic study was carried out in Northamptonshire, UK.

Dates to which data relate
The effectiveness data were taken from studies published between 1989 and 2000 and a single study for which the dates were not reported. The cost data were also taken from a study for which the dates were not reported. The price year was 1997.

Source of effectiveness data
The effectiveness data were derived from a review and synthesis of completed studies combined with a 'current' single study carried out by the authors.

Link between effectiveness and cost data
The costing was carried out prospectively on the same sample of patients as that used in the 'current' single study.

Study sample
The authors did not report whether power calculations were carried out to determine the sample size. In total, 62 households from a radon-affected area were tested and found to be above the radon action level. No further details were provided. The sample was appropriate for the study since it included households affected by radon.

Study design
The basis of the analysis was a cross-sectional study conducted at a single location in Northamptonshire, UK.

**Analysis of effectiveness**
The analysis was based on the observation of 62 households. The primary outcome appears to have been the number of occupants in each household and the average number of hours spent in the home each day.

**Effectiveness results**
There were 149 occupants in the 62 households. Household members spent, on average, 18.1 hours/day in the home. The authors calculated that this gave an annual risk reduction achieved by remediation of 2.132.

**Clinical conclusions**
The authors concluded "the assumption regarding benefits stream affects the calculation of the number of averted lung cancer cases in a profound way".

**Outcomes assessed in the review**
The outcome assessed in the review was the length of the benefit stream profile gained by radon mitigation.

**Study designs and other criteria for inclusion in the review**
Studies using an estimate of the length of time between exposure and lung cancer manifestation were included.

**Sources searched to identify primary studies**
Not reported.

**Criteria used to ensure the validity of primary studies**
Not reported.

**Methods used to judge relevance and validity, and for extracting data**
Not reported.

**Number of primary studies included**
Six studies were included in the review.

**Methods of combining primary studies**
The primary studies were used to determine the range of the delay in onset between exposure and onset of cancer. Therefore, the individual estimates were not combined.

**Investigation of differences between primary studies**
Although differences were discussed, the reason for the differences seems to have been a lack of evidence. The authors therefore made different assumptions in their studies.

**Results of the review**
The length of the benefit stream profile ranged from 1 to 25 years.
Methods used to derive estimates of effectiveness
The authors made assumptions to supplement the effectiveness estimates.

Estimates of effectiveness and key assumptions
The authors assumed that there was a single average risk of lung cancer. This was reported to be in line with other studies. A 40-year time horizon was assumed.

Measure of benefits used in the economic analysis
The summary measure of benefit was the number of life-years gained (LYG).

Direct costs
A perspective for the costing analysis was not reported. Ongoing costs were discounted at a rate of 6%. The authors reported that a number of stages of cost were used. These related to the radon detection and identification stage, the remediation stage (capital, running and maintenance costs) and lung cancer treatment costs. No further details were given. The costs and the quantities were not reported separately. The source of the estimates and the dates when the data were collected were unclear. The price year was 1997.

Statistical analysis of costs
A statistical analysis of the costs was not reported.

Indirect Costs
The indirect costs were not included in the analysis. Since the remediation efforts were not described in full, it was not possible to assess whether and/or which indirect costs might be relevant to the study.

Currency
UK pounds sterling (€).

Sensitivity analysis
A one-way sensitivity analysis was conducted to estimate the impact of the time between exposure and onset of cancer. This was carried out due to a lack of evidence in this area. The sensitivity limits were determined from a review of the literature.

Estimated benefits used in the economic analysis
The number of LYG were:

23.951 with 1 year between exposure and onset;
19.710 with 5 years between exposure and onset;
16.314 with 10 years between exposure and onset;
12.210 with 18 years between exposure and onset;
9.606 with 25 years between exposure and onset; and
6.979 with 35 years between exposure and onset.
Cost results
The treatment costs averted were:

12,184.82 with 1 year between exposure and onset;
10,026.92 with 5 years between exposure and onset;
8,299.28 with 10 years between exposure and onset;
6,211.62 with 18 years between exposure and onset;
4,886.88 with 25 years between exposure and onset; and
3,550.59 with 35 years between exposure and onset.

Synthesis of costs and benefits
The cost per LYG was:

14,912.90 with 1 year between exposure and onset;
18,231.19 with 5 years between exposure and onset;
22,132.18 with 10 years between exposure and onset;
29,742.19 with 18 years between exposure and onset;
37,942.19 with 25 years between exposure and onset; and
52,416.27 with 35 years between exposure and onset.

Authors' conclusions
The authors concluded that "the preferred model" gave a cost-effectiveness ratio of 37,943 per life-year gained (LYG) and that this was a "very high and unattractive cost-effectiveness ratio for a lung cancer prevention programme". No indication was given as to why this was the preferred model. In addition, no comparison with alternative lung cancer programmes was made to justify the statement that 37,943 was a very high cost-effectiveness ratio.

CRD COMMENTARY - Selection of comparators
There was no comparator as the authors used a cross-sectional design to observe the cost-effectiveness of radon remediation. The authors did not identify different types of remediation, scales of the programme, or locations for the programme that could be used as a comparator. The standard practice in the authors' setting was unclear.

Validity of estimate of measure of effectiveness
The authors combined elements of both a single study and a review and synthesis of published data. This combination prevented the authors from giving a detailed description of either element, and so reduced the validity and reliability of the results and conclusions presented. For instance, the reason for using the single study was not clear since similar data (e.g. population data) might have been obtained from published sources, which would have increased the generalisability of the results. Moreover, the authors might have measured, reported, and incorporated actual radon levels. Identifying two patient groups, whether differing by location, radon level or the type of remediation, would have provided data from which to draw comparisons. From the point of view of a review of published data, very few details were reported and there was no attempt to combine data to identify a mean value for the benefit profile.
Validity of estimate of measure of benefit
LYG were used as the summary measure of benefit. The authors pointed out that this estimate improves the comparability of the results with other reported cost-effectiveness results.

Validity of estimate of costs
A perspective for the costing analysis was not reported. Therefore, it is not possible to comment on whether all the relevant costs were included in the analysis. Although a broad overview of the costing was reported, very few details of the methods used were provided and the costs and the quantities were not reported separately. Again, this reduces the validity of the results. Nevertheless, the authors provided an informative summary of the costs involved in radon remediation.

Other issues
The authors did not compare their cost-effectiveness results with those of other authors, yet still felt able to claim that 37,943 was a high and unattractive cost-effectiveness ratio for a lung cancer prevention programme. Further information is needed to substantiate this claim. The issue of generalisability to other settings was addressed with the authors acknowledging differences between their sample of individuals and the general population. The results were not presented selectively. However, the authors stated that their preferred model used 25 years between exposure and onset, although the reasons for using this as the preferred model were unclear. The authors pointed out limitations in their study in terms of the limitations of cost-effectiveness ratios, claiming that such ratios could not indicate "the most efficient scale of a project". However, it should be noted that the study was not designed in such a way as to explore an optimum, or even different scale.

Implications of the study
The authors did not make any recommendations for policy or practice as a result of their study. They suggested evaluating different programmes in different regions as a starting point for further work.

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None stated.

Bibliographic details

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Other publications of related interest


MeSH
Aged; Cost-Benefit Analysis; Environmental Monitoring; Female; Housing; Humans; Life Expectancy; Lung Neoplasms /economics /etiology /prevention & control; Male; Middle Aged; Models, Theoretical; Neoplasms, Radiation-Induced /economics /prevention & control; Public Health; Radon; Water Pollutants, Radioactive /economics; Water Pollution /prevention & control

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