Radon and lung cancer: a cost-effectiveness analysis
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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
Screening for residential radon exposure.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
A population of about 250 million people whose age structure reflected the 1990 US census.

Setting
Community. The study was carried out in the USA.

Dates to which data relate
Effectiveness data were collected from studies previously published between 1978 and 1997. Resource use and cost data were derived from studies published between 1984 and 1992 and from 1994 sources. The price year was 1993.

Source of effectiveness data
Effectiveness data were derived from a literature review.

Modelling
A 2-year decision analytic model was used to determine the cost-effectiveness of the 5 strategies for radon testing and mitigation.

Outcomes assessed in the review
The review assessed compliance probabilities for purchasing a radon test, completing the test, retesting, and mitigating.

Study designs and other criteria for inclusion in the review
Not stated.

Sources searched to identify primary studies
Not stated.
Criteria used to ensure the validity of primary studies
Not stated.

Methods used to judge relevance and validity, and for extracting data
Summary statistics from each study.

Number of primary studies included
Approximately 12 studies were included in the review.

Methods of combining primary studies
Narrative method.

Investigation of differences between primary studies
Not stated.

Results of the review
The probability of being a member of the target population was 0.83. The probability of purchasing a short-term test varied between 0.0305 (best estimate) and 1 (full compliance). The probability of using the short-term test, if purchased, varied between 0.558 (best estimate) and 1 (full compliance). The probability of retesting varied between 0.407 (best estimate) and 1 (full compliance). The probability of purchasing a short-term test for retesting was 1. The probability of using the long-term test, if purchased, varied between 0.558 (best estimate) and 1 (full compliance). The probability of mitigating varied between 0.22 (best estimate) and 1 (full compliance). The probability of a post-mitigation radon test greater than 4 pCi/L was 0.05.

Measure of benefits used in the economic analysis
The number of lung cancer deaths prevented and number of life years were used as the primary measures of benefit. Deaths from lung cancer were discounted at an annual rate of 4%.

Direct costs
Direct costs were discounted at an annual discount rate of 4%. Quantities and costs were reported separately. Direct costs included costs associated with the intervention (programme, testing, and mitigation) and radon-related lung cancer deaths (direct medical costs). The quantity/cost boundary adopted was that of society. The estimation of quantities and costs was based on actual data. The cost for the intensive targeted programme was based on a community radon intervention in the Washington DC area. The price year was 1993.

Statistical analysis of costs
Not reported.

Indirect Costs
The authors also examined costs associated with productivity losses from lung cancer morbidity and mortality.

Currency
US dollars ($).
Sensitivity analysis
One-way sensitivity analyses were performed on the compliance probabilities and costs.

Estimated benefits used in the economic analysis
The number of lung cancer deaths averted under universal screening varied between 292 (2 pCi/L) and 4 (20 pCi/L). The number of lung cancer deaths averted under targeted screening varied between 152 (2 pCi/L) and 1 (20 pCi/L). The number of lung cancer deaths averted under modified universal screening varied between 1,048 (2 pCi/L) and 105 (20 pCi/L). The number of lung cancer deaths averted under modified targeted screening varied between 546 (2 pCi/L) and 10 (20 pCi/L). The number of lung cancer deaths prevented increased with the degree of smoking.

Cost results
Cost results were not reported separately.

Synthesis of costs and benefits
Costs per lung cancer death prevented, including medical costs and productivity losses, were:

- universal screening between $3,030,000 (4 pCi/L) and $68,440,000 (20 pCi/L);
- targeted screening between $2,040,000 (4 pCi/L) and $148,670,000 (20 pCi/L);
- modified universal screening between $920,000 (4 pCi/L) and $2,550,000 (20 pCi/L);
- modified targeted screening between $520,000 (4 pCi/L) and $9,470,000 (20 pCi/L).

Costs per life year were:

- universal screening between $480,000 (4 pCi/L) and $1,440,000 (10 pCi/L);
- targeted screening between $330,000 (4 pCi/L) and $730,000 (10 pCi/L);
- modified universal screening between $110,000 (8 pCi/L) and $500,000 (20 pCi/L);
- modified targeted screening between $70,000 (8 pCi/L) and $2,410,000 (20 pCi/L).

Performing an intervention in the homes of smokers was more cost-effective than performing one in the home of someone who had never smoked. From the first decade through the fourth decade of life, the cost-effectiveness estimates for the universal and targeted scenarios decrease, after which they progressively increase with increasing age. The cost-effectiveness results were sensitive to changes in the probabilities of retesting, of mitigating or of successfully mitigating, and costs.

Authors’ conclusions
Increased cost-effectiveness can be achieved by adherence to existing recommendations, i.e. by increasing the proportion of people who would retest their homes and mitigate if necessary.

CRD COMMENTARY - Selection of comparators
The rationale for the choice of the comparators was clear. You, as a user of the database, should verify whether these health technologies are relevant to your setting.

Validity of estimate of measure of benefit
Relevant measures of benefit were used. Given that data for many of the variables were sparse, frequently dated, and of
questionable generalisability, the authors often had to use data from national surveys. Risk estimates were based on formulae developed from mining studies. Their extrapolation to the residential environment is uncertain. Because total lung cancer and all-cause mortality rates were disaggregated on the basis of summary relative risk and prevalence estimates, some error may have been introduced in the resulting estimates. The authors did not consider the impact of residential mobility on lifetime radon exposure and risk for lung cancer. The analysis did not factor the impact of modifications to existing housing units on the time of onset of lung cancer and the number of lung cancers.

Validity of estimate of costs
Relevant direct and indirect costs were included. More details could have been provided about the method for calculating the various cost items. The cost estimate for the targeted programme may have overestimated the true costs.

Other issues
Sensitivity analyses were performed to allow for uncertainty surrounding the effectiveness and cost estimates. Comparisons with other relevant studies were made. The generalisability of the results to other settings or countries was not discussed.

Implications of the study
New cost-effectiveness estimates may need to be developed when additional data from residential case-control studies of radon exposure and lung cancer become available.

Source of funding
None stated.

Bibliographic details

PubMedID
10076484

Indexing Status
Subject indexing assigned by NLM

MeSH
Aged; Air Pollutants, Radioactive / adverse effects; Cost-Benefit Analysis; Decision Trees; Female; Housing; Humans; Lung Neoplasms / chemically induced / economics / mortality / prevention & control; Male; Mass Screening / economics / methods; Radiation Monitoring / economics / methods; Radon / adverse effects; Sensitivity and Specificity; United States / epidemiology; United States Environmental Protection Agency; Value of Life

AccessionNumber
21999008129

Date bibliographic record published
30/04/2000

Date abstract record published
30/04/2000