Cost-effectiveness of positron emission tomography for non-small cell lung carcinoma in Canada
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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 positron emission tomography (PET) plus computed tomography (CT) for the staging of non-small-cell lung carcinoma (NSCLC) was compared with CT alone. To confirm the PET results, a biopsy was performed regardless of the result of CT. For patients with a positive CT, a biopsy was performed.

Type of intervention
Diagnosis.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised a total of 1,000 hypothetical individuals, average age 65 years, presenting with suspected NSCLC.

Setting
The setting was secondary care. The economic study was carried out in Canada.

Dates to which data relate
The effectiveness data were derived from studies published between 1982 and 2001. The resource use data were obtained from studies published between 1989 and 2004. The price year was 2000.

Source of effectiveness data
The effectiveness data were derived from a review of published studies, augmented by authors' assumptions.

Modelling
A decision tree model was constructed to predict the cost and effectiveness for each strategy. The structure of the tree was determined by reviewing established protocols from the literature and from current local practice. The time horizon of the model was from the initial diagnosis of the disease to the end of the initial treatment.

Outcomes assessed in the review
The outcomes assessed were:
unresectable lung cancer prevalence;
mortality, sensitivity and specificity with CT;
mortality, sensitivity and specificity with PET;
mortality with biopsy;
mortality with radiation therapy;
mortality with surgical resection; and
the life expectancies of the local population, patients after radiation therapy and patients after curative surgery.

**Study designs and other criteria for inclusion in the review**
Both retrospective and prospective studies were included in the review. The authors stated that only studies confirming the diagnosis of biopsy were included. Studies that did not present the numbers used to derive the sensitivity and specificity, and studies with sensitivity and specificity that depended strictly on the number of identified lesions, were excluded.

**Sources searched to identify primary studies**
The literature search comprised searches of MEDLINE, EMBASE, published abstracts and references listed in the identified studies between 1965 and 2000. Population life expectancies were extracted from Canadian statistics.

**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**
Twenty studies were included in the review.

**Methods of combining primary studies**
The parameters derived from the primary studies were combined using a meta-analysis.

**Investigation of differences between primary studies**
Not reported.

**Results of the review**
Unresectable lung cancer prevalence was 0.335.
Mortality with CT was 0.0025%. The sensitivity of CT was 67% and the specificity was 73%.
Mortality with PET was 0%. The sensitivity of PET was 91% and the specificity was 96%.
Mortality with biopsy was 0.3%.
Mortality with radiation therapy was 0%.
Mortality with surgical resection was 3%.

Life expectancy was 18.3 years for the local population, 0.83 years for patients after radiation therapy, and 4.6 years for patients after curative surgery.

Methods used to derive estimates of effectiveness
The authors made assumptions about the sensitivity and specificity of biopsy.

Estimates of effectiveness and key assumptions
The sensitivity and specificity of biopsy were assumed to be 100%.

Measure of benefits used in the economic analysis
The summary measure of benefit in the economic analysis was the increase in life expectancy.

Direct costs
The cost/quantity boundary adopted in the economic analysis was that of the health care system. It appears that all the categories of costs related to diagnosis and surgery have been included. The costs of follow-up visits, social work visits and nutrition visits were excluded. The costs were not reported separately from the resources used. The cost data were derived from published studies, and all costs were adjusted to 2000 costs using the Canadian Consumer Price Index. Discounting was not conducted as the costs were incurred within one year.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
In line with the perspective adopted, the indirect costs were not included.

Currency
Canadian dollars (Can$).

Sensitivity analysis
A univariate sensitivity analysis was conducted to analyse the uncertainty in the model input parameters. The variables varied in the analysis included disease prevalence, CT, PET, surgery and biopsy cost, CT sensitivity and specificity, and PET sensitivity and specificity. For each variable, the authors derived the limits at which the PET plus CT strategy was dominant.

Estimated benefits used in the economic analysis
Compared with CT alone, the PET plus CT strategy resulted in an increase in life expectancy of 3.1 days.

Cost results
The expected cost was $17,595 per person for CT alone and $16,140 per person for CT plus PET.

Cost-savings of $1,455 were expected.
Synthesis of costs and benefits
The CT plus PET strategy was strictly dominating, as it incurred less costs and resulted in an increase in life expectancy.

The sensitivity analysis revealed that the cost-savings remained in favour of the CT plus PET strategy within certain limits. More specifically, disease prevalence greater than 12.9%, PET cost of less than $2,484, surgery cost of more than $1,729, CT sensitivity lower than 86.3%, and PET sensitivity higher than 37.8%. For any values of CT cost, biopsy cost, CT specificity and PET specificity, the CT plus PET strategy remained dominant.

Authors’ conclusions
Positron emission tomography (PET) was cost-effective for the staging of non-small-cell lung carcinoma (NSCLC).

CRD COMMENTARY - Selection of comparators
The rationale for the choice of the comparator appears to have been clear, as it represented current practice for the staging of NSCLC. You should decide whether it is a valid comparator in your own setting.

Validity of estimate of measure of effectiveness
The model parameters were mainly derived from published studies, and criteria were applied to the search for primary studies. A meta-analysis was conducted to combine the estimates of effectiveness. However, the authors do not appear to have investigated the validity of the meta-analysis, by investigating differences between the primary studies or publication bias, or by providing information on the designs of the primary studies. The authors made assumptions about the accuracy of biopsy. All key variables were varied in a one-way sensitivity analysis.

Validity of estimate of measure of benefit
Life expectancy was used as the measure of health benefit. The decision tree model used to estimate the benefit was appropriate. However, as a measure of benefit, life expectancy only permits partial health technology comparisons since quality of life is not taken into consideration.

Validity of estimate of costs
The authors stated explicitly which perspective was adopted in the study. As such, it appears that all the relevant categories of cost have been included in the analysis, although some unit costs appear to have been omitted. Visit costs were excluded because the number of visits made by individuals was undetermined, and the difference in the cost of visits did not depend on the diagnostic methods. In addition, downstream costs from both diagnosis and immediate therapeutic treatments were excluded on the grounds that they were not relevant to the perspective or timeframe under evaluation in this study. The costs were treated deterministically in the base-case although extensive one-way sensitivity analyses, in which the economic inputs were varied over plausible ranges, were conducted. Discounting was not relevant as all the costs were incurred during a time horizon of less than two years. The price year was reported, which aids reflation exercises in other setting

Other issues
The authors did not compare their findings with those from other published studies. The issue of the generalisability of the study results to other settings was not explicitly addressed. Further, the use of probabilistic methods would have better captured the uncertainty in the model parameters. The authors acknowledged limitations of the study. For instance, the model in the study was constructed based on the authors’ local practices. Such practices may not be similar to other settings, and this is likely to limit the replication of the study. The assumption of 100% accuracy for biopsy was unlikely to be valid.

Implications of the study
This study suggests that 2-fluoro-2-D-(18F)fluorodeoxyglucose-PET for the staging of NSCLC may benefit patients in
terms of an increase in life expectancy, and the health care system in terms of reduced costs. The authors recommended that further studies be undertaken to determine regional options for centres with smaller catchment areas.

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None stated.

Bibliographic details

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Other publications of related interest


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Subject indexing assigned by NLM

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