The cost-effectiveness of chest radiography as a screening test for chronic obstructive pulmonary disease among the Bangkok elderly


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
Nine indices of chest radiography (CXR) were assessed. Spirometry might have been used as the 'gold' standard diagnostic test for chronic obstructive pulmonary disease (COPD), although this was not clear.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised elderly individuals, aged 60 years or older, who were residing in the study setting.

Setting
The setting was the community. The economic study was carried out in Thailand.

Dates to which data relate
The effectiveness evidence was collected in January 1998. The cost data might have been collated at the same time, although this was not explicitly stated. A price year was not reported.

Source of effectiveness data
The effectiveness data were derived from a single study.

Link between effectiveness and cost data
The cost analysis appears to have been carried out prospectively on the same sample of patients as that used in the effectiveness analysis.

Study sample
The authors did not report that power calculations were carried out to estimate the impact of chance on the results. The sample was selected by including individuals aged 60 years or older, who were residing within 10 km of the study setting at the time of the study and were ambulatory, and who agreed to participate. Patients were excluded if they had an upper respiratory tract infection on the day of the study. Only those who could complete the spirometry and the CXR were analysed. The initial sample was appropriate for the clinical question, as it included patients at risk from COPD in whom screening may confirm the presence of COPD. A total of 3,123 elderly patients agreed to participate, although only 3,094 (99.1%) were included. Of these, 220 were confirmed as having COPD and 2,874 were confirmed as not
having COPD.

**Study design**
The analysis was based on a cross-sectional diagnostic study that was based in 124 communities surrounding Siriraj Hospital, Mahidol University, Bangkok. The patients appear to have been tested with a spirometer to assess their true COPD status, and then with CXR indices to assess the accuracy (sensitivity and specificity) of the latter test.

**Analysis of effectiveness**
The primary outcomes assessed were the sensitivity, specificity and risk ratio associated with each of the CXR indices. Also assessed was the $z$ cut-off point for maximum average accuracy and associated false-negative score. Patients with and without COPD (according to the gold standard test) were compared in terms of age, gender and smoking status (amount smoked). Significant differences were found in each of these characteristics. The COPD patients were older than their counterparts (70.2 years versus 67.7 years; $p<0.001$) and were predominantly males (gender ratio 2.6:1 versus 0.6:1; $p<0.002$). There were also more tobacco smokers in the COPD group (75.5% versus 33.7%; $p<0.002$) with a higher number of pack-years (32.8 versus 24.7; $p<0.001$) than in the non-COPD group.

**Effectiveness results**
The postrib index had a sensitivity of 0.935 and a specificity of 0.265 (risk ratio, RR=4.5, 95% confidence interval, CI: 3.11 - 6.51).

The antrib index had a sensitivity of 0.926 and a specificity of 0.231 (RR 4.88, 95% CI: 3.03 - 7.86).

The lattrac index had a sensitivity of 0.565 and a specificity of 0.604 (RR 2.16, 95% CI: 1.64 - 2.85).

The patrac index had a sensitivity of 0.943 and a specificity of 0.059 (RR 1.77, 95% CI: 1.14 - 2.76).

The patrac/lattrac index had a sensitivity of 0.909 and a specificity of 0.076 (RR 1.51, 95% CI: 1.01 - 2.24).

The retro index had a sensitivity of 0.304 and a specificity of 0.881 (RR 3.64, 95% CI: 2.66 - 4.97).

The padi index had a sensitivity of 0.737 and a specificity of 0.448 (RR 2.76, 95% CI: 2.03 - 3.74).

The ladi index had a sensitivity of 0.710 and a specificity of 0.679 (RR 5.84, 95% CI: 4.33 - 7.89).

The angle index had a sensitivity of 0.419 and a specificity of 0.835 (RR 4.10, 95% CI: 3.07 - 5.46).

The $z$ score was a weighted average of all the CXR indices.

The $z$ cut-off point with the greatest average accuracy of 74.1% was 0.07. The associated false-negative score was 53 missed cases.

**Clinical conclusions**
The authors claimed that their study showed "the efficacy of a CXR with two views as a screening test for diagnosing COPD using the gold standard diagnostic method".

**Measure of benefits used in the economic analysis**
The number of cases detected per individual screened was estimated as a summary measure of health benefit. The authors also estimated a cost-effective screening cut-off point, which was defined as the cut-off point with the lowest cost.
Direct costs
Very few details of the costing analysis were reported. For instance, the authors did not report the perspective from which the analysis was carried out. The authors stated "the costs of spirometry and CXR were calculated from costs of equipment with depreciation, materials, personnel salaries and duration of the tests". There was no report of the source used to estimate the unit costs, and whether the estimates were based on actual data, derived using modelling, or obtained from literature. The annual costs of influenza infection treatment were included in the analysis to estimate the false-negative and true-negative costs, and were derived from the literature. The quantities were not reported separately from the unit costs. Discounting was not necessary since the authors were concerned with the immediate costs associated with the screening tests. The dates when the costs were collected were not reported, and neither was a price year. The authors aimed to estimate the cost of diagnosis and the cost of screening one elderly person.

Statistical analysis of costs
The authors did not report a statistical analysis of the costs.

Indirect Costs
The indirect costs were not estimated.

Currency
Thailand baht (Baht).

Sensitivity analysis
There was no report of a sensitivity analysis.

Estimated benefits used in the economic analysis
The number of cases detected per individual screened was 0.06.

The z cut-off with the lowest cost was 0.04. This was associated with a sensitivity of 84.1% and a specificity of 42.9%.

Cost results
Screening one individual using CXR cost Baht 120.29.

Synthesis of costs and benefits
Incremental cost-effectiveness ratios were not calculated. Only the cost per case detected with CXR was evaluated.

The cost to detect one case of COPD was Baht 2,008 and 17 individuals needed to be screened.

Authors' conclusions
The authors concluded "it is apparently clear that CXR is probably not a useful screening method for COPD except to obtain additional data during the annual CXR check up for the elderly". They argued that chest radiography (CXR) was more useful as a diagnostic test than as a screening test for chronic obstructive pulmonary disease (COPD).

CRD COMMENTARY - Selection of comparators
The authors assessed different indices of CXR. Spirometry was also used to assess the patients, although it was unclear whether this actually represented the gold standard screening or diagnostic test. If spirometry gives the true disease status of the patient, then the authors were able to provide a true reflection of the accuracy of screening using the CXR indices.
Validity of estimate of measure of effectiveness
The analysis was based on a diagnostic study design, which is appropriate for assessing the cost-effectiveness of a screening test. However, there needed to be substantially more clarity about the gold standard used to assess true COPD status, and the advantages and disadvantages of CXR relative to this comparator. The study sample comprised elderly individuals located in proximity to the study setting. It was both representative of the study population and appropriate for the study question. The authors might have linked the optimal z scores identified back to the components of the CXR indices in order to assess which of the indices was most useful.

Validity of estimate of measure of benefit
The number of cases detected per individual screened was used as a summary measure of health benefit. This measure was not comparable across a broad range of health technologies. Therefore, the number of life-years gained or quality-adjusted life-years saved would have been more appropriate health benefit measures.

Validity of estimate of costs
Very few details of the costing analysis were reported. This severely limits the readers' ability to understand, interpret, and translate the results to an alternative setting. Most importantly, a perspective was not reported, and it is therefore not possible to assess whether all the relevant costs were incorporated. The costs included suggest that the perspective of the health care provider might have been used. Since all costs were incurred during a very short time period, discounting was unnecessary and was therefore not performed. There was no clear report of the dates over which the costs were estimated and no price year was reported, which will hamper any possible inflation exercises.

Other issues
The authors did not compare their findings with those of other authors. They also did not address the issue of generalisability, which is highly limited. The authors presented a range of effectiveness results, both for the overall indices and for the components of the index, which gave a useful insight into the effectiveness of CXR. The conclusion that CXR may be more useful as a diagnostic test is not supported by the analyses, as the study did not set out to address this question. Had the question of a screening test been addressed, the authors might have used a different sample of patients, such as those who had specific symptoms or had received prior screening that suggested risk factors for COPD. The limitation mentioned was not including the cost of a doctor to interpret the results of the screening. The authors did not discuss the implications of this limitation.

Implications of the study
The authors did not make any recommendations for policy or practice resulting from their study. They also did not suggest any areas for further research.

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Bibliographic details

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Other publications of related interest


**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
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