The most cost-effective screening method 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
Nineteen screening strategies to identify patients with chronic obstructive pulmonary disease (COPD) were examined. The strategies were based on the combination of three main tools, mini-peak expiratory flow rate (miniPEF), chest radiography (CXR) and questionnaire (Q). The following strategies were investigated:

strategy 1, miniPEF;
strategy 2, CXR;
strategy 3, Q;
strategy 4, miniPEF plus CXR (parallel);
strategy 5, miniPEF, CXR (serial);
strategy 6, CXR, miniPEF (serial);
strategy 7, miniPEF plus Q (parallel);
strategy 8, miniPEF, Q (serial);
strategy 9, Q, miniPEF (serial);
strategy 10, CXR plus Q (parallel);
strategy 11, CXR, Q (serial);
strategy 12, Q, CXR (serial);
strategy 13, miniPEF plus CXR plus Q (parallel);
strategy 14, miniPEF, CXR, Q (serial);
strategy 15, miniPEF, Q, CXR (serial);
strategy 16, CXR, miniPEF, Q (serial);
strategy 17, CXR, Q, miniPEF (serial);
strategy 18, Q, miniPEF, CXR (serial); and
strategy 19, Q, CXR, miniPEF (serial).

Type of intervention
Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised elderly people aged 60 years and older. Patients with upper respiratory tract infection were excluded.

Setting
Although not explicitly reported, the setting is likely to have been secondary care. The economic study was carried out in Thailand.

Dates to which data relate
The effectiveness data were gathered in 1998. The dates when the resources use data were gathered were not reported. The price year was also not reported.

Source of effectiveness data
The effectiveness evidence was derived from a single study.

Link between effectiveness and cost data
The costing was not carried out on the same sample of patients as that used in the effectiveness study.

Study sample
Power calculations were not reported. An initial sample of 3,123 elderly patients who were ambulatory was identified from all eligible patients within a 10-km radius of the study hospital. However, complete data were available for 3,094 patients (99.1%). The mean age of the sample was 67.9 (+/- 6.4) years. The gender distribution (male:female) was 0.6:1.

Study design
This was a diagnostic study that was carried out at the Siriraj Hospital, Mahidol University, Thailand. The participants underwent all screening strategies (miniPEF, Q and CXR) plus the gold standard (spirometry). The sequence of tests was not reported. The patients were not followed after the test results were obtained. The outcome assessment was not performed blinded.

Analysis of effectiveness
All of the patients included in the initial study sample were accounted for in the effectiveness analysis. The outcomes used were the number of patients suffering from COPD and the number of responses related to the three main screening strategies (Q, CXR and miniPEF).

Effectiveness results
Of the 3,094 patients included in the study, 220 were suffering from COPD.

A total of 269 individuals with a negative result with Q had instead a positive result with miniPEF, while 1,461 had a negative result both with Q and miniPEF.
A total of 433 individuals with a positive result with Q also had a positive result with miniPEF, while 931 who had a positive result with Q had a negative result with miniPEF.

A total of 322 patients negative with CXR were positive with miniPEF, while 1,445 were negative with both tests.

A total of 380 patients positive with CXR were also positive with miniPEF, while 947 patients positive with CXR were negative with miniPEF.

A total of 654 patients were negative with CXR and positive with Q, while 1,113 were negative to both tests.

Finally, 710 patients had a positive result with both Q and CXR, while 617 were positive with CXR but negative with Q.

**Clinical conclusions**
The effectiveness analysis provided the clinical data that were used as model inputs (probabilities) in the decision analysis.

**Modelling**
A simple decision tree model was constructed to determine the costs and benefits associated with the 19 screening strategies under evaluation. The structure of the tree was reported. Each strategy under evaluation was followed by the gold standard. False or true positives and false or true negatives were identified from the model, so as to estimate the cost to detect one case of COPD associated with each pathway.

**Measure of benefits used in the economic analysis**
The summary benefit measure used was the number of cases detected per one individual screened. This was derived from the decision model. Other model outputs were the rates of false negatives and false positives, and the number of individuals screened to detect one case of COPD.

**Direct costs**
Discounting was not relevant because of the short timeframe of the analysis. The unit costs were presented separately from the quantities of resources used. The health services included in the economic evaluation were all screening tests considered in each model pathway. The cost/resource boundary of the study was not explicitly reported. Resource use was estimated on the basis of the number of procedures included in each screening option. The source of the cost data was not reported, but it could have been the study institution. The price year was not reported.

**Statistical analysis of costs**
The costs were treated deterministically.

**Indirect Costs**
The indirect costs were not considered in the economic evaluation.

**Currency**
Thailand bahts (THB).

**Sensitivity analysis**
Sensitivity analyses were not carried out.
Estimated benefits used in the economic analysis
The estimated number of cases detected per one individual screened (CD), the rates of false negatives (FN) and false positives (FP), and the number-needed-to-screen to detect one case of COPD (NNS) were as follows:

- CD 0.052, FN 1.9%, FP 17.5%, and NNS 19.2 with strategy 1;
- CD 0.060, FN 1.1%, FP 36.9%, and NNS 16.7 with strategy 2;
- CD 0.060, FN 1.2%, FP 38%, and NNS 16.7 with strategy 3;
- CD 0.70, FN 0.2%, FP 46.4%, and NNS 14.3 with strategy 4;
- CD 0.043, FN 2.8%, FP 8%, and NNS 23.3 with strategy 5;
- CD 0.043, FN 2.8%, FP 7.9%, and NNS 23.3 with strategy 6;
- CD 0.051, FN 0.2%, FP 57.1%, and NNS 19.6 with strategy 7;
- CD 0.051, FN 2.1%, FP 17.8%, and NNS 19.6 with strategy 8;
- CD 0.043, FN 2.7%, FP 9.7%, and NNS 23.3 with strategy 9;
- CD 0.139, FN 16.1%, FP 38.9%, and NNS 7.2 with strategy 10;
- CD 0.051, FN 2%, FP 17.8%, and NNS 19.6 with strategy 11;
- CD 0.043, FN 2.8%, FP 9.7%, NNS 23.3 with strategy 12;
- CD 0.036, FN 2.8%, FP 9.6%, and NNS 27.8 with strategy 13;
- CD 0.036, FN 2.8%, FP 8%, and NNS 27.8 with strategy 14;
- CD 0.070, FN 31.1%, FP 61.9%, and NNS 14.3 with strategy 15;
- CD 0.036, FN 3.4%, FP 8%, and NNS 27.8 with strategy 16;
- CD 0.036, FN 2.7%, FP 9.6%, and NNS 27.8 with strategy 17;
- CD 0.036, FN 2.5%, FP 6.1%, and NNS 27.8 with strategy 18; and
- CD 0.036, FN 2%, FP 6.1%, and NNS 27.8 with strategy 19.

Cost results
The estimated costs were:

- strategy 1, THB 47.99;
- strategy 2, THB 120.29;
- strategy 3, THB 92.12;
- strategy 4, THB 132.68;
- strategy 5, THB 47.99;
- strategy 6, THB 123.84;
strategy 7, THB 189.04;  
strategy 8, THB 92.30;  
strategy 9, THB 51.62;  
strategy 10, THB 197.75;  
strategy 11, THB 127.15;  
strategy 12, THB 96.15;  
strategy 13, THB 197.75;  
strategy 14, THB 316.20;  
strategy 15, THB 295.80;  
strategy 16, THB 198.74;  
strategy 17, THB 197.15;  
strategy 18, THB 196.26; and  
strategy 19, THB 197.55.

**Synthesis of costs and benefits**  
The average cost-effectiveness ratios were calculated to combine the costs and benefits of the alternative screening strategies.

The average cost to detect one case of COPD was:

strategy 1, THB 923;  
strategy 2, THB 2,008;  
strategy 3, THB 1,538;  
strategy 4, THB 1,897;  
strategy 5, THB 1,116;  
strategy 6, THB 2,880;  
strategy 7, THB 3,707;  
strategy 8, THB 1,810;  
strategy 9, THB 1,200;  
strategy 10, THB 1,423;  
strategy 11, THB 2,492;  
strategy 12, THB 2,236;
strategy 13, THB 5,493;
strategy 14, THB 8,790;
strategy 15, THB 4,230;
strategy 16, THB 5,521;
strategy 17, THB 5,481;
strategy 18, THB 5,456; and
strategy 19, THB 5,488.

Thus, miniPEF was the most cost-effective strategy among the 19 options (in terms of the average cost to detect one case of COPD).

Authors’ conclusions
Mini-peak expiratory flow rate (miniPEF) represented the most cost-effective option for the screening of chronic obstructive pulmonary disease (COPD) in individuals aged 60 years and older. In centres where the miniPEF was not available, the most cost-effective strategy was the questionnaire. The use of less expensive staff would further reduce the costs associated with the questionnaire.

CRD COMMENTARY - Selection of comparators
The selection of the comparators was appropriate as all three main screening tools represented widely used approaches for the diagnosis of COPD. A number of alternative screening strategies were also considered. There was limited information on each tool. You should decide whether they are valid comparators in your own setting.

Validity of estimate of measure of effectiveness
The analysis of the effectiveness was based on a diagnostic study. The main drawback of such a design was that the sequence of the test performance was not reported, which was a crucial issue because it would appear that the outcomes were not assessed in a blinded fashion. Further, it was not stated whether the study sample was appropriate for the study question. The participants were recruited from a large geographic area, and the study sample appears to have been representative of the patient population because wide inclusion criteria were used. These issues should be considered when determining the internal validity of the analysis.

Validity of estimate of measure of benefit
The main summary benefit measure was specific to the interventions examined in the study. It is not comparable with the benefits of other health care interventions. The impact of the screening strategies on quality of life was not investigated since the analysis focused mainly on test accuracy.

Validity of estimate of costs
The authors did not state explicitly which perspective was adopted in the study, but it appears that only hospital costs have been considered in the analysis. Only those costs strictly related to the screening options were included. The unit costs were presented separately from the quantities of resources used. The cost estimates were specific to the study setting and sensitivity analyses were not performed. Similarly, no statistical analyses of the costs were carried out. The price year was not reported, which makes reflation exercises in other settings difficult.

Other issues
The authors compared their findings with those from a published economic evaluation of COPD screening strategies,
and comparable results were observed. The issue of the generalisability of the study results to other settings was not addressed and sensitivity analyses were not performed. This reduced the external validity of the analysis. The study referred to the general population of individuals aged 60 years and over and this was reflected in the authors’ conclusions. A limitation of the study was that all of the strategies were compared in terms of the average cost-effectiveness ratio and no incremental analysis was performed.

**Implications of the study**
The study results suggested that miniPEF should be used as the most cost-effective COPD screening strategy.

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**Other publications of related interest**


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