Comparison of induced versus expectorated sputum for diagnosis of pulmonary tuberculosis by acid-fast smear

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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
Induced versus expectorated sputum for diagnosis of pulmonary tuberculosis by acid-fast smear.

Type of intervention
Diagnosis.

Economic study type
Cost-effectiveness analysis.

Study population
Male and female patients with cultures from respiratory secretions that were positive for Mycobacterium tuberculosis. No further details were given.

Setting
Urban tertiary care academic medical centre. The economic study was carried out in New York, USA.

Dates to which data relate
The main effectiveness data were obtained from a single study conducted between 1989 and 1994. Resource and cost data were taken from 1989-94 sources. The price year was not clearly stated.

Source of effectiveness data
The estimate for positive acid-fast smears of expectorated and induced sputum were obtained from a single study.

Link between effectiveness and cost data
The costing was retrospectively undertaken on the same patient sample as that used for the effectiveness study.

Study sample
One hundred and fourteen patients with cultures positive for tuberculosis were included in the study (44 were HIV seropositive). Acid-fast smears of expectorated sputum and sputum induction were used in 79 and 24 of these patients, respectively. Data have been analysed by subgroups of HIV serostatus: 31 positive and 48 negative. No further details were given.

Study design
The study was a retrospective case-series. The follow-up was not clearly stated. In only 103 patients were sputum
samples obtained by one or both of the two diagnostic methods. The remaining 11 patients were excluded from the analysis as the diagnoses were made by culture of specimens from bronchoalveolar lavage.

**Analysis of effectiveness**
The analysis of effectiveness was based on treatment completers only. The primary health outcomes were positive acid-fast smears of expectorated and induced sputum.

**Effectiveness results**
Overall 33 of 79 patients (42%) had positive acid-fast smears of expectorated sputum and 6 of 24 (25%) had positive smears of induced sputum, \(p=0.21\). In the HIV-seropositive group, 42% of the 31 patients for whom expectorated sputum samples were analysed, had positive acid-fast bacilli smears and 24% of the 17 patients from whom induced sputum samples were analysed had positive smears. In the HIV-seronegative group, 42% of the 48 patients who had expectorated sputum samples analysed produced positive acid-fast bacilli smears and 29% of the 7 patients who had induced sputum samples analysed produced positive smears. All results were non-significant.

**Clinical conclusions**
Induced sputum offered no advantage over routine expectorated sputum for the diagnosis of pulmonary tuberculosis. When data were analysed for subgroups by HIV serostatus there was no significant difference in the results.

**Measure of benefits used in the economic analysis**
The measure of benefits was positive acid-fast smears of expectorated and induced sputum.

**Direct costs**
Supplies and respiratory therapist costs were included in the analysis. The quantities were reported separately from the prices. The quantity/cost boundary adopted was the hospital. Discounting was not undertaken due to the short study period. The price year was not clearly stated.

**Statistical analysis of costs**
Not undertaken.

**Indirect Costs**
Not considered.

**Currency**
US dollars ($).

**Sensitivity analysis**
No sensitivity analysis was performed.

**Estimated benefits used in the economic analysis**
Overall 33 of 79 patients (42%) had positive acid-fast smears of expectorated sputum and 6 of 24 (25%) had positive smears of induced sputum, \(p=0.21\). In the HIV-seropositive group, 42% of the 31 patients for whom expectorated sputum samples were analysed, had positive acid-fast bacilli smears and 24% of the 17 patients from whom induced sputum samples were analysed had positive smears. In the HIV-seronegative group, 42% of the 48 patients who had expectorated sputum samples analysed produced positive acid-fast bacilli smears and 29% of the 7 patients who had
induced sputum samples analysed produced positive smears.

Cost results
The total cost per year was $44,870 ($20,600 for supplies and $24,270 for respiratory therapist). The total cost per induction was $28.65 ($13.15 for supplies and $15.50 for respiratory therapist). These costs are assumed to be incremental as it is likely that the costs of expectorated collection were incurred as part of routine nursing care.

Synthesis of costs and benefits
Costs and benefits were not combined.

Authors' conclusions
Sputum induction was shown to be costly and induced sputum offered no advantage over routine expectorated sputum for the diagnosis of pulmonary tuberculosis.

CRD COMMENTARY - Selection of comparators
The reason for the choice of the comparator is clear. Sputum induction has been used in attempting to increase the diagnostic yield of staining for acid-fast bacilli. You, as a user of this database, should consider whether this is a widely used health technology in your own setting.

Validity of estimate of measure of benefit
The estimate of benefit measure used in the economic analysis is likely to be internally valid. However, as noted by the authors, the study suffers from some limitations as 13 patients with a productive cough had expectorated samples that were found to be positive before an induced sample was taken. The data have not been used selectively.

Validity of estimate of costs
Resource quantities were reported separately from the prices. Adequate details of methods of quantity/cost estimation were given. However, no cost for expectorated sputum was explicitly given, although it is not likely to have been additional to standard care.

Other issues
The authors' conclusions are not likely to be justified given the uncertainties in the data. The issue of generalisability to other settings or countries was not addressed. However, appropriate comparisons were made with other studies particularly in relation to the sensitivity of acid-fast smear for diagnosing cases of tuberculosis confirmed by positive culture.

Implications of the study
Further studies are required to address whether induced sputum has a higher yield on culture in the HIV-seropositive population. A prospective controlled study is needed.

Source of funding
None stated.

Bibliographic details