The use of high-efficiency particulate air-filter respirators to protect hospital workers from tuberculosis: a cost-effectiveness analysis

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 high-efficiency particulate air filters (HEPA respirators) to protect hospital workers from tuberculosis.

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
Hospital workers visiting isolation rooms within the hospital.

Setting
Hospital (tertiary care centre). The economic study was conducted at Charlottesville, USA.

Dates to which data relate
No dates were stated for the resources used. Effectiveness data were collected from June 1992 to May 1993. Prices were expressed in 1993 dollars.

Source of effectiveness data
Derived from a single study and opinions.

Link between effectiveness and cost data
The costings were undertaken retrospectively after the effectiveness results were known. Cost data were not collected on the hospital workers included in the effectiveness study.

Study sample
No power calculations were used. The sample consisted of 3852 hospital workers exposed to patients admitted to the University of Virginia Hospital with tuberculosis.

Study design
Case series, single centre study. The duration of follow-up was not reported.
Analysis of effectiveness
Analysis was based on intention to treat. Outcomes were the rates at which the purified protein-derivative (PPD) skin test became positive in hospital workers. A conversion was defined as a newly positive PPD (purified protein derivative) with induration of 10mm or more at 48 to 72 hours.

Effectiveness results
There were eight new positive PPD tests in 1992 among 3852 health care workers (0.2 percent). But five of these conversions were attributed to the booster phenomenon; two of the remaining health care workers had not worked with a patient in isolation and one had a newly positive PPD test after exposure to a patient not yet in isolation. Therefore, there were no conversions attributable to transmission in the isolation rooms.

Methods used to derive estimates of effectiveness
Estimates of effectiveness were based on authors' assumptions.

Estimates of effectiveness and key assumptions
The authors assumed that one conversion could be prevented each year with the use of HEPA respirators. On the basis of this and other assumptions, the authors calculated that the number of years needed to prevent a single case of occupational tuberculosis would be 41 years with the use of HEPA respirators.

Measure of benefits used in the economic analysis
Rates of conversion of PPP skin test.

Direct costs
Costs and quantities were analysed separately (the cost of each mask, and the number of masks used in one year were provided). Health care costs were measured in terms of operating costs, such as the cost of using disposable HEPA respirators. Direct costs to the hospital were included in the analysis. The estimation of the annual costs were based on maximal and minimal expected number of health workers caring for each patient and use of mask. Costs were expressed in 1993 dollars.

Indirect Costs
Indirect costs to the hospital were only considered for the training and testing of the masks for each worker. Lost productivity was measured in terms of the lost of time (hours) for the health care workers. Costs and quantities were not analysed separately. The estimation of quantities was based on quantity data at the hospital i.e. the time taken for the training and testing of the proper mask fit for one health care worker. The estimation of costs was based on cost data at the hospital. Costs were expressed in 1993 dollars.

Currency
US dollars ($).

Sensitivity analysis
The impact of minimal and maximal annual cost estimates for the use of several types of mask were calculated as well as the reduction in the number of respirators.

Estimated benefits used in the economic analysis
One conversion could be prevented each year with the use of EPA respirators. Therefore, a single case of occupational tuberculosis would be prevented in 41 years.
Cost results
(See below under: Synthesis of costs and benefits).

Synthesis of costs and benefits
Preventing a single case of occupational tuberculosis during the next 41 years by using HEPA respirators and implementing a respiratory-protection program would cost the hospital between $1,333,090 and $18,508,947. If the number of respirators were reduced by 50 per cent, the minimal and maximal estimates would be $1,030,923 and $15,665,659, respectively.

Authors' conclusions
The current administrative and engineering controls within the University of Virginia Hospital are very effective in preventing the nosocomial transmission of tuberculosis. The addition of HEPA respirators would offer negligible protective efficacy at great cost.

CRD Commentary
The authors themselves recognise the need of epidemiologic data to demonstrate the efficacy of the HEPA respirator programme. The cost description of implementing the programme is quite accurate, however, an appropriate cost-effectiveness analysis would have also included the cost of treating the case of tuberculosis.

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