Cost-effectiveness of measles outbreak intervention strategies

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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
Alternative measles outbreak intervention strategies in schools.

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The study population was a single, hypothetical, primary school population of 500 students (aged 5 to 10 years) and their younger siblings.

Setting
The setting was community, primary care, and hospital. The economic study was carried out in western Sydney, Australia.

Dates to which data relate
Effectiveness and resource use data were collected from studies published between 1977 and 1995. Cost data were taken from hospital records and from studies published between 1986 and 1989. The price year was not reported.

Source of effectiveness data
Effectiveness data were derived from a literature review.

Modelling
A decision analytic model was used to determine the cost-effectiveness of the measles outbreak intervention strategies. A linear model of disease spread was used.

Outcomes assessed in the review
The review assessed vaccination rate and effectiveness, infection rate, number of siblings, natural immunity, and clinic attendance rate.

Study designs and other criteria for inclusion in the review
Not stated.
Sources searched to identify primary studies
Not stated.

Criteria used to ensure the validity of primary studies
Not stated.

Methods used to judge relevance and validity, and for extracting data
Summary statistics from individual studies were used.

Number of primary studies included
At least 9 primary studies were included in the review.

Methods of combining primary studies
The narrative method was used to combine studies.

Investigation of differences between primary studies
Not stated.

Results of the review
Figures in parentheses indicate ranges tested in the sensitivity analyses.

The prior vaccination rate was 83% (60-95).
Vaccine effectiveness was 95% (85-100).
The infection rate was 48% (32-63) for school children and 75% (65-80) for their siblings.
The number of siblings aged 12 months and over was 0.40 (0.2-0.6).
The number of siblings aged 6 to 12 months was 0.06 (0.03-0.09).
Natural immunity was 0% (0-10) for school-aged children, 0% (0-10) for siblings aged 12 months and over, and 5% (0-20) for siblings aged 6 to 12 months.
Clinic attendance rate was 84% (50-100) for school-aged children and 75% (50-100) for siblings.

Measure of benefits used in the economic analysis
The number of cases prevented was used as the measure of benefits.

Direct costs
Direct costs were discounted at a rate of 5% (time horizon greater than 1 year). Quantities and costs were reported separately. Direct costs included costs of the vaccine and its administration, costs associated with establishing the clinic, costs of treating vaccine complications, and treatment costs (general practitioner and hospital). The quantity/cost boundary adopted was that of the health service. The estimation of quantities and costs was based on actual data. Costs and quantities were obtained from hospital records and published studies. The price year was not reported.

Statistical analysis of costs
The authors provided estimates of total costs.

**Indirect Costs**
Indirect costs were not included.

**Currency**
Australian dollars (Aus$).

**Sensitivity analysis**
In order to address variability in the data and assumptions, one-way sensitivity analyses were conducted on model parameters, using arbitrary ranges for the variables.

**Estimated benefits used in the economic analysis**
An unchecked measles outbreak would lead to 65.3 measles cases. The number of cases prevented for each strategy was as follows:

- Strategy 1: 43.72;
- Strategy 2: 44.08;
- Strategy 3: 44.14;
- Strategy 4: 52.13;
- Strategy 5: 52.51; and
- Strategy 6: 52.58.

**Cost results**
Total vaccination costs for each strategy were as follows:

- Strategy 1: Aus$1,440;
- Strategy 2: Aus$1,870;
- Strategy 3: Aus$1,940;
- Strategy 4: Aus$8,470;
- Strategy 5: Aus$11,010; and

The reduction in hospital costs ranged from Aus$14,700 in strategy 1 to Aus$17,400 in strategy 6. Net savings ranged from Aus$13,260 in strategy 1 to Aus$5,950 in strategy 6.

**Synthesis of costs and benefits**
Full details for each strategy are given in the original article. In summary, the average cost per case prevented ranged from Aus$32.90 in strategy 1 to Aus$217.80 in strategy 6 under the assumption that no hospital savings were realised. Incremental cost per case prevented ranged from Aus$32.90 in strategy 1 to Aus$6,796 in strategy 6 under the
assumption that no hospital savings were realised. The results were sensitive to the costs of vaccination.

**Authors’ conclusions**
The study provided evidence of the cost-effectiveness of vaccination in outbreak control. Decisions about which groups of children to aim at and whether to conduct school-based clinics will be influenced by local circumstances, particularly the baseline measles vaccination rate and the measles attack rate among infants.

**CRD COMMENTARY - Selection of comparators**
A justification was given for the comparators used, namely no vaccination. You, as a user of the database, should decide if these health technologies are relevant to your setting.

**Validity of estimate of measure of effectiveness**
The authors undertook a literature review to derive estimates for the model which seemed appropriate, although they did not state that a systematic review of the literature had been undertaken. In this respect, more information about the methods of the review could have been provided. The validity of results was enhanced by sensitivity analyses to account for variability in the estimates. However, the authors used arbitrary ranges in the sensitivity analyses. The authors noted several developments in the biology of measles infection and intervention strategies, which are likely to have an impact on effectiveness.

**Validity of estimate of measure of benefit**
The estimation of benefits was obtained directly from the effectiveness analysis.

**Validity of estimate of costs**
Good features of the cost analysis were that all relevant direct cost categories were included, quantities and costs were reported separately, and direct costs were discounted. The validity of the cost results was further enhanced by appropriate sensitivity analyses over what would appear to have been plausible ranges. However, the price year was not reported. The authors used scheduled fees for visits to general practitioners, which do not reflect true opportunity costs. Hospital costs were based on the experience at one teaching hospital, thus limiting their generalisability.

**Other issues**
The authors did make appropriate comparisons of their findings with those from other studies and the issue of generalisability to other settings was addressed. The authors did not present their results selectively. The study considered a primary school population of 500 students (aged 5 to 10 years) and their younger siblings and this was reflected in the authors’ conclusions. Although using a linear approach, the authors acknowledged that a non-linear process more realistically describes disease spread. Moreover, they limited the transmission of the disease from pupil to pupil within a single school and from pupil to sibling outside of the school, which may exaggerate the cost per case prevented. The authors did not consider a strategy of encouraging parents to take their children to a local general practitioner for vaccination, thus limiting the generalisability of the results.

**Implications of the study**
The study provided evidence of the cost-effectiveness of vaccination in outbreak control. The authors suggest that decisions about which groups of children to aim at and whether to conduct school-based clinics will be influenced by local circumstances, particularly the baseline measles vaccination rate and the measles attack rate among infants.

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