Comparison of cost and benefits of each model for rubella immunization in Japan

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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
The vaccination of children against rubella.

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised Japanese children aged between 1 and 3 years for the first rubella vaccination, and between 6 and 9 years for the second vaccination.

Setting
The setting was the community. The economic study was conducted in Okayama Prefecture, Japan.

Dates to which data relate
The effectiveness data were derived from studies published in Japan between 1997 and 2000. The dates during which the resource use data were collected were not given. The price year was not reported.

Source of effectiveness data
The effectiveness data were derived from a review or synthesis of completed studies.

Modelling
Decision trees were used to compare the three proposed vaccination programmes in relation to their resulting antibody-positive detection rates and the costs required. All three programmes comprised two vaccination sessions. Details of the programmes were as follows.

Programme 1: the first vaccination was administered on an individual basis to children between the age of 1 and 3, with the second vaccination administered similarly at the age of 6 to 9.

Programme 2: the first vaccination was administered as in programme 1, whereas the second vaccination was administered within groups as part of a primary school vaccination programme.

Programme 3: the first vaccination was administered as in programme 1, whereas the second individual vaccination was based on the results of a urine test conducted annually in primary schools.
Outcomes assessed in the review
The effectiveness results were derived from the outcomes in the literature. The outcomes were:

the vaccination success rate;

the accumulated coverage rates of rubella vaccination, which was administered on an individual basis until the age of 3;

the group (school) rubella vaccination coverage rates;

the natural rubella infection rate at the age of 13; and

the school urine test coverage rates.

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
Not stated.

Number of primary studies included
Five primary studies were included in the review

Methods of combining primary studies
Not carried out.

Investigation of differences between primary studies
Not stated.

Results of the review
The vaccination success rate was 95%.

The accumulated coverage rate of individual rubella vaccination to the age of 3 was approximately 35%.

The group (school) rubella vaccination coverage rate was 70%.

The natural rubella infection rate at the age of 13 was 50%.

The school urine test coverage rate was 97%.

Given these data, the positive rates of rubella antibody detection were predicted for the three vaccination programmes using:
natural infection rates (up to age 7) of 10 and 20%;

first and second vaccination coverage rates of 30 and 40% for individual vaccination, 70% for group vaccination, and 90% for the individual vaccination based on urine test results.

Measure of benefits used in the economic analysis
The measure of benefits used was the predicted, positive rate of rubella antibody detection.

Direct costs
The direct costs included the costs of rubella vaccination and urine antibody testing. These were derived from the actual costs in the area where the economic study was performed. The cost of urine antibody testing was based on serum antibody testing, which uses the same methods. The costs were not discounted. The price year was not stated. The costs and quantities were not reported separately.

Statistical analysis of costs
Not carried out.

Indirect Costs
The indirect costs were not included.

Currency
Japanese yen (Y).

Sensitivity analysis
A series of sensitivity analyses was conducted to investigate the effects of the first and second vaccination rates on the positive rate of antibody detection.

Estimated benefits used in the economic analysis
When the natural infection rate was set at 20%, the positive rate of antibody detection was 58.8 to 68.9% (mean 64.0%) for programme 1, 83.6 to 86.1% (mean 84.9%) for programme 2, and 90.5 to 91.9% (mean 91.2%) for programme 3.

When the natural infection rate was set at 10%, the positive rate of antibody detection was 53.9 to 65.2% (mean 59.8%) for programme 1, 81.6 to 84.5% (mean 83.0%) for programme 2, and 89.1 to 90.6% (mean 89.9%) for programme 3.

Cost results
When the natural infection rate was set at 20%, the mean total costs were 7.27 billion Y for programme 1, 10.51 billion Y for programme 2, and 12.25 billion Y for programme 3.

When the natural infection rate was set at 10%, the mean total costs were 7.56 billion Y for programme 1, 11.04 billion Y for programme 2, and 12.82 billion Y for programme 3.

Synthesis of costs and benefits
The total cost for a gain of 1% in the antibody-positive detection rate was calculated for the three programmes. Costs/antibody-positive detection rates were reported.

When the natural infection rate was 20%, the costs were 0.113 billion Y for programme 1, 0.124 billion Y for
programme 2, and 0.134 billion Y for programme 3.

When the natural infection rate was 10%, the costs were 0.126 billion Y for programme 1, 0.133 billion Y for programme 2, and 0.143 billion Y for programme 3.

**Authors' conclusions**
Programme 3, where the first vaccination was administered on an individual basis between the age of 1 and 3, and the second individual vaccination was based on an annual urine test at primary school, was the most effective strategy in improving the positive rate of rubella antibody detection. However, it was also the most costly programme. Despite this, the authors regarded it as the best strategy, since they expected the future cost of urine antibody testing to be halved. They concluded that the best strategy in Japan would be the re-introduction of the MMR vaccine. However, until this can be done, the third programme would be the best alternative.

**CRD COMMENTARY - Selection of comparators**
The choice of the comparators was clear; they represented plausible ways of organising the vaccination programmes considered in Japan.

**Validity of estimate of measure of effectiveness**
The effectiveness measures were derived from a review of the literature, although there was no indication as to whether a systematic review of the literature had been undertaken. In addition, no information was provided on how the studies were identified, or the criteria on which they were selected and assessed. It is, therefore, difficult to comment on the validity of the estimates, as other relevant studies may have been omitted. This potential shortcoming was partly addressed by conducting sensitivity analyses over what appear to have been plausible ranges. It is unclear how the failure rate of the vaccine was determined.

**Validity of estimate of measure of benefit**
Appropriate measures of benefit were used. These were derived directly from the effectiveness results using the modelling process.

**Validity of estimate of costs**
The cost data included all the cost categories relevant to the perspective adopted, i.e. the Japanese health care system. No sensitivity analysis was conducted on the costs. However, this may reflect the Japanese health care system, which fixes costs centrally. The price year was not reported, which made reflation exercises problematic. In addition, it was difficult to generalise the results to other settings.

**Other issues**
The authors did not compare their results with other studies. The issue of generalisability was not overtly discussed. However, it was partially addressed in that different modes of organising vaccination programmes were taken into account in the strategies tested, and sensitivity analyses were performed.

**Implications of the study**
The authors suggested that, if sufficient urine tests can be performed, the compliance rate for rubella vaccination should increase. However, the most cost-effective strategy would be to re-introduce the MMR vaccine into the Japanese health care system.

**Source of funding**
None given.
Bibliographic details

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