Cost-effectiveness of varicella serotesting versus presumptive vaccination of school-age children and adolescents

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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
Vaccination against chicken pox and Serotesting (enzyme-linked immunosorbent assay) for varicella antibodies.

Type of intervention
Primary prevention and screening.

Economic study type
Cost-effectiveness analysis.

Study population
Hypothetical cohorts of 10,000 school-age children and 10,000 adolescents.

Setting
The practice setting was primary care. The economic study was carried out in California, USA.

Dates to which data relate
Probabilities were derived from published studies from 1986-1994 and unpublished reports and expert opinion from 1994. Cost data were for 1993.

Source of effectiveness data
Synthesis of studies.

Modelling
Two decision trees were constructed to outline different policies and outcomes.

Outcomes assessed in the review
The outcome assessed was the number of chicken pox cases prevented.

Study designs and other criteria for inclusion in the review
Published studies, unpublished reports and expert opinion. Other inclusion criteria were 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
Age of persons included in study.

Number of primary studies included
Nine published studies and two personal communications referring to unpublished studies.

Methods of combining primary studies
In order to predict outcomes a decision analysis model was constructed, using information from published studies, unpublished reports and expert opinion. The proportion of persons aged 18 to 35 years with previous varicella among those with a negative or uncertain history was derived using a simple weighted average of findings from four studies. For persons aged 6 to 17 this information was interpolated from available data for other age groups. Rates of adherence to follow-up for adolescents were averaged from published abstract and from unpublished data.

Investigation of differences between primary studies
Conflicting evidence was reported on whether, in adolescents, one dose of vaccine is as protective against future chicken pox as two doses. The model set the probability of having future chicken pox as equal for all adolescents with vaccine-induced protection, whether protection was achieved after one or two doses.

Results of the review
The authors’ decision analysis model predicts that with no intervention 25% of their hypothetical school-age cohort (aged 6 to 12 years) would develop chicken pox during the next 30 years. If the whole cohort received serological testing 65% would have vaccine induced protection and 89% of predicted cases of chicken pox would be prevented. If the whole cohort received vaccination 69% would have vaccine induced protection and 95% of predicted cases of chicken pox would be prevented.

For adolescents (aged 13 to 17 years) the model predicts that, with no intervention 15% of this cohort would develop chicken pox during the next 30 years. If the whole cohort received serological testing, 38% would have vaccine induced protection and 81% of predicted cases of chicken pox would be prevented. If the whole cohort received vaccination, 46% would have vaccine induced protection and 99% of predicted cases of chicken pox would be prevented. If the whole cohort were vaccinated and then tested before a second vaccination dose, 41% of the cohort would be protected and 89% of projected chicken pox cases prevented.

Measure of benefits used in the economic analysis
The number of chicken pox cases prevented and persons protected, derived using a decision analysis model.

Direct costs
All costs were discounted at 5%. Quantities were estimated using a decision tree. Medical costs alone and costs to society were presented separately. Short term medical costs were the direct costs of vaccination and testing including vaccine administration, venipuncture, labour and materials. Long term medical costs were those due to future chicken pox cases and included outpatient visits, emergency department visits, hospital stays and prescription and non-prescription medications. These quantities were derived using other published studies.

Indirect Costs
Work-loss costs were estimated for both the short and long term. Short-term work-loss costs were based on work missed by parents accompanying all children and 50% of adolescents (estimate based on personal communication) to follow-up visits. The quantity of work-loss was based on a previous published study. The cost of work-loss was estimated by gender, based on unpublished data. Long-term work-loss costs included time lost by parents of children with chicken pox, and the costs of lost productivity due to death or disability from the disease. Costs and quantities were derived using methods from other published studies.

**Currency**
US dollars ($).

**Sensitivity analysis**
Due to the uncertainty of decision analysis models the authors performed sensitivity analysis on several variables, namely: the proportions of persons with previous varicella among patients with a negative or uncertain history, the probability of making a first follow-up visit, the probability of developing varicella over the next 50 years and the costs of serotesting and vaccine doses. Two-way sensitivity analysis was presented.

**Estimated benefits used in the economic analysis**
Benefits were not discounted. Using baseline assumptions the authors found that vaccination of the whole school-aged cohort would prevent an additional 6% of predicted chicken pox cases compared to serological testing for the whole cohort. For the adolescent cohort, vaccination for all would prevent an additional 17% of predicted chicken pox cases compared to serological testing for the whole cohort. A policy of vaccinate and then test before second dose was found to prevent 8% more than serological testing alone for the whole cohort (but 9% less than vaccination alone). The model was based on a 30 year duration.

**Cost results**
The total (long term societal) cost of serological testing for the whole school-aged cohort was $535,700 and for the adolescent cohort was $454,800. The cost of vaccination for the whole school-aged cohort was $419,900 and for the adolescent cohort was $825,100. For the adolescent cohort the total cost of the vaccinate then test policy was $605,800. The total comparator costs (no intervention) were $573,100 for the school-aged cohort and $347,600 for the adolescent cohort. Costs were discounted at a rate of 5% per year. An intervention and comparator duration of 30 years was assumed.

**Synthesis of costs and benefits**
For the school-aged cohort the short-term medical cost per chicken pox case prevented was $164 using the test all’ policy and $166 using the vaccinate all’ policy. The incremental medical cost of the vaccinate all’ policy compared to the test all’ policy was $197 per chicken pox case prevented. The short-term cost to society per chicken pox case prevented was $213 using the test all’ policy (vaccinate all was still $166). A vaccinate all’ policy was more cost-effective. The authors reported that, in the longer term, both interventions are projected to save money compared to no intervention. These results were sensitive to the proportion of patients who had previously had varicella despite negative or uncertain history. At probabilities of 0.28 and higher the test all’ policy had a lower cost per case prevented than the vaccinate all’ policy. Results were also shown to be sensitive to the rate of adherence to follow-up under the test all’ policy and the price of the vaccine.

For the adolescent cohort the short term medical cost per chicken pox case prevented was $287 using the test all’ policy and $517 using the vaccinate all’ policy. Using a policy of vaccinate then test, the short term medical cost was $377 per chicken pox case prevented. In long term societal cost, the test all’ policy was the most cost effective of all interventions, costing $89 per chicken pox case prevented. The incremental cost per chicken pox case prevented for the vaccinate then test all’ policy was $1375 compared to the test all’ policy. The incremental cost per chicken pox case prevented for the vaccinate all’ policy was $1,522 relative to the vaccinate then test all’ policy. These results were sensitive to the probability of adherence to the first follow-up but relatively insensitive to changes in other variables over plausible
Authors' conclusions
Presumptively vaccinating all patients with a negative or uncertain history of varicella was projected to be a relatively cost-effective policy compared to serological testing for school-age children but not for adolescents.

CRD Commentary
No information about the search strategy and selection criteria for sources of evidence was provided by the authors other than their availability. A large emphasis was given to expert opinion acquired by personal communication. The economic model used was appropriate to setting out the various policies considered for varicella prevention. However, this was not a comprehensive analysis of all policy options available. Some key assumptions in the model, especially the accuracy of a negative or uncertain history, were based on little empirical evidence. This is very significant given that results were found to be very sensitive to this variable. The authors did acknowledge the limitation of their study and emphasised the need for further research.

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