Cost-effectiveness of serotesting compared with universal immunization for varicella in refugee children from six geographic regions

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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
Serotesting and selective immunisation was compared with universal immunisation against varicella in refugee children.

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised immigrant children entering the USA. Children for whom a history of varicella was not recorded were excluded from the calculation of the positive and negative predictive value.

Setting
The setting was primary care. The economic study was carried out at the International Clinic at the Boston Medical Center, USA.

Dates to which data relate
The effectiveness and price data were collected between March 1996 and January 2000. Resource use was not relevant to the study.

Source of effectiveness data
The effectiveness data were derived from a single study, supplemented by authors' assumptions.

Link between effectiveness and cost data
The costing was carried out prospectively on the same sample of patients as that used in the effectiveness study.

Study sample
The use of power calculations, to rule out the influence of chance on the results, was not reported. The sample consisted of refugee children, aged 1 to 20 years, who were entering the USA and attending a two-visit refugee health assessment between March 1996 and January 2000. The study involved children from the former Yugoslavia, Kosovo, East Africa, Vietnam, Iraq/Kurdistan and the Caribbean. Children aged less than one year were excluded due to the presence of a maternal antibody to varicella. Due to the age-specific prevalence of varicella, the children were divided into three age groups, namely 1 to 4, 5 to 12, and 13 to 20 years. The initial sample was appropriate for the clinical study question since it included immigrant children, all of whom were given a serotest to test for the varicella antibody. The serotest
acted as the 'gold' standard test against which the history of varicella was assessed. A total of 637 children entered the study from Yugoslavia (274), Kosovo (97), East Africa (155), Vietnam (40), Iraq/Kurdistan (36), and the Caribbean (35).

Study design
The basis of the analysis was a diagnostic study, which was conducted in a single international clinic. The patients were not followed up since the study assessed the prevalence of varicella and the accuracy of history as a predictor, at a single point in time. The health assessment of the patients did, however, require two visits. The time between these visits was not reported.

Analysis of effectiveness
The analysis was based on the history of varicella, and whether varicella antibodies were present in a given individual. The primary outcomes were:
- the prevalence of the varicella antibody;
- the threshold prevalence beyond which it is more cost-effective to test than to immunise without testing;
- the positive predictive value (PPV) of history; and
- the negative predictive value (NPV) of history.

The prevalence of the varicella antibody was assessed in terms of age and country of origin, to avoid the impact of these confounding factors.

Effectiveness results
The critical value of antibody prevalence was 34% in children aged less than 13 years old, and 17% in children aged at least 13 years old.

The authors reported that the critical value was sensitive to variation in compliance.

The PPV was:
- 93% (95% confidence interval, CI: 89 - 97) for former Yugoslavia,
- 100% for East Africa,
- 100% for Iraq/Kurdistan,
- 100% for the Caribbean,
- 50% (95% CI: 33 - 67) for Vietnam, and
- 100% for Kosovo.

The NPV was:
- 66% (95% CI: 59 - 73) for former Yugoslavia,
- 43% (95% CI: 29 - 57) for East Africa,
- 60% (95% CI: 37 - 83) for Iraq/Kurdistan,
- 46% (95% CI: 24 - 68) for the Caribbean,
37% (95% CI: 20 - 54) for Vietnam, and 28% (95% CI: 18 - 38) for Kosovo.

**Clinical conclusions**
In all countries of origin, the prevalence was less than 34% in children aged 1 to 4 years. Therefore, the optimal strategy was to immunise without serotesting. In all countries of origin, the prevalence was greater than 34% in children aged 5 to 12 years, and greater than 17% in children aged 13 to 20 years. Therefore, serotesting was the optimal strategy for both age groups. The authors concluded "the PPV of a positive history was high among children in all regions except Vietnam" and the NPV was a "poor indicator of the absence of varicella antibodies".

**Modelling**
A model described by Plans Rubio (see Other Publications of Related Interest) was used to determine a prevalence threshold for the varicella antibody, above which it is more cost-effective to test for the antibody than to immunise without testing.

**Methods used to derive estimates of effectiveness**
The authors made assumptions to supplement the effectiveness estimates.

**Estimates of effectiveness and key assumptions**
The authors assumed that the attack rate of varicella was 90% in susceptible individuals. They also assumed that the efficacy of one dose of vaccine was 70 to 98% in children aged under 13 years, and 89% in children aged 13 years or older.

**Measure of benefits used in the economic analysis**
No summary measure of benefits was estimated. The study was therefore classified as a cost-consequences analysis.

**Direct costs**
The perspective adopted for the cost analysis was not stated, although the costs seem to have been estimated from the perspective of the hospital. No discounting was used, but it was unnecessary as the costs estimated were those incurred immediately in the vaccination process (i.e. screening, vaccination and vaccine administration). The unit costs were presented separately and were derived from actual data. The screening cost was the cost at the Boston Medical Center, while the vaccination cost was based on the Centre for Disease Control contract price. The authors assumed a mean disease cost for children aged younger 13 years and another for children aged 13 or older. The prices were measured between March 1996 and January 2000. However, a price year was not reported. The authors used their cost estimates in a model to estimate the prevalence threshold above which it was more cost-effective to test for the antibody than to immunise without testing. No overall costs of vaccination or immunisation were reported.

**Statistical analysis of costs**
No statistical analysis of the costs was reported.

**Indirect Costs**
The indirect costs were not estimated. These were not relevant if the perspective adopted in the analysis was that of the hospital.

**Currency**
US dollars ($).

Sensitivity analysis
A one-way sensitivity analysis was used to explore the effect of increasing the cost of screening and decreasing the cost of vaccination. A threshold analysis was also presented.

Estimated benefits used in the economic analysis
This was a cost-consequences analysis. See the 'Effectiveness Results' section.

Cost results
The screening cost for the varicella antibody was $17.

The Centre for Disease Control contract price of varicella plus the cost of vaccine administration was $49.78 per dose.

The mean disease cost was assumed to be $37 in children aged younger 13 years, and $42 in children aged 13 years or older.

The authors reported that the critical value was sensitive to variations in the screening cost and vaccination cost.

Synthesis of costs and benefits
The costs and benefits were not combined as this was a cost-consequences analysis.

Authors’ conclusions
Varicella immunisation without serotesting was cost-effective in children aged younger than 5 years, while testing for varicella prior to immunisation was cost-effective in children aged 5 years and older.

CRD COMMENTARY - Selection of comparators
The authors aimed to determine the optimal immunisation strategy by comparing universal immunisation to selective immunisation using serotesting. These alternatives were justified by reference to a desire to reduce the costs associated with unnecessary immunisation, to reduce the risk of adverse vaccine events, and to reduce the inconvenience to the families. Current practice was reported to be universal immunisation.

Validity of estimate of measure of effectiveness
The analysis used a diagnostic study, which was appropriate for the study question. The study sample comprised immigrant children aged between 1 and 20 years and was representative of the study population. To avoid potential confounding bias of age and country of origin, the analysis was stratified by these factors.

Validity of estimate of measure of benefit
Not relevant as the study was a cost-consequences analysis.

Validity of estimate of costs
The authors did not attempt to estimate the complete costs of disease, the cost of vaccination, or the cost of screening for any given population. Instead, they estimated the unit costs associated with screening and vaccination. They used a model to combine data on the PPV of serotesting, the attack rate of the disease, compliance, and vaccine efficacy to estimate a threshold prevalence of the disease that would trigger policymakers to prefer to test and immunise specific individuals rather than immunise universally. This methodology was entirely appropriate for the study question posed.
The authors did not state the perspective adopted in the analysis, which makes it impossible to determine whether all the relevant costs were included. However, the analysis seems to have been carried out from a hospital perspective and the costs relevant to this perspective were included. Further information on the costs of varicella would have been useful to allow the reader to develop a better understanding of the results presented. Given that the authors reported the results were sensitive to variations in the cost, any differences that might occur if an alternative perspective were adopted are likely to affect the results and conclusions obtained. The unit costs were reported separately. The price year was not reported.

Other issues
The authors made appropriate comparisons of their findings with those of other published studies and found that similar results had been reported. The authors addressed the issue of generalisability by referring to the diverse geographical, climatic and socio-economic situations from which the sample was drawn. This increases the external validity of the study. The results were not presented selectively. The conclusions accurately reflected the results presented and were appropriate for the clinical question posed. The authors highlighted some limitations of using varicella history as an indicator of the need for immunisation. For example, the small number of children with a positive history, but without the antibody, who would go unvaccinated and so would remain susceptible.

Implications of the study
The authors recommended that the most cost-effective strategy is to immunise children under 5 years of age without serotesting and to serotest children aged 5 years and older. No areas for further work were highlighted.

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Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
Adolescent; Africa, Eastern /ethnology; Antibodies, Viral /analysis; Boston /epidemiology; Caribbean Region /ethnology; Chickenpox /blood /epidemiology /prevention & control; Child; Child, Preschool; Cost-Benefit Analysis; Enzyme-Linked Immunosorbent Assay /economics; Female; Herpesvirus 3, Human /immunology /isolation & purification; Humans; Infant; Iraq /ethnology; Male; Mass Vaccination /economics; Prevalence; Refugees; Serologic Tests /economics; Vietnam /ethnology; Yugoslavia /ethnology

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