Cost-effectiveness of a routine varicella vaccination program for US children

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
Varicella vaccination

Type of intervention
Primary prevention

Economic study type
Cost-effectiveness analysis.

Study population
A hypothetical cohort of healthy children aged 5 to 6 years.

Setting
Primary care. The economic study was carried out in, USA.

Dates to which data relate
The effectiveness data mainly related to a 1993 report. Costs were derived from 1985 and 1991-94 studies, and adjusted to 1990.

Source of effectiveness data
Opinions.

Methods used to derive estimates of effectiveness
The assumptions on effectiveness were mainly based on a consensus panel of national varicella and vaccine experts.

Estimates of effectiveness and key assumptions
The assumptions related to vaccine efficacy parameters: complete protection six weeks after vaccination was estimated to be 90%, partial waning of immunity by the time of death was expected in 15% of the subjects, relative susceptibility to chickenpox of a vaccinated person was estimated to be 12%, relative infectiousness was 40%, and relative probability of major sequelae (such as pneumonia, encephalitis, long term disability after encephalitis, and death) was 1%. It was assumed that the vaccination coverage levels would be 97%.
Measure of benefits used in the economic analysis
Chickenpox cases, major complications or deaths prevented, and life years saved were used in the cost-effectiveness analysis.

Direct costs
Costs and quantities were not reported separately. Costs were collected from a variety of published and unpublished sources (e.g., hospital databases). Costs included charges for varicella related hospitalization, outpatient visits and costs of non-prescription medication, the costs of a therapeutic course of acyclovir, vaccine doses and long-term care for disability from varicella encephalitis. The last two costs were guessed. All of the costs were estimated in 1990 dollars.

Costs were discounted at a rate of 5%.

Costs were considered from the health care payer's (primarily health insurers' and parents') perspective.

Indirect Costs
Costs were discounted at a rate of 5%. Costs and quantities were not reported separately. Costs were considered from the patients' (if adult), relatives' and societal perspective. The value of work loss was used as a proxy for the time costs due to varicella. The age-specific cost of a day of work loss was derived from mean annual earnings tables for US persons in 1990. Other resource data were based on surveys and unpublished estimation.

Currency
US dollars

Sensitivity analysis
A sensitivity analysis was performed to test vaccination coverage, vaccine efficacy rate, vaccine price and vaccine administration strategies. One-way and multi-way simple sensitivity analyses were used, as well as analysis of extremes.

Estimated benefits used in the economic analysis
Annually, a varicella vaccination programme is predicted to prevent: 3.7 million (94%) of the chickenpox cases that would be expected without vaccination, 9300 major complications, 52 deaths. The results were projected for a 30 year period following the introduction of the vaccination programme.

Cost results
Over the first 30 years of a vaccination programme, the total medical costs were $90 million without a vaccination programme, and $98 million with a vaccination programme. The total medical plus work loss costs for vaccination and no vaccination programs were $146 million and $529 million respectively. Therefore, from a societal perspective, the programme gave rise to a saving of $384 million. Costs were discounted at 5%.

Synthesis of costs and benefits
From the health care payer's perspective, i.e. considering medical costs only, the incremental cost per case of chickenpox prevented was $2.10; $840 per major complication prevented, $2500 per life-years saved, $428,000 per long-term disability prevented, $150,000 per death prevented when only costs were discounted at 5%. When costs as well as future health outcomes were discounted at 5% these figures changed to $4.20, $1650 and $16000, $837,000 and $294,000 respectively.

The results were very sensitive to assumptions about the level of vaccination coverage: the incremental medical cost per year of life saved increased to $7400 at the 50% coverage level. Moreover, the cost-effectiveness was highly sensitive to vaccine price: the incremental cost per life year saved increased linearly by $683 for every dollar that the vaccine
price increased.

**Authors' conclusions**
The authors concluded that at a cost of $35 for each vaccine dose, a routine varicella vaccination programme for pre-school children will not save money from the health care payer’s perspective, i.e., when only medical costs are considered. But it would still be desirable from the societal perspective, i.e. when work-loss costs are also taken into account.

**CRD Commentary**
This is a cost-effectiveness study and not a cost-benefit analysis since the measure of benefit used by the authors (i.e. the reduction in disease costs) was inappropriate. Another method, for example the willingness to pay approach, should have been used. The study was detailed, and it addressed the issue of the opportunity costs comparing the varicella vaccination program with other programmes. A very small remark is that the authors erroneously reported the incremental cost-effectiveness ratios of cost-effectiveness ratios. Therefore the comparison with the other programmes could be biased.

**Implications of the study**
An evaluation with actual vaccine price and other real data may be useful.

**Bibliographic details**

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**Other publications of related interest**

**Indexing Status**
Subject indexing assigned by NLM

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