Prevention of chickenpox in reproductive-age women: cost-effectiveness of routine prenatal screening with postpartum vaccination of susceptibles

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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
Prenatal screening with postpartum vaccination for the prevention of chickenpox in women of reproductive-age.

Type of intervention
Screening and primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
Hypothetical cohort of 4 million women, aged 15-49 years old, presenting for prenatal care over 1 year.

Setting
Hospital. The study was carried out in Seattle, Washington, USA.

Dates to which data relate
Effectiveness data were collected from studies published between 1975 and 1996. Cost data were collected from a study published in 1994 and other sources. The price year was 1995.

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

Modelling
A decision analytic model was used to determine the cost-effectiveness of the three alternative strategies over 20 years.

Outcomes assessed in the review
The review assessed the following outcomes: prevalence of varicella seronegativity among pregnant women, sensitivity and specificity of varicella history in adults, sensitivity and specificity of serologic test, vaccination coverage, vaccine efficacy, vaccine complication rate, annual incidence of chickenpox, varicella sequelae rate, chickenpox-related health care use, work loss for women with chickenpox, age-specific proportion of women in work force, annual age-specific prevalence of pregnancy, fetal and infant effects of maternal chickenpox infection.

Study designs and other criteria for inclusion in the review
Not stated.
Sources searched to identify primary studies
Effectiveness estimates were derived from published studies and from unpublished state and national data.

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
Approximately 31 studies were included in the review.

Methods of combining primary studies
Narrative method. Some effectiveness estimates were calculated as the weighted average of findings from the primary studies.

Investigation of differences between primary studies
Not stated.

Results of the review
A varicella seronegativity prevalence of 0.09% was used. The Sensitivity and specificity of prior history of chickenpox in adults was estimated to be 0.76 and 0.75, respectively. The Sensitivity of the serologic test was 0.86 and specificity was 0.99. Vaccine coverage was estimated to be 0.9. The rate of seroconversion has been reported to be 77% after one varicella vaccine dose and 99% after two doses, without variation by age. The vaccine provides 65-90% protection against clinical varicella infection and serious complications of the disease have been estimated to be reduced by 95% in vaccinated subjects who develop chickenpox.

Adverse vaccine events include pain and swelling at the vaccination site in approximately 25% of cases and a varicella-like rash with a median of 5 vesicles in fewer than 5% of vaccinated people. About 2% of those vaccinated would be expected to seek outpatient medical care for a vaccine reaction. The annual incidence of chickenpox per 100,000 seronegative adults aged over 20 years was 1,800 and per 100,000 seronegative adolescents aged 15-19 years old was 3,050.

Measure of benefits used in the economic analysis
The absolute number of cases of adult or fetal-neonatal chickenpox was used as the measure of benefits.

Direct costs
Costs were discounted at an annual rate of 5%. Quantities and costs were reported separately. Direct costs included programme costs related to serologic testing, vaccination, and treatment of vaccine-related adverse reactions. Costs were calculated from the perspective of both the health care system and society. The estimation of quantities and costs was based on actual data. The cost of vaccine was based on hospital pharmacy charges. The costs for varicella-related hospitalisations were obtained from charges recorded in a Washington State hospital discharge database. Price estimates for emergency department and outpatient physician visits were based on 1996 reimbursement schedules from a large third-party payer for the Pacific Northwest region. The cost of long-term care for women or neonates who develop permanent neurologic sequelae and major disability following varicella was derived from estimates of the average Medicaid reimbursement per recipient in residential services. The medical care component of the consumer price index
was used to inflate cost estimates. The price year was 1995.

**Statistical analysis of costs**
Not reported.

**Indirect Costs**
Indirect costs of varicella infection were estimated by productivity loss costs: the value of work lost due to illness. The cost of death or long-term morbidity from chickenpox or disease-related consequences was estimated as the cost of lost future earnings using the human capital approach.

**Currency**
US dollars ($).

**Sensitivity analysis**
One-way sensitivity analyses were performed on effectiveness estimates and costs.

**Estimated benefits used in the economic analysis**
With no intervention, approximately 113,000 cases of adult chickenpox would occur among 360,000 susceptible women resulting in more than 2,600 hospitalisations and 113 deaths. 6,000 of these cases would occur during a subsequent pregnancy, leading to 71 cases of congenital varicella syndrome and 129 cases of neonatal chickenpox. From those 129 cases of neonatal chickenpox, 90 infant deaths and 13 cases with long-term disabilities would be expected. Selective serotesting would prevent nearly 50,000 cases compared with no intervention. Moreover, the number of hospitalised cases and the number of deaths were reduced by 65%. More than 6,200 non-discounted life years would be saved. The "serotest all" strategy would prevent 57% of adult cases compared with no intervention. Compared with selective serotesting, this alternative would prevent an additional 25% of cases and save more than 2,000 life years.

**Cost results**
With no intervention, varicella-related disease was predicted to result in $30.5 million in discounted medical costs and $110 million in discounted work-loss costs. The annual programme cost of selective serotesting was $54 million, but would save $18 million in discounted medical costs and more than $58 million in indirect costs compared with no intervention. The programme cost of the "serotest all" strategy was $159 million. Discounted savings from work and mortality loss costs prevented by the "serotest all" strategy, along with total medical costs, resulted in a net cost of $58 million compared with no intervention.

**Synthesis of costs and benefits**
Selective serotesting dominated no intervention. The cost-effectiveness of "serotest all" over no intervention was $1,400 per adult chickenpox case prevented. Selective serotesting remained a dominant strategy in terms of the prevention of fetal or neonatal disease, hospitalisations, deaths, and years of life saved, from the societal perspective. The cost-effectiveness of selective serotesting over serotest all was $1,100 per adult chickenpox case prevented. Parameters with the greatest effect on the incremental cost-effectiveness ratio included the prevalence of varicella seronegativity and the annual incidence of chickenpox. The model was relatively insensitive to the costs of infection acquired during subsequent pregnancies.

**Authors' conclusions**
The selective serotesting strategy could prevent nearly half of chickenpox cases in women of reproductive-age and is cost-saving from the societal perspective. From the health payer's perspective, it compares favourably with other
generally accepted preventive practices.

**CRD COMMENTARY - Selection of comparators**

The rationale for the selection of the comparators was clear. You, as a user of the database, should verify whether these health technologies are relevant to your setting.

**Validity of estimate of measure of benefit**

The effectiveness data used to construct the decision tree have been derived from what may have been a non-systematic review of the literature. The internal validity of the data derived from the literature cannot be fully assessed given the limited information provided about the review and the quality assessment of the primary studies. The authors did not attempt to value the pain and suffering caused by varicella infection. Given that the goal of screening and vaccination is to prevent morbidity from chickenpox rather than to save lives, the value of cost per life year saved might underestimate the benefit of this strategy. The results were sensitive to the prevalence of varicella seronegativity, which may vary across patient populations.

**Validity of estimate of costs**

Both direct and indirect costs were included. Some cost estimates were based on charges and, hence, do not reflect true opportunity costs. Cost estimates were derived from local sources and are unlikely to be generalisable to other settings.

**Other issues**

The lack of data on the safety of varicella vaccine administered postpartum, and specifically to lactating women, may be a barrier to implementation. Eventually, an effective programme of universal infant immunisation may obviate the need for prenatal screening. Adequate comparisons with other relevant studies were not made. However, the generalisability of the results to other settings or countries was discussed. The authors do not appear to have presented their results selectively. The study enrolled women of reproductive-age and this was reflected in the authors’ conclusions.

**Implications of the study**

Selective serotesting with postpartum vaccination should be considered for the prevention of varicella infection and its outcomes among susceptible women of childbearing age. Future research should focus on the safety of varicella vaccine administered postpartum.

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