Economic analysis of a child vaccination project among Asian Americans in Philadelphia, PA


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 health technology studied was a vaccination programme against the hepatitis B virus. Three separate doses of the vaccine were administered during a completed course.

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis; Cost-benefit analysis.

Study population
The study population comprised Asian American and Pacific Island children aged between two and thirteen, living in the south and southwest districts of Philadelphia.

Setting
The setting was community care. The economic study was carried out in Philadelphia, PA, USA.

Dates to which data relate
The effectiveness data were drawn from the study and were for the years 1994 to 1996. The resources used, costs of design, cost of education and outreach costs were reported in 1995 US dollars. Dates for the prices used were not stated.

Source of effectiveness data
The effectiveness data were drawn from a single study.

Link between effectiveness and cost data
The costing was undertaken prospectively on the same patient sample as used in the effectiveness analysis.

Study sample
A database of 4,384 Asian American children who were within the age range of two to thirteen years was used to track the children's vaccination status over the intervention period. The Asian American children in the community were located by a search of the School District of Philadelphia, The Philadelphia Department of Public Health District Health Centers, The Children's Hospital of Philadelphia, Mercy Health Plan, two community-based organisations and a Buddhist temple. The immunisation records of these children were examined to access the coverage of hepatitis B vaccination.
Study design
The study took the form of an economic model based on a retrospective cohort.

Analysis of effectiveness
Two measures of effectiveness were reported. The first measured the change in doses of vaccine given as a result of the project (children receiving at least one dose, children completing vaccination series, and children seroprotected), whilst the second reported the number of life years saved.

Effectiveness results
As a result of the project, 1,113 more children received at least one dose of vaccination (pre-intervention = 357, post-intervention = 1,470). 522 extra children completed the vaccination course of three doses (pre-intervention = 157, post-intervention = 679).

The additional number of children that would be immune due to the vaccination was, at a 20% first-dose rate seroprotection 748 (17.1%), at 35% first-dose rate seroprotection 806 (18.4%) and at 50% first-dose rate seroprotection 864 (19.7%).

It was estimated that between 53 and 266 life years would be saved due to the immunisation project, depending on the infection rates (15% and 75% respectively).

Clinical conclusions
The protection against hepatitis B is increased due to the vaccination project, resulting in a substantial number of life years being saved.

Measure of benefits used in the economic analysis
The summary measure of benefit in the study was years of life saved. Future benefits were discounted at 3% and 5%.

Direct costs
The price of the vaccination was that given by the federal contract price; calculations were also performed using the price used by the private sector for the vaccine. Other costs included education (including postage, stationary, advertising and printing), costs for design (salaries and tracking system) and outreach costs (salary and benefits) in addition to the vaccination costs. The estimation of resource use was based on direct measurement. The cost of infection included direct medical costs, which were the inpatient, outpatient, scanner and laboratory costs for acute and chronic hepatitis B infection. Costs were not discounted, since doses were administered within the first year. The price year was 1995.

Statistical analysis of costs
Variability in the cost data was considered, because a range of values for some costs was available. A stochastic risk analysis was performed and, due to the output showing little variability, uncertainty in the costs was ignored. The 2.5th and 97.5th percentiles were within 10% of each other.

Indirect Costs
The indirect infection costs were medical visits, loss of earnings due to illnesses related to hepatitis B and loss of earnings due to mortality caused by chronic hepatitis B, cirrhosis and primary hepatocellular carcinoma.

Currency
US dollars ($).
Sensitivity analysis
A sensitivity analysis was performed on the discounted cost per discounted year of life saved and the benefit/cost ratio. The parameters tested included the assumptions made about the discount rate and the infection rate. The infection rate was tested at increments of 15% in the range of 15% and 75%, and the discount rate was changed between 3% and 5%. Ratios were calculated for all possible combinations of discount rates and infection rates.

Estimated benefits used in the economic analysis
For the base case, using a 30% infection rate, 106 life years are saved.

With an infection rate of 60% the years of life saved increased to 213.

As the infection rate was varied between 15% and 75%, the years of life saved ranged from 53 to 266 respectively.

Cost results
The federal contract price of the vaccine was $7.09 per dose for children younger than eleven and $7.75 per dose for those older than eleven. The private sector prices were $16.17 per dose for children younger than eleven and $18 per dose for those older than eleven.

Total planning costs amounted to $34,470, education cost $118,540, outreach costs were $22,197, whilst the total vaccination costs were $23,453.

The total cost of intervention was $268,660.

Synthesis of costs and benefits
When assuming that 60% of the vaccines were bought from the private sector the minimum discounted cost per discounted year of life saved was $4,836 (assuming a 15% infection rate) and the maximum was $58,135 (assuming a 75% infection rate). The minimum for the benefit/cost ratios was 0.99:1 and the maximum was 10.58:1.

When assuming that 100% of the vaccines were bought from the private sector the minimum discounted cost per discounted year of life saved was $4,988 (assuming a 15% infection rate) and the maximum was $59,964 (assuming a 75% infection rate). The minimum for the benefit/cost ratio was 0.96:1 and the maximum was 10.25:1.

Authors' conclusions
The authors concluded that although the intervention was labour intensive, the intervention costs were relatively high and the change in vaccination status was only marginal, the intervention was cost-beneficial. Hepatitis B vaccination had increased. The authors conclude that this increase in vaccination was due to the intervention because no other catch-up efforts were undertaken in Philadelphia, before or after the project and that, in other cities observed before any catch-up methods were adopted, the increase in vaccination had only been about 1%.

CRD COMMENTARY - Selection of comparators
The effectiveness of the immunisation project was compared pre- and post-project. This was a reasonable selection of comparator, since it is effectively comparing the intervention with a "do nothing" approach. Since no other methods exist for the vaccination of children, the authors compared the cost-effectiveness results of this study with those of other life-saving interventions.

Validity of estimate of measure of effectiveness
The analysis was based on a study design that was appropriate for the study question. The effectiveness of the project in targeting children to receive vaccinations was measured, as well as the effectiveness of the vaccinations.
Validity of estimate of measure of benefit
The authors did not provide details as to how years of life saved were measured. Quality-adjusted life years (QALYs) would have been a more useful measure, since they incorporate the quality of life as well as the length of life. Benefit/cost ratios were also provided, but it is unclear if health benefits (i.e. life years saved) were included in this measure. If only monetary outcomes (i.e. treatment costs) were used in the benefit/cost ratios, this suggests that a cost-minimisation approach was undertaken.

Validity of estimate of costs
Costs were reported in detail, though only for total costs. Resource use and costs were not reported separately. The cost estimates were based on assumptions as to what proportion of patients used private healthcare, and were heavily dependent on this factor. Since costs were estimated locally, the generalisability of the findings will be limited.

Other issues
More appropriate comparisons of the findings should have been undertaken. The issue of generalisability to other settings was addressed. The authors did discuss limitations to their study, namely that the use of years of life saved and not quality-adjusted life years will cause problems when comparing the results with other studies, and that they did not consider costs of adverse events due to the vaccination. This is an important factor in the consideration of vaccination projects.

Implications of the study
The authors conclude that the project was effective in increasing the coverage of immunity to hepatitis B in young Asian Americans and Pacific Islanders in Philadelphia, and that the project was cost-beneficial.

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