Economic evaluation of infant and adolescent hepatitis B vaccination in the UK
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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.

CRD summary
This study examined the cost-effectiveness of hepatitis B virus (HBV) vaccination programmes, focusing on the threshold vaccine price that provided good value for money. At the vaccine price at the time, a universal infant or adolescent vaccination programme, or a selective programme for intermediate or high-risk infants, was not cost-effective from the perspective of the UK NHS. The methods were robust and the authors’ conclusions appear to be valid, but more detail on the data sources would have been useful.

Type of economic evaluation
Cost-utility analysis

Study objective
This study examined the cost-effectiveness of universal or selective infant or adolescent hepatitis B virus (HBV) vaccination programmes, focusing on the threshold vaccine price that provided good value for money.

Interventions
Three options were considered: a three-dose infant vaccination programme that was administered with other routine vaccinations before the age of six months; a two-dose programme for all adolescents at age 12 years; and a selective vaccination programme for infants of intermediate- or high-risk ethnic origin or living in high-incidence locations. These were compared with no vaccination.

Location/setting
UK/primary care.

Methods
Analytical approach:
The analysis was based on a Markov model that simulated a birth cohort over its lifetime. The authors stated that the perspective of the UK NHS was adopted.

Effectiveness data:
The clinical data were from a selection of published studies and country-specific registries. The reasons for selecting values, from those available in the literature, were reported in an appendix. Most of the epidemiological data were from UK sources, while the transition probabilities were from published studies, conducted in developed or developing countries, to represent intermediate- and high-risk populations. Some of the data on vaccine efficacy were from a Cochrane review. No waning effect and no herd immunity was assumed. The incidence of HBV was the key input of the model and was from UK databases and registries.

Monetary benefit and utility valuations:
The utility values for the health conditions were from a Health Technology Assessment report that estimated them using expert panels and clinician reports.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary benefit measure and were discounted at an annual rate of 3.5%.

Cost data:
The economic analysis included the cost of vaccination (acquisition and administration) and health care for acute HBV,
fulminant hepatitis, chronic HBV, compensated and decompensated cirrhosis, hepatocellular carcinoma, liver transplant, and transplant aftercare (for the remainder of life). The administration costs were only included for adolescent vaccination. The economic data were mainly from the health care literature. The vaccine price was from the British National Formulary. All costs were in UK pounds sterling (£), the price year was 2007, and a 3.5% annual discount rate was applied.

Analysis of uncertainty:
Both one- and multi-way sensitivity analyses were carried out, using published and assumed ranges of values for selected inputs. Other scenarios were considered, varying the annual rate of loss of vaccine-induced immunity, the HBV-associated health care costs, and the discount rate. The price of the vaccine was varied in a threshold analysis, with a maximum willingness-to-pay of £30,000 per QALY.

Results
Compared with no vaccination, universal infant vaccination saved 58 QALYs and £0.7 million in health care costs. The discounted cost of the programme was £15.9 million, resulting in an incremental cost per QALY gained of £263,000 for all infants, or £172,000 for male infants, and £554,000 for female infants. The incremental cost per QALY gained with an adolescent immunisation programme was £493,000 or £352,000 for males and £829,000 for females. The incremental cost per QALY gained with selective infant vaccination was £90,000 and was not cost-effective even in males at £64,000.

For vaccination to be below the cost-effectiveness threshold of £30,000 per QALY, the cost per vaccinated child had to be £4.09 for the universal infant programme (£27 in the base case), £3.53 for the adolescent programme (£34 in the base case) and £10.73 for the selective infant programme. These threshold values were sensitive to variations in the duration of vaccine-induced immunity (the shorter the duration of protection, the lower the threshold cost per vaccination). Increases in the discount rate were associated with higher threshold costs, but they were always lower than the UK prices at the time.

Authors' conclusions
The authors concluded that at the vaccine prices in the UK at the time the three vaccination programmes were not cost-effective from the perspective of the NHS.

CRD commentary
Interventions:
The selection of the comparators was appropriate as the vaccination strategy (either in the general population or in a high-risk subgroup) was compared with no vaccination, which was the usual care in several settings.

Effectiveness/benefits:
No systematic review was reported to identify the relevant sources of data. The authors explained their selection of the data, but few characteristics of the studies chosen were provided. In general, UK sources were used for the epidemiological data, while other data were from published economic evaluations. A detailed description of these sources would have helped to objectively assess the validity of the clinical inputs. QALYs were a valid benefit measure for patients at risk of developing HBV, given the impact of the disease on both survival and quality of life.

Costs:
The economic analysis was consistent with the perspective of the health care payer, and the categories of costs reflected this perspective. Limited information was provided on the derivation of the unit costs and resource quantities, reducing the ability to replicate the economic analysis. Standard UK sources appear to have been used for most of the cost data. Only the key costs were varied in the sensitivity analysis. The price year and the use of discounting were appropriately presented.

Analysis and results:
The results were extensively presented, especially for the clinical and economic burden of the disease. The authors reported the threshold vaccine price that would have made it cost-effective in different scenarios. The decision model was clearly presented. The uncertainty was investigated, using a deterministic approach that considered variations in
individual inputs one at a time as well as simultaneously. The results of a probabilistic sensitivity analysis were reported, but the analysis was not described. The authors stated that the HBV incidence in the UK was lower than in other countries, which explained why universal vaccination was not cost-effective. The inclusion of herd immunity could have produced better results for the vaccination strategy. The authors stated that, given the low cost of vaccination required to make a universal programme cost-effective, the best policy in the UK would be to combine the vaccine with other antigens given in the usual infant vaccination programme.

Concluding remarks:
The methods were robust and the authors' conclusions appear to be valid, but more detail on the data sources would have been useful.

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