Cost and cost-effectiveness of childhood vaccination against rotavirus in France
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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
The study determined the cost-effectiveness, in France, of routine childhood vaccination against rotavirus with new vaccines in comparison with no vaccination. The authors concluded that rotavirus vaccination reduced the burden of disease-related morbidity, but that it was not cost-effective from the viewpoint of the health care system due to the high cost of vaccine acquisition. The quality of the study appears to be good with a clear presentation of sources and results. The authors’ conclusions are likely to be valid.

Type of economic evaluation
Cost-effectiveness analysis, cost-utility analysis

Study objective
The objective was to determine the cost-effectiveness of routine childhood vaccination, using new vaccines against rotavirus, in comparison with no vaccination in France. This study represented the basis for expert advice provided to the Ministry of Health by the French Advisory Board on Immunization.

Interventions
Rotavirus vaccination was performed during the first four months of life as part of routine infant immunisation. The new vaccines were a monovalent vaccine based on an attenuated human rotavirus strain (RotaRix®) and a pentavalent human-bovine reassortant rotavirus vaccine (RotaTeq®). These were administered orally between the ages of two and four months (two doses for monovalent vaccine and three for pentavalent vaccine). The two vaccination options were compared with a strategy of no vaccination.

Location/setting
France/primary care.

Methods
Analytical approach:
A Markov model was developed in order to simulate the impact of vaccination on the natural history of disease in a hypothetical birth cohort of 750,000 children who were followed up until the age of 35 months. The time horizon of the analysis was three years. The authors stated that a societal perspective was adopted.

Effectiveness data:
The clinical data were derived from a selection of known, relevant studies. Most epidemiological model inputs were obtained from national databases such as the French Communicable Diseases Computer Networks and the National Hospital Discharge Database. Longitudinal studies were also used. Vaccine effectiveness was derived from published double-blind, randomised controlled trials (RCTs). Expert opinion was also used in some circumstances in order to adapt data to the local context. The methods used to estimate the proportion of severe diarrhoea cases and hospitalisation were reported and justified.

Monetary benefit and utility valuations:
Utility valuations were derived from a recent prospective Canadian study which used both the Health Utilities Index mark 2 (HUI2) for child quality of life and the EuroQol for caregiver quality of life.

Measure of benefit:
Life-years (LYs), quality-adjusted life-years (QALYs), and hospitalisations were used as the summary benefit
measures. They were estimated using the decision model. Benefits were discounted at an annual rate of 3%.

Cost data:
The cost categories were vaccination (acquisition), general practitioner or paediatrician consultation, visits to the emergency department, and hospitalisation. Resource consumption reflected French treatment patterns. The costs were based on experts’ opinions or French official prices. Some estimates were also obtained from published French studies. All costs were in Euros (EUR) and a 3% annual discount rate was applied. The price year was 2005.

Analysis of uncertainty:
A deterministic sensitivity analysis was undertaken in order to address the issue of uncertainty. Most model inputs were varied, especially those derived from non-French sources. Wide ranges of values were tested and both one- and two-way sensitivity analyses were performed.

Results
The expected costs in the whole cohort (750,000 children) were EUR 26,448,638 without vaccination and EUR 95,379,218 with vaccination.

The expected LYs were 22,564,012 without vaccination and 22,564,243 with vaccination. The expected QALYs were 22,562,079 without vaccination and 22,562,577 with vaccination. The expected hospitalisations were 17,798 without vaccination and 7,270 with vaccination.

Thus, the incremental cost per LY gained with vaccination was EUR 298,401, the incremental cost per QALY gained was EUR 138,693, and the incremental cost per hospitalisation avoided was EUR 6,547. These results were obtained assuming a vaccine cost of EUR 150 per course.

The incremental cost per QALY gained was EUR 98,000 using the monovalent vaccine (EUR 114 per course) and EUR 151,000 using the pentavalent vaccine (EUR 161 per course).

The sensitivity analysis indicated that the most influential model inputs were disease incidence, mortality rates, and vaccine price. In particular, the incremental cost per QALY fell below the threshold of 50,000 US dollars when the cost per vaccine course was lower than EUR 65. Assuming a vaccine cost of EUR 100, the incidence of rotavirus should be doubled in order to obtain a cost-effectiveness ratio lower than EUR 50,000.

Authors’ conclusions
The authors concluded that rotavirus vaccination reduced the burden of disease-related morbidity, but was not cost-effective from the viewpoint of the health care system due to the high cost of vaccine acquisition.

CRD commentary
Interventions:
The selection of no intervention as the basic comparator was appropriate as it was the current strategy in the authors’ setting. This is also likely to be a valid comparator in other health care systems. Two types of rotavirus vaccine were considered, namely monovalent and pentavalent. They were assumed to be equally effective, as demonstrated in published studies.

Effectiveness/benefits:
The clinical evidence was derived from selected studies which appear to have been appropriate. The selection of national databases for epidemiological data reflects country-specific patterns of disease. Furthermore, RCTs are a validated source of treatment effectiveness. The authors described the approach used to derive these data from the available sources. The derivation of the benefit measures was clear and the choice of using three different measures was appropriate in terms of making the study findings more generalisable. Furthermore, QALYs and LYs allow cross-disease comparisons.

Costs:
The analysis of costs was transparently carried out. The cost categories were reported and unit costs were provided. The
sources of costs were described and reflected the payer's perspective, though the authors stated that the perspective was societal. The authors justified the exclusion of indirect costs (i.e. productivity losses) by the reduction in QALYs included for caregivers, which should cover such costs. Their inclusion, as the authors pointed out, could have resulted in double counting. Different vaccine prices were selected in order to consider the two types of vaccine available. Alternative cost estimates were tested in the sensitivity analysis, which enhances the external validity of the economic analysis. The price year and the use of discounting were reported and were in accordance with French guidelines.

Analysis and results:
The synthesis of costs and benefits was appropriately carried out. The base-case findings and the results of the sensitivity analyses were clearly presented. The issue of uncertainty was addressed by focusing on the most influential model inputs. The use of a comprehensive probabilistic sensitivity analysis would have further improved the validity of the study. The authors compared their findings with those from other studies, and discussed the potential explanations for different results. Some limitations of the analysis such as the need for mixing data from multiple sources and the need for assumptions were also noted.

Concluding remarks:
Overall, the quality of the study appears to be good with a clear presentation of sources and results. The authors’ conclusions are likely to be valid.

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MeSH
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