Cost-effectiveness of universal rotavirus vaccination in reducing rotavirus gastroenteritis in Ireland

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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 analysis assessed the cost-effectiveness of universal infant rotavirus vaccination, compared with no immunisation, considering various scenarios. The authors concluded that universal vaccination was not cost-effective, under base-case conditions, but it could be cost-effective with a lower vaccine price or from a wider societal perspective. The methods were robust and the uncertainty was extensively investigated. The authors' conclusions appear to be valid.

Type of economic evaluation
Cost-utility analysis

Study objective
This analysis assessed the cost-effectiveness of universal infant rotavirus vaccination, compared with no immunisation, considering various scenarios.

Interventions
The intervention was universal infant rotavirus vaccination using two doses of Rotarix. The comparator was no vaccination.

Location/setting
Ireland/primary care.

Methods
Analytical approach:
The analysis was based on an existing decision-analytic model that was adapted to the Irish setting. A five-year time horizon was considered. The authors stated that it was carried out from the perspective of the health care payer, in the base case, and a societal perspective was considered.

Effectiveness data:
The clinical data were identified by a review of the published literature. Vaccine efficacy and tolerability was a key input and was based on evidence from European trials. Some calculations and assumptions had to be made to convert some of the efficacy data to fit the model parameters. Other epidemiological inputs were from Irish databases of vaccine surveillance, such as the Irish College of General Practitioners' sentinel system. In the absence of Irish data, values from other European countries were used. Mortality was from Irish life tables.

Monetary benefit and utility valuations:
The utility values were from a Canadian study that used the Health Utilities Index 2 (HUI2).

Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary benefit measure and they were discounted at an annual rate of 4%.

Cost data:
The economic analysis included the costs of vaccination (vaccine acquisition and administration), general practitioner (GP) visits, hospitalisations, accident and emergency visits, hospital-acquired infections, and prescriptions for oral
rehydration sachets. For the societal perspective, the indirect costs were also considered and these included the work lost caring for children with gastrointestinal disease and out-of-pocket expenses incurred for a private GP visit and over-the-counter medications. Most of the costs were from official Irish sources, such as the Primary Care Reimbursement Service, the National Immunisation Office, and the Health Service Executive. The remaining costs were from hospital databases and published sources. A 4% annual discount rate was applied. All costs were in Euros (EUR) and the price year was 2009.

Analysis of uncertainty:
One-way sensitivity analyses were carried out on the model inputs, especially the vaccine price and the cost of its administration. Some alternative scenarios were considered; using a different vaccine (three-dose RotaTeq in place of Rotarix), changing the impact of vaccination on caregiver health-related quality of life (HRQoL), including productivity losses, and including home-treated cases. A probabilistic sensitivity analysis was performed, with 1,000 different parameter sets, sampled from each probability distribution. The type of distribution for each set of inputs was reported.

Results
In the base case, from a health care perspective, with a vaccine price of EUR 100, utilities for the child only, and no home-treated cases, the costs were EUR 5,520,100 with no vaccination and EUR 7,418,100 with vaccination. The QALYs lost were 20.9 with no vaccination and 3.961 with vaccination. The incremental cost per QALY gained was EUR 112,048. The incremental cost per life-year gained was EUR 11,103,154, reflecting the few deaths associated with rotavirus.

The cost-utility ratio fell to EUR 68,896 if the QALYs lost by one caregiver were included, to EUR 36,789 if home-treated cases were included, or to EUR 20,819 if both of these were included. At a vaccine price of EUR 70 per course, vaccination was dominant over no vaccination, as it saved costs and was more effective. The ratio for RotaTeq was similar to (slightly higher than) that for Rotarix.

The most influential inputs were the vaccine price and its administration costs, the number of accident and emergency visits, the discount rate, the number of hospitalisations, and the utility values. The incremental cost per QALY remained above the threshold of EUR 20,000 in most instances. In the base case, vaccination was cost-effective in none of the probabilistic simulations. In the most favourable scenario, it was cost-effective in 25.7%.

From a societal perspective, vaccination was cost-effective in most scenarios, and the cost-utility in the most unfavourable scenario was EUR 72,736.

Authors’ conclusions
The authors concluded that universal vaccination was not cost-effective, under base-case conditions, but it could be cost-effective with a lower vaccine price or from a wider societal perspective.

CRD commentary
Interventions:
The selection of the comparators was appropriate as the proposed vaccination was compared against the usual care in the authors’ setting, which was no immunisation. The two vaccines were not directly compared because of the different gastroenteritis severity scoring scales and different endpoints used in their publications.

Effectiveness/benefits:
A literature review was conducted to identify the key clinical estimates, but the methods and inclusion criteria for this review were not reported. The sources of data were generally valid and included clinical trials for treatment effect and safety, and large local databases for the epidemiology. Some assumptions were needed due to a lack of data for some model parameters and this was acknowledged as a drawback of the analysis. Extensive sensitivity analysis, with several scenarios, was conducted to overcome this issue. The authors acknowledged that the assessment of HRQoL is difficult for children, but the UK National Institute for Health and Clinical Excellence (NICE) recommended the use of instruments such as the HUI2. The Canadian study was chosen because it used the HUI2 to assess the preferences for health conditions in children suffering from gastroenteritis.

Costs:
The economic analysis was satisfactorily conducted. The costs were relevant for each of the two perspectives. The data source and many of the unit costs and resource quantities were reported. The sources were representative of the Irish setting. Variations in the key economic inputs were considered in the sensitivity analyses. The price year was reported, allowing reflation exercises. Discounting was appropriately applied to the future costs.

Analysis and results:
The results were extensively presented. Incremental cost-utility ratios were calculated to synthesise the costs and benefits of the two strategies. A wide range of scenarios was considered and this improves the transferability of the analysis to other settings. The uncertainty was extensively investigated in deterministic and probabilistic analyses, and the methods and main results were clearly reported and discussed. The authors compared their results with those of other published studies that generally had contrasting results, due to differences in the model parameters, assumptions, and structure. The authors acknowledged that some of the benefits of vaccination might have not been included, such as herd immunity and the impact on other caregivers (only one caregiver was considered).

Concluding remarks:
The methods were robust and the uncertainty was extensively investigated. The authors’ conclusions appear to be valid.

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