Cost-effectiveness of rotavirus vaccination: exploring caregiver(s) and "no medical care" disease impact in Belgium

Bilcke J, Van Damme P, Beutels P

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 universal childhood rotavirus vaccination considering caregiver burden and the burden of sick children for whom no medical care is sought. Fully funded universal vaccination was not likely to be cost-effective, especially from the perspective of the health care system, but it was more efficient than the current Belgian practice of partial reimbursement. There was generally high uncertainty around the base-case values. The study was well conducted and the authors’ conclusions appear to be valid.

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

Study objective
This study examined the cost-effectiveness of universal childhood rotavirus vaccination, considering the caregiver burden and the burden of sick children for whom no medical care is sought.

Interventions
A strategy of fully funded universal vaccination against rotavirus in children was compared with no vaccination. Another strategy was considered, which represented the current situation, where the two-dose Rotarix or the three-dose RotaTeq vaccine could be bought at their market prices and partially reimbursed.

Location/setting
Belgium/primary care.

Methods
Analytical approach:
The analysis was based on a deterministic compartmental static model with a seven-year time horizon. The authors stated that the analysis took two perspectives, that of the health care payer and that of society.

Effectiveness data:
The clinical evidence came from a selection of relevant sources, which were known to the authors and included nationally representative databases, for epidemiological data, and phase III clinical trials performed in Western countries (Europe and the USA), for vaccine efficacy, which was the key endpoint of the clinical analysis. Some assumptions were required when published data were not available, for example, to assess the waning effect of the vaccine and the risk of death due to rotavirus.

Monetary benefit and utility valuations:
The utility estimates were derived from a prospective Canadian study that used the Health Utility Index (HUI-2) and the European Quality of life (EQ-5D) questionnaires. Losses in quality of life were considered for both children and caregivers, when the health care perspective was adopted, while only children’s losses were incorporated in the societal perspective.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the main summary benefit measure and were discounted at an annual rate of 1.5%. Other benefit measures were also considered, including life-years (LYs) gained, cases prevented, hospitalisations...
prevented, and deaths averted.

**Cost data:**
Health care costs included: hospitalisations, out-patient visits, general practitioner visits, paediatrician visits, and vaccines (acquisition and administration). The cost of work lost was added to these items in the societal analysis. The costs and quantities of resources used were derived from national registries, such as the Minimal Clinical Data registry, which is mandatory for all Belgian hospitals, and the National Christian Sickness Fund (the largest health insurance company in Belgium). These data were supplemented with information from a large Belgian hospital and evidence from other national databases on primary and secondary care. The vaccine costs were based on market prices, considering discounts in a fully funded universal vaccination programme. All costs were in Euros (EUR) and were discounted at an annual rate of 3%. The price year was 2006.

**Analysis of uncertainty:**
A multivariate sensitivity analysis was undertaken, considering published ranges of values and pre-determined probabilistic distributions for the model inputs. The median cost-utility ratios were calculated and the statistical approaches used to address the issue of uncertainty were reported. Scenario analyses were also carried out on specific model inputs, such as the vaccine price, instrument used to calculate QALYs, efficacy estimates, and the inclusion of QALY losses or not for caregivers.

**Results**
The partially reimbursed vaccination strategy (the current strategy in Belgium) was dominated by the universal programme, which was more effective and less expensive.

Considering all children aged under seven years in Belgium, compared with no vaccination, the fully funded universal vaccination programme gained 161 QALYs with Rotarix and 141 QALYs with RotaTeq. The additional costs were EUR 8,316,780 with Rotarix and EUR 9,334,795 with RotaTeq from the health care perspective and EUR 736,186 with Rotarix and EUR 2,706,957 with RotaTeq from the societal perspective.

From the health care perspective, the median incremental cost per QALY gained with universal vaccination over no vaccination was EUR 51,030 (95% range 25,808 to 98,519) with Rotarix and EUR 65,767 (95% range 34,758 to 122,755) with RotaTeq. Vaccination would be cost-saving if the vaccine cost per dose was 64% for Rotarix and 72% for RotaTeq lower than the baseline price. The most influential model inputs were the annual rate of deaths due to rotavirus, the waning of efficacy, the discount rate, vaccine administration costs, the type of care delivered (out-patient versus in-patient), and assumptions about the derivation of QALYs.

The scenario analysis showed that the inclusion or exclusion of QALY losses for one caregiver per child dramatically changed the cost-effectiveness results. For example, assuming no QALY loss for caregivers the probability of vaccination of being cost-effective at EUR 50,000 per QALY was 8% for Rotarix and 2% for RotaTeq, but this rose to 48% for Rotarix and 18% for RotaTeq when a 50% QALY loss per caregiver was considered and 81% for Rotarix and 52% for RotaTeq when a 100% QALY loss per caregiver was used.

From the societal perspective, better results were achieved. The incremental cost per QALY gained with universal vaccination was EUR 7,572 (95% range cost-saving to 105,767) with Rotarix and EUR 30,227 (95% range cost-saving to 144,002) with RotaTeq. The number of days of work absence was the key driver of the societal analysis, followed by assumptions on the QALY derivation and vaccine administration costs.

**Authors' conclusions**
The authors concluded that a fully funded universal vaccination programme was not likely to be cost-effective, especially from the perspective of the health care system, but it was a more efficient alternative to the current Belgian practice of partial reimbursement for vaccination. These results were strongly influenced by the inclusion or exclusion of QALY losses for caregivers.

**CRD commentary**
*Interventions:*
The selection of the comparators was appropriate and included the current immunisation strategy in the authors’ setting.

**Effectiveness/benefits:**
The clinical data came from sources that were selected as the most appropriate for the analysis. The efficacy data were from published randomised controlled trials, which are generally considered to be the best source for these data. Other inputs were from national databases, which are appropriate sources as they represent long-term trends and epidemiological patterns of disease. The use of several benefit measures makes the findings relevant to clinicians or payers, who might be interested in different outcomes of a vaccination programme. QALYs are a valid benefit measure and capture the impact of the disease on quality of life of both children and their caregivers, which was the aim of the analysis. The derivation of the utility values was based on a Canadian study and its key methods were reported. Alternative assumptions for the derivation of these estimates were appropriately considered in the sensitivity analysis.

**Costs:**
The analysis of costs was satisfactorily carried out. The use of two different perspectives makes the economic results interesting for different payers. Extensive details on the cost categories, data sources, unit costs, quantities of resources used, price year, and use of statistical analyses were reported, enhancing the transparency of the economic analysis. The use of alternative assumptions was investigated in the sensitivity analysis.

**Analysis and results:**
The analytic approach used to synthesise the costs and benefits was appropriate. The expected clinical and economic outcomes of the model were extensively reported. The issue of uncertainty was satisfactorily investigated and the key areas of uncertainty were highlighted. The authors discussed these and acknowledged that some of the model inputs were based on assumptions, which had a high impact on the cost-effectiveness results. The authors compared their results with those of other published studies and highlighted the strengths and differences.

**Concluding remarks:**
The study was well conducted and presented and the authors’ conclusions appear to be valid.

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