Cost-effectiveness of rotavirus vaccination in the Netherlands: the results of a consensus model

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 aimed to identify the most important factors that explained the large differences in cost-effectiveness estimates from existing models of universal vaccination against rotavirus gastroenteritis for infants within the National Immunisation Program of The Netherlands. The authors concluded that the rotavirus vaccine could be cost-effective in The Netherlands depending on the vaccine price and the impact of rotavirus gastroenteritis on children's quality of life. The authors' conclusions appear appropriate within the scope of the study.

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

Study objective
The aim of the study was to identify the most important factors that had major impact on and would explain the large differences in cost-effectiveness estimates from previous models of universal vaccination against rotavirus gastroenteritis for children within the National Immunisation Program of The Netherlands.

Interventions
Rotavirus vaccination (within the framework of the Dutch National Immunization Program) was compared with no vaccination. Rotavirus vaccine was administered in three doses to infants during the first year after birth. Two registered rotavirus vaccines (Rotarix and RotaTeq) were used and were assumed to be interchangeable.

Location/setting
The Netherlands/primary care.

Methods
Analytical approach:
A decision-tree model was used to synthesise evidence from published literature and epidemiological data. Four previous cost-effectiveness studies of rotavirus vaccines have been undertaken for The Netherlands; the authors updated the estimates used. The rotavirus incidence was calculated using raw data from two epidemiological studies (de Wit, et al. 2001, see ‘Other Publications of Related Interest’ below for bibliographic details). The study population was a hypothetical birth cohort of 180,000 newborn babies. The time horizon was five years. The authors stated that the study perspective was societal.

Effectiveness data:
The key effectiveness parameter was the vaccine efficacy. Vaccine efficacy, waning immunity and between-dose efficacy estimates were obtained from a selection of published epidemiological reports with approximately three years of follow-up data.

Monetary benefit and utility valuations:
Utility estimates for rotavirus infections were available from two published studies that used the EQ-5D and took into account severity and age-dependency factors (Brisson, et al. 2010 and Martin, et al. 2008, see ‘Other Publications of Related Interest’ below for bibliographic details).

Measure of benefit:
The measures of benefit used were rotavirus cases averted and quality-adjusted life-years (QALYs), discounted annually at 1.5%.

Cost data:
Direct medical costs included the costs of vaccine and other medications (oral rehydration, paracetamol), pharmacist prescription fees, general practitioner consultations, and hospitalisation for severe cases. Indirect costs included the costs of patient travel, productivity losses, and costs of diapers. A productivity elasticity of 0.8 was applied to work losses. Values were abstracted from the published literature.

Instead of including an estimate of the fixed cost per infant vaccinated initially in the model, maximum costs were derived for different willingness to pay cost-effectiveness thresholds. Incremental cost-effectiveness ratios (ICER) were reported for different vaccine costs derived from this approach.

Prices were presented in Euros (EUR). The price year was 2010. A 4% annual discount was applied.

Analysis of uncertainty:
The model parameters for vaccine cost, herd immunity protection effects, QALY decrements, mortality of severe infections and productivity elasticity were examined in scenario and one-way analyses. Multi-way analyses were undertaken with different vaccine costs per child (EUR 50, EUR 75, EUR 100) against changes in other estimates. Probabilistic sensitivity analyses were performed with triangular, log-normal and normal distributions applied to key parameters and 5,000 Monte Carlo simulations run. Sensitivity analyses were presented in a tornado diagram and cost-effectiveness acceptability curves.

Results
Over five years, the undiscounted total number of rotavirus cases with vaccination was 25,281 compared with 59,495 cases for no vaccination, which resulted in 34,214 cases averted. Total discounted QALYs lost were 64 for rotavirus vaccination compared with 173 QALYs lost for no vaccination, corresponding to 109 QALYs gained.

For a vaccine cost of EUR 75 per child, the incremental cost-effectiveness ratio was EUR 46,717 per QALY. For a vaccine cost of EUR 100 per child, the incremental cost-effectiveness ratio was EUR 85,468 per QALY.

Applying a total cost of EUR 75 per child vaccinated, the incremental cost-effectiveness ratio was most sensitive to the total direct costs of hospitalisations (ICER EUR 35,000 to EUR 58,000) and to QALY decrements for home treated children (ICER EUR 42,000 to EUR 53,000). Potential herd immunity protection effects and varying mortality in hospitalised cases also had a significant impact on the cost-effectiveness ratio. The likelihood that rotavirus vaccination was cost-effective was 74% with a threshold of EUR 50,000 per QALY gained or 14% with a threshold of EUR 20,000 per QALY gained.

Authors’ conclusions
The authors concluded that the inclusion of rotavirus vaccination in the Dutch National Immunization Program could be cost-effective depending on the exact cost of the vaccine and impact of rotavirus on children’s quality of life.

CRD commentary
Interventions:
The strategies were well described. It was unclear how feasible and affordable it would be to expand existing infant immunization schedules (considering issues such as administration, education and monitoring activities) in other settings.

Effectiveness/benefits:
The methods used to identify the clinical evidence for the study were not reported and the alternative evidence available was not described. Given the objective of the study, it seemed that this analysis was a response to other papers to be read in conjunction with them. Little information was provided in the paper about the values and methods used for measuring and valuing the utility estimates or the vaccine effectiveness.

Costs:
Although the costing methods were briefly described, the unit costs were clearly presented and appeared to be reasonable and comprehensive. The relevant costs for the study perspective were included.

Analysis and results:
One-way sensitivity analyses were reported clearly in the paper; the results demonstrated some volatility of the base results to variation in key variables. The authors discussed their findings related to four other similar Dutch cost-effectiveness analyses; they found that their results were midway between these studies. The authors suggested further research was required to obtain stronger data for mortality of severe cases and quality of life impact for children with rotavirus. The methods, analyses and results were mostly clear and comprehensive.

Concluding remarks:
It seemed that the reason there was a lack of information on the clinical estimates in this paper was because it should be read in conjunction with the papers reporting the related cost-effectiveness analyses. The authors’ conclusions appear appropriate given the scope of the study.

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