The cost-effectiveness of rotavirus vaccination in Australia

Newall A T, Beutels P, Macartney K, Wood J, MacIntyre C R

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 two rotavirus vaccines for the prevention of acute gastroenteritis in young children. It was found that rotavirus vaccination could be considered a cost-effective health intervention, especially from the perspective of Australian society. However, the findings were sensitive to the assumptions on caregivers’ quality of life and the negotiated vaccine price. The study was based on valid methodology, with extensive investigation of potential areas of uncertainty. Thus, 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 two rotavirus vaccines, which have received universal funding in Australia for the prevention of acute gastroenteritis in children under five years old.

Interventions
The two vaccines were Rotarix (GlaxoSmithKline) and RotaTeq (CSL/Merck). Rotarix was given in a two dose schedule at about two and four months of age. RotaTeq was given in a three dose schedule, at about two, four, and six months of age. Each strategy was compared with a no-vaccination strategy.

Location/setting
Australia/primary care.

Methods
Analytical approach:
This economic evaluation was based on a Markov model, which compared no vaccination with the two vaccination strategies. The analysis followed a cohort of children over their first five years of life. The authors stated that the analysis was carried out from two perspectives: that of the health care payer and that of society.

Effectiveness data:
The clinical data appear to have been derived from a selection of known, relevant studies, clinical trials, and national databases. For example, the data on vaccine efficacy came from large clinical trials, while the mortality risk due to rotavirus (which was very rare) was taken from the National Morbidity Database. Other data came from published studies, often adapted to the local situation. The vaccine coverage came from the national immunisation registry.

Monetary benefit and utility valuations:
The utility valuations for children and caregivers were derived from a Canadian study. In this study, questionnaires were completed by parents on behalf of their children, given the difficulties in assessing the quality of life (QOL) in children under five years. In the base-case analysis, only the utility weights for the child and the primary caregiver were considered. To avoid double counting, the loss in parental QOL was excluded, when lost productivity costs were included.

Measure of benefit:
Quality-adjusted life-years (QALYs) were used as the primary benefit measure. These were discounted at an annual rate of 5%. Secondary benefit measures were deaths, hospitalisations, emergency department visits, and general practitioner visits.
Cost data:
The economic analysis included the costs of vaccine acquisition and administration, hospitalisations, emergency
department visits, general practitioner visits, and, for the societal perspective only, productivity losses of caregivers.
The cost of vaccine came from manufacturers’ prices, while the cost of administration was calculated, using a micro-
costing approach, based on the time used. Other health care costs came from national official lists or published studies.
The resource use data were based on authors’ opinions or other published sources. The additional societal costs came
from a Canadian study of work-days lost and average Australian weekly earnings. All costs were in Australian dollars
(AUD) and were discounted at an annual rate of 5%. The price year was 2005.

Analysis of uncertainty:
Deterministic one- and two-way sensitivity analyses were undertaken on the model inputs, using published ranges of
values or alternative estimates defined by the authors. A Monte Carlo simulation was also performed by assigning
probabilistic distributions to the model inputs and the details of this were reported. Furthermore, other scenarios were
considered, using other published evidence, for the efficacy and epidemiological inputs.

Results
Under the base-case assumptions (for the child and one caregiver), and from the perspective of the health care payer,
the expected costs were AUD 108.7 for no vaccination, AUD 185.2 for Rotarix, and AUD 199.4 for RotaTeq. The
QALYs were 19.40218 for no vaccination, 19.40346 for Rotarix, and 19.40353 for RotaTeq. Thus, the incremental
cost per QALY gained over no vaccination was AUD 60.073 with Rotarix and AUD 67.681 with RotaTeq.

From the societal perspective (for the child only), both vaccinations saved money (AUD 30.7 for Rotarix and AUD
22.1 for RotaTeq) and gained QALYs (0.00062 for Rotarix and 0.00065 for RotaTeq) over no vaccination, making
them dominant strategies.

The deterministic sensitivity analysis indicated that QOL was the most influential model input. Another important
parameter was the vaccination cost. For example, if vaccine prices were dropped to AUD 40 per dose the ICER would
be reduced to AUD 2,746 per QALY for Rotarix (price AUD 80, in the base case) and AUD 26,974 per QALY for
RotaTeq (price AUD 60, in the base case), from the third-party payer perspective.

The probabilistic sensitivity analysis showed that, at a willingness to pay of AUD 70,000 per QALY, the probability that
vaccination would be cost-effective was 62% with Rotarix and 51% with RotaTeq. The inclusion of QALY gains from
two caregivers, rather than one, substantially improved the cost-effectiveness of the two vaccinations.

Authors’ conclusions
The authors concluded that rotavirus vaccination could be considered a cost-effective health intervention, especially
from the perspective of Australian society. However, these findings were sensitive to the assumptions on caregivers’
quality of life and the negotiated vaccine price.

CRD commentary
Interventions:
The selection of the two comparators was appropriate given that the only two registered vaccines in Australia were
considered. No vaccination was the appropriate background comparator as it reflected the current pattern of care in the
authors’ setting.

Effectiveness/benefits:
The approach used to derive the clinical data appears to have been based on the authors’ knowledge of specific sources.
National databases for epidemiological data and clinical trials for vaccine efficacy represented valid sources of data.
However, in general, the authors did not provide an extensive description of these sources, making an objective
assessment of the validity of the data impossible. Nevertheless, the appropriate use of sensitivity analyses should have
overcome this potential limitation. A key issue was whether the utility weights were an appropriate assessment of the
quality of life, given the difficulties in estimating these values in children. However, the use of QALYs was appropriate
given their relevance for this specific disease. Furthermore, they can be compared with the benefits of other health care
interventions.
Costs:
The authors adopted two separate perspectives, which are relevant to different payers. The unit costs were presented for separate items, but information on the resource consumption was not extensively provided. Some details on the quantities of resources used were based on the authors’ opinions and were reported. The sources of data were reported and were consistent with the two viewpoints. The price year was given, making reflation exercises for other time periods possible. In general, the economic analysis was well presented.

Analysis and results:
The synthesis of costs and benefits was appropriately performed using an incremental approach. The issue of uncertainty was satisfactorily addressed in the sensitivity analysis, which used appropriate approaches for both individual and multiple model parameters. The decision model was described and appears to have been appropriate. The results of both the base case and the sensitivity analyses were clearly presented and discussed.

Concluding remarks:
On the whole, the study was based on valid methodology, with extensive investigation of potential areas of uncertainty. Thus, the authors’ conclusions appear to be valid.

Funding
Supported by grants from the National Health and Medical Research Council (NHMRC) of Australia and GlaxoSmithKline Australia.

Bibliographic details

PubMedID
18022735

DOI
10.1016/j.vaccine.2007.10.009

Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
Australia; Child, Preschool; Cost-Benefit Analysis; Gastroenteritis /prevention & control; Humans; Infant; Infant, Newborn; Rotavirus /immunology; Rotavirus Infections /prevention & control; Rotavirus Vaccines /economics

AccessionNumber
22008000154