Cost-effectiveness analysis of routine rotavirus vaccination in Brazil

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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 objective was to examine the cost-effectiveness of a universal rotavirus vaccination programme in children five years old or younger. The authors concluded that the universal immunisation strategy was cost-effective from both the societal and the Brazilian health care system perspectives. The study was well conducted and the key elements of the analysis were well reported. The authors’ conclusions appear to be robust.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
The objective was to examine the cost-effectiveness of a universal rotavirus vaccination programme for children aged five years or younger.

Interventions
A childhood rotavirus vaccination strategy, using a live attenuated monovalent human G1P[8] vaccine, administered to infants at two and four months of age, was compared with no immunisation.

Location/setting
Brazil/primary care.

Methods
Analytical approach:
The analysis was based on a decision tree model with a five-year time horizon. The authors stated that a health care system perspective and a societal perspective were adopted.

Effectiveness data:
The clinical data came from a selection of sources, which included national statistics, published articles, and national databases. The key clinical input was the vaccine effectiveness, which was based on data from clinical trials. The incidence of rotavirus and its impact on episodes of diarrhoea were taken from a national public health database. Authors’ assumptions were also used for some estimates, such as vaccine coverage, which was assumed to be equal to that of hepatitis B vaccine in Brazil.

Monetary benefit and utility valuations:
Not included.

Measure of benefit:
The summary benefit measures were the cases averted, deaths averted, and life-years (LYs). Outcomes were discounted at an annual rate of 6%.

Cost data:
The economic analysis included the following cost categories: hospitalisations, physician visits, laboratory tests, medications, and vaccination (acquisition, administration, and losses from vaccine waste). In the societal analysis, the additional costs of home-based care, transport, and loss of earnings by caregivers were included. The economic data were derived from the national public health database, demographic surveys, and a national study on rotavirus disease-associated costs conducted in two cities in Sao Paulo state. The vaccine price was based on the value established in an
agreement between the Brazilian Ministry of Health and the vaccine manufacturer. All costs were in Brazilian reais (BRL). Future costs were discounted at 6% per annum and the price year was not reported.

Analysis of uncertainty:
A deterministic one-way sensitivity analysis was carried out on the key model inputs such as the diarrhoea incidence, severity, and mortality, vaccine coverage and efficacy rates, vaccine and hospitalisation costs, and discount rate. Whenever possible, alternative values were from published sources, otherwise, arbitrary ranges were used. Best- and worst-case scenarios were also considered.

Results
In a hypothetical cohort of 3,300,000 newborns followed-up for five years, the vaccination strategy averted 1,735,351 cases (54%) and 703 deaths (75%), with a gain of 48,521 LYs (75%) in comparison with no vaccination. Assuming a vaccine price of BRL 18.6 per dose, the costs averted with vaccination were BRL 71,778,377 from the societal perspective and BRL 38,536,514 from the health care system perspective, while the additional costs of vaccination were BRL 121,673,966.

The discounted incremental cost with vaccination was BRL 37 per case averted, BRL 91,670 per death averted, and BRL 1,329 per LY gained, from the societal perspective; and BRL 57 per case averted, BRL 138,947 per death averted, and BRL 2,014 per LY gained, from the health care system perspective. Using the gross domestic product as the criterion for defining the cost-effectiveness of a health care intervention, the analysis showed that vaccination was a very cost-effective strategy.

The break-even price at which the vaccination cost would be counterbalanced by treatment costs averted was BRL 9.98 from the societal perspective and BRL 4.24 from the health care system perspective.

The sensitivity analysis showed that the most influential model inputs were the diarrhoea incidence, diarrhoea severity, vaccine coverage, and vaccine cost. For instance, with a 25% reduction in diarrhoea incidence, the incremental cost per LY gained with vaccination rose substantially. In the best-case scenario, vaccination was dominant, which is more effective and less expensive, from both perspectives. In the worst-case scenario, the incremental cost per LY gained was BRL 9,247 from the societal perspective and BRL 10,431 from the health care system perspective.

Authors’ conclusions
The authors concluded that the universal immunisation strategy was cost-effective from both the societal perspective and that of the Brazilian health care system.

CRD commentary
Interventions:
No vaccination was an appropriate comparator as it reflected the pattern of care in the authors’ setting.

Effectiveness/benefits:
The authors briefly mentioned that a literature review was conducted to obtain the data on morbidity and mortality due to rotavirus, but no details were given and all estimates appear to have been obtained from a national database. In general, nationwide administrative databases are considered to be a valid source of evidence given the large sample of patients involved and this should ensure that the data were representative. The vaccine efficacy data were obtained from clinical trials which are considered to be an appropriate source for the treatment effect. The use of assumptions to derive some data might have introduced some uncertainty in the results. The authors acknowledged that the assumption of no adverse events associated with the vaccine should be confirmed in a large population, but other assumptions, such as no herd immunity, appear to have been biased against vaccination produce conservative results. Both disease-specific and more generalisable benefit measures were appropriately used and a recommended discount rate was applied.

Costs:
The analysis of costs was satisfactorily carried out for the two perspectives, including the types of costs and the sources of data. More information on the quantities of resources, the price year, and unit costs would have improved the transparency of the analysis. Only the key cost estimates were varied in the sensitivity analysis. The authors
acknowledged that hospitalisation costs might have been underestimated, which could have biased the analysis against
the vaccination strategy.

Analysis and results:
The expected costs and benefits of the two strategies were clearly presented and both discounted and undiscounted
results were reported. The issue of uncertainty was investigated using a deterministic approach, which considered only
single variations. A comprehensive approach based on simultaneous changes of multiple inputs would have been more
appropriate, but the results remained favourable to the vaccination strategy even in the worst-case scenario. The
generalisability of the results to other settings was not explicitly investigated and they should therefore be considered to
be country specific. The authors stated that other studies found similar results in other locations.

Concluding remarks:
The study was well conducted and the key elements of the analysis were well reported. The authors’ conclusions appear
to be robust.

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Other publications of related interest
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Carlin JB, Jackson T, Lane L, Bishop RF, Barnes GL. Cost-effectiveness of rotavirus vaccination in Australia. Australia

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