The cost-effectiveness of rotavirus vaccination in Armenia
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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 study examined the cost-effectiveness of universal infant rotavirus vaccination. The authors concluded that universal vaccination in Armenia was likely to be highly cost-effective. The methods were valid and the model assumptions were clearly presented. The authors’ conclusions appear to be robust.

Type of economic evaluation
Cost-utility analysis

Study objective
This study examined the cost-effectiveness of universal infant rotavirus vaccination.

Interventions
Universal vaccination, using Rotarix administered at 10 and 14 weeks of age, was compared against no vaccination.

Location/setting
Armenia/primary care.

Methods
Analytical approach:
The analysis was a decision simulation based on a published age cohort model that was adapted to the Armenian setting. The time horizon was 2012-2025. The authors stated that the analysis was carried out from the perspectives of the Ministry of Health, the total health care system (Ministry of Health and the Global Alliance for Vaccines and Immunization; GAVI Alliance), and society (with or without indirect costs).

Effectiveness data:
The clinical inputs were from a selection of sources including an official census, a World Health Organization (WHO) comprehensive multi-year plan for immunisation, surveillance databases, and an email survey of primary health care providers. The surveillance databases and the email survey were primary studies conducted in Armenia. Other data were extrapolated from populations with similar mortality in children under five years. Vaccine coverage and efficacy were key inputs. Efficacy was assumed to be equal to that found in trials conducted in Latin America.

Monetary benefit and utility valuations:
The disability weights were WHO estimates.

Measure of benefit:
Disability-adjusted life-years (DALYs) were the summary benefit measure and were discounted at an annual rate of 3%.

Cost data:
The economic analysis included the costs of vaccination and the treatment of rotavirus. Vaccination included vaccine acquisition, administration, social mobilisation, advocacy, communication, training, and monitoring. Most of these costs were from the Ministry of Health, the WHO multi-year plan for immunisation, and the GAVI Alliance. The analysis considered a linear drop in vaccine price due to price maturity. The direct medical costs of rotavirus treatment included hospitalisations and primary care consultations. These resources were estimated using Armenian surveillance data and the unit costs were from the health care authorities. The direct societal costs were transport and accommodation for...
caregivers seeking medical care, and were based on official rates. The indirect societal costs were productivity losses due to death from rotavirus (estimated using the human capital approach), and carer's time during hospitalisation or illness (estimated using average wages for women). All costs were presented in US $ and a 3% annual discount rate was applied. The price year was 2010.

Analysis of uncertainty:
Alternative scenarios were considered for: the disability weights, vaccine price maturity, number of hospitalisations and primary care consultations, symptomatic rotavirus cases, deaths, vaccine administration costs, travel costs, health care costs, and productivity losses. Alternative assumptions were from published sources or authors’ opinions. In some scenarios, up to 10 inputs were varied simultaneously.

Results
Without discounting, over five years, for the 2012 birth cohort, vaccination cost $660,000 and, compared with no vaccination, it reduced health care costs by $92,000, reduced direct societal costs by $7,000, reduced indirect societal costs by $232,000, and reduced the DALYs lost by 298.

Over five years, for the 2025 birth cohort, vaccination cost $257,000 and it reduced health care costs by $182,000, reduced direct societal costs by $13,800, reduced indirect societal costs by $459,000, and reduced the DALYs lost by 588.

In the analysis of birth cohorts from 2012 to 2025, the incremental cost per DALY saved was about $650 from the perspective of the Ministry of Health, $850 from a total health care perspective, $820 from a direct societal perspective, and $44 when including indirect societal costs. The gross domestic product per capita in Armenia in 2008 was about $3,800, indicating that rotavirus vaccination was highly cost-effective.

Even in pessimistic scenarios in the sensitivity analysis vaccination remained cost-effective. The inclusion of age-weighted DALYs had the strongest impact on the cost-effectiveness results.

Authors’ conclusions
The authors concluded that universal rotavirus vaccination for infants in Armenia was likely to be highly cost-effective.

CRD commentary
Interventions:
The selection of the comparators was appropriate as the proposed immunisation strategy was compared with no vaccination.

Effectiveness/benefits:
Differing sources were used for the clinical inputs. The two primary studies were conducted in Armenia and provided most of the information for hospitalisations and primary health care consultations. Other data were from studies conducted in other countries, and the authors justified their use of these sources. Few details were provided on the clinical sources, making it difficult to fully judge their validity. Extensive sensitivity analysis was conducted on most of the clinical parameters. DALYs were an appropriate benefit measure, recommended by WHO guidelines. An alternative calculation for the DALYs (age weighting) was considered in the sensitivity analysis.

Costs:
Various points of view were considered to assess the impact of vaccination for different payers, and generally the results were consistent for all four perspectives. The data sources were appropriate, and a linear drop in vaccine price over time and GAVI co-financing of immunisation were considered; these issues are relevant for a developing country. Some unit costs were reported, but most costs were presented as category totals. A few resource quantities were given. The price year was clearly stated, allowing reflation exercises. The impact of variations in the key costs was appropriately investigated in the sensitivity analyses.

Analysis and results:
The results were clearly presented and various model outcomes were reported. An incremental approach was used to synthesise the costs and benefits of vaccination versus no vaccination. The time horizon was 2012 to 2025 because this
was when the price per dose for Rotarix was expected to fall to $1. The uncertainty was investigated, using alternative assumptions for selected inputs. The authors acknowledged some limitations of their analysis, mainly due to the lack of Armenian data for some parameters. The indirect effect of vaccination was not considered, and this could further favour vaccination. The findings should be considered to be specific to Armenia.

Concluding remarks:
The methods were valid and the model assumptions were clearly presented. The authors’ conclusions appear to be robust.

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