Cost-effectiveness analysis of a universal infant immunization program with meningococcal
C conjugate vaccine in Brazil

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**CRD summary**

The study examined the cost-effectiveness of administering a universal meningococcal C conjugate vaccination programme in Brazil to a hypothetical cohort of children younger than one year old compared with vaccinating only a high-risk population. The authors concluded that the inclusion of a three-dose meningococcal C conjugate vaccine to the existing vaccination schedule was cost-effective in Brazil. The study methods, analyses and results are clear and comprehensive and are a reasonable assessment of the findings.

**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.

**Type of economic evaluation**

Cost-effectiveness analysis

**Study objective**

The study examined the cost-effectiveness of administering a universal meningococcal C conjugate vaccination programme in Brazil to a hypothetical cohort of 3.1 million children born in 2006 and younger than one year old.

**Interventions**

Universal infant meningococcal C conjugate was compared with an alternative strategy of vaccinating only a high-risk population. Three doses of meningococcal C conjugate were administered, two doses in the first semester of life and one booster dose in the second year of life. It was assumed that the meningococcal C conjugate vaccine was administered simultaneously with existing vaccinations in the Brazilian infant immunization schedule; coverage rate was assumed to be 94%.

**Location/setting**

Brazil/primary care

**Methods**

**Analytical approach:**

A decision-tree model was used to synthesise evidence from published literature and publicly available national epidemiological data on the frequency and outcomes of meningococcal disease (from the SINAN database). The time horizon was 10 years. The authors stated that the study took both the health-care system (Sistema Unico de Saude) and societal perspectives.

**Effectiveness data:**

The key clinical outcome was cases of meningococcal meningitis and suspected bacterial meningitis. The number of cases avoided by the meningococcal C conjugate vaccine, case fatality rates and adverse events from meningococcal disease (skin necrosis, amputation, neurological sequelae, deafness or no sequelae) were evaluated. A selection of relevant published epidemiological reports on hospitalisations and case-fatalities were used (such as SINAN and Network Surveillance System for the Bacterial Agents Responsible for Pneumonia and Meningitis/SIREVA II). Vaccine efficacy was based on a selection of five relevant publications published from 2004 to 2009 (Trotter CL et al. 2004, Larrauri A et al. 2005, Bettinger JA et al. 2009, Campbell H et al. 2009, and Martinez AI et al. 2009, see 'Other Publications of Related Interest’ below for bibliographic details).

**Monetary benefit and utility valuations:**

Not relevant.
Measure of benefit:
The measures of benefit used were pneumococcal cases avoided and life-years saved. Annual discounting of 5% was applied.

Cost data:
Direct medical costs included the vaccine, medical visits, hospitalisations, laboratory tests, imaging tests, and medications. The societal perspective included all direct medical costs plus transportation to health services and caregiver work loss. Values were abstracted from hospital data sets for days in hospital and national pricing schedules for other resources. The Human Capital Method was used to value work time lost by mothers of children acutely ill from meningococcal disease. Prices were presented in 2006 Brazilian reais (BRL). Discounting was applied annually at 5%.

Analysis of uncertainty:
The sensitivity of the results to changes in key model parameters (such as vaccine effectiveness, case fatality rates, vaccine price, hospital costs) was evaluated. Probabilistic sensitivity analysis was also performed. Sensitivity analyses were presented in a tornado graph, a cost-effectiveness acceptability curve and line graphs.

Results
For the comparison strategy of only vaccinating high-risk individuals, 2,728 children would acquire meningococcal disease and 474 were predicted to die over 10 years. With a universal meningococcal C conjugate vaccination program, 1,218 cases and 210 deaths would be avoided. Universal vaccination would cost BRL 320 million extra in total costs and save BRL 7.9 million in avoided disease treatment costs.

The incremental cost-effectiveness ratios were reported with costs and outcomes discounted and not discounted. With discounting, the incremental cost per case avoided was BRL 304,551 and per life year saved was BRL 25,088 from a health system perspective. From a societal perspective with discounting, the incremental cost per case avoided was BRL 301,100 and per life year saved was BRL 24,804.

The cost-effectiveness ratios were sensitive to vaccine effectiveness, case fatality, disease incidence and vaccine price with the cost per life year saved rising to BRL 69,622 for lower estimates of meningococcal disease due to serogroup C (0.20). From the probabilistic sensitivity analyses, there was an 87% probability that universal meningococcal C conjugate vaccination would be cost-effective at a threshold of three gross domestic products per capita per disability-adjusted life-year averted.

Authors’ conclusions
The authors concluded that the inclusion of a three-dose universal meningococcal C conjugate vaccination was cost-effective and the recent decision by the Brazilian Government to introduce the vaccine was economically justified.

CRD commentary
Interventions:
The strategies were briefly described. The feasible and affordable of expanding existing infant immunization schedules in other settings should consider such issues as uptake rates, administration, education and monitoring activities.

Effectiveness/benefits:
No information was provided on the type and quality of the studies that provided the vaccine efficacy estimates or on the search strategy or inclusion criteria. No information was provided on the method of evidence synthesis. The included studies were referenced but little data was provided in the paper on their validity.

Costs:
The costing assumptions and sources that provided the basis for some assumptions were stated. The methods were generally well reported. The study perspectives were stated. The costs relevant to both health care system and societal perspectives were adequately described. Health system costs for administration, education and monitoring activities did not appear to be included and may have been important contributors to overall costs.

Analysis and results:
The results from the one-way sensitivity analyses were reported clearly in the paper and demonstrated some volatility of the base results to variation in key variables. Limitations of the study were highlighted such as: the potential but unknown under reporting or misdiagnosis in the SINAN database; and the difficulty measuring the sequelae of meningococcal disease.

Concluding remarks:
The methods, analyses and results were clear and appear comprehensive. The conclusions reached by the authors are a reasonable assessment of the study findings.

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