Should university students be vaccinated against meningococcal disease in Canada?

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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.

Health technology
The health technology under consideration in this paper was vaccination against invasive meningococcal disease (IMD) using the meningociccal quadrivalent (A, C, Y and W-135) polysaccharide vaccine (Men-4-PS) or the meningococcal monovalent C conjugate vaccine (Men-C-Con).

Type of intervention
Primary prevention

Economic study type
Cost-effectiveness analysis; cost-utility analysis.

Study population
The study population comprised a hypothetical cohort (100,000) of university students in Canada. 50% were assumed to have been vaccinated at the time of university admission.

Setting
The setting was primary care. The economic study was carried out in Canada.

Dates to which data relate
The effectiveness data were taken from studies published between 1971 and 2002. Resource use and cost data were related to studies published between 1998 and 2002. The price year was reported.

Source of effectiveness data
Effectiveness data were derived from a review of the literature and estimates of effectiveness based on opinion.

Modelling
A simulation model was used to estimate the economic implications of the vaccination programmes under consideration. The time horizon was 10 years.

Outcomes assessed in the review
The following model input parameters were derived from the review of primary studies: life expectancy at 18 years old; quality adjusted life expectancy at 18 years old; case fatality; sequelae rate in survivors; quality of life of survivors with sequelae; polysaccharide vaccine efficacy in first year; and conjugate vaccine efficacy in first year.

Study designs and other criteria for inclusion in the review
Not reported.

Sources searched to identify primary studies
Not reported.

Criteria used to ensure the validity of primary studies
Not reported.

Methods used to judge relevance and validity, and for extracting data
Not reported.

Number of primary studies included
Five primary studies were used to identify model input parameters.

Methods of combining primary studies
Not reported.

Investigation of differences between primary studies
Not reported.

Results of the review
The following model input parameters were derived from the review of primary studies:

- life expectancy at 18 years old = 60.5 years;
- quality adjusted life expectancy at 18 years old = 50.1 years;
- case fatality = 11%;
- sequelae rate in survivors = 20%;
- quality of life of survivors with sequelae = 72%;
- polysaccharide vaccine efficacy in first year = 90%; and
- conjugate vaccine efficacy in first year = 90%.

Methods used to derive estimates of effectiveness
A number of model input parameters were derived from expert opinion and personal communication with Health Canada and the Quebec Ministry of Health.

Estimates of effectiveness and key assumptions
The following model input parameters were derived from expert opinion:

- polysaccharide vaccine efficacy decrease = 10% per year;
- conjugate vaccine efficacy decrease = 1% per year; and
programme coverage of target population = 50%.

The following model input parameters were derived from personal communication with Health Canada and the Quebec Ministry of Health:

IMD cumulative incidence age 18 to 21 years = 6.5 per 100,000;

IMD cumulative incidence age 22 to 27 years = 2.8 per 100,000;

proportion of cases serogroup C = 55%; and

proportion of cases in serogroups A, W-135 and Y = 10%.

Measure of benefits used in the economic analysis
The economic analysis measured health benefits in terms of the number of IMD cases averted, the number of deaths averted, the number of life years gained and the number of QALYs gained. The valuation of quality of life was taken from a published study, but the methods of valuing health states were not reported.

Direct costs
The direct costs to the health care payer were included in this analysis. Three cost elements were identified: the cost of the vaccine, the cost of administering the vaccine, and the costs associated with treating each case of IMD. The costs of administering the vaccine and disease treatment costs were taken from previously published studies. The cost of the two vaccines was taken from personal communication with the Quebec Ministry of Health. Resource use was taken from the model that provided the clinical effectiveness evidence. This used data from papers published between 1971 and 2002. No price year was reported. Unit costs were reported and resource use was explicitly specified in the paper. Costs were discounted at a rate of 3% per annum.

Statistical analysis of costs
No statistical analysis of costs was undertaken.

Indirect Costs
The losses of lifetime earnings as a result of IMD were included in the economic analysis. Lifetime earnings and the relative productivity of IMD survivors with sequelae were identified from a review of the literature. Unit costs were reported and resource use was explicitly specified in the paper. No price year was reported. Costs were discounted at a rate of 3% per annum.

Currency
Canadian dollars (Can$).

Sensitivity analysis
A one way sensitivity analysis was undertaken to assess the impact of higher and lower incidence of IMD. The method of selecting the higher and lower incidences was not reported.

Estimated benefits used in the economic analysis
Both vaccines considered by this study would avert 2 cases of IMD over 10 years. The number of deaths averted, life years gained and QALYs gained were not reported in the paper.
Cost results
The total cost of a vaccination programme using polysaccharide vaccine would be $2,981,000 for a cohort of 100,000 compared to $3,731,000 for a programme using the conjugate vaccine.

Synthesis of costs and benefits
The following cost-effectiveness ratios were identified for the screening programme using polysaccharide vaccine:

cost per IMD case averted = $1,434,000;
cost per death averted = $13,040,000;
cost per life year gained = $466,000; and
costs per QALY gained = $364,000.

The following cost-effectiveness ratios were identified for the screening programme using conjugate vaccine:

cost per IMD case averted = $1,619,00;
cost per death averted = $14,714,000;
cost per life year gained = $525,000; and

costs per QALY gained = $411,000.

Sensitivity analysis indicated that assuming a low incidence of IMD would result in a cost-effectiveness ratio of $2,751,000 per IMD case averted using the polysaccharide vaccine and $2,695,000 using the conjugate vaccine. Assuming a high incidence would result in a cost-effectiveness ratio of $532,000 per IMD case averted for the polysaccharide vaccine and $695,000 per case averted for the conjugate vaccine.

Authors' conclusions
The author concluded that, from a public health perspective, the routine vaccination of first year university students was not a viable option. However, from an individual perspective the costs of the vaccine may be worth the benefit.

CRD COMMENTARY - Selection of comparators
This study compared two vaccination strategies with a do nothing approach. The rationale for their choice was given. You should consider how these relate to current practice in your own setting prior to applying the results of this study.

Validity of estimate of measure of effectiveness
The estimate of the clinical impact of the vaccination programmes was taken from a simulation model. The model input parameters were taken from previously published studies, expert opinion and personal communications. No details of the methods used to identify and assess the primary studies were provided for some of the model input parameters included in the paper. No details of the recruitment and methods of the expert(s) that provided the expert opinion were reported. As a result it is difficult to comment on the validity and generalisability of the model parameters. Appropriate sensitivity analyses, however, were performed and this enhances the strength of the findings.

Validity of estimate of measure of benefit
The estimates of health benefit are taken from the model that provided the clinical effectiveness data. The valuation of quality of life with IMD sequelae was taken from published studies and the methods were not reported in this paper. The validity of the benefits results was enhanced by the cost-effectiveness and cost-utility analyses.
Validity of estimate of costs
The paper reported that a societal perspective was adopted. The analysis included the costs of the vaccination programme, the health care costs associated with treating the disease, and lost productivity. However, no assessment of the social care or personal costs that might be incurred as a result of the disease was made. Costs were taken from previously published studies and personal communication with the Quebec Ministry of Health. However, no statistical or sensitivity analysis of costs was undertaken. This reduces the possibility of generalising these findings to other settings. Costs were appropriately discounted and unit costs were clearly identified which will assist the generalisability of the study findings. No price year was reported which limits the generalisability of the study and will prevent any future reflation exercises.

Other issues
The author presented the results in a comprehensive manner and the conclusion reflects the analysis. The author compared his findings with other similar studies but did not consider how this study might be generalised to other settings.

Implications of the study
The author does not make any direct recommendations for further research or changes to practice as the programmes examined are not cost-effective from a societal perspective. However, the student/parents' perspective indicates that vaccination cost may be worth the benefit in reducing IMD risk during university years.

Source of funding
None stated.

Bibliographic details

PubMedID
18159440

Indexing Status
Subject indexing assigned by NLM

AccessionNumber
22004008827

Date bibliographic record published
31/05/2005

Date abstract record published
31/05/2005