A cost-effectiveness analysis of universal childhood hepatitis A vaccination in China

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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 assessed the cost-effectiveness of universal childhood vaccination against hepatitis A virus (HAV) in comparison with no vaccination, in five Chinese regions, defined by the population prevalence of the antibody to HAV. The vaccination strategy was cost-effective in China and should be implemented first in regions with the lowest infection level. The study was well conducted although the sources of the clinical evidence were not fully described. The extensive use of sensitivity analyses makes the authors' conclusions more robust.

Type of economic evaluation
Cost-effectiveness analysis, cost-utility analysis

Study objective
The objective was to assess the cost-effectiveness of a programme of universal childhood vaccination against hepatitis A virus (HAV) in comparison with no vaccination in five Chinese regions, defined by the prevalence of the antibody to HAV (anti-HAV) in the population.

Interventions
Universal HAV vaccination, using an inactivated vaccine, was planned at ages 12 and 18 months for all healthy children. The alternative strategy of no vaccination reflected the usual pattern of care in most regions.

Location/setting
China/primary care.

Methods
Analytical approach:
This economic evaluation was based on a Markov model which assessed the costs and benefits of vaccination in a hypothetical cohort of 1,000,000 children from five regions with anti-HAV prevalences of lowest, lower, intermediate, higher, and highest. The time horizon was a lifetime, which was 72 years in China. The authors stated that the perspectives of both the health care system and society were adopted.

Effectiveness data:
The clinical data came from a selection of known, relevant sources, including national surveys and other published sources, the main characteristics of which were not reported. In general, the epidemiological data and vaccine coverage rates were taken from Chinese sources and were based on large surveys, while other data (such as vaccine efficacy) were taken from other published sources. Only when Chinese-specific data were not available, was evidence from other countries used. These data were supported by experts' opinions.

Monetary benefit and utility valuations:
The utility estimate associated with the state "lived with HAV" was derived from a study of American adults and no other details were given.

Measure of benefit:
Quality-adjusted life-years (QALYs) and life-years (LYs) were used as the summary benefit measure. A 5% annual discount rate was applied.

Cost data:
The categories of costs were vaccine acquisition and administration (nurse labour, storage, transportation, and injection), medical treatment of HAV, and work losses associated with HAV treatment. The costs of vaccination adverse events were not considered. The price of vaccine was based on the current national government contract price, from the manufacturer. The cost of vaccine administration was based on the local government health system. The costs of medical services were derived from a review of records from the National Health Service Survey in 2003 and from recent national literature. The value of work losses was calculated using the per capita daily gross domestic product (GDP). The resource use for most cost categories was based on published studies. The price year was 2005. Future costs were discounted at an annual rate of 5% and all costs were in Chinese Yuan (CNY).

Analysis of uncertainty:
A deterministic sensitivity analysis was carried out on the key model inputs to deal with the issue of uncertainty. The ranges of values or alternative estimates were defined by the authors or were derived from published studies.

Results
The vaccination strategy was more effective in comparison with no vaccination in all regions. Specifically, the QALYs gained were 5390 in the lowest, 5676 in the lower, 5585 in the intermediate, 4767 in the higher, and 2782 in the highest prevalence regions, for the cohort of one million children. However, the vaccination policy increased the number of deaths due to HAV in the highest prevalence region. This was due to the loss of vaccine immunisation over time, which increased the risk of death in the oldest population members.

In comparison with no vaccination, and from the perspective of the health system (and the perspective of the society, in brackets), the costs saved, for the cohort of one million children, were CNY 39,711,598 (69,148,953) in the lowest, CNY 44,195,889 (68,762,442) in the lower, CNY 42,294,687 (56,270,459) in the intermediate, and CNY 28,499,126 (34,303,226) in the higher prevalence regions. In the highest prevalence region, the vaccination cost an additional CNY 4,654,479 (CNY 6,309,985).

Thus, in the lowest, lower, intermediate, and higher prevalence areas, the universal vaccination was the dominant strategy (simultaneously less expensive and more effective). In the highest prevalence area, for vaccination, the incremental cost per QALY gained was CNY 1,673 (CNY 2,268), while the incremental cost per LY gained was CNY 21,955 (CNY 29,764). These figures still appear to be cost-effective.

The sensitivity analysis showed some interesting findings. If vaccine protection lasted for a lifetime (as protection does from natural infection), the vaccination would be effective in reducing all HAV outcomes in all regions. At high values of annual losses of vaccine protection, the probability of death due to HAV increased not only in the highest and higher infection regions, but also in intermediate and lower infection regions.

Authors’ conclusions
The authors concluded that universal childhood HAV vaccination was a cost-effective strategy in China and should be implemented first in provinces with the lowest infection level.

CRD commentary
Interventions:
The selection of the strategies was appropriate and they are likely to be relevant options in other settings. The authors stated that other comparisons might have been relevant, such as screening for immunity and vaccinating only susceptible individuals.

Effectiveness/benefits:
The approach used to select the sources of data was not clearly described. The selected studies may have been known to the authors, but no formal justification for their selection was provided, except for national surveys, which clearly were the most appropriate source of domestic data. The design and other key features of the published studies were not provided, which prevents an objective assessment of the validity of the clinical estimates. The authors acknowledged the uncertainty underlying these clinical data and undertook an extensive sensitivity analysis on them. Little information was reported for the derivation of the utility values used to calculate the QALYs. The authors stated that these figures were taken from a study of American patients but the instrument used to elicit the patient preferences was not
described. Both QALYs and LYs are validated benefit measures, allow cross-disease comparisons, and capture the impact of the disease on patient health.

**Costs:**
The use of two perspectives for the economic analysis makes the study findings more generalisable to other settings. The costs were presented as macro-categories and a detailed breakdown of items was not provided. This reduces the transparency of the economic analysis. The sources of data were reported and the authors justified the exclusion of some cost categories. The price year and the use of discounting were reported. Variations in cost estimates were considered in the sensitivity analysis.

**Analysis and results:**
The synthesis of the costs and benefits was appropriately performed by means of an incremental analysis. The issue of uncertainty focused on the most influential model inputs. The analysis differentiated among areas with various endemic level of disease, which makes the study findings transferable to other epidemiologic settings. The results of both the base-case and the sensitivity analyses were clearly presented. The authors noted some limitations to their analysis. Firstly, the model did not consider the impact of herd immunity. Secondly, the same assumptions for costs and domestic GDP were made for all Chinese regions, but these figures may vary substantially depending on the setting. Thirdly, some assumptions on vaccine efficacy may have overestimated the benefits of the immunisation strategy.

**Concluding remarks:**
Overall, the study was well conducted although the sources of the clinical evidence were not described in depth. Nevertheless, the extensive use of sensitivity analyses makes the authors’ conclusions more robust.

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