Cost effectiveness of vaccinating food service workers against hepatitis A infection.
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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
Vaccination of food service workers (FSW) against hepatitis A was compared to no vaccination.

Type of intervention
Prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The study population was reported as comprising FSW aged 20 years, in the 10 western United States with the highest reported rates of hepatitis A among adults between 1990 and 1997. No inclusion or exclusion criteria were explicitly reported.

Setting
The study was set in Arizona, California, Idaho, Missouri, New Mexico, Nevada, Oklahoma, Oregon, Utah and Washington in the United States. These states had the highest reported rates of hepatitis A in adults between 1990 and 1997. The health care setting for the vaccination policy was the community in terms of the FSW workplace.

Dates to which data relate
The study used efficacy data published in 1997 and cost data published between 1989 and 1996. The price year used was reported to be 1997.

Source of effectiveness data
Correspondence with the authors subsequent to this abstract being written indicates that all the primary studies were identified from Medline.

Modelling
A decision analytic model was used to predict the costs and outcomes of hepatitis A infection with and without a policy of vaccinating FSWs at 20 years of age.

Outcomes assessed in the review
The following outcomes of hepatitis A infection were assessed in the review:

Infection incidence: annual infection risk.
Infection severity: infections causing symptoms, duration of symptoms, hospitalisation amongst symptomatic patients, fulminant illness amongst symptomatic patients, liver transplantation among patients with fulminant illness, deaths among symptomatic patients, duration of work loss for hospitalised patients, duration of illness for non-hospitalised patients.

The following outcomes of hepatitis A vaccination were assessed in the review:

- Long term efficacy following complete vaccination schedule;
- Protective efficacy following two vaccine doses; and,
- Protective efficacy following a single dose vaccine.

### Study designs and other criteria for inclusion in the review

Parameter estimates were obtained from published reports and national databases (Centres for Disease Control and Prevention, USA). Data were also used from a case study series and estimates of patient survival and vaccine effectiveness derived by an expert panel. The authors did not report predefined study designs or other inclusion and exclusion criteria required for studies to be included in the review.

### Sources searched to identify primary studies

The sources searched to identify primary studies were not reported.

### Criteria used to ensure the validity of primary studies

The study did not report the criteria used to ensure the validity of primary studies.

### Methods used to judge relevance and validity, and for extracting data

The authors did not report the criteria used to judge the relevance and validity of data or to determine which data were extracted.

### Number of primary studies included

Seven primary studies were included in the review.

### Methods of combining primary studies

Correspondence with the authors indicates that an expert panel was used to combine data from different sources.

### Investigation of differences between primary studies

The authors did not investigate the differences between primary studies.

### Results of the review

The following results of outcomes of hepatitis A were reported:

- **Infection incidence:**
  - Annual infection risk 15.7/10,000.

- **Infection severity:**
  - Infections causing symptoms 73%.
duration of symptoms 38 days,
hospitalisation amongst symptomatic patients 10%,
fulminant illness amongst symptomatic patients 9/10,000,
liver transplantation among patients with fulminant illness 23%,
deaths among symptomatic patients 18/10,000,
duration of work loss for hospitalised patients 15.5 days,
duration of illness for non-hospitalised patients 32.2 days.

The following results of outcomes of hepatitis A vaccination were reported in the review:

long term efficacy following complete vaccination schedule: 93 to 95%;

protective efficacy following two vaccine doses were estimated to be 95% at 5 years and 10 years, 90% at 20 years,
81% at 30 years and 74% at 50 years, and,

protective efficacy following a single dose vaccine were estimated to be 73% at 5 years, 62% at 10 years, 42% at 20 years,
32% at 30 years and 21% at 50 years.

**Measure of benefits used in the economic analysis**
The authors used years of life saved (YOLS) as a measure of economic benefit. Hepatitis A deaths were converted into
life years lost based on the age of each fatal case and life expectancies for the general US population. YOLS were
converted to present values using a 3% annual discount rate.

**Direct costs**
Resource use and costs were not reported separately. Correspondence with the authors indicates that the resource use
data were derived from one published paper. The following costs of hepatitis A infection were included in the analysis:

Infection costs per patient:
treatment for non-hospitalised patient $740;
treatment for hospitalised patient without fulminant illness $6,914;
treatment for hospitalised patient with fulminant illness $20,651; and,
liver transplantation (lifetime cost) $500,000.

The direct costs of disease control and public notification were also included:

Disease control costs per outbreak:
health department personnel $121,977;
serologic studies/physician fees $153,734; and,
immune globulin injections $519,759.

Disease control costs per public notification (without outbreak):
health department personnel $3,508; and,

immune globulin injections $1,885.

Estimates were derived on the basis that each notification would take 80 public health personnel hours and an average of 244 immune globulin doses were assumed to be administered following each public notification.

The cost of vaccination was estimated from a programme developed by SmithKline Beecham and the National Restaurant Association. Median vaccine and administration costs were reported as $43 and $10.75 per dose respectively.

Treatment costs for outpatients and inpatients without fulminant disease were estimated from a case series study. Treatment costs for patients with fulminant disease were derived from an expert panel, a report of liver transplant costs and estimates of transplant patient survival.

Costs were adjusted to 1997 levels using the Consumer Price Index for Medical Care and the Employment Cost Index and a discount rate of 3% was reported.

**Statistical analysis of costs**
No statistical analysis of costs was reported.

**Indirect Costs**
The following indirect costs were included in the analysis:

Work loss day, FSW infection $58; and,

Work loss day, food-associated infection $116.

The authors stated that the work loss duration was derived from a case series study. For food-associated cases, work loss was valued using national data describing workforce participation and earnings. The authors stated that FSW loss was assigned a lower value because wages in that sector are 49% of those in the private sector. Although costs incurred by the health system were considered, those incurred by the food services business were not.

**Currency**
US dollars ($). No currency conversions were reported.

**Sensitivity analysis**
The authors reported that several sensitivity analyses were conducted by varying parameters thought to have the greatest effects on cost effectiveness. The sensitivity analysis was conducted by changing the following parameters: discount rates; estimates of food service employment duration; probability of food borne outbreak from an infected FSW; and, probability of public notification of an infected FSW.

**Estimated benefits used in the economic analysis**
The authors estimated that, in the 10 states considered, vaccination of 100,000 20 year old FSW would save 274.9 life-years. Side effects of vaccination were not included.

**Cost results**
The following cost results were reported:

vaccination costs without vaccination policy: $0.
with vaccination policy: $8,062,500.

Hepatitis A treatment costs without vaccination policy: $3,753,215,
with vaccination policy: $748,140.

Public health intervention costs without vaccination costs: $2,578,230,
with vaccination policy: $279,862.

Work loss costs without vaccination policy: $4,037,011,
with vaccination policy: $904,544.

The total societal costs were reported as $10,368,456 without a vaccination policy and $9,995,046 with a policy. The total health system costs were $6,331,445 (without policy) and $9,090,502 (with policy).

It was reported that vaccinating 100,000 FSWs would cost $8.1 million, but would reduce the costs of hepatitis A treatment, public health intervention and work loss by $3.0 million, $2.3 million, and $3.1 million, respectively.

All costs were adjusted to 1997 prices and were converted to present values using a 3% discount rate.

Synthesis of costs and benefits
The costs and benefits were combined as an incremental cost effectiveness ratio to give a cost per YOLS. The ratio was calculated by dividing vaccination policy costs by the difference in life-years lost due to fatal hepatitis A cases.

The authors reported that a vaccination policy would cost the health care system $13,969 per YOLS, with both costs and YOLS discounted to their present value. The authors reported that although the hepatitis A events were modelled over a 45-year period, most benefits occurred within 5 years.

The base case assumptions were varied in a series of sensitivity analyses. A change in the discount rate had an important influence on the results, due to the 45-year model duration. Without discounting, the costs of a vaccination policy were only $4,672 per YOLS.

Authors' conclusions
The authors concluded that, although the vaccination policy would reduce societal costs, it would cost the health care system $13,969 per YOLS, and this was regarded as a ratio that exceeds generally accepted standards of cost-effectiveness. In spite of the cost-effectiveness results they reported the public health benefits of the policy and suggested that some form of public financing could be an appropriate solution to implement the policy.

CRD COMMENTARY - Selection of comparators
A justification was given for the comparator used, namely that the no vaccination policy represented current practice. You as a user of this database should decide if this is a widely used health technology in your own setting.

Validity of estimate of measure of effectiveness
The authors did not report whether a systematic or selective review of the literature had been undertaken and did not report the methods used to identify studies, assess the validity of studies, extract data or combine data from different sources. The authors did not report whether differences between primary studies were investigated when estimating effectiveness data for the model. The authors also reported that expert opinion was used to derive estimates. However, it is not clear which data were derived in this manner. Correspondence with the authors indicates that a description of the expert panel process is given in a separate publication. The reference for this paper is given below. The authors used a model to estimate the impact of vaccination on the life years lost due to hepatitis A, but did not report whether or how
the structure of the model was validated. The authors conducted sensitivity analyses to assess the robustness of the results to changes in the values of parameters. Not all parameters were included in the sensitivity analysis and the authors do not report the criteria for selection of the parameters to be tested. These factors mean that it is difficult to assess the validity of the data and the model used to estimate the impact of vaccinating FSWs against hepatitis A.

Validity of estimate of measure of benefit
The authors used life years lost as the summary measure of health benefit. This excludes any impact of changes in morbidity on the overall health and social well being of the population at risk of hepatitis A or those vaccinated. The authors did not report any long term sequelae (other than death) of hepatitis A or side-effects of vaccination. In correspondence subsequent to this abstract being written, the authors report that, for survivors, there are no adverse long term sequelae associated with hepatitis A. The authors also note in this correspondence that quality of life effects of hepatitis A will be published separately.

Validity of estimate of costs
Costs and quantities were not reported separately. Costs were discounted and adjusted to the same price year. The estimates of cost were derived from published literature, databases and expert opinion. The authors did not report any assessment of the validity of the data from these sources and did not report the methods used to combine data from different sources. Costs of any long term health sequelae from hepatitis A infection or from side effects of vaccination were not included. Although the authors reported that costs were estimated from both a societal and health system perspective the full range of indirect costs were not included. The authors stated that economic losses may also accrue to business owners when FSW are infected with hepatitis A. However, these costs were not included in the analysis. The reader should decide whether the omitted costs are likely to affect the authors’ conclusions.

Other issues
The authors did not make appropriate comparisons of their findings with those from other studies and did not address the issue of generalisability to other settings.

The authors reported a number of further limitations of their study. They did not consider the effects of infected patrons further spreading the virus through personal contact and they did not consider that FSW with longer employment tenures may be more likely to receive the second vaccine dose. They also stated that their estimate of FSW employment duration may be particularly conservative.

Implications of the study
The authors concluded that the public health benefits of vaccination outweigh the additional costs to the health care system. Therefore public financing of hepatitis vaccination for FSW is worthwhile.

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