Comparison of the cost and effectiveness of two strategies for maintaining hepatitis B immunity in hemodialysis patients

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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
Two strategies for maintaining hepatitis B immunity among haemodialysis patients, screening versus no screening, were examined. Under the screening option, only patients with undetectable or low levels (less than 10 mIU/mL) of antibodies to hepatitis B surface antigen (anti-HBs) received hepatitis B virus (HBV) immunisation through re-vaccination. Under the no-screening strategy, all patients were automatically re-vaccinated annually regardless of their anti-HBs status.

Type of intervention
Secondary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised a hypothetical cohort of 1,000 haemodialysis patients who had already responded to primary vaccination series. This meant that they had an antibody titer of greater than 10 mIU/mL.

Setting
The setting was secondary care (a haemodialysis centre). The economic study was carried out in the USA.

Dates to which data relate
The dates relating to the effectiveness and resource use data were not reported. The price year was not stated.

Source of effectiveness data
The effectiveness evidence came from a non-systematic review of published studies.

Modelling
A decision tree model was constructed to evaluate the costs and benefits of the two strategies under examination. The model considered a cohort of 1,000 haemodialysis patients who were followed for 5 years. In the no-screening branch all patients were given a HBV vaccine booster without checking for immunity. In the screening branch all patients were screened for HBV immunity, and only those with an antibody titer of less than 10 mIU/mL were given a HBV vaccine booster. Patients with a positive HBs surface antigen (HBsAg) were considered to have newly-acquired HBV if anti-hepatitis B core (anti-HBc) immunoglobulin (Ig) M serologies were also positive.

Outcomes assessed in the review
The health outcomes evaluated in the review were the following probability values:

- incidence of HBV,
- fulminant liver failure,
- fatal and chronic infection after fulminant liver failure,
- icteric infection,
- recovery and chronic infection after icteric infection,
- non-icteric infection, and
- recovery and chronic infection after non-icteric infection.

The characteristics of the tests and vaccine were also estimated from the review of the literature. The test characteristics were the specificity of HBsAg and anti-HBc IgM and the sensitivity of HBsAg. The vaccine characteristics were compliance, vaccine decay, and booster response in anti-HBs negative patients and in anti-HBs unknown patients.

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

**Sources searched to identify primary studies**
MEDLINE was searched from 1966 to 2000 using the keywords "hemodialysis", "hepatitis B virus" and "immunization". The references of studies identified from the searches were checked for further relevant studies.

**Criteria used to ensure the validity of primary studies**
Not stated.

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

**Number of primary studies included**
Not reported.

**Methods of combining primary studies**
Not reported.

**Investigation of differences between primary studies**
Not stated.

**Results of the review**
The incidence of HBV was 0.005.

The probability values were:
0.02 for fulminant liver failure,
0.70 for fatal infection and 0.30 for chronic infection after fulminant liver failure,
0.06 for icteric infection,
0.22 for recovery and 0.78 for chronic infection after icteric infection,
0.92 for non-icteric infection, and
0.22 for recovery and 0.78 for chronic infection after non-icteric infection.
The specificity was 0.95 for HBsAg and 0.99 for anti-HBc IgM. The sensitivity of HBsAg was 0.99.
Vaccine compliance was 1.0 (range: 0.20 - 1.0).
Vaccine decay (proportion of vaccinated patients who lose immunity after one year) was 0.22 (range: 0.03 - 0.39).
Booster response was 0.15 in anti-HBs negative patients and 0.7 (range: 0.40 - 1.0) in anti-HBs unknown patients.

**Measure of benefits used in the economic analysis**
The benefit measure used in the economic analysis was the number of cases of infection prevented. It was obtained through the decision model.

**Direct costs**
Discounting was relevant since the patients were followed for five years. However, it appears that no discount rate has been used in the analysis. The unit costs were reported for a limited number of cost items, but details of the resource use were not provided. The health services included in the economic analysis were HBsAg, anti-HBc IgM, hepatic panel, HBsAg, vaccine, acute hepatitis requiring hospitalisation, acute hepatitis not requiring hospitalisation, and follow-up care. The hepatic panel covered serum albumin, total bilirubin, alkaline phosphatase, amino aspartate transferase and amino alanine transferase.

The cost/resource boundary adopted in the study was that of the third-party payer. The costs of treating acute HBV infection requiring hospitalisation were derived using diagnosis-related group reimbursement rates. The costs of treating acute HBV not requiring hospitalisation were obtained from the literature (see Other Publications of Related Interest). The sources of the other costs were not reported. Resource use for haemodialysis patients was based on recommendations set by the Centers for Disease Control and Prevention and the authors' assumptions. The authors stated that costs were adjusted for inflation, but no details were provided. The price year was not stated.

**Statistical analysis of costs**
The costs were treated deterministically in the base-case.

**Indirect Costs**
The indirect costs were not included in the economic evaluation.

**Currency**
US dollars ($).

**Sensitivity analysis**
Several sensitivity analyses were carried out to evaluate the robustness of the cost-effectiveness ratios to variations in
most of the model inputs used in the decision model. Univariate analyses appear to have been used.

**Estimated benefits used in the economic analysis**
The screening strategy was associated with 21 cases of HBV infections, while the no-screening strategy led to 29 infections.

**Cost results**
The mean cost per patient was $261 with screening and $1,129 with no screening.

**Synthesis of costs and benefits**
An incremental cost-effectiveness analysis was carried out to combine the estimated costs and benefits of the two strategies. However, an actual cost-effectiveness ratio was not calculated because the screening strategy was dominant, meaning that it was both more effective (fewer cases of infection) and less costly. This conclusion was robust to the variations investigated in the sensitivity analyses. Also, the screening strategy remained the dominant option under several scenarios. The compliance rate was the factor with the greatest impact on the results.

**Authors' conclusions**
The current clinical practice of regularly screening haemodialysis patients for maintaining immunity was more cost-effective than administering the vaccine booster without checking the patient's status of immunity.

**CRD COMMENTARY - Selection of comparators**
The rationale for the choice of the comparators was clear. Screening represented the current standard of practice among haemodialysis patients in the USA, against which the no-screening strategy was tested. You should decide whether they are valid comparators in your own setting.

**Validity of estimate of measure of effectiveness**
The effectiveness evidence came from a non-systematic review of the literature. The authors described the search methods, but the inclusion criteria were not mentioned and the conduct of the review was not discussed. In particular, the methods used to assess the validity of the primary studies and to assess the process of data extraction were not stated. The number of primary studies included in the review was not reported. It was not clear how the authors combined the estimates coming from the primary studies and whether they considered differences among the primary studies when estimating the effectiveness. These issues make it difficult to evaluate the internal validity of the analysis.

**Validity of estimate of measure of benefit**
The benefit measure was the number of cases of HBV averted. It was obtained through a decision tree model, the main characteristics of which were described and reported graphically. This measure represents the natural outcome of the vaccination programme. However, it makes it difficult to compare the benefits of the study intervention with those obtained through other programmes funded by the health care system.

**Validity of estimate of costs**
The perspective adopted in the study was explicitly stated. It appears that all the relevant categories of costs have been included in the economic analysis. However, only limited details of the economic study were provided. The unit costs were reported only for a small number of items and resource use was not discussed. The price year was not stated, thus making it difficult to reproduce the study in other settings. The costs and the quantities appear to have been treated deterministically in the base-case analysis, although some sensitivity analyses were conducted. The cost estimates were specific to the Medicare setting. Resource consumption appears to have been based on the authors’ assumptions. The authors did not carry out any discounting, although the costs were incurred during a period of five years.
Other issues
The authors did not compare their findings with those from other studies. They also did not address the issue of the generalisability of the study results to other settings. Thus, the external validity of the analysis was low despite some sensitivity analyses being conducted. The authors noted some limitations of the analysis. First, the use of a 5-year time horizon was not adequate to capture all the benefits and costs of the interventions considered in the analysis. Second, the model did not include death unrelated to HBV as an outcome (although life expectancy of haemodialysis patients usually exceeds 5 years). Finally, the sensitivity of HBsAg was not varied.

Implications of the study
The study results suggest that haemodialysis patients should receive an HBV immunisation booster only after screening for anti-HBs titers. Thus, the current practice of screening for HBV immunity is cost-effective.

Source of funding
None stated.

Bibliographic details

PubMedID
12163275

Other publications of related interest

Indexing Status
Subject indexing assigned by NLM

MeSH
Algorithms; Computer Simulation; Cost-Benefit Analysis; Costs and Cost Analysis; Decision Support Techniques; Hepatitis B /complications /epidemiology /prevention & control /transmission; Hepatitis B Antibodies /blood; Hepatitis B Vaccines /administration & dosage /economics /immunology; Hepatitis B, Chronic /economics /prevention & control; Hospitalization /economics; Humans; Immunization Schedule; Immunization, Secondary /economics; Incidence; Kidney Failure, Chronic /complications /therapy; Liver Failure /economics /etiology /prevention & control; Mass Screening /economics; Models, Immunological; Models, Theoretical; Renal Dialysis /adverse effects; Seroepidemiologic Studies; United States

AccessionNumber
22002009510

Date bibliographic record published
31/01/2004

Date abstract record published
31/01/2004