Web interface-supported transmission risk assessment and cost-effectiveness analysis of postdonation screening: a global model applied to Ghana, Thailand, and the Netherlands


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 examined cost-effectiveness of screening for hepatitis C virus (HCV), hepatitis B virus, and human immunodeficiency virus (HIV), in blood donations, using a web interface applicable to country-specific epidemiological settings. HIV and HCV antibody plus antigen tests instead of antibody screening alone were generally cost-effective in countries with young transfusion recipients and a high risk of viral transmission. The cost-effectiveness framework was conventional and the conclusions appear to be robust, despite limited reporting of the data sources.

Type of economic evaluation
Cost-utility analysis

Study objective
This study examined the cost-effectiveness of various blood donation screening strategies for hepatitis C virus (HCV), hepatitis B virus (HBV) and human immunodeficiency virus (HIV), using an easy-to-use web interface applicable to country-specific epidemiological settings and resource availabilities.

Interventions
The following strategies were compared with no screening:

- Antibody screening, which included HIV-antibody, HCV-antibody, and Hepatitis B surface antigen (HBsAg).
- Antibody plus antigen screening, which included HIV-antibody plus protein 24 antigen, HCV-antibody plus antigen, and HBsAg.
- Antibody plus a minipool of 24 donations nucleic acid amplification testing (MP24-NAT) for HBV, HCV, and HIV, which included MP24-NAT, HIV-antibody, HCV-antibody and HBsAg.
- Antibody plus a minipool of six donations nucleic acid amplification testing (MP6-NAT) for HBV, HCV, and HIV, which included MP6-NAT, HIV-antibody, HCV-antibody and HBsAg.
- Antibody plus individual donation nucleic acid amplification testing (NAT) for HBV, HCV, and HIV, which included NAT, HIV-antibody, HCV-antibody and HBsAg.

Location/setting
Ghana (high incidence of disease), Thailand (intermediate incidence of disease), and the Netherlands (low incidence of disease)/hospital.

Methods
Analytical approach:
The analysis was based on a computer simulation with a two-stage Markov model. A lifetime horizon was considered. The authors stated that the analyses took the perspective of the health care system.

Effectiveness data:
The clinical data came from a selection of relevant studies for each of the three countries. In general, country-specific blood banks, national hospitals, and blood supply foundations were used for the data on patient populations, epidemiology, such as incidence and prevalence, and the number of donations per transfusion in each country. The data on disease progression were from published studies. The risk of disease transmission was a key input to the model.

Monetary benefit and utility valuations:
Disability weights were from a published study.

Measure of benefit:
Disability-adjusted life-years (DALYs) were used as the summary benefit measure and were discounted at an annual rate of 3%.

Cost data:
The economic analysis included the costs of screening (tests and reagents) and the costs of transfusion-acquired infections, which included treatment of disease-related complications, such as cirrhosis, hepatocellular carcinoma and liver transplantation, and antiretroviral therapy and standard care for HIV patients. The economic data were mainly from country-specific sources, except for the Netherlands where German data were used. The costs were in US dollars ($), the price year was 2006, and a 3% annual discount rate was applied.

Analysis of uncertainty:
Various sensitivity analyses were carried out using the web interface. The results of varying assumptions on the mean age of blood transfusion recipient, the incidence (or prevalence) of viral markers in donors, and the treatment costs for HBV, HCV and HIV were reported.

Results
All projected costs and benefits were reported for the three countries and all strategies. The criterion for cost-effectiveness was three times the per-capita gross national income (GNI).

**Ghana:** The incremental cost-utility ratios (ICURs) were $608 for antibody plus antigen compared with antibody alone, $1,154 for MP24-NAT compared with antibody plus antigen, $2,468 for MP6-NAT compared with MP24-NAT, and $8,306 for individual NAT compared with MP6-NAT. The GNI per capita was $450 and the ICUR threshold was $1,350.

**Thailand:** The ICURs were $5,765 for antibody plus antigen compared with antibody alone, $12,930 for MP24-NAT compared with antibody plus antigen, $18,836 for MP6-NAT compared with MP24-NAT, and $91,617 for individual NAT compared with MP6-NAT. The GNI per capita was $2,750 and the ICUR threshold was $8,250.

**Netherlands:** The ICURs were $5,819,518 for antibody plus antigen compared with antibody alone, $59,127,509 for MP24-NAT compared with antibody plus antigen, $300,925 for MP6-NAT compared with MP24-NAT, and $60,502,453 for individual NAT compared with MP6-NAT. The GNI per capita was $36,620 and the ICUR threshold was $109,860.

Sensitivity analysis showed that the results were strongly sensitive to changes in the cost of the tests (a test cost reduction of 25% yielded a 65% to more than 90% lower ICURs) and the incidence or prevalence of transfusion-transmissible infection in donors. Other variables had less impact on the cost-effectiveness results, but the mean age of the blood transfusion recipient was important in the Netherlands.

Authors' conclusions
The authors concluded that introducing HIV and HCV antibody and antigen tests instead of antibody screening alone was generally cost-effective in countries with a relatively young transfusion recipient population and with a high risk of viral transmission, such as Ghana or Thailand. The advanced age of the transfused population and a small risk of viral transmission meant that screening was not cost-effective in the Netherlands. Further research was needed to provide reliable local data.
CRD commentary

Interventions:
The rationale for the selection of the comparators was clear. Several available screening strategies were considered and focused on the addition of more sensitive tests.

Effectiveness/benefits:
It appears that the authors selected relevant sources of data, without a systematic review, and relied mainly on country-specific databases. This was a strength of the analysis that aimed to involve local experts and decision makers to obtain up-to-date country-specific data. Provision of more details on these databases and on other studies used to derive other epidemiological inputs would have been useful to assess the quality of the clinical evidence. DALYs were an appropriate benefit measure that captured the burden of disease in terms of survival and disease-related disability. No information on the derivation of disability weights was reported.

Costs:
The cost categories were consistent with the perspective stated. The authors stated that some of the costs of screening (such as labour, training and amortised costs of equipment) were unavailable and thus not included. Unit costs of screening tests were reported, but costs of disease-related conditions were presented as category totals. Local sources were used for most of the cost data and this appears to have been appropriate, but no information on resource consumption was given. Alternative assumptions on costs were considered in the sensitivity analyses.

Analysis and results:
The projected costs and benefits were appropriately reported, with the incremental ratios. The authors adopted a widely accepted criterion for the selection of the most cost-effective strategy. Conventional discounting was applied to both the costs and benefits. The uncertainty was investigated by means of several univariate sensitivity analyses, but only a few results were reported. The three countries were selected appropriately to represent different epidemiological settings that might be generalisable to similar countries worldwide. The model was an excellent user-friendly simulation that could provide easy access for local experts.

Concluding remarks:
The cost-effectiveness framework was conventional and the authors' conclusions appear to be robust. More details on data sources would have improved the validity of the results.

Funding
Supported by a grant from Bio-Rad.

Bibliographic details

PubMedID
19709093

DOI
10.1111/j.1537-2995.2009.02351.x

Original Paper URL

Indexing Status
Subject indexing assigned by NLM

MeSH
Blood Banks /economics /methods; Blood Donors /statistics & numerical data; Blood Transfusion /adverse effects