

Cost-effectiveness of community-based screening and treatment for chronic hepatitis B in The Gambia: an economic modelling analysis

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Summary

Background Despite the high burden of hepatitis B virus (HBV) infection in sub-Saharan Africa, absence of widespread screening and poor access to treatment leads to most people remaining undiagnosed until later stages of disease when prognosis is poor and treatment options are limited. We examined the cost-effectiveness of community-based screening and early treatment with antiviral therapy for HBV in The Gambia.

Methods In this economic evaluation, we combined a decision tree with a Markov state transition model to compare a screen and treat intervention consisting of adult community-based screening using a hepatitis B surface antigen (HBsAg) rapid test and subsequent HBV antiviral therapy versus current practice, in which there is an absence of publicly provided screening or treatment for HBV. We used data from the PROLIFICA study to parameterise epidemiological, primary screening, and cost information, and other model parameter inputs were obtained from a literature search. Outcome measures were cost per disability-adjusted life-year (DALY) averted; cost per life-year saved; and cost per quality-adjusted life-year (QALY) gained. We calculated the incremental cost-effectiveness ratios (ICERs) between current practice and the screen and treat intervention. Costs were assessed from a health provider perspective. Costs (expressed in 2013 US\$) and health outcomes were discounted at 3% per year.

Findings In The Gambia, where the prevalence of HBsAg is 8·8% in people older than 30 years, adult screening and treatment for HBV has an incremental cost-effectiveness ratio (ICER) of \$540 per DALY averted, \$645 per life-year saved, and \$511 per QALY gained, compared with current practice. These ICERs are in line with willingness-to-pay levels of one times the country's gross domestic product per capita (\$487) per DALY averted, and remain robust over a wide range of epidemiological and cost parameter inputs.

Interpretation Adult community-based screening and treatment for HBV in The Gambia is likely to be a cost-effective intervention. Higher cost-effectiveness might be achievable with targeted facility-based screening, price reductions of drugs and diagnostics, and integration of HBV screening with other public health interventions.

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Introduction

An estimated 250 million people worldwide are chronically infected with hepatitis B virus (HBV), which is often asymptomatic during the early stages of disease.¹ If left untreated, about 25% of infected individuals will progress to cirrhosis or hepatocellular carcinoma, for which prognosis is poor. Approximately 1 million people die every year from HBV-related end-stage liver disease; the burden is concentrated in resource-poor settings, including West Africa, where more than 70% of cases of hepatocellular carcinoma in people younger than 50 years are caused by HBV.² Screening, which aims to identify people with asymptomatic infection and offer early intervention with antiviral therapy, could be an important public health measure to prevent HBV-related morbidity and mortality.

International recommendations, including the new WHO guidelines, recommend treatment for chronic HBV infection.³ However, in practice, publicly funded

treatment for HBV mono-infection is not available in sub-Saharan Africa.⁴ Poor infrastructure, high diagnostic and treatment costs, limited community awareness, and absence of trained health-care professionals are just a few of the possible contributing factors that account for this discrepancy. Treatment for chronic HBV infection, without active screening, has been shown to be cost-effective in many settings;^{5,6} however, screening studies have focused on high-risk target groups in high-income countries rather than the general population in highly endemic low-income countries.⁷ The advent of potent antiviral drugs such as tenofovir, now available at generic prices for HIV treatment but effective in the treatment of both HIV and HBV, makes screening and treatment for chronic HBV infection potentially feasible in more low-income and middle-income countries.

To our knowledge, this study is the first economic evaluation of a community screening and treatment

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Research in context

Evidence before this study

We searched PubMed for articles published before September, 2015, with terms incorporating "Hepatitis B", "HBV", or "CHB" and "Cost*" or "Economic" and "Screen*", "Test*", or "Diagnosis". We found no previous studies describing costs or cost-effectiveness of community-based screening for hepatitis B virus (HBV) infection in low-income or middle-income countries. Research in high-income countries included two previous community-based studies of cost-effectiveness of screening, and further studies of screening in groups classified as high risk, including immigrant populations, many of which were based on hypothetical cohorts, rather than real-life screening data.

Added value of this study

To our knowledge, this study is the first to investigate the cost-effectiveness of adult screening and treatment for HBV at the community level in a low-income or middle-income setting.

Furthermore, the study includes real-life cost and effectiveness parameter data from a large-scale screening and treatment programme in The Gambia. The model incorporates clinically salient features and is unique in presenting results using three different outcome measures.

Implications of all the available evidence

Ambitious targets for improving testing and treatment for HBV form part of the recent WHO Global Health Sector Strategy for viral hepatitis. Evidence on how to achieve these targets will be needed to help guide national policies. Screening and treatment for hepatitis B has been shown to be a feasible and cost-effective intervention in The Gambia and should be considered as a public health strategy to reduce mortality and morbidity from cirrhosis and liver cancer. Our study helps to inform such decisions, and highlights the need for further similar analyses in other highly endemic countries.

strategy for chronic HBV infection in a low-income or middle-income setting. It aims to inform decisions on health policy and resource allocation by presenting the possible costs and benefits of improving rates of diagnosis and treatment of people with asymptomatic HBV infection in sub-Saharan Africa, a strategy that has so far had a very limited evidence base.

Methods

Model structure

We developed a decision tree representing the intervention characteristics of screening and treatment and combined this tree with Markov models representing the untreated and treated natural history of chronic HBV infection (appendix). We identified eight mutually exclusive health domains to represent the clinical states of the natural history of chronic HBV infection, in accordance with internationally accepted definitions.⁶⁰ These stages were based on HBeAg status (a serological marker representing high infectivity), HBV viral load, alanine aminotransferase concentration, and degree of liver fibrosis. Transition parameters between health states were obtained from results of a literature review (table 1). The model was created in Tree Age Pro 2014 and was used to simulate disease progression in the cohorts, in annual cycles for a period of 40 years. We used data from the PROLIFICA study to parameterise epidemiological, screening, and cost information, and other model parameter inputs were obtained from a literature search.

Study setting

The multicentre PROLIFICA study assessed the feasibility of a screen and treat HBV intervention programme across the western part of The Gambia (NCT02129829). Study methods are described in detail

elsewhere.⁶¹ The study was approved by The Gambia Government/MRC Joint Ethics committee.

Comparator strategies

In this economic evaluation, we compared the screen and treat intervention versus current practice. Our baseline strategy reflects current practice—specifically, the absence of publicly provided screening or treatment for HBV in The Gambia. Therefore, costs for this strategy reflect those incurred if and when patients present at the later stages of disease because of morbidity from cirrhosis and hepatocellular carcinoma, when patient outcomes are also poorer.

For the screen and treat intervention, community-based screening consisted of initial community sensitisation, door-to-door household registration of eligible participants (aged ≥ 30 years), and testing for hepatitis B surface antigen (HBsAg; a marker of being infected with HBV), by use of a rapid point-of-care test.⁶¹ This part of the intervention was carried out by field workers. Individuals with a positive test result were offered outpatient review for diagnostic assessment including routine blood tests, HBV viral load, screening for co-infection with HIV, hepatitis C virus (HCV), or hepatitis delta virus (HDV), liver ultrasound scan, and transient elastography (FibroScan) for assessment of liver fibrosis. Patients meeting European Association for the Study of the Liver (EASL) criteria⁶⁰ for treatment were prescribed tenofovir monotherapy. Standard monitoring was done in accordance with international guidelines and we assumed lifelong treatment. We assumed that there was no resistance to tenofovir¹³ and that antiviral treatment would halt disease progression (if patients were completely adherent to treatment). However, for individuals with already established cirrhosis, there

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