

The cost-effectiveness of screening for *Helicobacter pylori* to reduce mortality and morbidity from gastric cancer and peptic ulcer disease: a discrete-event simulation model

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Executive summary

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Executive summary

Background

Helicobacter pylori is a Gram-negative bacterium that causes chronic inflammation of the stomach (gastritis). Such infection is a major cause of peptic ulcer disease and gastric cancer.

H. pylori infection fulfils many of the criteria for population screening. It can be detected by a simple test, and eradicated effectively. This speeds peptic ulcer healing and prevents recurrence, but the effect that eradicating *H. pylori* has on the risk of gastric cancer is unknown. Screening may not be cost-effective, given the decline in *H. pylori* prevalence and in gastric cancer, the scope for opportunistic eradication of *H. pylori* and the possibility of antibiotic resistance.

Objective

The objective of the study was to develop a discrete-event simulation model to evaluate the cost-effectiveness of population screening for *H. pylori* in England and Wales to prevent both gastric cancer and peptic ulcer disease.

Method

A model was developed using the ‘patient-oriented simulation technique’. In this model, without screening most *H. pylori*-positive individuals remained asymptomatic, but a proportion developed dyspepsia and presented to primary care where testing and eradication therapy could be given. *H. pylori*-positive individuals were assigned increased risks of developing peptic ulcer disease and gastric cancer. In the screening scenarios, the population was invited to attend screening; those found to be *H. pylori*-positive were offered eradication therapy. The risk of developing peptic ulcer was considered to reduce immediately to that of *H. pylori*-negative individuals. The effect of eradication on gastric cancer risk was modelled by assuming a time lag before such risk reverted to *H. pylori*-negative levels. UK data were used where possible. The decline in gastric cancer incidence was taken into account by age cohort modelling.

Costs were NHS costs based at year 2000 prices. Discounting used base rates of 6% for both costs and benefits. The model was run for an 80-year period for the base case, to allow the impact of screening on gastric cancer risk to accrue. Sensitivity analyses were performed, to explore different scenarios and where there was uncertainty about the estimated values used in the model. Both incident and prevalent screening rounds were modelled, using the population of England and Wales. There were four age-related scenarios: screen all people aged 20–49 as a prevalent round and then 20-year-olds for the next 20 years as an incident round; screen those aged 30–49 as a prevalent round and then 30-year-olds for 30 years as an incident round; screen those aged 40–49 as a prevalent round and then 40-year-olds for 40 years as an incident round, and finally screen all 50-year-olds for 50 years as an incident round.

Results

Population screening would involve screening approximately 25 million individuals if uptake was 70%, with over 5 million people being treated. The number of deaths prevented falls with increasing age at screening, but so does the present value of costs because there would be less prevalent screening and costs are deferred.

In the base case the cost-effectiveness of *H. pylori* screening improves with age and is under £10,000 per life-year saved (LYS) for all age groups, though over an 80-year follow-up. Lowering the discount rate for benefits significantly improves the cost/LYS to under £2000 in all groups. Increasing the time lag for reversion of gastric cancer risk to 20 years or increasing the level of opportunistic eradication reduces the relative advantage for screening. Screening at age 40 might be the most pragmatic policy, balancing cost-effectiveness and the feasibility of screening.

The cost/LYS for the base run at age 40 is £5866 falling to £1027 if the benefit is discounted at 1.5%. Screening by serology is more cost-effective than using the urea breath test. Using a less

efficacious but cheaper eradication regimen is as cost-effective but with fewer deaths prevented. The cost-effectiveness is sensitive to the *H. pylori* prevalence, lag time, relative risk, cohort estimate and compliance. Moreover, cost/LYS rises to over £20,000 if there is a high level of opportunistic eradication of *H. pylori* in patients presenting with dyspepsia and a reduced efficacy of eradication on gastric cancer risk.

The benefits of screening take time to accrue and are very sensitive to the discount rate. At 6% rates the cost-effectiveness does not fall below £20,000 for 30 years.

Conclusion

Population screening for *H. pylori* is likely to be cost-effective with a cost/LYS of under £10,000 for the base assumptions, which compares favourably with other screening programmes. However the benefits take time to accrue and this cost/LYS is over an 80-year follow-up. Once-only screening at age 40 with a prevalent round for people aged 40–49 appears to be the most pragmatic policy. A major uncertainty is the effect of eradication of *H. pylori* on gastric cancer risk. The cost-effectiveness of *H. pylori* screening would be reduced if there were extensive *H. pylori* opportunistic testing of all dyspeptic individuals presenting to primary care.

Policy implications

A national *H. pylori* screening programme of prevalent 40 to 49-year-olds and incident 40-year-olds may be cost-effective. It would significantly reduce the incidence of peptic ulcers and gastric cancer at a relatively low cost to the NHS. However there is some uncertainty over some of the estimates, notably the efficacy of eradication in preventing gastric cancer and complicated ulcer, and concerning antibiotic resistance. A major drawback is the delay before benefits accrue. More evidence is needed before it can be recommended.

Research recommendations

Key issues that could be addressed include:

- The association between *H. pylori*, non-steroidal anti-inflammatory drugs (NSAIDs) and complicated peptic ulcer disease, in order to derive the independent relative risk of complicated ulcer in *H. pylori*-positive individuals compared with those who are *H. pylori*-negative. Case-control studies are needed; these could be undertaken relatively quickly.
- The efficacy of eradication of *H. pylori* on pre-cancerous pathological changes; the results of current trials concerning gastric metaplasia are awaited.
- The cost-effectiveness of a 'test and treat' policy for peptic ulcer disease (a trial funded by the Medical Research Council is currently underway), and the impact of such a policy on opportunistic screening.
- The model could be used to re-evaluate the cost-effectiveness of *H. pylori* screening in the light of updated data on the key parameters. If appropriate, a pilot *H. pylori* screening programme could be evaluated, probably screening all 40 to 49-year-olds as a prevalent round and then all individuals as they reach the age of 40. This would provide information on compliance, eradication and reinfection (in a sample), the impact on peptic ulcer disease and gastric pathology, and the impact of opportunistic testing in the non-screened group.

Finally, the model can be used to evaluate the effects of screening in other populations.

Publication

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NHS R&D HTA Programme

The NHS R&D Health Technology Assessment (HTA) Programme was set up in 1993 to ensure that high-quality research information on the costs, effectiveness and broader impact of health technologies is produced in the most efficient way for those who use, manage and provide care in the NHS.

Initially, six HTA panels (pharmaceuticals, acute sector, primary and community care, diagnostics and imaging, population screening, methodology) helped to set the research priorities for the HTA Programme. However, during the past few years there have been a number of changes in and around NHS R&D, such as the establishment of the National Institute for Clinical Excellence (NICE) and the creation of three new research programmes: Service Delivery and Organisation (SDO); New and Emerging Applications of Technology (NEAT); and the Methodology Programme.

This has meant that the HTA panels can now focus more explicitly on health technologies ('health technologies' are broadly defined to include all interventions used to promote health, prevent and treat disease, and improve rehabilitation and long term care) rather than settings of care. Therefore the panel structure has been redefined and replaced by three new panels: Pharmaceuticals; Therapeutic Procedures (including devices and operations); and Diagnostic Technologies and Screening.

The HTA Programme continues to commission both primary and secondary research. The HTA Commissioning Board, supported by the National Coordinating Centre for Health Technology Assessment (NCCHTA), will consider and advise the Programme Director on the best research projects to pursue in order to address the research priorities identified by the three HTA panels.

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The views expressed in this publication are those of the authors and not necessarily those of the HTA Programme or the Department of Health. The editors wish to emphasise that funding and publication of this research by the NHS should not be taken as implicit support for the recommendations for policy contained herein. In particular, policy options in the area of screening will be considered by the National Screening Committee. This Committee, chaired by the Chief Medical Officer, will take into account the views expressed here, further available evidence and other relevant considerations.

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