Cost-effectiveness of population screening for Helicobacter pylori in preventing gastric cancer and peptic ulcer disease, using simulation

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
The study examined screening for Helicobacter pylori (H. pylori) by serological testing and opportunistic screening of patients with dyspepsia or gastric ulcers by urea breath test in different populations:

- the existing population aged 20 to 49 years and all new 20-year-olds;
- the existing population aged 30 to 49 years and all new 30-year-olds;
- the existing population aged 40 to 49 years and all new 40-year-olds; and
- all new 50-year-olds.

Positive cases were treated with triple therapy with the proton-pump inhibitor (PPI) clarithromycin-metranidazole.

Type of intervention
Screening and treatment

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised the total population of England and Wales, within the age groups specified (see 'Health Technology' section).

Setting
The setting was primary care. The economic study was carried out in England and Wales.

Dates to which data relate
The effectiveness data were modelled from papers published between 1993 and 1997. The resource use information was derived from sources published between 1998 and 2000. The price year was 2000.

Source of effectiveness data
The effectiveness data were mainly derived from a review of completed studies, with the authors making assumptions about additional items.

Modelling
A patient-oriented simulation technique was used to determine the clinical and cost implications of the screening
strategy.

**Outcomes assessed in the review**
The following model parameters were identified by the review:

- the H. pylori prevalence rates;
- the relative risk of a peptic ulcer if H. pylori positive;
- the relative risk of gastric cancer if H. pylori positive;
- the sensitivity and specificity of population serological testing and urea breath testing for H. pylori; and
- the efficacy of treating H. pylori with triple therapy with the PPI clarithromycin-metranidazole.

**Study designs and other criteria for inclusion in the review**
The authors indicated that the data were taken from observational studies. No further details of the inclusion and exclusion criteria were provided.

**Sources searched to identify primary studies**
The authors searched MEDLINE and the Cochrane Library, the bibliographies of retrieved papers, and routine data. They also contacted experts in the field.

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

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

**Number of primary studies included**
The model parameters were identified from eight published studies.

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

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

**Results of the review**
The model parameters identified from the review were as follows:

- the relative risk of a peptic ulcer if H. pylori positive was 3;
- the relative risk of gastric cancer if H. pylori positive was 3;
- population serological testing for H. pylori had a sensitivity of 95% and a specificity of 90%;
urea breath testing for H. pylori had a sensitivity of 98% and a specificity of 96%;
the efficacy of treating H. pylori with triple therapy with the PPI clarithromycin-metranidazole was 90%;
the prevalence of H. pylori was 32% in men aged 40 - 44 years and 27% in women aged 40 - 44 years;
the prevalence of H. pylori was 37% in men aged 45 - 49 years and 32% in women aged 45 - 49 years.

Methods used to derive estimates of effectiveness
The authors appear to have made assumptions about several model input parameters.

Estimates of effectiveness and key assumptions
The authors assumed that there would be a 10-year time lag for previously H. pylori positive individuals to reduce their
risk of gastric cancer to that of H. pylori negative persons. They also assumed that compliance with population
screening would be 70% and treatment compliance would be 80% in this group. It was also assumed that screening and
treatment compliance was 100% amongst patients with dyspepsia or gastric ulcers.

Measure of benefits used in the economic analysis
The measure of health benefit used was the life-years saved. This was derived from the model that utilised the clinical
effectiveness data, described above. However, the paper only included this information for the screening of the existing
population aged 40 to 49 years and all new 40-year-olds.

Direct costs
The costs of the health care payer (NHS) were identified in this analysis. These included the costs of inviting people to
screening, the costs of screening and treatment, and the costs saved from ulcer and cancer cases averted. The estimates
of resource use were modelled. The unit costs appear to have been taken from published papers. The unit costs were
detailed in the paper, but no clear information on resource use was reported. The price year was 2000 and future costs
were discounted at a rate of 6% per annum.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
No indirect costs were included in this study.

Currency
UK pounds sterling (￡).

Sensitivity analysis
A factorial sensitivity analysis was undertaken to assess variability in the data. The paper reported the ranges used in
this analysis, but there was no indication of how they were obtained.

Estimated benefits used in the economic analysis
The study estimated that the implementation of the screening of existing 40- to 49-year-olds and new 40-year-olds
would prevent 16,263 deaths. Screening 50-year-olds would prevent 13,156 deaths, screening 30- to 49-year-olds would
prevent 17,360 deaths, and screening 20- to 49-year-olds would prevent 17,440 deaths.
Cost results
The total discounted cost, including averted costs associated with gastric cancer and peptic ulcer disease up to the age of 75 years, in the first year of the screening programme were:

for the existing population aged 20 to 49 years and all new 20-year-olds, 354.9 million;
for the existing population aged 30 to 49 years and all new 30-year-olds, 279.3 million;
for the existing population aged 40 to 49 years and all new 40-year-olds, 197.7 million; and
for all new 50-year-olds, 117.4 million.

Synthesis of costs and benefits
The paper reported that screening existing 40- to 49-year-olds and new 40-year-olds would result in a cost per life-year saved of 5,866 in comparison with no screening programme. Details of the cost per life-year saved with the other screening options were not provided in the paper; they were only indicated in a diagram.

The sensitivity analysis indicated that increasing the age of the screening population, increasing the risk of peptic ulcers and gastric cancer amongst people with H. pylori, and increasing the H. pylori prevalence decreased the cost-effectiveness of screening. Lowering the prevalence of H. pylori, increasing the opportunistic eradication and lag, and altering the cancer and peptic ulcer disease outcomes increased the cost-effectiveness of screening to more than 10,000.

Authors' conclusions
Screening for Helicobacter pylori (H. pylori) at the age of 40 years was a cost-effective intervention.

CRD COMMENTARY - Selection of comparators
The authors investigated the cost-effectiveness of screening across different populations and treatment regimens with no screening. You should consider how this relates to current practice in your own setting.

Validity of estimate of measure of effectiveness
The clinical model parameters were derived from different sources, including a review of the literature. The authors did not indicate that a systematic review was undertaken to identify studies, but they did identify the sources searched. It is therefore possible that the search strategy adopted might have been biased. The methods used to extract and combine the data from the primary studies were not reported.

Validity of estimate of measure of benefit
The measure of health benefit used in the economic analysis was the life-years saved. This was taken from the model that provided the clinical effectiveness evidence.

Validity of estimate of costs
All the appropriate costs that would be incurred by the health care payer (NHS) appear to have been included in this analysis. The paper reported the unit costs but not resource use, which will make it difficult to directly recalculate the results of this study for other settings. The costs were appropriately discounted and a clear price year was reported. This assists the generalisability of the study and makes future reflation exercises possible. The generalisability of this study is also aided by the fact that a comprehensive sensitivity analysis, which considered variability in the data, was undertaken.
Other issues
The authors did not present their findings in a clear and comprehensive manner, possibly due to the large amount of data produced by the study. The average cost-effectiveness ratios were not reported. The authors' conclusions were not based on an incremental cost-effectiveness analysis, which was the appropriate analysis to undertake. They compared their results with a similar study and compared their cost-effectiveness result with other screening programmes. The authors accepted the fact that their analysis was limited by uncertainty over the data used.

Implications of the study
The authors called for further research to address uncertainty around the impact of eradication of H. pylori on the risk of developing gastric cancer and the risk associated with complicated peptic ulcers.

Source of funding
Funded by the National Research and Development Health Technology Assessment Programme.

Bibliographic details

PubMedID
14561268

DOI
10.1258/096914103769011067

Indexing Status
Subject indexing assigned by NLM

MeSH
Adult; Cohort Studies; Computer Simulation; Cost-Benefit Analysis; England /epidemiology; Female; Helicobacter Infections /complications /diagnosis /economics; Helicobacter pylori /isolation & purification; Humans; Male; Mass Screening /economics; Middle Aged; Models, Statistical; Peptic Ulcer /economics /microbiology /prevention & control; Stomach Neoplasms /economics /microbiology /prevention & control; Wales /epidemiology

AccessionNumber
22003001317

Date bibliographic record published
31/01/2006

Date abstract record published
31/01/2006