Optimal resource allocation for curing Chlamydia trachomatis infection among asymptomatic women at clinics operating on a fixed budget

Tao G, Gift T L, Walsh C M, Irwin K L, Kassler W J

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
Strategies for the screening and treatment of Chlamydia trachomatis (C. trachomatis) were examined. Screening was performed using a DNA probe assay (Pace2, Gen-Probe) or a ligase chain reaction (LCR) test (LCx LCR, Abbott Laboratories). Patients with a positive test with treated with either doxycycline or azithromycin.

Type of intervention
Screening and treatment.

Economic study type
Cost-effectiveness analysis and cost-benefit analysis.

Study population
The study population comprised women attending a family planning clinic without symptoms of C. trachomatis. The three age groups considered were younger than 20 years old, age 20 to 24 years, and older than 24 years.

Setting
The setting was primary care. The economic study was carried out in Atlanta (GA), USA.

Dates to which data relate
The effectiveness data were taken from studies published between 1991 and 2000. The resource data were taken from papers published between 1993 and 2000. The price year was unclear.

Source of effectiveness data
The effectiveness data were derived from a review or synthesis of completed studies.

Modelling
A resource allocation model was used to determine the optimal combination of screening coverage, test selection, and treatment for controlling C. trachomatis in asymptomatic women attending a family planning clinic with a fixed budget. The model was based on a binary integer linear programming method.

From the clinic perspective, the optimal strategy was defined as the strategy that maximised the number of women with C. trachomatis infection who were cured with any given control budget. From the health care system perspective, the optimal strategy was defined as that which maximised the cost-saving value with any given C. trachomatis control budget.
Outcomes assessed in the review
The following model parameters were derived from the literature:

the number of clinic visits,

the prevalence of C. trachomatis in each age group,

the sensitivity and specificity of the DNA probe and LCR tests, and

the effectiveness of doxycycline and azithromycin.

Study designs and other criteria for inclusion in the review
The paper did not report the criteria applied to the studies used to identify model parameters.

The age distribution and the age-specific prevalence of C. trachomatis infection were not derived from a review of the literature. Instead, they were derived using data from 5,078 annual visits by women universally screened in a publicly funded family planning clinic system in Philadelphia (Dicker et al., see Other Publications of Related Interest).

Sources searched to identify primary studies
The sources used to identify the primary studies were not listed.

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
Five studies provided the clinical and epidemiological parameters used in the model.

Methods of combining primary studies
Not reported.

Investigation of differences between primary studies
Not reported.

Results of the review
The number of clinic visits per year was 1,378 for women younger than 20 years, 1,548 for women aged 20 to 24 years, and 2,152 for women older than 24 years.

The prevalence of C. trachomatis was 0.106 amongst women younger than 20 years, 0.069 amongst women aged 20 to 24 years, and 0.023 amongst women older than 24 years.

The sensitivity of the DNA probe was 0.628 and the specificity was 0.998.

The sensitivity of the LCR test was 0.927 and the specificity was 0.999.

The effectiveness of doxycycline was 0.900.
The effectiveness of azithromycin was 0.965.

**Methods used to derive estimates of effectiveness**
The authors made assumptions about the total budget for the screening and treatment of C. trachomatis per visit to the family planning clinic and the prevalence of C. trachomatis infection.

**Estimates of effectiveness and key assumptions**
The authors assumed that there was a budget of $6 per woman per visit. The authors used the positive rate with LCR in the Philadelphia-funded family programme (6%) as the prevalence of C. trachomatis infection.

**Measure of benefits used in the economic analysis**
The measures of benefits used were the number of women cured of C. trachomatis and the monetary benefit of the screening and treatment options.

**Direct costs**
This study considered the costs of the family planning clinic. These comprised the costs of performing the screening test, treatment and complications arising from uncured C. trachomatis. Resource use was estimated using the study model. The cost data were taken from published sources. The unit costs of the tests and treatments were reported. Discounting was not undertaken, but this was appropriate as the timeframe was one year. The cost data were taken from papers published between 1993 and 2000, but the costs do not appear to have been reflated to a single year. Estimates of resource use were derived from data published between 1991 and 2000. The price year was unclear.

**Statistical analysis of costs**
The cost data were treated deterministically.

**Indirect Costs**
No indirect costs were included in the analysis.

**Currency**
US dollars ($).

**Sensitivity analysis**
A multi-level sensitivity analysis was undertaken to assess the robustness of the study findings and the generalisability of its results. The ranges of sensitivity, specificity and effectiveness data were reported. However, a justification for the ranges used was not provided. To assess the generalisability of the results, data from Oregon and Washington on the age distribution of women attending a family planning clinic and the prevalence of C. trachomatis were substituted into the model.

**Estimated benefits used in the economic analysis**
The number of women cured varied between 83 and 270 according to the screening coverage, the test selected and the treatment. For example:

- if all women attending the family planning clinic were screened using the DNA test, and women with a positive test were treated with azithromycin, 183 women would be cured;
- if women younger than 20 years were screened using the DNA test, and women with a positive test were treated with
doxycycline, 83 women would be cured;

if all women attending the family planning clinic were screened using the LCR test, and women with a positive test were treated with azithromycin, 270 women would be cured.

**Cost results**
The total costs varied between $6,315 and $63,645 according to the screening coverage, the test selected and the treatment. For example:

if all women attending the family planning clinic were screened using the DNA test, and women with a positive test were treated with azithromycin, the total cost was $24,746 or $4.90 per visit;

if women younger than 20 years were screened using the DNA test, and women with a positive test were treated with doxycycline, the total cost was $6,315 or $1.20 per visit;

if all women attending the family planning clinic were screened using the LCR test, and women with a positive test were treated with azithromycin, the total cost was $63,645 or $12.50 per visit.

**Synthesis of costs and benefits**
The cost-savings varied between $67,988 and $179,799 according to the screening coverage, the test selected and the treatment.

For example, screening all women with the DNA test and treating all women with a positive test with azithromycin resulted in a cost-saving of $140,176 per year. This strategy was the optimal one for a fixed budget of $6 per visit.

Under a budget of less than $12.40 per visit, the optimal strategy was screening all females younger than 25 years with the LCR test and treating those who tested positive with azithromycin. This resulted in cost-savings of $166,229.

The sensitivity analysis showed that the variation in the costs of the two tests had a clear impact on the optimal strategy. When the cost of the DNA test increased from $4.50 to $5.70, the optimum strategy was screening all women with the DNA test, but treating positive cases with doxycycline. If the cost of the LCR test was reduced from $12.00 to $10.20, the optimum strategy involved only screening women younger than 25 years with the LCR test, and treating all positive tests with doxycycline. The cost of complications from uncured C. trachomatis and the different populations did not alter the optimal strategy.

**Authors' conclusions**
The optimal strategy for Chlamydia trachomatis (C. trachomatis) screening coverage, test selection and treatment selection varied greatly as fixed budget levels changed. Given a budget of $6 per clinic visit, the most cost-effective strategy was to screen all women using the DNA test and treat positive cases with azithromycin.

**CRD COMMENTARY - Selection of comparators**
This study did not have an explicit comparator. You should consider how the different screening and treatment options considered in this study relate to your own setting.

**Validity of estimate of measure of effectiveness**
The estimates of effectiveness were taken from published studies. A systematic review was not undertaken to identify studies to inform the model parameters, and the main parameters were derived from a single study. Although the sensitivity and specificity of the LCR test were not equal to 1 (false positives and false negatives may occur), the authors used the positive rate as the prevalence for C. trachomatis. No justification for this was provided. Nevertheless, all the model parameters were varied in a sensitivity analysis. This enhances the validity of the results.
Validity of estimate of measure of benefit
The number of cases of C. trachomatis cured and the future health care costs saved were used as the measures of benefits. These data were taken from the study model and were appropriately assessed.

Validity of estimate of costs
The perspective of a health care provider was adopted in the analysis. The costs of testing, treatment and the consequences of uncured cases were assessed. The authors admitted that the costs or savings arising from prevented disease transmission, the side effects of treatment, and the potential costs of counselling should also have been assessed. The unit costs and resource use were reported separately. This increases the potential to apply the findings of this study to other settings. The resource use data were modelled and appropriate sensitivity analyses were undertaken. The fact that the data was subject to a sensitivity analysis increases the robustness of the findings and their generalisability. No clear price year was used in the study. The cost data were taken from a paper published over a period of 6 years, which does not appear to have been synchronised to a single year. This introduces a degree of confusion into the study. No discounting was undertaken, but this was appropriate as the timeframe was one year.

Other issues
The authors did not compare their findings with other published studies. They also did not directly consider the generalisability to other settings. The authors appear to have presented their data comprehensively and their conclusions reflected the analysis.

Implications of the study
The authors did not make any recommendations for changing practice. They called for further work to extend the model to involve more sexually transmitted diseases.

Source of funding
None stated.

Bibliographic details

PubMedID
12438908

Other publications of related interest

Indexing Status
Subject indexing assigned by NLM

MeSH
Ambulatory Care Facilities; Budgets /organization & administration; Chlamydia Infections /economics; Chlamydia trachomatis /isolation & purification; Cost-Benefit Analysis; Family Planning Services; Female; Health Resources /organization & administration; Humans; Ligase Chain Reaction; Mass Screening; Pregnancy; Pregnancy Complications, Infectious /economics; Resource Allocation /organization & administration; United States

AccessionNumber