Systematic screening for Chlamydia trachomatis: estimating cost-effectiveness using dynamic modeling and Dutch data

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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 evaluated a one-off systematic Chlamydia trachomatis (CT) screening programme that screened for chlamydial deoxyribonucleic acid using the polymerase chain reaction (PCR) method. The screening programme included partner treatment when required and was compared with no screening.

Type of intervention
Screening and treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The population comprised a hypothetical population of 100,000 with a 1:1 gender ratio, uniform age distribution between 15 and 29 years, and a 2% baseline prevalence of CT. The population was split into four cohorts according to gender and number of sexual partners.

Setting
The setting was primary care. The economic study was carried out in the Netherlands.

Dates to which data relate
The clinical data were derived from studies published between 1980 and 2005. The cost data were derived from a published in 2001. The price year was 2002.

Source of effectiveness data
The clinical parameters used in the epidemiologic model were:

the average number of individuals per half year;

the transmission probability of CT without condom use, depending on the number of partners;

the proportion of symptomatic infections in males and females;

the recovery rate; and

the influx and efflux rates.

The clinical parameters of the decision model included:
the probability of developing pelvic inflammatory disease (PID) and chronic pelvic pain (CPP);

the probability of vertical transmission resulting in neonatal conjunctivitis and pneumonia, CPP and PID, and ectopic pregnancies;

the overall birth rates; and

the birth rates of first children.

In addition, output from the epidemiological model (incidence and prevalence with and without screening) was also used.

**Modelling**
The economic model was based on a static model developed by Postma et al. (2001, see 'Other Publications of Related Interest' below for bibliographic details), which was modified to represent a dynamic model. A dynamic epidemiological model, namely a dynamic Susceptible-Infected-Susceptible model, was used to estimate the incidence and prevalence of CT in the population. These data were then fed into the economic model. Details of the models were presented in full.

**Sources searched to identify primary studies**
The epidemiological and clinical effectiveness data were mainly derived from the literature and the pilot study (Van Bergen et al. 2005, see ,Other Publications of Related Interest- below for bibliographic details) undertaken in the Netherlands. The study designs were not discussed, thus it is not possible to make an objective assessment of the validity of the estimates used.

**Methods used to judge relevance and validity, and for extracting data**
The process used to identify the data was not reported. No inclusion criteria for any of the parameters were specified. The method used to select the estimates was neither reported, nor discussed.

**Measure of benefits used in the economic analysis**
The measures of benefit were the major outcomes averted (MOA) and the cases of PID averted. Outcomes characterised as major were symptomatic PID, chronic pelvic pain, ectopic pregnancy, infertility or neonatal pneumonia. These were aggregated into a single figure which was presented as a summary measure. PID cases were also presented separately as PID was reported to be conditional for some of the other outcomes. The benefits were discounted at an annual rate of 4%.

**Direct costs**
The analysis included the direct medical costs attributed to CT complications. Specifically, inpatient and outpatient treatment of symptomatic PID, CPP, ectopic pregnancy and epididymitis neonatal pneumonia, male urethritis and cervicitis, and inpatient and outpatient costs of infertility investigation, in vitro fertilisation (IVF), and neonatal conjunctivitis. For each category of costs, summary average costs per patient were reported. Screening programme costs included the cost of implementation, package sent to individuals, PCR test, sending a reminder and the results, general practitioner visits for those with a positive test result, treatment with azithromycin for a positive test result, and prescription fee for those positively screened. The cost data were derived from a published study and were adjusted for inflation and reported for the price year 2002. The costs were discounted at an annual rate of 4%.

**Statistical analysis of costs**
The cost data were treated deterministically.
Indirect Costs
Average productivity losses per patient due to CT complications were reported for all categories of complications reported in the Direct Costs section (above). Productivity losses were reported separately for two age groups (15 to 24 years and 24 to 29 years). As the time horizon was 10 years, the costs were discounted at a rate of 4%. The price year was 2002.

Currency
Euros (EUR).

Sensitivity analysis
Parameter uncertainty was investigated using one-way sensitivity analyses. The parameters investigated and the ranges, which were derived from published literature, were reported. The impact of regular partner treatment and related rate of asymptomatic infections on the results (not accounted for at baseline) was also investigated. Model uncertainty was also investigated for several scenarios. Specifically, the screening of women alone, the omission of partner treatment, the exclusion of reminder sending, and the provision of treatment to 56% of partners (of those, 85% were current partners and 15% ex-partners) and 68% of partners (95% of current and 5% of ex-partners) of male and female index cases, respectively.

Estimated benefits used in the economic analysis
Over a 10-year period, the number of discounted major outcomes and cases of PID averted from screening a cohort of 100,000 were 752 and 1,024 cases, respectively.

Over a 10-year period, the number of discounted major outcomes and cases of PID averted from no screening were 1,217 and 1,658 cases, respectively.

Cost results
For a cohort of 100,000 patients, the discounted costs over a 10-year period were EUR 2,927,528 for the screening strategy and EUR 2,754,059 for the no screening strategy.

Synthesis of costs and benefits
An incremental analysis was performed. This demonstrated that the screening strategy resulted in an incremental cost of EUR 274 per PID averted and EUR 373 per MOA.

The sensitivity analyses demonstrated that the results were most sensitive to changes in PID progression rate, the recovery rate, and the exclusion of production costs from the analysis. Partner treatment and sending a reminder improved the cost-effectiveness of the treatment programme, resulting in an incremental cost of EUR 158 per MOA averted and EUR 116 per case of PID averted. Not sending a reminder resulted in an incremental cost of EUR 748 per MOA averted and EUR 549 per PID averted. Restricting screening only to the female population resulted in cost-savings compared with no screening.

Authors' conclusions
The screening programme resulted in an extra cost of EUR 373 per major outcome prevented. However, targeting screening only at the female population between the age of 15 and 29 years resulted in cost-savings and was strongly endorsed by the authors.

CRD COMMENTARY - Selection of comparators
The study investigated the cost-effectiveness of a screening programme. Therefore, in order to allow its impact to be clearly evaluated, the choice of no screening as the comparator was justified. In addition, the comparator represented...
current practice in many health care systems, including the National Health Service in the UK.

**Validity of estimate of measure of effectiveness**
The authors do not appear to have undertaken a systematic review of the literature. The data used seem to have been those that the authors considered the most relevant. Whilst this is a common approach in economic modelling, it does not ensure that the best available evidence has been identified and used. Since the estimates were derived from more than one source it is likely that some form of synthesis was required, but no details of any such synthesis were reported. The authors stated that their results were sensitive to the model parameters chosen, and that there was uncertainty about some parameters.

**Validity of estimate of measure of benefit**
The measures of benefit were the MOA and cases of PID averted. These were derived directly from the model. Justification was provided for the aggregation of what were considered the major outcomes into a single figure. Some of the disaggregated results were also presented. The benefits were discounted at an annual rate of 4%. Discount rates were thoroughly investigated in the sensitivity analyses and do not seem to have an impact on the results.

**Validity of estimate of costs**
The authors stated that they had adopted a societal perspective and productivity losses were included. However, the patients' out-of-pocket payments were not accounted for in the analysis, although in this instance they might have been negligible. The authors reported summary average costs per patient for each cost category, thus it is uncertain whether all the relevant costs were included in the analysis (e.g. medication costs for IVF). As access to IVF treatment varies between settings, the inclusion of its costs should be treated with caution. The cost data were taken from a published study and were treated deterministically. Comprehensive sensitivity analyses of the costs were not performed, although the costs of the PCR test were analysed to assess the robustness of the estimate used. In terms of productivity losses, the costs and the quantities were not reported separately and the sources of the costs were not reported at all; these factors will not enable the analysis to be easily reworked for other settings.

**Other issues**
The authors did not compare their cost-effectiveness results with those reported in other published studies. However, it was not clear whether this was due to an absence of relevant published literature. The issue of the generalisability of the results to other settings was not directly addressed. The authors do not appear to have presented their results selectively and their conclusions reflect the scope of the analysis. The authors acknowledged a number of limitations to their study, mainly arising from the uncertainty surrounding the parameter estimates. The model assumed uniform age and gender distribution in the population with no migration, a stable steady-state prevalence over time, and a comparable prevalence between those who participate in screening and those who do not. All these assumptions facilitated the model structure, but do not reflect reality. In addition, owing to the lack of adequate data, the construction of a network model, which would have been a more accurate reflection of reality, could not be attained.

**Implications of the study**
From a pharmacoeconomic point of view, the authors recommended the adoption of a screening programme addressed solely at the female population. However, they acknowledged that further parameters (e.g. ethical, budgetary and organisational) should be accounted for in decision making. Although, the authors did not provide explicit recommendations for further research, the discussion highlighted areas where more research-based information is necessary.

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**Bibliographic details**

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Subject indexing assigned by NLM

MeSH
Adult; Age Factors; Chlamydia Infections /diagnosis /economics /physiopathology; Chlamydia trachomatis /isolation & purification; Cost-Benefit Analysis; Disease Progression; Female; Health Care Costs; Humans; Male; Mass Screening /economics; Models, Econometric; Netherlands; Pilot Projects; Prevalence; Quality-Adjusted Life Years; Sexual Partners

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