Should asymptomatic patients be tested for *Chlamydia trachomatis* in general practice?

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SUMMARY. Routine testing for Chlamydia trachomatis *during gynaecological examinations has been suggested as a preventive measure against pelvic inflammatory disease and other health risks associated with chlamydial genital infections. This study examined the cost and effectiveness of routine testing for* C trachomatis *in general practice. An epidemiological model was used to predict how routine testing and treatment of positive cases would affect the future number of cases of pelvic inflammatory disease, infertility and ectopic pregnancy in a general practice population. The cost of routine test and treatment, and savings resulting from prevented future morbidity, were also estimated. For the population under study, a routine test for chlamydial infections in asymptomatic, 18–24 year old women during gynaecological examinations was found to be cost effective but this was not the case for older women. At least two years should elapse between repeated tests.*

Introduction

CHLAMYDIA TRACHOMATIS is one of the most common pathogens transmitted by sexual intercourse,[1] and a major causative agent in cervicitis, urethritis and pelvic inflammatory disease.[1-3] In turn, pelvic inflammatory disease increases the risk of ectopic pregnancy, infertility and chronic pelvic pain.[4,5]

Chlamydial infections are often asymptomatic and, therefore, screening of sexually active women has been suggested as a preventive measure against pelvic inflammatory disease and the other health problems associated with chlamydial infections. However, mass screening is impractical owing to the high cost of tests. Routine testing during appointments for family planning or gynaecological problems has been suggested as a more cost effective alternative, and the results of routine testing are reported by several authors.[6-10]

In previous studies the cost effectiveness of testing for *C trachomatis* in pregnant women[11] and during gynaecological outpatient visits[12] has been analysed. In this study, the cost effectiveness of testing for *C trachomatis* in asymptomatic patients during gynaecological examinations in general practice is considered.

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Method

Routine testing for C trachomatis

Specimens are collected from asymptomatic women during gynaecological examinations and forwarded to a laboratory for culture. The patients are informed of the outcome of the test by post one week after the test. Patients with positive test results receive a prescription for lymecyclin for seven days, including treatment for their partner.

It was assumed that test sensitivity and specificity were 75% and 100% respectively, that 95% of patients with positive test results complied with prescribed treatment, and that 90% of those treated were cured.[13,14]

The test has no known side effects, and the side effects of treatment are not serious.[13] Side effects and the costs associated with side effects can therefore be ignored. The test and treatment are described in more detail elsewhere.[10]

Epidemiological model

The consequences of routine testing were assessed by means of a computer based epidemiological model of chlamydial infections and their sequelae.[12] The model simulates future cases of chlamydial infection and pelvic inflammatory disease in two groups: patients with asymptomatic infections remaining untested, and asymptomatic patients being tested and receiving treatment where necessary. The effectiveness of routine testing is the difference in morbidity between these two groups.

The model is based on what is known about the incidence and progress of chlamydial infections and their sequelae. Based on a Swedish follow up study of 103 asymptomatic, chlamydia infected teenagers,[15] the average duration of chlamydial infections is estimated to be 52 weeks. From the same material, the probability, q, that an asymptomatic, chlamydia infected woman will develop pelvic inflammatory disease, was estimated to be 0.2 (95% confidence interval 0.06–0.44).

Infertility and ectopic pregnancy are secondary to pelvic inflammatory disease and are not direct consequences of the chlamydial infection. On the basis of published data,[4,5] it is commonly assumed that 20% of all cases of pelvic inflammatory disease cause infertility, of which 50% are subject to infertility evaluation and management, and that 2.5% of all pelvic inflammatory disease cases cause an ectopic pregnancy.[8,9,16] In this study, these estimates were used as averages for 15–35 year old patients with pelvic inflammatory disease. In the model, the risk of an infertility problem or an ectopic pregnancy varied with the age of the patient according to the average number of childbirths among women of that age.[17]

For patients of a given age with pelvic inflammatory disease, the time delay to an ectopic pregnancy is distributed according to the average length of time to the next childbirth among women of that age. The time delay to an infertility problem was derived in a similar manner. It was assumed, however, that infertility evaluation is delayed by one extra year, and, if the patient is less than 25 years old, until that age has been reached.

The computations of age specific risks and time delay distributions were based on age specific birth rates published by the Central Bureau of Statistics of Norway.[17]

Patient population

The risk of chlamydia infection depends on cultural and behavioural factors, and the incidence of these infections in a general practice population is likely to vary from one place to another. Therefore, estimates of incidence rates must be based on local data.

The estimates in this study were based on a previous study of *C trachomatis* among 489 unselected, under 35 year old, asymptomatic women, having a gynaecological examination in a general practice clinic in Trondheim in the period May 1985 to February 1987.[10] The average incidence rate is estimated to be 8.4% per year. It is highest among young patients, and decreases with age at a rate of 13% per year.

Cost estimates

The cost of routine testing includes the cost of the test and the cost of treating positive cases. This is offset by future savings from prevented cases of pelvic inflammatory disease, infertility and ectopic pregnancies. The cost estimates presented here are based on costs at the general practice clinic and the University Hospital in Trondheim in 1987.

The cost of each test was estimated to be Nkr 107 (£10) and this includes the labour and materials involved in collecting the test specimen, transportation to the laboratory, culture and informing the patient by post. The cost of drug treatment for the patient and her partner was estimated to be Nkr 175 (£16).

The total cost of an episode of pelvic inflammatory disease includes hospital outpatient and inpatient care, the patient's travelling expenses and the patient's loss of productive output. The expected costs of infertility management and ectopic pregnancies are included in this total cost. The costs of pelvic inflammatory disease, ectopic pregnancy and infertility management were adjusted for the time at which the routine test was carried out, using a discount rate of 5% per year.

Hospital inpatient costs per case of pelvic inflammatory disease, infertility management and ectopic pregnancy were estimated to be Nkr 8200, Nkr 19 600 and Nkr 11 200 (£750, £1780 and £1020), respectively. These estimates were based on a daily rate, and adjusted for surgery. Associated outpatient costs were estimated to be Nkr 350, Nkr 700 and Nkr 350 (£32, £64, £32), respectively. Seventy five per cent of cases of pelvic inflammatory disease are treated on an outpatient basis, and the cost estimate for outpatient treatment was Nkr 1500 (£136), assuming three visits. This estimate included the price of consultation, laboratory tests, drugs and patient travel.

The value of lost productive output as a result of pelvic inflammatory disease, infertility and ectopic pregnancies was estimated on the basis of average sick leave periods, which were assumed to be two, seven and four weeks, respectively. Average weekly earnings by age were derived from national statistics.[17] The average loss per week for students, housewives and employed persons of a given age was assumed to be equal to the average weekly earnings of employed women of that age.

The total discounted cost of an episode of pelvic inflammatory disease is age dependent: Nkr 9719 (£884) for 16 year old patients, increasing to a maximum of Nkr 11 037 (£1003) at the age of 24 years, and decreasing to Nkr 9105 (£828) at the age of 34 years. The cost of health care alone was Nkr 4975, Nkr 4765 and Nkr 3369 (£452, £433 and £306), respectively.

Results

Table 1 shows the observed prevalence of chlamydia positive cases in the patient population, and the corresponding rates predicted by the epidemiological model. The chi-square test shows a reasonable goodness of fit ($P > 0.25$).

Table 1. Predicted and observed percentages of patients with chlamydia positive cultures by age.

Age (years)	Number of patients	Percentage of patients with positive cultures	
		Predicted	Observed
15–19	41	*13.4*	*12.2*
20–24	214	*11.4*	*11.7*
25–29	167	*6.5*	*6.6*
30–34	67	*3.5*	*0.0*

Figure 1 illustrates the impact of routine testing. The curves are based on model predictions, and show the cumulative number of cases of pelvic inflammatory disease in two populations of 1000 asymptomatic women, one of which was subject to routine testing at age 20 years. The vertical distance between the two curves represents the number of cases of pelvic inflammatory disease prevented by routine testing and this approaches a constant value, which is equal to the long term preventive effect of routine testing.

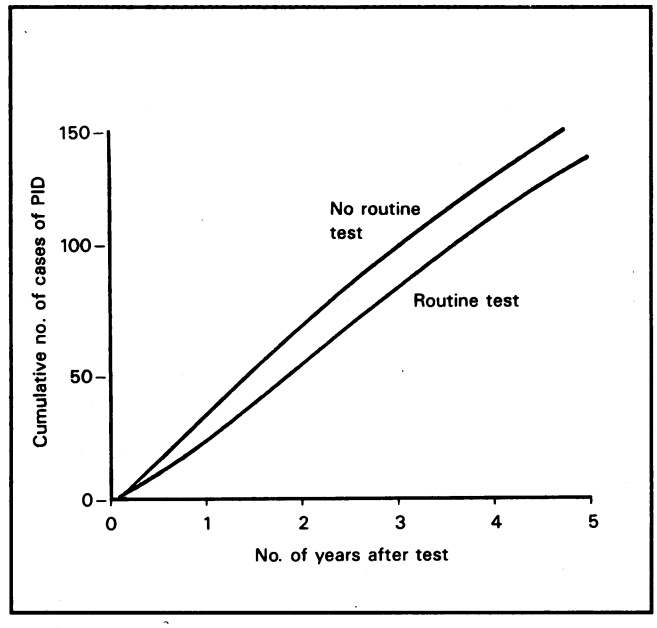

Figure 1. *The effect of routine testing. Cumulative number of cases of pelvic inflammatory disease (PID) in a population of 1000 patients, tested at the age of 20 years, compared with that of a non-tested population of 1000 patients.*

The effectiveness of routine testing depends on the age of the patient. Table 2 shows the preventive effect of routine testing by patient age, expressed as the number of cases of pelvic inflammatory disease, infertility evaluation and management, and ectopic pregnancy prevented by testing 1000 asymptomatic patients.

To obtain the results in Table 2 it is assumed that patients have not been tested for chlamydia for a long time. The model predicts the effect of a repeated test after six months to be 65% of the full effect shown in Table 2, and 79%, 92% and 97% of the full effect after one, two and three years, respectively.

The results in Table 2 apply to a population with a prevalence of positive cases as shown in Table 1. Further approximate estimates can be derived from Table 2 using the fact that the number of prevented cases is roughly proportional to the prevalence.

Table 2. Number of cases of pelvic inflammatory disease, infertility evaluation and management, and ectopic pregnancy prevented by routine testing of 1000 patients by age.

Age (years)	No. of prevented cases of: Pelvic inflammatory disease	Infertility evaluation and management	Ectopic pregnancy
16	12.6	1.76	0.44
18	18.1	2.53	0.63
20	17.3	2.25	0.56
22	17.2	1.89	0.47
24	14.3	1.29	0.32
26	11.6	0.81	0.20
28	9.2	0.46	0.12
30	7.3	0.22	0.05
32	5.7	0.11	0.03
34	4.4	0.04	0.01

The major source of uncertainty in the results is *q*, the probability that asymptomatic, chlamydia infected patients will develop pelvic inflammatory disease. The number of prevented cases varies in direct proportion to *q*. Based on the 95% confidence interval (0.06–0.44), the high estimates of prevented cases will be about twice the estimates in Table 2, and the low estimates about one third of the estimates.

Cost estimates are presented in Table 3. The difference between the total and net costs represents the savings. The net cost is negative for 18–24 year old patients. The net cost per prevented case of pelvic inflammatory disease is also shown in Table 3 and is also negative for 18–24 year olds. The uncertainty is illustrated by a 50% confidence interval, based on the 50% confidence interval of *q*.

Whereas practically all of the total costs are health care costs, a considerable part of the savings were in terms of avoiding lost productive output. Therefore, the net health care cost is higher than the net cost shown in Table 3. The net health care cost per prevented case of pelvic inflammatory disease was Nkr 2175 (£198) for 18 year old patients, Nkr 3904 (£355) for 24 year olds and Nkr 11 890 (£1081) for 30 year olds.

Discussion

This analysis demonstrates the uncertainty which is often present in medical decision making. It has been indicated that the risk of pelvic inflammatory disease among chlamydia infected women, *q*, is not constant as has been assumed in this analysis, but age dependent, and highest among teenage patients.[18] If this is true, the results for teenage patients should still be valid, as the estimate of *q* is based on a teenage population.[15] For older patients, a decreasing *q* would imply that the effectiveness of routine testing is less than is indicated here, and the error would increase with the age of the patient.

The results presented here indicate that routine testing for *C trachomatis* at gynaecological visits might be cost effective for younger patients. For older patients, whether to offer testing depends on how much one is willing to pay to prevent the suffering and risks associated with pelvic inflammatory disease. For 26 year old patients, the upper confidence limit of cost per prevented case of pelvic inflammatory disease is Nkr 3830 (£348), which might not be considered reasonable. A conservative approach is recommended for patients aged 25 years and above.

In this study, both health care cost, direct patient cost and loss of productive output were taken into account. If only health care costs are considered, the net cost is very much higher, and routine testing could hardly be justified.

As indicated in Figure 1, routine testing will prevent only a certain fraction of the total number of cases of pelvic inflammatory disease, and this reduction applies only to a section of the population. Therefore, routine testing is no substitute for other public health measures aimed at changes in sexual behaviour and contraceptive methods.

The cost effectiveness of routine testing depends on the prevalence of chlamydial infections, on the cost of testing and other cost factors. Prevalence figures reported in studies from a number of other western countries[1,8-10,15,19,20] are in the same range as those reported here and even though differences in costs are to be expected, the relative size of each major cost component is unlikely to be very different from one country to the next. Therefore, the results of this study should be of interest in other countries. In the general practice clinic in Trondheim, routine testing for *C trachomatis* at gynaecological visits is now recommended for 18–25 year old patients but not if the patient has been tested during the last two years.

Table 3. Total and net cost of routine testing and treatment of 1000 patients by age, and net cost per prevented case of pelvic inflammatory disease, together with the 50% confidence interval (CI).

Age (years)	Cost of routine testing and treatment of 1000 patients (£) Total	Net	Net cost per prevented case of PID (50% CI) (£)	
16	11 368	528	42	(−428, 343)
18	11 964	−4466	−183	(−701, 71)
20	11 762	−4461	−260	(−727, 70)
22	11 656	−4607	−271	(−743, 63)
24	11 269	−2279	−161	(−633, 172)
26	10 921	333	29	(−428, 348)
28	10 636	2580	283	(−157, 587)
30	10 410	4279	596	(166, 880)
32	10 231	5648	1007	(589, 1272)
34	10 092	6672	1536	(1128, 1788)

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