Original article

# Epidemiology of genital *Chlamydia trachomatis* in England and Wales

I Simms, M Catchpole, R Brugha, P Rogers, H Mallinson, A Nicoll

**Objective:** To describe the recent epidemiology of genital *Chlamydia trachomatis* infection in England and Wales.
**Design:** Retrospective study of routinely available surveillance datasets and ad hoc prevalence studies.
**Methods:** Numbers of new cases of genital *C trachomatis* infection, obtained from the Department of Health and Welsh Office, were combined with the estimated mid-year resident population of England and Wales. Rates were analysed for trend over time using a log linear age period model in GLIM4. Ad hoc prevalence and case finding studies carried out over the past 20 years were critically assessed in terms of study design and testing methodologies.
**Results:** Attendance rates at genitourinary medicine (GUM) clinics were higher for women than men over the period 1989 to 1994 as were the number of laboratory reports. The highest rate of attendance (GUM clinic data) was for women aged 16 to 19 years. There was an overall significant linear decrease in the attendance rates over time for both men (p = 0·0172) and women (p = 0·0000) between 1989 and 1994. There was considerable variation in the prevalence of genital *C trachomatis* infection detected within different clinical settings, together with a substantial level of asymptomatic infection.
**Conclusions:** Genital *C trachomatis* infection is broadly distributed throughout the sexually active population, with a substantial reservoir of asymptomatic infection among those generally perceived to be at low risk of a sexually transmitted infection. Young people, particularly women aged 16 to 19 years, are at highest risk of genital *C trachomatis* infection. This is of concern since younger women are more susceptible than older women to developing complications of chlamydial infection, such as pelvic inflammatory disease. The broad distribution of infection across all sexually active health service attenders and the high level of asymptomatic infection suggest that a new, screening based, approach to the control of genital *C trachomatis* infection is required. Recommendations are made as to the epidemiological research required to guide such work.
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Keywords: *Chlamydia trachomatis*; epidemiology

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## Introduction

Genital *Chlamydia trachomatis* infection is the most common curable, bacterial sexually transmitted infection (STI) in England and Wales.[1 2] As an STI, genital *C trachomatis* infection has three important features; it is often subclinical, sequelae can be severe and, if untreated, infection may persist for more than a year.[3] Health service attender surveys based on universal testing indicate that infection may be asymptomatic in up to 70% of infected women,[4 5] and in 4% to 11% of infected men.[6 7] In women, infection may lead to pelvic inflammatory disease (PID), ectopic pregnancy and infertility. These are costly to treat, have potentially serious lifetime consequences and make genital *C trachomatis* infection the most economically important STI in industrialised countries after HIV infection.[8] Paradoxically, treatment of initial infection is cheap and effective and single dose treatment is becoming available.[9] The recent development of a variety of diagnostic tests, including enzyme immunoassay (EIA), direct fluorescent antigen detection (DFA) and DNA recombinant tests,[10 11] has led to the rapid expansion of diagnostic facilities.[12 13] Sensitive and specific urine based tests are now becoming available.[14] These developments have created the opportunity for population based approaches to the control of genital *C trachomatis* infection through screening those at risk.[15] Such screening programmes have been shown to be effective in reducing the prevalence of both genital *C trachomatis* infection and pelvic inflammatory disease in the other countries.[16 17] The development of such approaches in England and Wales will need to be guided by knowledge of the epidemiology of the infection in the population. However, published information describing its epidemi-

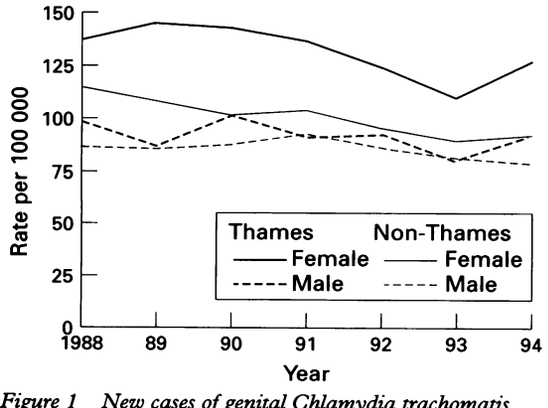


*Figure 1 New cases of genital Chlamydia trachomatis seen in GUM clinics by area and sex, England and Wales: 1989* to 1994. (*Data for England only.)*

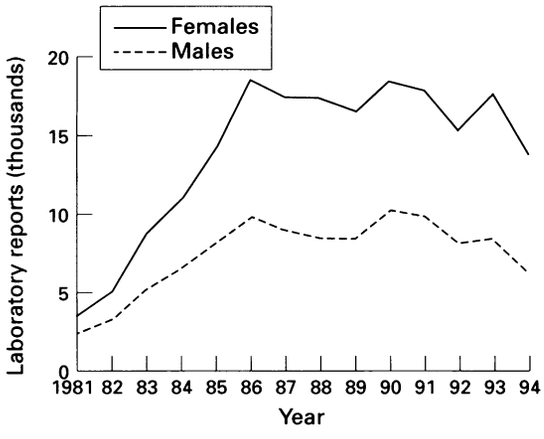


*Figure 2 Laboratory reports of Chlamydia trachomatis—England and Wales 1981 to 1994.*

ology in England and Wales is limited.[15] This paper summarises and discusses the most recently available epidemiological data, drawn from routine surveillance to the end of 1994, and published prevalence studies of genital *C trachomatis* infection in England and Wales.

## Data sources

Two sources of routine surveillance data were utilised. The first was quarterly returns from genitourinary medicine (GUM) clinics sent to the Department of Health and the Welsh Office on form KC60. The data are available by sex, age group (under 16, 16 to 19, 20 to 24, 25 to 34, 35 to 44, 45 and over) and regional health authority from 1989 (the first complete year that genital chlamydial infection was included as a separate diagnostic category) to 1994. Estimated rates of attendance for each age group were made by dividing the number of new cases in the calendar year by the estimated mid-year resident population of England and Wales aged between 15 and 59 for each age group.[18] The denominator used for the under 16 group was taken as the population aged 15 since the number of cases decrease with decreasing age. This may, however, overestimate the rate in this age group.

A second routine surveillance dataset, reports of laboratory diagnosed genital *C trachomatis* infection submitted to the Communicable Disease Surveillance Centre (CDSC) on a voluntary basis by microbiologists throughout England and Wales, was also used. Data on sex, age and laboratory name are submitted for each laboratory report. In addition, published reports from various ad hoc prevalence and case finding studies carried out in different populations over the past 20 years were reviewed. These were critically assessed for study design and laboratory testing methodologies.

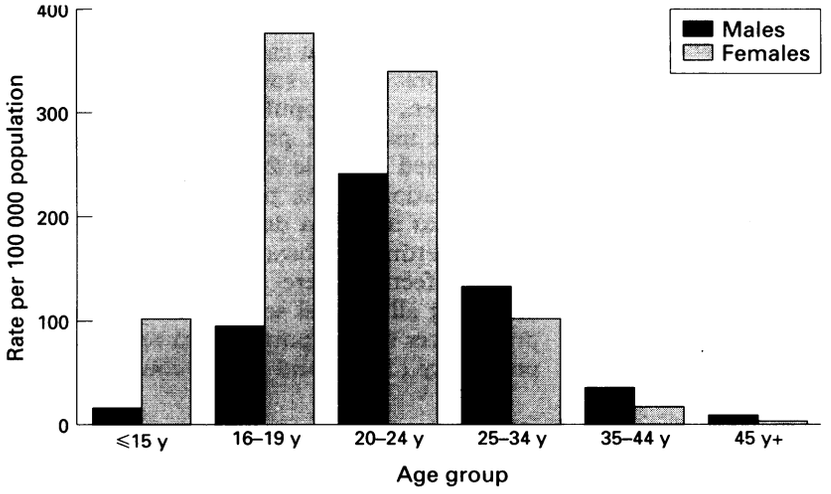


*Figure 3 New cases of genital Chlamydia trachomatis infection seen in GUM clinics by age group and sex: 1994.*

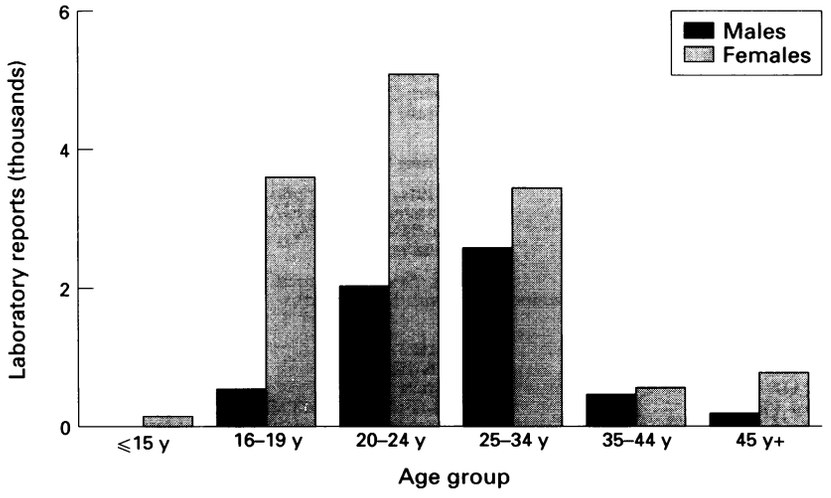


*Figure 4 Laboratory reports of genital Chlamydia trachomatis by age group and sex: 1994.*

## Methods

The age specific attendance rates were plotted over time for each sex separately. To investigate the observed trends in more detail the GUM clinic data were analysed using a log linear age period model.[19] The data were examined to see if there was evidence of an interaction between age group and year. Year and age group were included in the analysis as main effects and adjusted relative risks (RR) calculated using 1989 and the 16 to 19 age group as the baselines for year and age group, respectively. Year was subsequently analysed as a variable so that a polynomial could be fitted to the data for time trend analyses.

## Results

Over the period 1989 to 1994 attendance rates at GUM clinics by women with diagnosed genital *C trachomatis* infection were higher than those by men (fig 1), as were the number of laboratory reports of genital *C trachomatis* infection made to CDSC between 1981 and 1994 (fig 2). For women, there was a higher attendance rate in the Thames regions than in the rest of England and Wales in every year between 1989 and 1994 (fig 1).

Attendance rates were highest in women aged 16 to 19 whereas, for men, they peaked in the 20 to 24 year age group (fig 3). In contrast, laboratory reports for 1994 peak in women aged 20 to 24 and in men aged 25 to 34 (fig 4).

The KC60 data for the period 1989 to 1994 were analysed separately for men and women. The data showed little evidence of interaction between age group and year (fig 5), so models

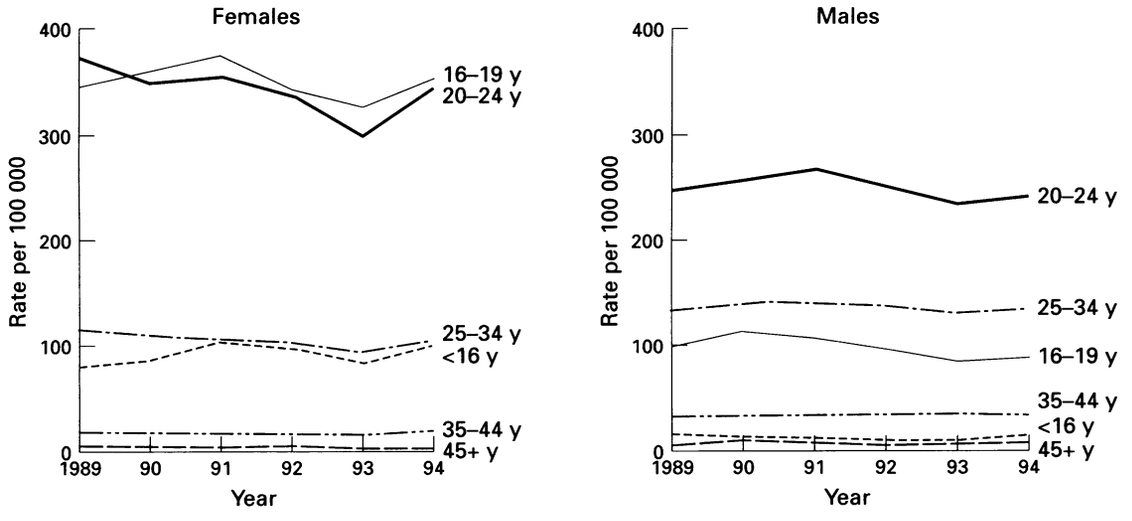


*Figure 5 New cases of Chlamydia trachomatis by year and age group—England and Wales 1989 to 1994.*

*Table 1 Adjusted relative risks for attendance at GUM clinics with genital C trachomatis infection*

| | *Adjusted RR (95% confidence limits)* | |
|---|---|---|
| *Year* | *Males* | *Females* |
| 1989 | 1·00 | 1·00 |
| 1990 | 1·06 (1·04–1·09) | 0·97 (0·95–0·99) |
| 1991 | 1·08 (1·05–1·10) | 0·99 (0·97–1·01) |
| 1992 | 1·03 (1·01–1·06) | 0·93 (0·91–0·95) |
| 1993 | 0·97 (0·95–0·99) | 0·85 (0·83–0·87) |
| 1994 | 1·00 (0·97–1·02) | 0·96 (0·94–0·98) |
| Age group (years) | | |
| under 16 | 0·14 (0·12–0·15) | 0·26 (0·25–0·28) |
| 16 to 19 | 1·00 | 1·00 |
| 20 to 24 | 2·54 (2·48–2·60) | 0·98 (0·96–1·00) |
| 25 to 34 | 1·38 (1·35–1·41) | 0·300 (0·296–0·306) |
| 35 to 44 | 0·35 (0·34–0·36) | 0·052 (0·050–0·054) |
| 45+ | 0·090 (0·086–0·094) | 0·012 ((0·011–0·012) |

including age group and year as main effects were fitted. RRs adjusted for the other variables are given in table 1; these quantify the results given in figure 5. There were significant differences between age groups in both sexes (in both p = 0·0000). For men, the 95% confidence limit (CL) show the RR for each age group to be significantly different from each other, whereas there was no difference in the RR between the 16 to 19 and 20 to 24 year age groups for women. In men, the RR of the attendance rates for genital *C trachomatis* infection rose to 1991, declined in 1992 and 1993 and subsequently rose in 1994 (fig 5). In women, the RR was stable until 1991 and fell in 1992 and 1993 but subsequently rose in 1994. Overall the data showed a significant linear decrease over time for both sexes (men, p = 0·0172; women, p = 0·0000). On average, the rate of attendance decreased by 1% and 2% per year for men and women respectively.

The prevalence surveys that have been undertaken, the populations studied, testing strategies used and prevalences detected are summarised in table 2. There was considerable variation in the prevalence of genital *C trachomatis* infection detected within different clinical settings. Substantial levels of asymptomatic infection were found among women attending all clinical services.[20–22] The highest prevalences were reported from termination of pregnancy (TOP) and GUM clinics, with the

*Table 2 Published health service attender based surveys**

| *Population* | *Location (year)* | *Sex* | *Prevalance (%) (sample size)* | *Test used* | *Author (reference)* |
|---|---|---|---|---|---|
| Termination of pregnancy | Swansea (1993) | Female | 9 (32/400) | EIA (Novo Norsisk) | Blackwell (36) |
| | London (1983) | Female | 7·8 (7/89) | Culture | Ridgway (24) |
| | Liverpool (1987) | Female | 11 (19/167) | Culture | Duthie (25) |
| Gynaecology clinic | London (1989) | Female | 3·6 (45/1267) | Culture | Fish (37) |
| | Kent (1993) | Female | 6·3 (102/1611) | EIA (IDEIA) | Edet (26) |
| General practice | Glasgow (1991) | Female | 12 (24/197) | EIA (IDEIA), compared with culture | Smith (21) |
| | London (1987) | Female | 10·7 (18/169) | DFA (MicroTrak), culture | Longhurst (38) |
| | Sheffield (1993) | Male | 6 (18/293) | EIA (Dako), confirmed with DFA (Syva) | Kudesia (29) |
| (including practice antenatal clinic) | London (1983) | Female | 8 (19/248) | Culture | Southgate (39) |
| Colposcopy | Glasgow (1991) | Female | 6 (6/101) | Culture (Syva MicroTrak) | Smith (21) |
| Family planning | Manchester (1989) | Female | 7·3 (33/452) | Culture, some samples examined using EIA test | Macaulay (27) |
| | Wirral (1990) | Female | 9·1 (23/252) | EIA (IDEIA), DFA and culture | Hopwood (28) |
| Community clinic (cervical smear) | Liverpool (1995) | Female | 7·1 (7/99) referred to GUM<br>7·1 (21/295) symptoms of infection<br>51·5 (33/64) asymptomatic | EIA (Syva) confirmed with DFA (Syva) | Hopwood (22) |
| Genitourinary medicine | London (1978) | Female | 20·4 (58/284) | Culture | Oriel (40) |
| | London (1994) | Female | 29 (38/182) | DFA (Syva) | Hay (41) |
| | Bristol (1980) | Female | 19 (154/796) | Culture | Richmond (42) |
| | Birmingham (1989) | Male | 16·1 (68/422) | EIA (Boots Celltech IDEIA), compared with culture | Matthews (43) |
| | Bristol (1990) | Male | 16·7 (103/615) | EIA, (IDEIA), confirmed with DFA (Syva) | Paul (20) |
| | London (1995) | Male | 8·6 (31/356) | Culture | Zelin (44) |
| (and antenatal clinic) | Liverpool (1984) | Female | 7 (18/252) | Culture | Wood (45) |

*The limited sample size in some surveys is due to the limited size of the population under study.

lower prevalences seen in general practice and family planning clinics. In those studies that reported both genital *Neisseria gonorrhoeae* and *C trachomatis* infection, the prevalence of genital *C trachomatis* infection was, with one exception,[23] substantially higher than that of gonorrhoea.[21 24 25] Younger age category, a new sexual partner in the last two months, use of non-barrier contraceptives and low socioeconomic status have been associated with genital chlamydial infection among female clinic attenders.[21 22 26-28] Younger age category is the only factor that has been associated with infection in male clinics attenders.[29]

## Discussion

Surveillance data and epidemiological studies provide an important insight into the epidemiology of genital *C trachomatis* infection in England and Wales. Comparisons between the surveillance data sources are difficult to make since the laboratory data are derived from a variety of clinical settings whereas the KC60 dataset only reflects attendances at GUM clinics. This could account for the differences in the age group and trend over time data between these datasets. Data interpretation is further complicated by the large pool of symptomatic and asymptomatic infection that is either seen in clinical settings other than GUM clinics or that remains undiagnosed. Population estimates, based on prevalence studies in population groups, suggest that only 10% of prevalent cases are identified within GUM clinics,[30] and that the KC60 dataset represents only a small proportion of prevalent infections. There are a number of problems associated with the interpretation of data derived from prevalence studies. The studies undertaken to date have generally been based on small numbers, confined to healthcare attender populations and have included a wide range of sampling and testing methodologies. The wide range of testing methodologies represents a particular problem because the sensitivity and specificity varies between testing strategies and over time.[31] This will have influenced not only the number of positive cases detected but also the number of false positives detected. These limitations indicate that the detected prevalences are not absolute levels and consequently the interpretation of risk factor data is difficult, as are comparisons between studies and extrapolation of findings to the wider population.

Infection is broadly distributed throughout the sexually active female population, with a substantial reservoir of asymptomatic infection among those generally perceived to be at low risk of an STI, such as general practice attenders. Young people, particularly women aged 16 to 20 years, are at highest risk of chlamydial infection. However, the surveillance data are likely to underestimate the prevalence of infection in this age group since younger sexually active people are less likely to be seen in GUM clinics.[32] This is of concern since younger women may be more susceptible than older women to developing complications of chlamydial infection, such as PID.[33-35]

The available data provide an incomplete epidemiological picture of what is being increasingly recognised as a disease of major public health importance. Surveillance has been mainly focused on high risk populations (that is, GUM clinic attenders) whereas the majority of genital *C trachomatis* infections are likely to be asymptomatic and broadly distributed throughout the general population. Since current evidence suggests that transmission by people with asymptomatic infection in lower behavioural risk groups is maintaining the epidemic,[4] a new approach to the control of genital *C trachomatis* infection is required. However, presently there is insufficient knowledge of the epidemiology of genital *C trachomatis* infection in England and Wales on which to base cost effective intervention strategies. Screening based studies in population groups are essential if our understanding of the epidemiology of genital *C trachomatis* infection, particularly asymptomatic infection, is to be improved. Representative cross sectional studies using validated and standardised diagnostic tests, sampling accessible population groups, such as TOP, GUM, general practice, family planning and gynaecology clinics, are needed. These will provide accurate estimates of the prevalence of genital *C trachomatis* infection and identify risk factors for infection which would be essential to the planning of future chlamydial control and prevention programmes.

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