

# Screening and treatment of *Chlamydia trachomatis* infections

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See also **RESEARCH**, p 903

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*Chlamydia trachomatis* is the most commonly diagnosed bacterial sexually transmitted infection worldwide.<sup>1,2</sup> Numbers of diagnoses have increased over the past 10 years as a result of more sensitive tests and increased testing. Genital infection with *C trachomatis* is asymptomatic in 50-88% of men and women,<sup>w1</sup> and 46% of infections clear spontaneously within a year.<sup>3</sup>

Persistent chlamydia infection can lead to pelvic inflammatory disease, ectopic pregnancy, and tubal infertility in women<sup>w2</sup> and epididymitis and epididymo-orchitis in men.<sup>2</sup> Here, we describe the diagnosis and management of chlamydia and discuss control strategies. Guidance on the laboratory diagnosis and treatment of chlamydia has a strong evidence base, but evidence on the natural course of infection and optimum control strategies is less robust.

## How common is chlamydia infection and who gets it?

Infection can occur at any age but is most common in people under 25,<sup>w3</sup> with rates of diagnosis peaking in women aged 16-19 and men aged 20-24 (fig 1). This may be because people in these age groups change partners frequently and because women clear the infection more quickly with increasing age.<sup>3</sup> Risk factors include age under 25 years, two or more sexual partners in the past year, and recent change of partner.

Although the true prevalence of this infection is not known, a systematic review in the United Kingdom estimated that 4-5% of women under 20 in the general population and 8-17% of women under 20 attending sexual health services were infected. Fewer data were available for men, but the review concluded that mean prevalence estimates by setting were similar to those for women.<sup>4</sup> European studies report similar figures for women.<sup>w5</sup>

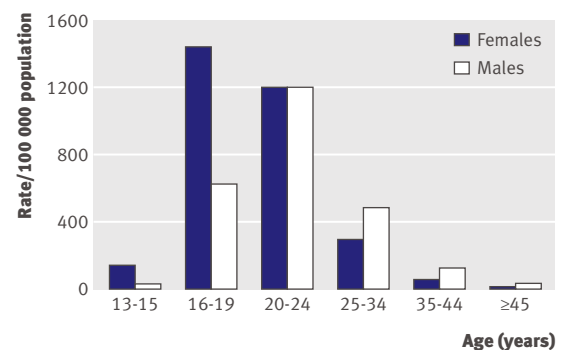


Fig 1 | Age distribution of chlamydia by sex in the UK, 2007. Adapted, with permission, from a 2008 report from the Health Protection Agency<sup>w4</sup>

## How common are the serious consequences of chlamydia infection?

Persistent infection may cause or underlie a range of adverse effects, but because these may all have other causes the burden of chlamydia related disease is hard to determine.

### Chlamydia infection in women

Upper genital tract infection with *C trachomatis* can cause ectopic pregnancy and tubal factor infertility. A systematic review found estimated incidences of pelvic inflammatory disease of 0-30% in women with untreated infection but insufficient evidence to define the relation.<sup>5</sup> A recent review of risk estimates of the complications of chlamydia infection concluded that 10-20% of women with pelvic inflammatory disease will develop tubal infertility and that chlamydia positive women have a 0.1-6% risk of developing tubal infertility.<sup>6</sup>

### SOURCES AND SELECTION CRITERIA

We searched Medline databases for *Chlamydia trachomatis*, chlamydia screening, pelvic inflammatory disease, and ectopic pregnancy. We looked at guidelines from the National Institute for Health and Clinical Excellence and the Scottish Intercollegiate Guidelines Network, in addition to reports from the European Centre for Disease Prevention and Control, the US Centers for Disease Control and Prevention, and World Health Organization.

### SUMMARY POINTS

Chlamydia is most common in people aged 16-25 and is usually asymptomatic. Untreated infection can cause pelvic inflammatory disease, ectopic pregnancy, and subfertility. Nucleic acid amplification testing is highly sensitive on non-invasive samples such as urine and self taken vaginal swabs. Mathematical modelling suggests that screening could reduce the prevalence of infection. The English national chlamydia screening programme aims to test sexually active under 25s by offering tests in general practice, pharmacies, sexual and reproductive health services, and other venues they visit. Partners and ex partners of test positive patients should be tested and treated.

Ectopic pregnancy occurs in about one in 1000 conceptions in England (about 8000 cases a year treated in hospital), which is similar to other European countries.<sup>1</sup> The relation between ectopic pregnancy and chlamydia infection is uncertain: three large retrospective cohort studies found a decreased risk of ectopic pregnancy in women with previous chlamydia infection,<sup>7</sup> no difference,<sup>8</sup> and an increased risk.<sup>9</sup> The women in these studies had diagnosed infections and were presumably treated, so the findings do not reflect the risk of ectopic pregnancy in women with untreated infections. A study that used population registry data from Amsterdam estimated that women with current genital chlamydia infection had a 0.07% risk of ectopic pregnancy.<sup>10</sup>

### Chlamydia infection in men

Chlamydia can cause epididymitis and epididymo-orchitis, but little is known about the epidemiology of complications in men.<sup>2</sup>

### Infection in pregnancy

Adverse pregnancy outcomes that have been associated with asymptomatic chlamydia infection include premature rupture of membranes, preterm delivery, low birth weight, and neonatal conjunctivitis and pneumonia.<sup>w6 w7</sup>

Debate on management exists: National Institute for Health and Clinical Excellence guidance does not recommend chlamydia screening during pregnancy,<sup>11</sup> whereas the US guidance does.<sup>2</sup>

### Other sequelae

In both sexes infection with chlamydia can cause sexually acquired reactive arthritis and proctitis.<sup>w8</sup>

### How effective is screening for chlamydia infection?

Mathematical models are used to look at the potential effect of chlamydia screening because empirical data are lacking. They are based on several assumptions about how the infection behaves and how screening works. One model suggests that screening could reduce prevalence by 30% after one year and 70% after five years if there is 26% coverage and 20% partner notification in both men and women. Continuous screening at 46% coverage (20% partner notification) could reduce prevalence by 40% after one year and 80% after seven years.<sup>w9</sup> A review of three current models, however, found that the predicted reduction in prevalence varied significantly, so that the conclusions drawn from all are uncertain.<sup>w10</sup>

A systematic review of economic evaluations found that the initial economic analyses suggested that screening was cost effective but the review criticised the modelling approach used and the parameters.<sup>12</sup> A high level of uncertainty remains, and more work is needed to understand the effectiveness of testing asymptomatic people and the various approaches used. Several groups are evaluating current screening programmes.<sup>w11</sup>

### What strategies can help to control chlamydia?

Any public health approach to preventing and controlling sexually transmitted infections must promote safer sexual behaviour, encourage early healthcare seeking behaviour,

### TIPS FOR HEALTHCARE PROFESSIONALS

- Chlamydia tests can be offered during any suitable consultation
- Physical examination is unnecessary. All tests can be done by patients themselves (urine and vaginal swabs)
- Testing is offered to all people under 25 and individuals should not feel targeted because of their sexual behaviour
- Share the responsibility of testing and management with other members of the primary care team, such as practice nurses and healthcare assistants
- Remember to advise on testing once a year or after a change of sexual partner

### Patients who test positive

Treatment is straightforward: a single 1 g dose of azithromycin (unless the patient is pregnant or allergic to azithromycin)

Advise that reinfection can occur if the sexual partner is not tested and treated

Emphasise that the patient should abstain from unprotected sex for seven days

Contacting and informing present and previous sexual partners is an important step in controlling chlamydia

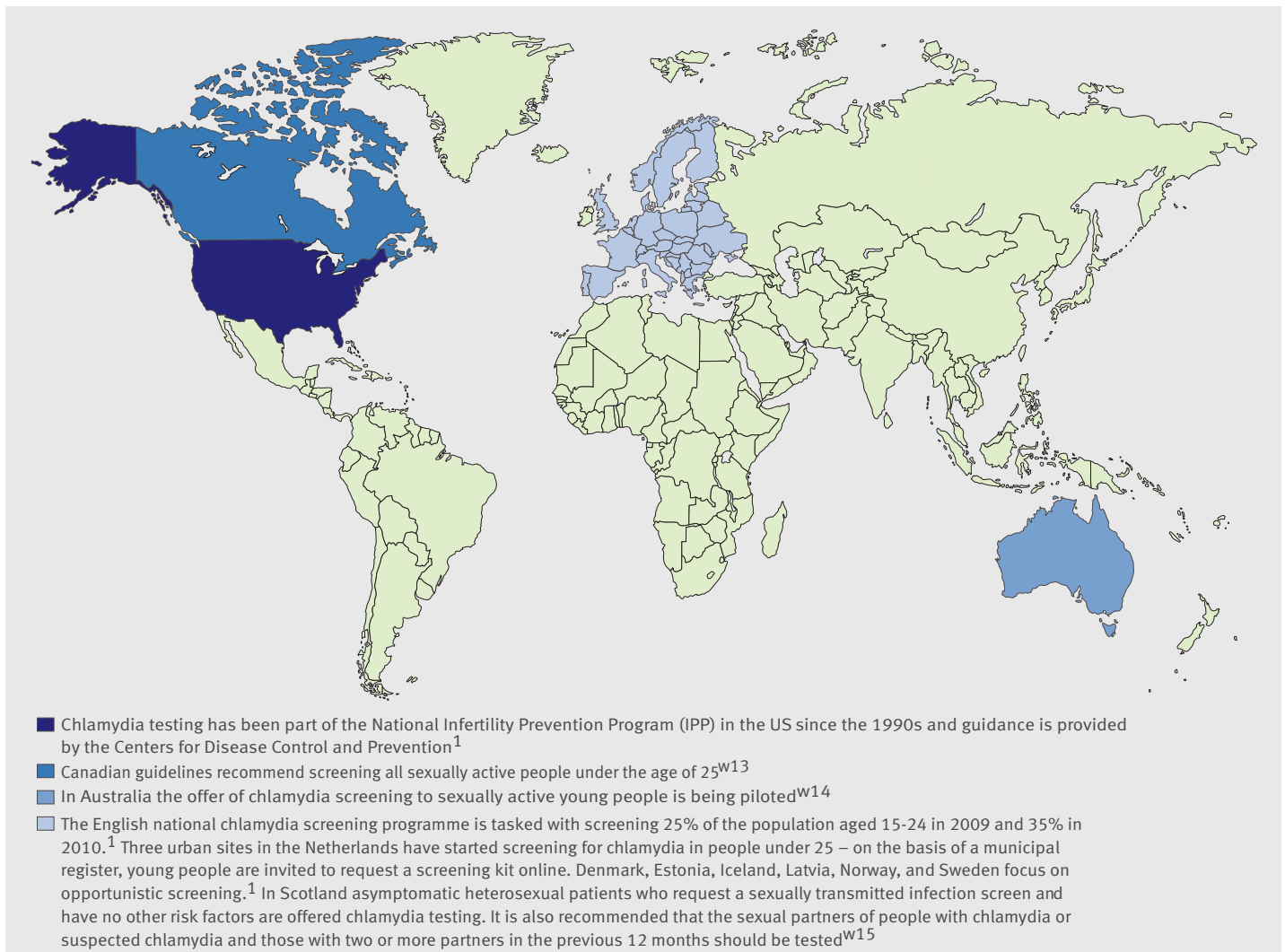
All patients who test positive should be advised to be tested for other sexually transmitted infections

and introduce prevention and care activities across all primary healthcare providers.

Evidence from randomised controlled trials on the public health effects of screening is limited because of the difficulty designing robust trials that are practical and feasible. Hence it is unclear which intervention is best to control chlamydia in the population.<sup>w12</sup> Two trials—one in 17 high schools in Denmark and one in high risk women in a health maintenance organisation in the United States—have evaluated the effect of a systematic offer of screening on the incidence of pelvic inflammatory disease. Both found that the incidence halved during the 12 months after the intervention,<sup>13 14</sup> but the robustness of the methodology of both studies has been criticised.<sup>15</sup> A more recent trial provided some evidence that screening reduced the rates of pelvic inflammatory disease, but it found that most of the disease occurred in women who tested negative for chlamydia when they entered the study and concluded that an annual chlamydia test was insufficient to prevent pelvic infection; it recommended repeat testing in people in high risk groups who change partner during the year.<sup>16</sup>

Internationally and in the UK a variety of control approaches have been used. Few organised programmes exist nationally,<sup>17</sup> and those that do range from opportunistic screening, such as the English national chlamydia screening programme and the US infertility prevention programme, to an internet based register that is being piloted in the Netherlands (fig 2).

Measuring the outcome of screening is complex and is influenced by changes in sexual behaviour and uptake of screening. In the US, women and men aged 16-24 years entering the national job training programme are universally screened for chlamydia. Recent trend data from this cohort from 2003 and 2007 found a reduction in positivity by 19% in women and 8% in men.<sup>18</sup>



**Fig 2 | Some international approaches to screening for chlamydia**

#### An opportunistic screening approach

The English national chlamydia screening programme offers opportunistic screening because most young people in England visit primary care sexual health services and response rates to invitations to screening in this age group are low. Two UK pilot studies conducted in 2001 showed that this approach was feasible in young women, with a high rate of uptake, detection of infection, and treatment in primary care.<sup>w16</sup>

Young men and women are offered tests when they visit primary care sexual health services such as community sexual and reproductive health services, general practice, and pharmacies. Repeat testing is recommended annually or after a change of sexual partner (fig 3).

Six other European countries offer opportunistic testing—Denmark, Estonia, Iceland, Latvia, Norway, and Sweden—but not as part of a national coordinated programme.<sup>1</sup> The US Centers for Disease Control and prevention (CDC) recommends that all sexually active women aged 25 years and younger should be screened for chlamydia.<sup>2</sup>

Regardless of the approach to screening, primary prevention of infection through delivering information about safer sex practices must underpin any strategy to control chlamydia.

#### Does testing young men improve the outcome of screening?

Most sequelae of chlamydia infection affect women, and most screening activities worldwide target young women. We have no direct evidence that the burden of disease in women falls when men are screened, and most modelling studies find that screening men is less cost effective than screening women. However, screening men may be a cost effective adjunct to screening women if men at high risk are targeted.<sup>19</sup>

The English screening programme offers screening to both men and women under the age of 25 to encourage young men to take an active part in maintaining their own sexual health and that of their partners. Young men form a large pool of undiagnosed and untreated infection but are difficult to reach because they visit healthcare facilities less often than young women.<sup>w17</sup> The development of non-invasive tests for men, such as urine based nucleic acid amplification testing, has made screening acceptable.<sup>20</sup> Consultation with young men has shown that many prefer testing for chlamydia via routes that prioritise anonymity, such as the internet.<sup>w18</sup>

#### What does testing for chlamydia involve?

##### Samples

Nucleic acid amplification testing requires self taken vaginal swabs or urine samples,<sup>w19</sup> and a clinical examination is not

## A PATIENT'S PERSPECTIVE

I caught chlamydia when I was 17, while cheating on my boyfriend. I was pretty naive at the time and we didn't use a condom properly. My main worry was getting pregnant, so we would put one on only half way through. I didn't realise this wasn't enough to protect us from sexually transmitted infections.

My boyfriend started experiencing some discharge and I knew something was wrong. We both went to our general practitioner and tested positive for chlamydia. The scary part was that I didn't experience any symptoms at all.

I admitted everything and the guy I had been sleeping with got himself checked out too. He also tested positive for chlamydia. It turned out he had been sleeping with lots of other girls, which really shocked me. The potential consequences were huge and so I made him contact them all. My boyfriend was great, we talked a lot, and luckily managed to get through it. Six years on and we're still together. I now regularly see my general practitioner and get tested for chlamydia once a year. You just have to give a urine sample—it's quick, simple, and painless. Everyone should get tested regularly and use condoms to make sure that they're protecting their own sexual health and their partner's.

Anonymous, Exeter

needed. Men should provide a first void 15-50 ml sample of urine, and women should provide a similar sample or a self taken vaginal swab.

## Tests

A 2002 review of tests from the 1990s onwards found that nucleic acid amplification is more sensitive and specific than enzyme immunoassay.<sup>w20</sup> Technology continues to develop, but currently no enzyme immunoassays, point of care tests, or DNA probe tests are recommended for the diagnosis of *C trachomatis* because of low sensitivity and specificity.<sup>21</sup> Nucleic acid amplification has a high sensitivity (90-97%) and specificity (99%),<sup>w21</sup> and samples are suitable for testing several days after collection, even if kept at room temperature.<sup>w22</sup>

## Potential effects of chlamydia screening

Possible harms from chlamydia screening are the distress

caused by a positive result and anxiety about partner notification.<sup>w23</sup> The positive effects include reassurance when tests are negative and the benefit of early treatment when tests are positive.<sup>w24</sup>

## How to manage a positive test result

## Treating the infected person

Chlamydia infection is easily treated. A single dose of azithromycin (1 g orally) is highly effective—more than 95% of those treated are negative for chlamydia after two weeks.<sup>22</sup> The single dose option increases compliance. Advise patients to avoid sexual contact during treatment and for seven days afterwards to prevent reinfection before the treatment has been effective. Box 1 gives a more comprehensive list of treatment options.

No test of cure is needed if treatment has been taken correctly and the advice to prevent reinfection has been followed. The exception is pregnant women, who have a reduced cure rate because increased hepatic clearance results in lower plasma concentrations of erythromycin.<sup>w26</sup> and a test six weeks after treatment is recommended. Reinfection is 20-30 per 100 person years<sup>23</sup> and the CDC recommends retesting after three to four months, although the English programme does not.<sup>2</sup>

## Treating partners

Two studies have shown that 57-75% of partners of people who test positive for chlamydia are also positive, so people who are diagnosed with chlamydia are at risk of reinfection if their partner is not treated. Treatment of partners is therefore an important part of the management of chlamydia infection.<sup>w27 w28</sup>

We have no clear evidence to guide how far back in time partners of the index case should be traced and informed. For asymptomatic people, the British Association for Sexual Health and HIV advises six months or the last partner before diagnosis if the interval between last sexual activity and diagnosis is longer than six months. For those with symptoms this period is one month.<sup>w25</sup>

## Notifying partners

Partner notification is the process of informing sexual

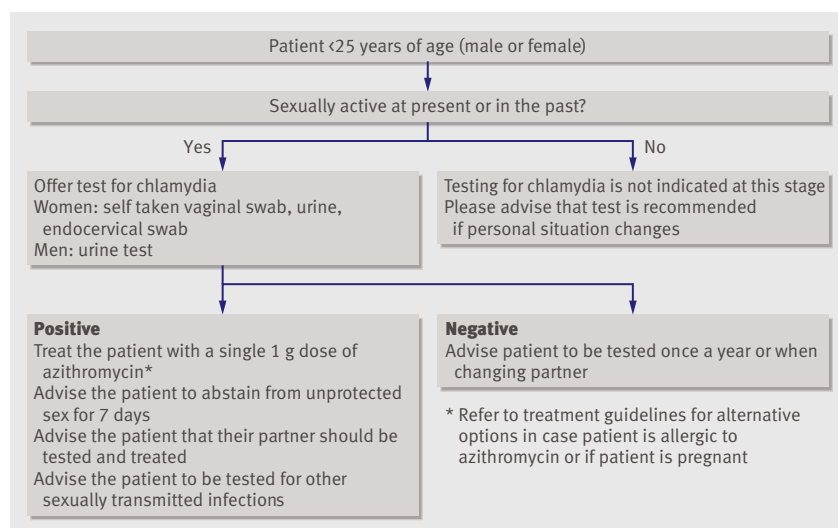


Fig 3 | English national chlamydia screening programme flow chart

## Box 1 | Treatment for chlamydia

## Recommended regimens

Azithromycin: single dose of 1 g  
Doxycycline: 100 mg twice daily for seven days

## Alternative regimens

Ofloxacin: 200 mg twice daily or 400 mg once daily × 7 days  
Erythromycin: 500 mg twice daily for 14 days or 500 mg four times daily for seven days  
Amoxicillin 500 mg three times daily for seven days.

## Pregnant women

Erythromycin: 500 mg four times daily for seven days or 500 mg twice daily for 14 days  
Amoxicillin: 500 mg three times daily for seven days  
Azithromycin: single dose of 1 g but see caution in the BNF  
Doxycycline and ofloxacin are contraindicated in pregnancy. For more information about treatment see British Association for Sexual Health and HIV guidelines<sup>w25</sup>



partners of people diagnosed with a sexually transmitted infection about their potential exposure to infection. It aims to increase testing and treatment among partners who are at high risk, to prevent reinfection of the index case, and to prevent onward transmission in the community. This is an important part of managing any sexually transmitted infection. The stigma attached to sexually transmitted infections can make partner notification difficult. More partners are likely to be treated if a health professional contacts them (provider referral) than if patients do this themselves (patient referral).<sup>24</sup> In practice, however, both patients and doctors prefer patient referral.<sup>25 26</sup> Current methods of patient referral reach only 40–60% of named sexual partners.<sup>25</sup>

New methods of partner management are emerging, and a systematic review of interventions to supplement simple patient referral found that involving index patients in the care of sexual partners improves the outcomes of partner notification for chlamydia, gonorrhoea, and non-specific urethritis. Patient delivered treatment for partners, home sampling, and additional information for partners were more effective than simple patient referral.<sup>24</sup> Although patient delivered partner treatment is not licensed in the UK, a variant that includes referring partners to local pharmacies for treatment or giving index patients treatment for their partners after a telephone consultation with the partner are being piloted.<sup>w29</sup>

#### ADDITIONAL EDUCATIONAL RESOURCES

##### Resources for healthcare professionals

National Chlamydia Screening Programme ([www.chlamydia-screening.nhs.uk/ps/index.html](http://www.chlamydia-screening.nhs.uk/ps/index.html))—Comprehensive resource for implementing chlamydia screening

European Centre for Disease Prevention and Control ([www.ecdc.europa.eu/en/publications/Publications/0906\\_GUI\\_Chlamydia\\_Control\\_in\\_Europe.pdf](http://www.ecdc.europa.eu/en/publications/Publications/0906_GUI_Chlamydia_Control_in_Europe.pdf))—Background information on epidemiology of chlamydia in Europe

British Association for Sexual Health and HIV ([www.bashh.org/guidelines](http://www.bashh.org/guidelines))—Comprehensive information on a wide range of sexual health topics

BMJ Learning. ([www.learning.bmj.com](http://www.learning.bmj.com))—emodule on chlamydia screening

##### Resources for patients

Patient UK ([www.patient.co.uk/health/Chlamydia-in-Women.htm](http://www.patient.co.uk/health/Chlamydia-in-Women.htm))—Information on symptoms and treatment

NHS Choice ([www.nhs.uk/worhtalkingabout](http://www.nhs.uk/worhtalkingabout))—Background to the advertising campaign on wider sexual health matters and contraception

NHS Choice ([www.nhs.uk/livewell/Sexandyoungpeople/Pages/Sex-and-young-people-hub.aspx](http://www.nhs.uk/livewell/Sexandyoungpeople/Pages/Sex-and-young-people-hub.aspx))—Website aimed at young people which deals with many areas, including relationships

Centres for Disease Control and Prevention ([www.cdc.gov/std/Chlamydia/STDFact-Chlamydia.htm](http://www.cdc.gov/std/Chlamydia/STDFact-Chlamydia.htm))—Factsheet for patients

BBC Wales ([www.bbc.co.uk/wales/comeclean](http://www.bbc.co.uk/wales/comeclean))—Information on a variety of sexually transmitted diseases

Brook ([www.brook.org.uk](http://www.brook.org.uk))—Confidential advice on sexually transmitted infections for under 25s

#### Box 2 | Tips from young people on how professionals should offer them a test<sup>w32</sup>

Use the word test, not screen

When offering us a test, establish the offer as a normal thing to do—we'd like to know that "all young people should have a chlamydia test at least once a year and with every new partner"

Tell us that we do not have to "be inspected" and that the test is easy to do ourselves

Use other opportunities to offer us a test, like when we are collecting a prescription or visiting the general practitioner for other reasons

A top tip from young men is to ensure that they are told clearly and simply that screening is "painless (simply a pee in a pot), it's free, easy to do and easy to treat"

#### Further screening for other sexually transmitted diseases

Patients who test positive for chlamydia should be offered more comprehensive screening and considered for referral to specialist services.<sup>2</sup> Many screening tests can be initiated in primary care such as blood tests for HIV and syphilis. Some primary care services offer dual nucleic acid amplification testing for chlamydia and gonorrhoea on a self taken vaginal swab or urine sample, but routine dual testing is not recommended unless the local prevalence of gonorrhoea is high.<sup>27</sup>

#### What is the best way to screen for chlamydia infection in community settings?

Chlamydia screening can be offered from a wide variety of venues. High levels of population screening are needed to ensure an effective screening programme.

##### General practice

Young people find screening in a general practice acceptable and most visit their doctor at least once a year.<sup>w30</sup> With appropriate training, general practices are well placed to screen for and treat chlamydia and to offer partner notification.<sup>w31</sup> In England, general practitioners, practice nurses, and healthcare assistants play an important role in offering chlamydia testing. An offer of screening can easily be made during any consultation and could fit in with a wider discussion about relationships, sexual health, and general lifestyle advice.

A routine offer of screening to all young people stops them feeling that they are being targeted because of their sexual behaviour.<sup>28</sup> Young people prefer not to be seen asking for, or being asked to take, chlamydia tests; this may mean that tests should not be initiated by doctors' receptionists (box 2).<sup>29</sup>

In England the national chlamydia screening programme has stimulated more discussion of sexual health in general practice, and chlamydia tests in this setting increased from 2341 in 2003–4 to 106 886 in 2008–9.<sup>w5</sup>

##### Pharmacies

UK pharmacies are increasingly important providers of chlamydia screening. About 79% of the UK population lives within 0.6 mile (1 km) of a pharmacy, pharmacies have long opening hours, and they already offer some sexual health services. Chlamydia screening has been shown to

be acceptable in this setting,<sup>w33</sup> and some pharmacies offer NHS funded treatment for people under 25 and their partners with chlamydia.

### Community sexual reproductive health

Community sexual reproductive health services already reach large numbers of young people for contraception and since the inception of the national chlamydia screening programme have been the major provider of screening tests.<sup>w34</sup> The addition of chlamydia screening to these services is often a first step towards more holistic sexual health care in these settings.<sup>w35</sup>

### Innovation within chlamydia screening programmes

Chlamydia screening initiatives have promoted innovation in sexual health through the widespread availability of self taken samples and access to testing through new routes and venues such as pharmacies. Web based testing offers 24 hour access and confidentiality,<sup>w18</sup> but it lacks the advantage of a dialogue with a healthcare professional, which reduces opportunities to offer additional information, services, or advice. A report from the US found that some websites offering chlamydia screening were unreliable and results were inaccurate.<sup>30</sup> In England online screening can be accessed through many sites, and a review of the merits of a single provider is under way.

### Conclusion

The optimal strategy for controlling *C trachomatis* is debatable and likely to remain so for some time. Evaluating the effect of screening programmes depends on accurate estimates of the prevalence of the infection in the population, changes in sexual behaviour, and rates of progression to serious disease, but accurate information on all of these factors is limited. Nonetheless, the benefit to individual patients of testing and appropriate treatment is indisputable, and we recommend that chlamydia testing be offered routinely to young people as part of a holistic approach to sexual health in primary care.

**Competing interests:** All authors have completed the Unified Competing Interest form at [www.icmje.org/coi\\_disclosure.pdf](http://www.icmje.org/coi_disclosure.pdf) (available on request from the corresponding author) and declare: (1) No financial support for the submitted work from anyone other than their employer; (2) No financial relationships with commercial entities that might have an interest in the submitted work; (3) No spouses, partners, or children with relationships with commercial entities that might have an interest in the submitted work; (4) All authors are affiliated to national chlamydia screening programme, SK as lead general practitioner, but have no other non-financial interests that may be relevant to the submitted work.

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**Patient consent obtained.**

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