Sexual Health Needs Assessment – chlamydia

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Chlamydia screening

Defining the issue

Chlamydia trachomatis is the most common bacterial sexually transmitted infection in the UK, particularly among young people under-25. It often has no symptoms, but if left untreated it may have longer-term consequences including pelvic pain, infertility and ectopic pregnancy. Testing for chlamydia is quick and easy, and it is simple to treat with antibiotics.

The natural history of genital chlamydia trachomatis infection is not thoroughly understood. Genital infections are asymptomatic in around 70% of women and men and although some infections resolve without treatment, others may persist for long periods and a proportion of these will progress to cause complications. Natural infection seems to provide very little immunity against reinfection. Improving the understanding of the natural history of chlamydia, in both females and males, is an important and active area of research.

Chlamydia is the focus of much attention, largely because of the ambitious screening programme devised to detect and treat as many cases as possible among young people, and ultimately drive down prevalence. Although the screening programme was launched on a less than robust evidence base, the government has indicated its determination to retain and improve it.

Why is this important?

Implications of having the condition/health consequences

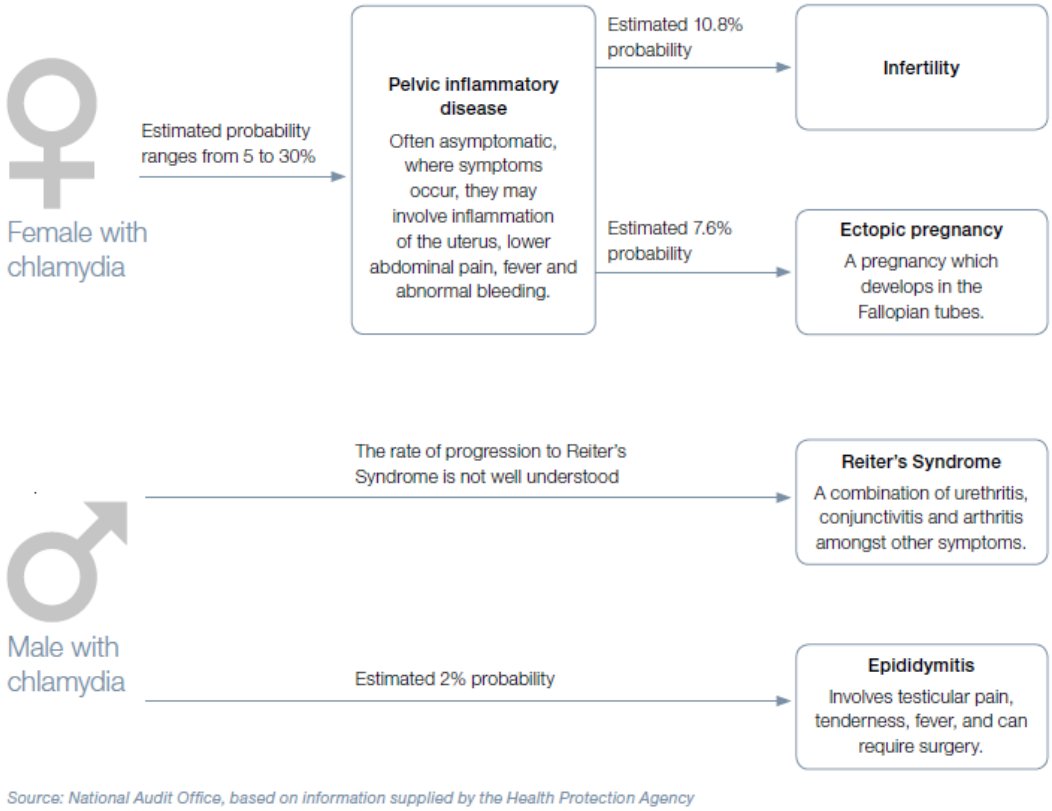
In females, chlamydia initially infects the cervix and the urethra where it can cause cervicitis (inflammation of the cervix) and urethritis (inflammation of the urethra). From the cervix, the bacteria can ascend to the upper genital tract where it may cause pelvic inflammatory disease (PID), with or without symptoms e.g. pelvic pain. It has been estimated that 10-20% of untreated infections result in PID. Inflammation of the fallopian tubes associated with PID can cause damage (e.g. fibrosis and scarring) that may result in future ectopic pregnancy and/or tubal-factor infertility. Other consequences of chlamydia in females include Reiter's syndrome (reactive arthritis) and Fitz-Hugh Curtis syndrome (also known as perihepatitis, which is inflammation of the lining of the liver).

In males, the consequences of genital chlamydia infection may include:

- urethritis;
- epididymitis (inflammation of the epididymis);
- prostatis (inflammation of the prostate gland);
- proctitis (rectal inflammation); and
- Reiter's syndrome (reactive arthritis).

As the following diagram from the National Audit Office illustrates, there is a lot of uncertainty about the links between chlamydia infection and possible health consequences. Experts have only a limited understanding of the probabilities of chlamydia infection causing disease; for example, estimates of the proportion of chlamydia-infected women who will go on to develop pelvic inflammatory disease range from five to 30 per cent.[1]

Diagram 1: Association between chlamydia infections and subsequent health complications



Source: National Audit Office, based on information supplied by the Health Protection Agency

Babies born to mothers with chlamydia infection may suffer from conjunctivitis and pneumonia.[2,3,4] There is also some recent evidence to suggest that women who have previously had chlamydia may be at increased risk of adverse birth outcomes including pre-eclampsia, spontaneous preterm birth or stillbirth, although there is some conflict between findings from different studies.[5,6,7] Further work would therefore be needed to establish whether chlamydia has a causal role in these outcomes.[8]

Chlamydia may also increase the risk of HIV transmission and there may be an association between chlamydia and persistent high risk human papillomavirus (HPV, a sexually transmitted virus that can cause cervical cancer).[9,10,11]

Chlamydia-related complications are associated with a reduced quality of life.[12,13,14] This can result in considerable healthcare costs.[15,16,17,18]

National/regional treatment costs

The most recent economic evaluation to explore the cost effectiveness of chlamydia screening in terms of cost per quality adjusted life year (QALY) using data from England was conducted at the outset of the chlamydia screening programme.[19] The authors estimated that opportunistic screening of under-25 year old men and women every year would cost £27,269 for every QALY gained, compared to no screening, and assuming a 10% rate of progression from acute chlamydia infection to PID. This is within the acceptable range used by the National Institute for Health and Care Excellence (NICE) of up to £20-30k per QALY gained, and was thus considered cost effective.

Higher rates of testing were found to increase the cost effectiveness of screening. Lower rates of progression from chlamydia infection to PID decreased the cost effectiveness of screening.

Chlamydia screening is not something which is undertaken in the expectation of being a cost *saving* for the NHS, but rather in the hope of improving health at reasonable cost.[20,21] A study published in 2007 concludes that the cost effectiveness of chlamydia screening hinges on the probability of infected women developing PID. It further suggests that this probability is likely to be no more than 10%, much lower than most previous studies had assumed. This would mean that chlamydia screening is only borderline cost effective according to the usual NICE criteria of £20-30k per QALY gained.

NHS guidance for commissioners states that integration into local sexual health service economies is the most efficient, sustainable and cost effective approach to delivering chlamydia screening.[22] When commissioning sexual health services, consideration of the relationship between chlamydia testing and other related services, for example testing for other STIs, prevention, condom distribution, and contraception, will maximise opportunities for integration and help local NHS organisations to realise cost savings.

New Public Health Outcomes Framework indicator

Published in early 2012, the Department of Health (DH) Public Health Outcomes Framework (PHOF) 2013-16 included an indicator on the chlamydia diagnosis rate in 15-24 year olds, underlining the importance of reducing the prevalence of chlamydia infection in young adults in England. Public Health England recommends that local areas should be working towards achieving a diagnosis rate of at least 2,300 per 100,000 (the recommended diagnosis rate level was recently reduced from ≥2,400 to >2,300 diagnoses per 100,000 15-24 year old resident population annually).

This follows changes to the chlamydia reporting system; it is now possible to remove previously double-counted tests from national and local totals. The >2,400 diagnosis rate was set on data from the previous reporting system, which included double-counted diagnoses. As these will now be removed from chlamydia datasets, the recommended diagnosis rate has been reduced accordingly.

The inclusion of the new indicator in the PHOF is one indication of the importance which the DH continues to attach to the chlamydia screening programme. It has stated its intention to work to improve the quality and cost-effectiveness of the National Chlamydia Screening Programme (NCSP), and described its vision that “all sexually active young people should be offered chlamydia testing as a routine part of every primary care and sexual health consultation”.[23]

Chlamydia screening – who is at risk and why

Opportunistic screening for chlamydia in young people under the age of 25 was first suggested in 1998, and was endorsed in the Department of Health’s sexual health and HIV strategy in 2001. A phased roll-out of the National Chlamydia Screening Programme began in 2003-04, but it took until March 2008 before all primary care trusts were involved. Although local authorities are not explicitly required to participate post-April 2013, the DH confirms its continued support for the programme.[24]

The programme only really gathered momentum when it became the subject of a vital signs indicator (VSB 13) which dictated that the percentage of young people aged 15-24 receiving chlamydia screening should reach 17% by 2008-09, 25% by 2009-10 and 35% by 2010-11. These original targets were defined only to include screening 'in the community' – i.e. other than in genitourinary medicine (GUM) clinics. One reason for this was as part of a general drive to encourage the development of sexual health services in a wider range of settings. Another reason was that chlamydia infection is often symptomless, and GUM clinics tend to be attended by those who do have symptoms or perceive themselves to be at risk.

The targets were based on the understanding that these were the sort of screening levels which needed to be sustained over several years to bring about a substantial reduction in chlamydia prevalence. Screening levels did rise sharply, but the targets were not achieved either locally or nationally.

The Health Protection Agency (HPA) reports over 186,000 new cases diagnosed in 2011, with sexually active young adults remaining at highest risk of infection. Highest rates are

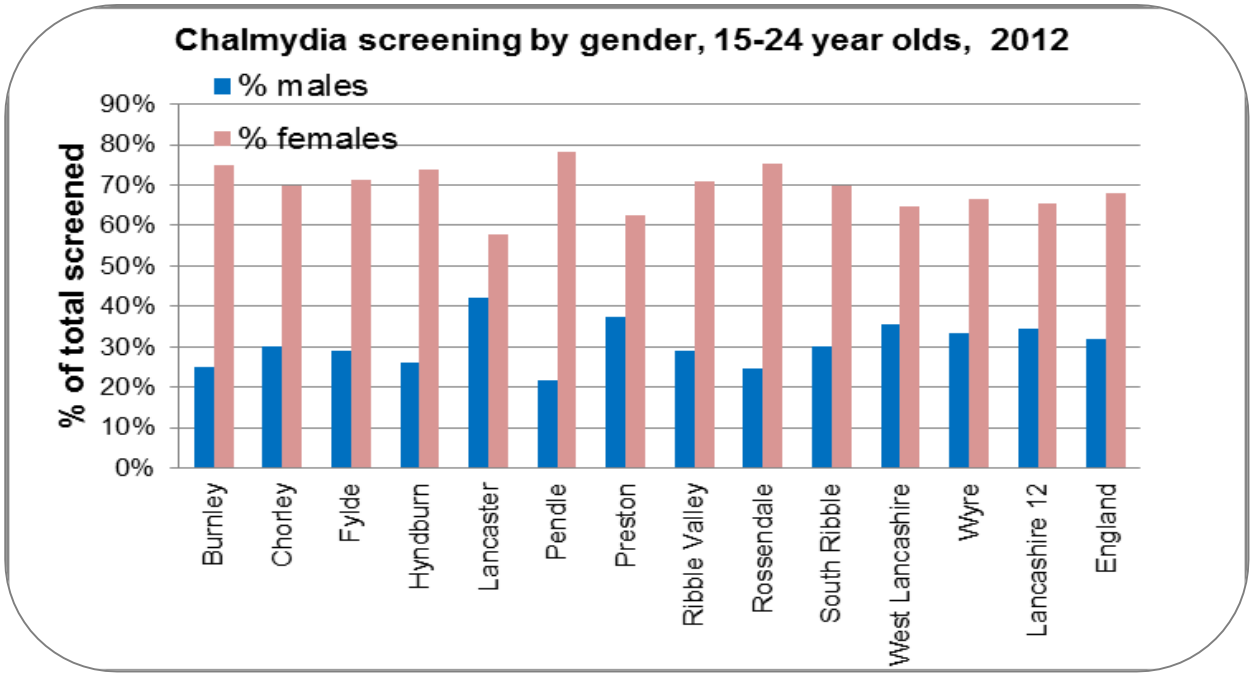
seen in mainly young men and women under 25 years. A health technology assessment of chlamydia screening in 2007 concluded that there were no risk factors, other than young age, which could help to target screening more effectively.[25]

Public Health England advises against targeting particular groups on the basis of their sexual behaviour, as this might lead to stigma and discrimination and undermine attempts to normalise the discussion of sexual health with young people. It also points out that chlamydia infection is quite often found in people without any obvious risk factors.[26]

Gender breakdown

Taking all venues together, females accounted for 66% of chlamydia screening in Lancashire* in 2012. This compares with 68% in England as a whole, and 69% in the North West. Figure 1 shows the gender split by district.

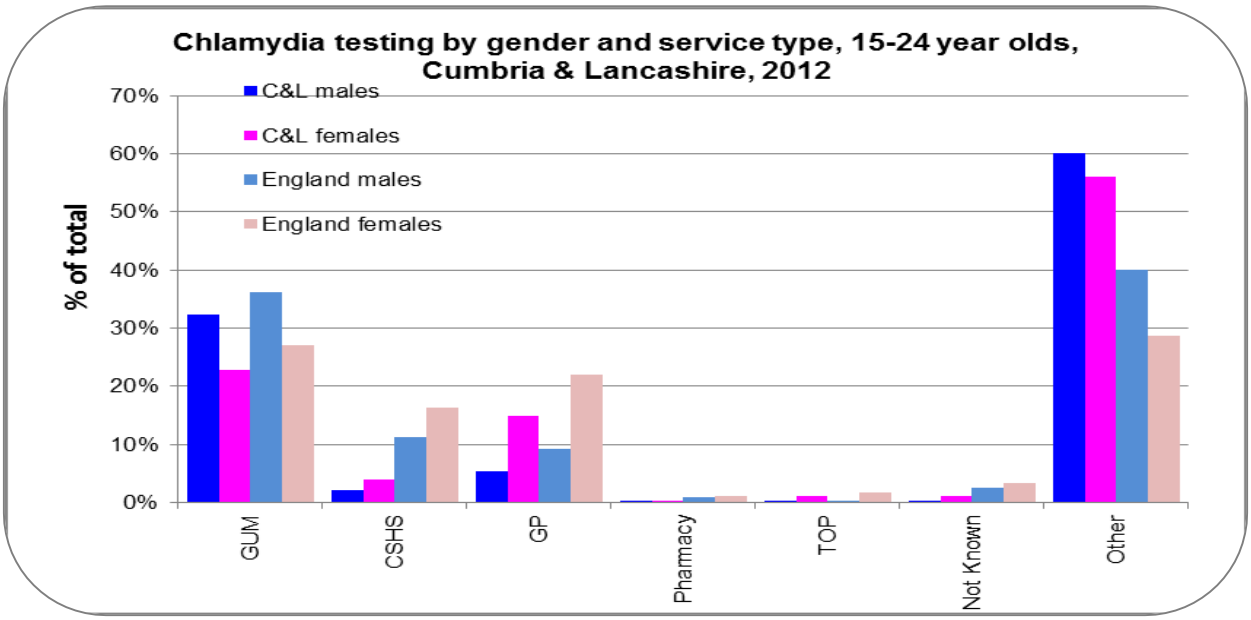
Figure 1: Chlamydia screening by gender, 15-24 year olds in Lancashire 2012



As figure 2 shows in Cumbria and Lancashire the male/female split varies by venue: a higher percentage of females than males use GP and community sexual health services (CSHS) services and a higher percentage of males, than females, use GUM service.[27]

* Lancashire refers to the 12 districts in the county council area; Lancashire-14 refers to the 12 districts plus the two unitary authorities of Blackburn with Darwen and Blackpool.

Figure 2: Chlamydia testing by gender and venue – Cumbria and Lancashire (2012)

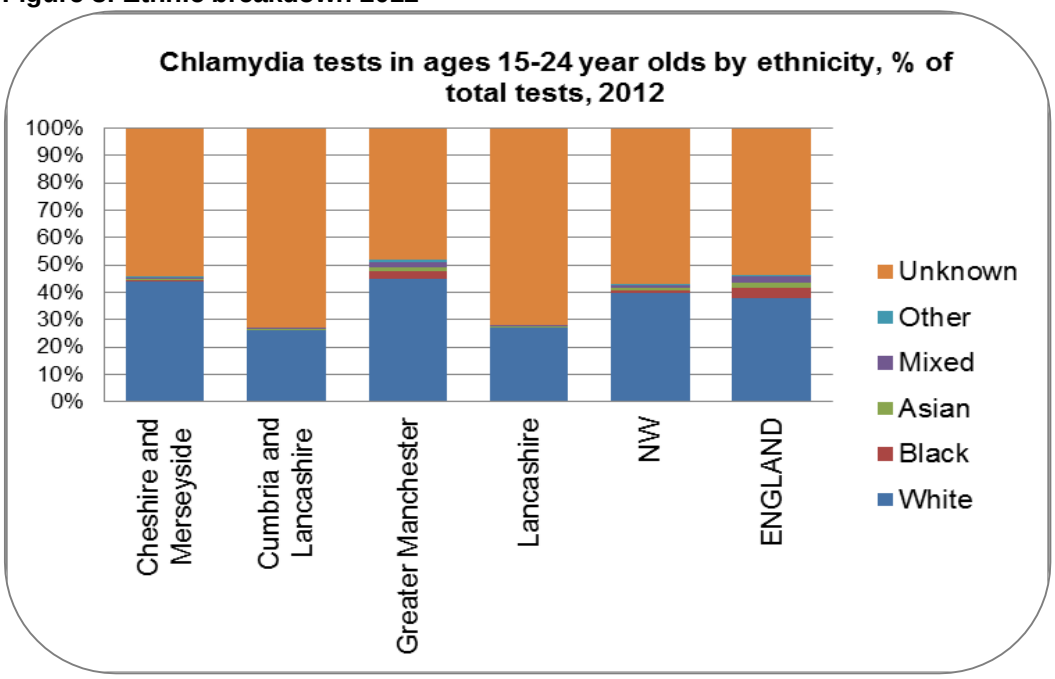


Note: TOP – termination of pregnancy

Ethnicity

Figure 3 shows that in 2012 in Lancashire ethnicity was only recorded for 28% of the tests carried out, and of this total 27% were for people of white ethnic origin and 1% were other ethnic groups. In Lancashire the percentage of tests where ethnicity is unknown is higher than the England percentage, thereby indicating possible concerns with ethnicity recording. Out of the 42,137 tests carried out on Lancashire residents, the ethnicity of the service user was only recorded for 11,813 tests.

Figure 3: Ethnic breakdown 2012



Routes of infection

Chlamydia is primarily transmitted through sexual contact with an infected partner. Chlamydia can also be spread perinatally from an untreated mother to her baby during childbirth, resulting in conjunctivitis or pneumonia in some exposed infants. People who have had chlamydia and have been treated may get infected again if they have sexual contact with a person infected with chlamydia.

Partner notification

Partner notification is recommended in order to prevent re-infection and to interrupt the transmission of infection to other sexual partners. Partner notification is an effective method of identifying individuals with infection.[28] For example in 2013 in North England, 26,428 of 15-24 year olds were tested for chlamydia in a GUM clinic as a result of their partner having been tested; 38% of these tested positive for chlamydia.[29]

Chlamydia screening – level of need in the population

Prevalence

Obtaining accurate estimates of the true prevalence of chlamydia is difficult as the infection is often asymptomatic and is liable to remain undetected, though modelling suggests that the level of testing that has been achieved in England through opportunistic screening will probably have resulted in reductions in prevalence, and that achieving the Public Health Outcomes Framework (PHOF) chlamydia diagnosis rate (≥2,300) will further contribute to control of chlamydia prevalence in coming years. Several different approaches are currently being taken to try to estimate and monitor prevalence. Another way of assessing the level of need associated with chlamydia would be to monitor occurrences of its possible consequences, such as PID and ectopic pregnancy. The (HPA) is stepping up such analysis at the national level, but this means monitoring *all* cases, whether or not caused by chlamydia. It has been estimated that only about 30% of PID is due to chlamydia.[30]

Local level indicators

At the local level, the HPA can monitor how well the screening programme is being run, using output indicators such as coverage, positivity, diagnostic rate, and rates of treatment and partner notification which are understood to have an impact on the prevalence of chlamydia. Data is collected on all chlamydia tests undertaken in England from NHS laboratories and local authority/NHS commissioned laboratories, to measure screening activity. These data are used to provide detailed reports at a national and local level, on screening coverage, the proportion of chlamydia tests that are positive and the chlamydia diagnosis rate in England.

Chlamydia screening – good practice

Three of the key measures which can be used to assess screening programme performance are:

- coverage – the percentage of young people tested;
- positivity – the percentage of those tests which prove positive; and
- diagnostic rate – the number of positive tests per 100,000 young people aged 16-24.

Up until 2011, the main focus was on boosting coverage, but the PHOF now measures the diagnostic rate, which is effectively a combination of coverage and positivity. In a clear change of emphasis, the DH has stated that: *"*work with low-risk groups that identifies small numbers of positive cases should cease".[31]

The new indicator is based on *all* screening in GUM clinics as well as in the community. To start with a high rate is to be regarded as desirable. All areas were initially urged to aim for a diagnostic rate of at least 2,400 per 100,000. This was reduced to 2,300 per 100,000 in June 2013, due to the introduction of new data collection systems which are less susceptible to double-counting.

The coverage needed to achieve the recommended diagnosis rate varies according to the percentage infected amongst those tested. As a guide, a diagnosis rate around 2,300/100,000 is achieved by a total test coverage of 28.8% if the percentage infected amongst all tests is close to 8%.[32]

Table 1: Actions for local areas to improve chlamydia screening provision with regard to diagnosis rate

	Percentage infected	
Diagnosis rate	High (above 12%)	Low (below 5%)
Low (below 2,300/100,000)	Increase coverage. Review percentages infected by venue type, and consider expanding testing in core services.	Review percentage infected by venue type and consider moving resources from venue types with a lower percentage infected (e.g. outreach) to venue types with a higher percentage infected, particularly those with high potential throughput (e.g. core services). Ensure potential of diagnoses from partner notification is maximised.
High (above 2,300/100,000)	If most tests done in venue type with a higher percentage infected, consider whether access to testing is adequate for all young people. If testing is being accessed at range of community venues and percentage infected is high at all venues, continue.	Consider moving resources from venue types with a lower percentage infected (e.g. outreach) to those with higher percentage infected, to improve efficiency.

Coverage, positivity and diagnostic rate

Chlamydia testing activity dataset

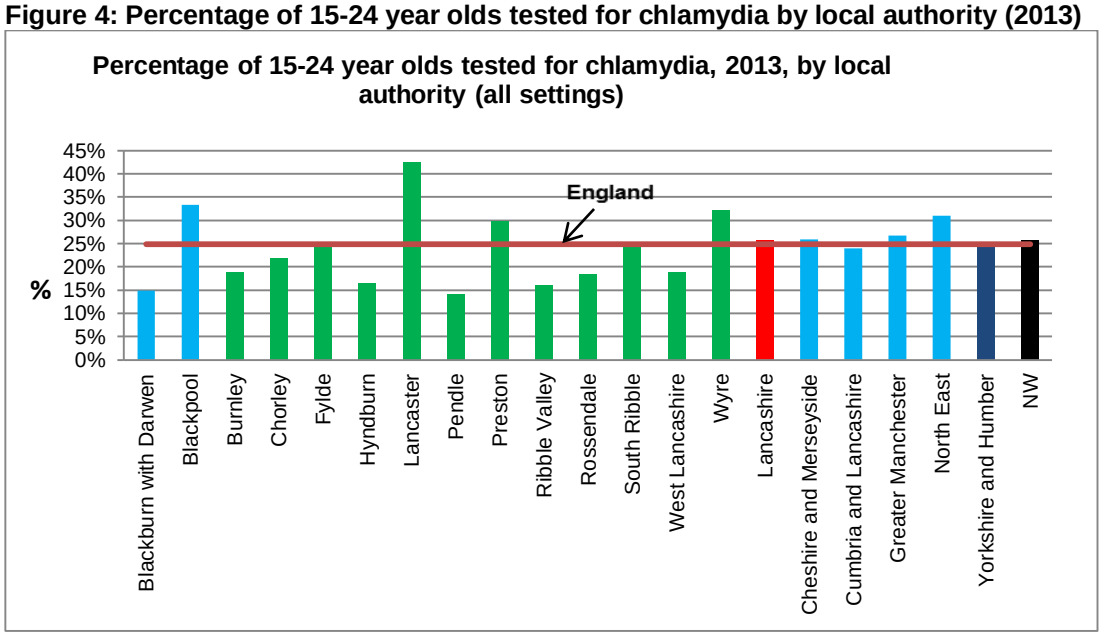
The 2012 screening rates now available from the NCSP site are the first to be based on a new data collection system known as the chlamydia testing activity dataset (CTAD). The published 2013 diagnostic rate for Lancashire is 2,292 per 100,000 of the population, which is very close to the target of 2,300, and appears at first glance to be a slight improvement on the 2012 rate of 2,226. CTAD data is attributed to local authorities using the patient's postcode of residence where provided. If this is not provided, other reported location data are checked in order: the patient's GP's postcode; the postcode of testing service; the patient's GP code; or the NCSP clinic code.

Several significant changes have been made in the way chlamydia data are reported in 2012. These improvements mean that data for 2012 onwards is not directly comparable with the data reported in earlier years.

Coverage

In 2013, coverage among 15-24 year olds in all settings in Lancashire was 25.8% compared to 24.9% in England (figure 4 below).[33] Variation across the county districts ranged from 14% in Pendle to 43% in Lancaster. This high coverage rate may be due to Lancaster being a university town and having a large proportion of young people who access the service.

Figure 4: Percentage of 15-24 year olds tested for chlamydia by local authority (2013)



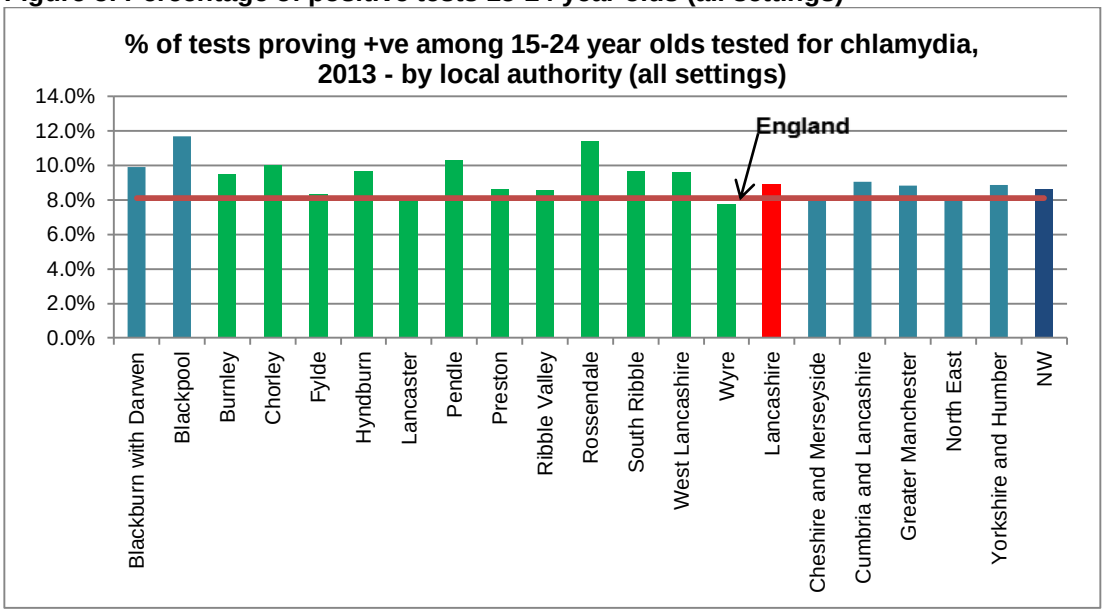
The districts of Preston, Lancaster and Wyre have had higher rates of testing compared to the rest of the Lancashire districts. In these districts the rate of positivity is also the lowest in the county, probably reflecting the ongoing success of higher testing over a long period of

time, which has resulted in increased awareness followed by increased treatment, and thus reduced prevalence (see next section).

Positivity

In 2012, Lancashire achieved a positivity rate of 8.9% compared to England's 8.1%. Across the county this ranges from 11.4% in Rossendale to 7.8% in Wyre. Wyre, Lancaster and Fylde all have positivity rates below the England average (see figure 5 below).

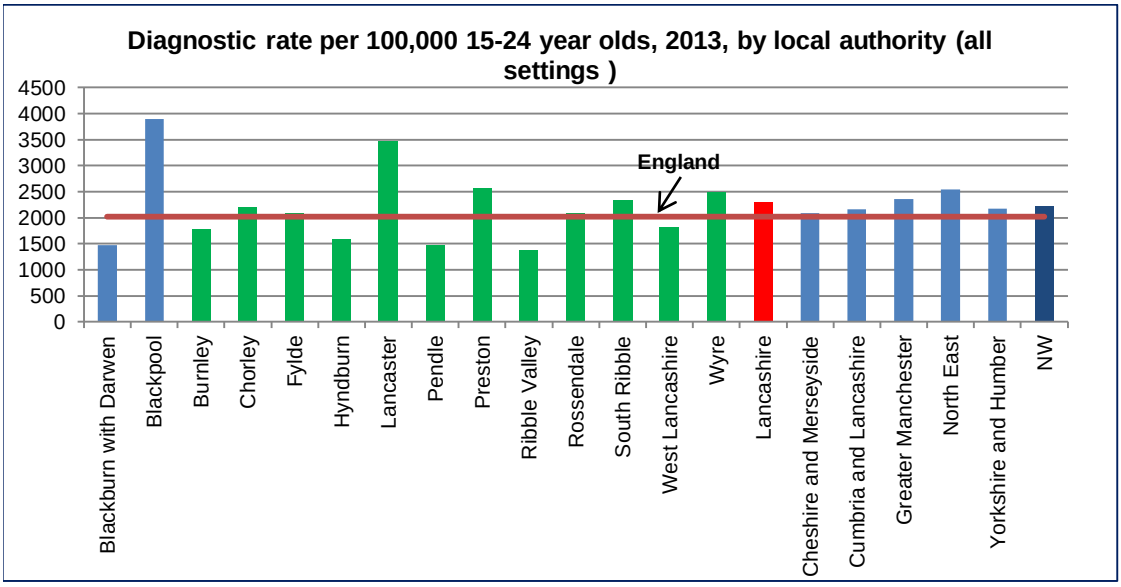
Figure 5: Percentage of positive tests 15-24 year olds (all settings)



Diagnostic rate

At 2,292 per 100,000, Lancashire's diagnostic rate in 2013 is just below the target (of 2,300) but higher than England's diagnostic rate of 2,016 (see figure 6 below).

Figure 6: Diagnostic rate per 100,000, 15-24 year olds (all settings)



Choice of venue

Latest data giving choice of venues is for 2012. In that year, 36.3% of Lancashire's chlamydia tests (in 15-24 year olds) took place within sexual and reproductive health services, primary care and genitourinary medicine venues, compared with 64.1% in England.[34] Figure 7 below shows how the 42,137 tests in Lancashire in 2012 were broken down by type of venue.

Figure 7: Chlamydia tests by area 2012

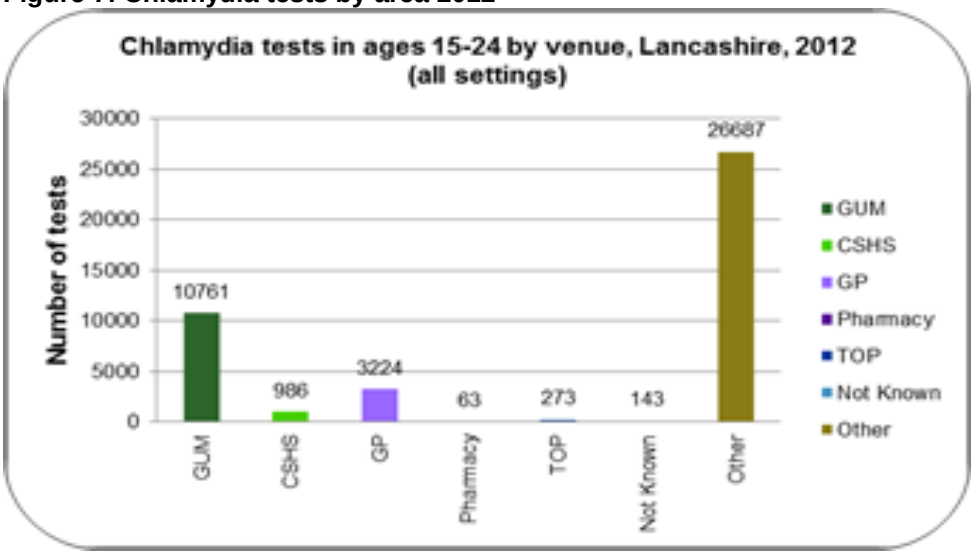
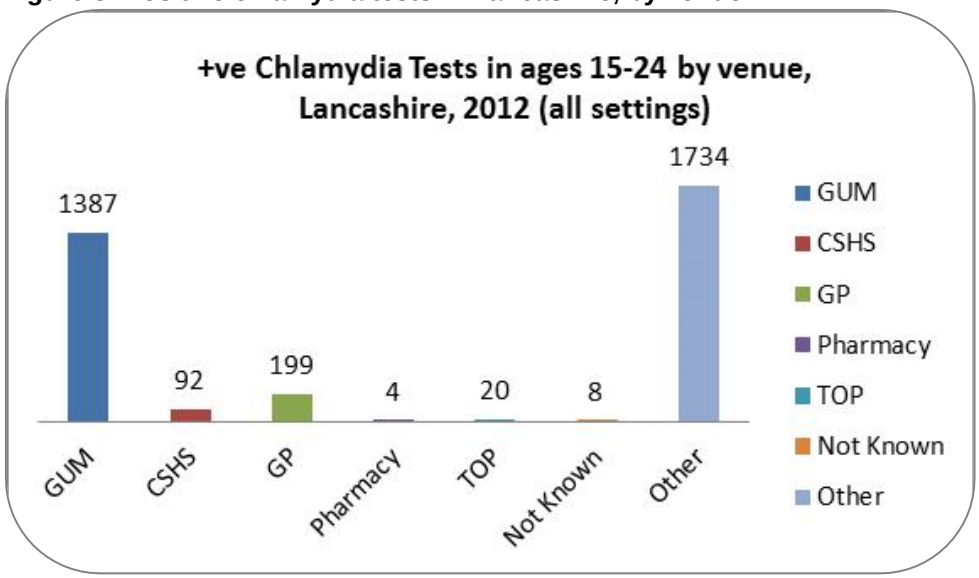


Figure 8 shows rates of positivity per type of venue. This indicates that positivity in GUM clinics is at 12% compared to 6% in other venues. This reflects the fact that community screening venues are by nature opportunistic, whilst GUM clinics are generally visited by clients with concerns, worries, other STI-related issues or actual symptoms.

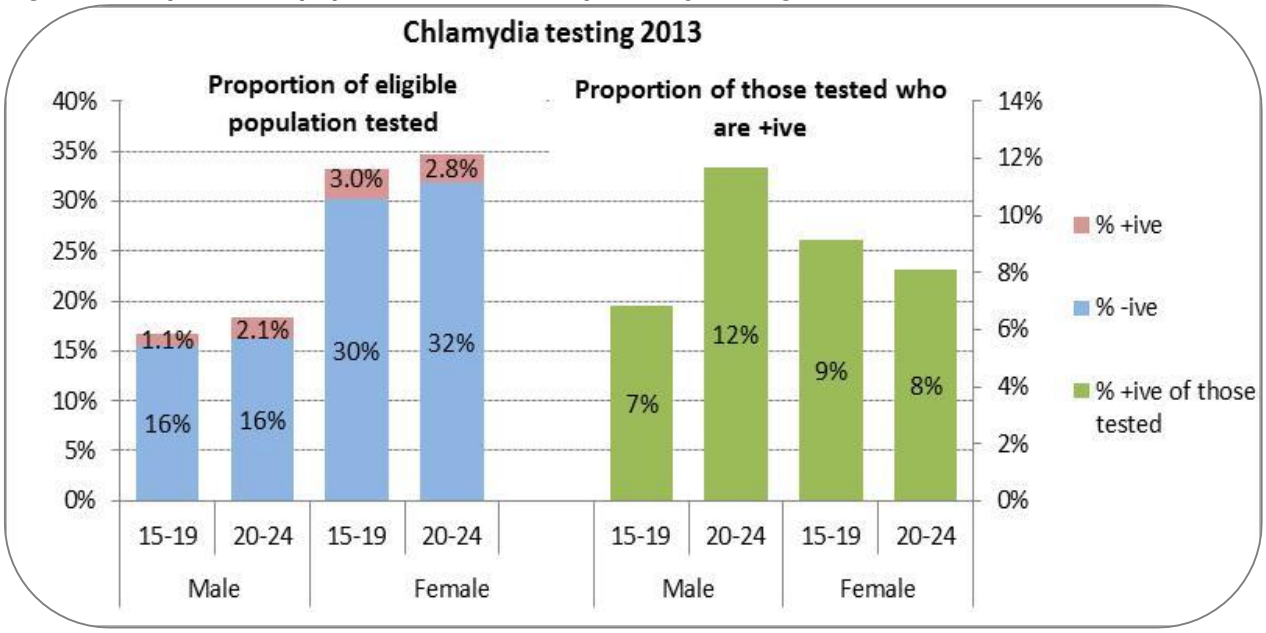
Figure 8: Positive chlamydia tests in Lancashire, by venue



Gender and age distribution

Figure 9 below indicates breakdown by gender (male/female) and by age (15-19 and 20-24). This shows the far greater level of testing of females and the higher levels of positivity in females. However, when positivity of those tested is viewed, the number of males aged 20-24 is the highest group of all. This suggests that male testing in this age bracket is more targeted, possibly following partner notification, and that there is still male stigma around chlamydia testing. This situation in Lancashire directly reflects the national picture.

Figure 9: Proportion of population tested and positivity amongst those tested.



Treatment and partner notification

The most recent treatment and partner notification figures published by Public Health England show data for Lancashire and Cumbria combined for 2013.[35]

There were 1,777 partner notifications across Lancashire and Cumbria and of these 1,627 (92%) were tested. This is below the 97% standard recommended by PHE but is slightly higher than the England average of 90%. Of the partner notifications tested there was a positivity rate of 44% compared to 37% across England. The partner notification ratio is 0.55, the same as the England average but below the recommended ratio of 0.6.[36]

National Chlamydia Screening Programme tool

NCSP has provided an Excel tool for calculating the number of tests likely to be needed in the community to achieve the required overall diagnostic rate.[37] One approach is to assume that the number of positive tests in GUM clinics will be much the same as the year before. Users can then experiment with various positivity rates outside of GUM, to find out how many tests they are likely to need to conduct in the community.

Good practice interventions

Using chlamydia screening as part of an integrated local sexual health services is an efficient way to deliver care. Chlamydia testing in non-genitourinary medicine (GUM) settings is significantly cheaper than requiring young people to attend GUM services, as costs for the simple test are much lower than for a full consultation in a GUM clinic. Ensuring that young people have access to chlamydia screening services which are integrated with a range of clinical sexual and reproductive health services – including primary care and contraceptive services – can allow specialist providers to focus resources on more complex and symptomatic patients, while helping to reduce the overall burden of disease. Furthermore, widespread testing increases the normalisation and de-stigmatisation of STI testing, making young people more able and willing to take responsibility for their sexual health.

The opportunistic screening approach to chlamydia screening has achieved relatively high rates of coverage. In the National Survey of Sexual Attitudes and Lifestyle (Natsal-3), 54% (95% confidence interval: 51%-57%) of sexually active 16 to 24 year old women, and 35% (95% CI: 32%-37%) of young men, had been tested for chlamydia in the past year.[38] The survey also showed that higher levels of testing are seen among those reporting greater numbers of sexual partners, who are therefore at increased risk of infection.[39]

As a large proportion of chlamydia infections are asymptomatic and chlamydia is not limited to 'high risk' groups, by offering screening to those without symptoms, and by providing screening in a range of community venues outside of specialist services, more infections will be diagnosed and treated than if only those with symptoms, or only those attending specialist services were tested. [40,4142] In England, 59% of chlamydia diagnoses among 15-24 year olds were made outside specialist GUM services in 2012.[43]

The NCSP recommends that all sexually active under-25 year old men and women be tested for chlamydia annually or on change of sexual partner (whichever is more frequent) because young adults are at risk of new or repeat infections, and therefore of developing complications.[44] Having a new sexual partner increases an individual's risk of having a new infection.[45,46] The NCSP focuses on sexually active under-25 year olds, as rates of chlamydia infection are known to be highest in this group.[47,48]

Current service provision

In Lancashire the current provision is only just short of the overall target of achieving 2,300 positive diagnoses per 100,000 of 15-24 year olds (2,292). However, this masks the fact that some areas in the county are well below the target (Hyndburn, Pendle and West

Lancashire), whilst conversely, Lancaster, Preston and Wyre are all well above the target rate (see figure 4).

Current evidence on the cost-effectiveness of chlamydia screening suggests that screening sexually active men and women under-25 years old (i.e. the NCSP screening strategy) can be cost-effective.

Identified gaps

The only distinguishable gaps are those areas of the county where testing and diagnosis are well below the norm for the county, region and England.

Recommendations

Around 75% of young adults visit their GP every year, providing an ideal opportunity to offer an annual chlamydia screen.

- Increase access to chlamydia screening in primary care.
- Testing continues to be offered to all women undergoing abortion

Pharmacists are already established providers of sexual health services (e.g. pregnancy tests, emergency contraception provision) and chlamydia screening is an appropriate addition to these services. However, chlamydia schemes via pharmacists have not been successful to date; with poor return rates and an associated lack of value for money as most utilised postal kits, which were taken but not returned. Following appropriate training and support pharmacists are also well placed to provide treatment and partner notification, with long opening hours and high-street presence.

- Investigate the benefit of widening access through pharmacists and to include treatment and partner notification.

It is noted that the performance across the county varies, increasing testing in those underperforming areas, while maintaining levels elsewhere would result in Lancashire being above the diagnosis target of 2,300/100,000.

- Promote and increase testing in areas where uptake is currently low.

A further issue for consideration is how to address the very small shortfall in the diagnosis rate – either in a county-wide context, or through district-level targeting.

- Embed chlamydia screening in core services and measure and respond to any poor performance.

References

[1] National Audit Office (2009). Young people's sexual health: the National Chlamydia Screening Programme.

[2] Stamm WE. Chlamydia trachomatis infections of the adult. In: Holmes KK, Sparling PF, Mardh P-A, Lemon SM, Stamm WE et al., editors. Sexually Transmitted Diseases. New York: 1999.

[3] Rours IG, Hammerschlag MR, Ott A, De Faber TJ, Verbrugh HA, de Groot R et al. Chlamydia trachomatis as a cause of neonatal conjunctivitis in Dutch infants. *Pediatrics* 2008; 121(2): e321-e326.

[4] Jain S, Perinatally acquired Chlamydia trachomatis associated morbidity in young infants. *J Matern Fetal Med* 1999; 8(3): 130-133.

[5] Rours GI, Duijts L, Moll HA, Arends LR, de Groot R, Jaddoe VW et al. Chlamydia trachomatis infection during pregnancy associated with preterm delivery: a population-based prospective cohort study. *Eur J Epidemiol* 2011.

[6] Haggerty CL, Klebanoff MA, Panum I, Uldum SA, Bass DC, Olsen J et al. Prenatal infection increases the risk of preeclampsia. *Pregnancy Hypertens* 2013; 3(3): 151-154.

[7] Fenton KA, Mercer CH, Johnson AM, Byron CL, McManus S, Erens B et al. Reported sexually transmitted disease clinic attendance and sexually transmitted infections in Britain: prevalence, risk factors, and proportionate population burden. *J Infect Dis* 2005; 191 Suppl 1:S127-S138.

[8] Thorne C. UK National Screening Committee Policy review Chlamydia screening in pregnancy: an advance review. 2011.

[9] Johnson LF, Lewis DA. The effect of genital tract infections on HIV-1 shedding in the genital tract: a systematic review and meta-analysis. *Sex Transm Infect* 2008; 35(11): 946-959.

[10] Silva J, Cerqueira F, Medeiros R, Chlamydia trachomatis infection: implications for HPV status and cervical cancer. *Arch Gynecol Obstet* 2013.

[11] Public Health England. Table 13: Number of contacts and STI diagnoses made through partner notification at GUM clinics in England, 2012. 2013.

[12] Haggerty CL, Schulz R, Ness RB. Lower quality of life among women with chronic pelvic pain after pelvic inflammatory disease. *Obstet Gynecol* 2003; 102(5 Pt 1): 934-939.

[13] Smith KJ, Tsevat J, Ness RB, Wiesenfeld HC, Roberts MS. Quality of Life Utilities for Pelvic Inflammatory Disease Health States. *Sexually Transmitted Diseases* 208; 35(3): 307-311.

[14] Statton KR, Durch JS, Lawrence RS. Vaccines for the 21st Century: A tool for decision making. 2000. Washington D.C., National Academy Press.

[15] Aghaizu A, Adams EJ, Turner K, Kerry S, Hay P, Simms I et al. What is the cost of pelvic inflammatory disease and how much could be prevented by screening for chlamydia trachomatis? Cost analysis of the Prevention of Pelvic Infection (POP) trial. Available from http://sti.bmj.com/content/87/4/312

[16] Adams EJ, Turner KM, Edmunds WJ. The cost effectiveness of opportunistic chlamydia screening in England. *Sex Transm Infect* 2007; 83(4): 267-274.

[17] Roberts TE, Robinson S, Barton PM, Bryan S, McCarthy A, Macleod J et al. Cost effectiveness of home based population screening for Chlamydia trachomatis in the UK: economic evaluation of chlamydia screening studies (ClaSS) project. *BMJ* 2007; 335(7614):291.

[18] Westaby DT, Wu O, Duncan WC, Critchely HO, Tong S, Horne AW. Has increased clinical experience with methotrexate reduced the direct costs of medical management of ectopic pregnancy compared to surgery? *BMC Pregnancy Childbirth* 2012.

[19] Ibid.

[20] Oakeshott P, Kerry S, Aghaizu A, Atherton H, Hay S, Taylor-Robinson D et al. Randomised controlled trial of screening for Chlamydia trachomatis to prevent pelvic inflammatory disease: the POPI (prevention of pelvic infection) trial. BMJ 2010: 340:c1642

[21] Aghaizu A, Adams EJ, Turner K, Kerry S, Hay P, Simms I et al. What is the cost of pelvic inflammatory disease and how much could be prevented by screening for chlamydia trachomatis? Cost analysis of the Prevention of Pelvic Infection (POP) trial.

[22] DH (2012) Integrating the National Chlamydia Screening Programme within local sexual health economies – Guidance for Commissioners and public health professionals. Department of Health, Feb 2012

[23] DH (2011). The future direction of the national chlamydia screening programme.

[24] Adams EJ, Turner KM, Edmunds WJ. The cost effectiveness of opportunistic chlamydia screening in England. *Sex Transm Infect* 2007; 83(4): 267-

[25] Low N, McCarthy A, Macleod J, Salisbury C, Campbell R, Toberts TE et al. Epidemiological, social, diagnostic and economic evaluation of population screening for genital chlamydial infection. Health Technol Assess 2007; 11 (8).

[26] PHE (2013). Public Health Outcomes Framework: Annual Chlamydia Diagnosis Rate (15-24 year olds) https://www.gov.uk/government/statistics/national-chlamydia-screening-programme-ncsp-data-tables

[27] NCSP site

[28] Turner K, Adams E, Grant A, Macleod J, Bell G, Clarke J et al. Costs and cost effectiveness of different strategies for chlamydia screening and partner notification: an economic and mathematical modelling study: BMJ 2010; 342:c7250

[29] Public Health England. Table 13: Number of contacts and STI diagnoses made through partner notification at GUM clinics in England, 2012. 2013.

[30] Aghaizu A, Adams EJ, Turner K, Kerry S, Hay P, Simms I et al. What is the cost of pelvic inflammatory disease and how much could be prevented by screening for chlamydia trachomatis? Cost analysis of the Prevention of Pelvic Infection (POP) trial.

[31] DH (2011). The future direction of the national chlamydia screening programme.

[32] PHE (2013). Public Health Outcomes Framework: Annual Chlamydia Diagnosis Rate (15-24 year olds) – FAQs. https://www.gov.uk/government/statistics/national-chlamydia-screening-programme-ncsp-data-tables

[33] NCSP site

[34] Ibid.

[35] Public Health England, 2013. Sexually Transmitted Infections Annual Data, Table 7: STI diagnoses & partner notifications 2012-2013. HPA, 2014.

[36] Ibid.

[37] Public Health England, 2014. National chlamydia screening programme standards (7th edition), Standard 4, May 2014.

[38] Sonnenberg P, Clifton S, Beddows S, Field N, Soldan K, Tanton C et al. Prevalence, risk factors, and uptake of interventions for sexually transmitted infections in Britain: findings from the National Surveys of Sexual Attitudes and Lifestyles (Natsal). *Lancet* 2013; 382 (9907): 1795-1806

[39] The National Survey of Sexual Attitudes and Lifestyles (2014):

[40] Low N, McCarthy A, Macleod J, Salisbury C, Campbell R, Toberts TE et al. Epidemiological, social, diagnostic and economic evaluation of population screening for genital chlamydial infection. Health Technol Assess 2007; 11 (8).

[41] Stamm WE. Chlamydia trachomatis infections of the adult. In: Holmes KK, Sparling PF, Mardh P-A, Lemon SM, Stamm WE et al., editors. Sexually Transmitted Diseases. New York: 1999.

[42] Sonnenberg P, Clifton S, Beddows S, Field N, Soldan K, Tanton C et al. Prevalence, risk factors, and uptake of interventions for sexually transmitted infections in Britain: findings from the National Surveys of Sexual Attitudes and Lifestyles (Natsal). *Lancet* 2013; 382 (9907): 1795-1806

[43] Public Health England. Table 7: Number and rates of chlamydia diagnoses in England, 2003 – 2012. 2013.

[44] Oakeshott P, Kerry S, Aghaizu A, Atherton H, Hay S, Taylor-Robinson D et al. Randomised controlled trial of screening for Chlamydia trachomatis to prevent pelvic inflammatory disease: the POPI (prevention of pelvic infection) trial. BMJ 2010: 340:c1642

[45] Fenton KA, Mercer CH, Johnson AM, Byron CL, McManus S, Erens B et al. Reported sexually transmitted disease clinic attendance and sexually transmitted infections in Britain: prevalence, risk factors, and proportionate population burden. *J Infect Dis* 2005; 191 Suppl 1:S127-S138.

[46] LaMontagne DS, Baster K, Emmett L, Nichols T, Randall S, McLean L et al. Incidence and reinfection rates of genital chlamydial infection among women aged 16-24 years attending general practice, family planning and genitourinary medicine clinics in England: a prospective cohort study by the Chlamydial Recall Study Advisory Group. *Sex Transm Infect* 2007; 83(4): 292-303.

[47] Sonnenberg P, Clifton S, Beddows S, Field N, Soldan K, Tanton C et al. Prevalence, risk factors, and uptake of interventons for sexually transmitted infections in Britain: findings from the National Surveys of Sexual Attitudes and Lifestyles (Natsal). *Lancet* 2013; 382 (9907): 1795-1806

[48] Fenton KA, Mercer CH, Johnson AM, Byron CL, McManus S, Erens B et al. Reported sexually transmitted disease clinic attendance and sexually transmitted infections in Britain: prevalence, risk factors, and proportionate population burden. *J Infect Dis* 2005; 191 Suppl 1:S127-S138.