# Web-tool to assess the cost-effectiveness of chlamydia point-of-care tests at the local level

Public Health England

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## INTRODUCTION

- *Chlamydia trachomatis* is the most commonly diagnosed bacterial sexually transmitted infection in the UK.
- There is an average delay of several days between being tested for chlamydia and receiving test results.
- Point-of-care tests (POCTs) for chlamydia, where patients are tested and treated in the same visit, have potential to improve control of infection by:
  - reducing transmission by diminishing the delay in treating infection
  - treating a greater number of infections through reduced loss to follow-up of index patients
  - increasing uptake of screening due to greater convenience[1,2].
- The cost-effectiveness of POCTs depends on multiple interacting factors including:
  - the cost per test
  - test sensitivity and specificity
  - clinical pathways
  - the risk behaviour of patients
  - the characteristics of the population including rates of care-seeking and screening
- To enable commissioners, providers, POCT manufacturers and others to assess the cost-effectiveness of POCTs for chlamydia, we developed a user-friendly, web-based tool (POCTiC).

## METHODS

*The model population is divided into the following states representing transmission of infection, care-seeking and treatment:*

***Uninfected (U)***
***Infected Care-Seeking due to symptoms ($I^C$)***
***Infected Non-Care-Seeking ($I^{NC}$)***
***Treated Presumptively ($T^{P,C}$) due to symptoms***
***Treated Post-test ($T^C$)***
***Treated Post-test, Screened ($T^{NC}$)***

If patients are lost to follow-up (i.e. they do not return for treatment after testing positive by conventional testing), or treatment fails or they are rapidly re-infected then they enter the $I^{NC}$ state. They may then recover naturally, or be treated as a result of partner notification or screening.
POCTs eliminate loss to follow-up and reduce treatment delay.

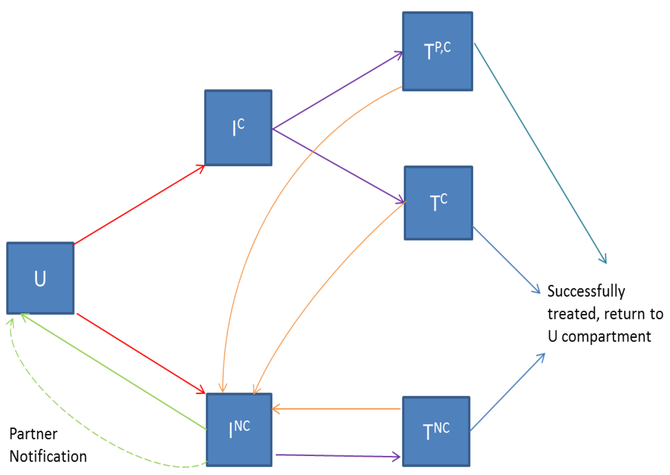


**Figure 1:** Compartmental structure of the dynamic transmission model for chlamydia

- As accounting for the benefits of infections averted is an essential component of cost-effectiveness analysis, the web-tool is based on a transmission-dynamic model (**Figure 1**).
- The tool represents heterogeneity in coverage (annual per-capita rate of testing) and diagnosis rate (annual per-capita rate of diagnosis) at local levels (**Figure 2**) and examines its effect on the impact of introducing POCTs.
- The model uses behaviour and prevalence data from a national survey (National Survey of Sexual Attitudes and Lifestyles, Natsal[3]), and surveillance data (Public Health England, PHE) to inform on local-level variation, represented by sampling parameter values from within their ranges of uncertainty and selecting parameter sets that reproduce local coverage and diagnosis rates.
- Chlamydia data at local level in England record numbers of tests and diagnoses in 15-24 year olds via:
  - ✓ GUMCAD[4]; Genitourinary Medicine Clinic Activity Dataset
  - ✓ NCSP[5]; National Chlamydia Screening Programme
  - ✓ Laboratory reports outside of GUM and not reported directly to NCSP[6]
- To calculate rates of testing and diagnosis, denominator local population sizes were obtained from the Office for National Statistics (ONS) for 326 Local Authorities (LAs) in England[7].
- The 15-24 year age group was used to determine starting ranges because these are the target ages for the NCSP in England[5] and have historically both higher coverage and diagnoses than any other age group[5]. Local settings for modelling were created by stratifying coverage and diagnosis rates in both sexes to provide 3 levels: Low, Medium, and High. Most LAs were defined by a few ranges (**Table 1**).
- 22 local settings were chosen as starting scenarios for the tool (**Figure 3**).

**TABLE 1**

| Coverage in females | Diagnosis rate in females | Coverage in males: Low – Diagnosis rate in males: Low | Low – Medium | Low – High | Medium – Low | Medium – Medium | Medium – High | High – Low | High – Medium | High – High |
|---|---|---|---|---|---|---|---|---|---|---|
| Low | Low | 105 | 11 | | 1 | 4 | | | | |
| | Medium | 47 | 62 | | 2 | 7 | | | | 1 |
| | High | | | | | | | | | |
| Medium | Low | | 1 | | | | | | | |
| | Medium | 12 | 27 | | 1 | 31 | 2 | | 1 | |
| | High | | 1 | | | 1 | 3 | | | |
| High | Low | | | | | | | | | |
| | Medium | | | | | 1 | | | 1 | |
| | High | | | | | | 1 | | | |

- The model (stratified by age, sex and partner change rate[8]) describes chlamydia transmission in a heterosexual population aged 15-44 years assuming a stable population structure (ONS data for 2011[7]).
- We generated 20,000 unique parameter sets using Latin hypercube (LHC) sampling[9], varying:
  - the parameters fitted at the national level, and;
  - at local level: the number of partners found per index case, annual screening rate, and proportion in the high-activity group, for each sex (reflecting variation in screening activity[5] and partner notification[10]).
- Candidate parameter sets were provisionally accepted if the equilibrium coverage and diagnosis rate for 15-24 year olds of each sex fell within the ranges defined in **Table 1**; the 80 parameter sets with prevalence closest to the national average were selected for each setting.

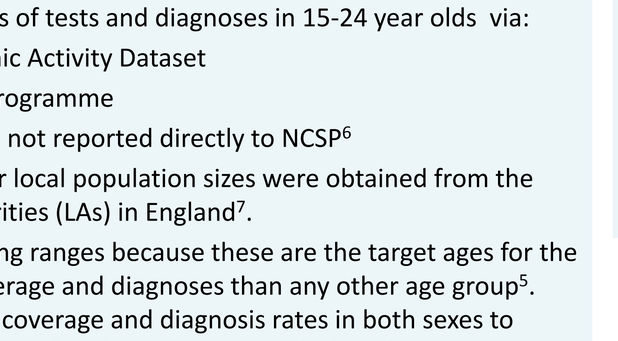


**Figure 3**: Equilibrium diagnosis rates as a function of coverage for males 15-24 (top) and females 15-24 (bottom) for each model across all 22 local settings in the tool. Blue dots are the diagnosis rate for a given model that represents a local setting; red dots are the values for each local authority; green dot is the national level and the dotted red lines are the maximum and minimum diagnosis rate and coverage rate across all 22 local settings in the tool.

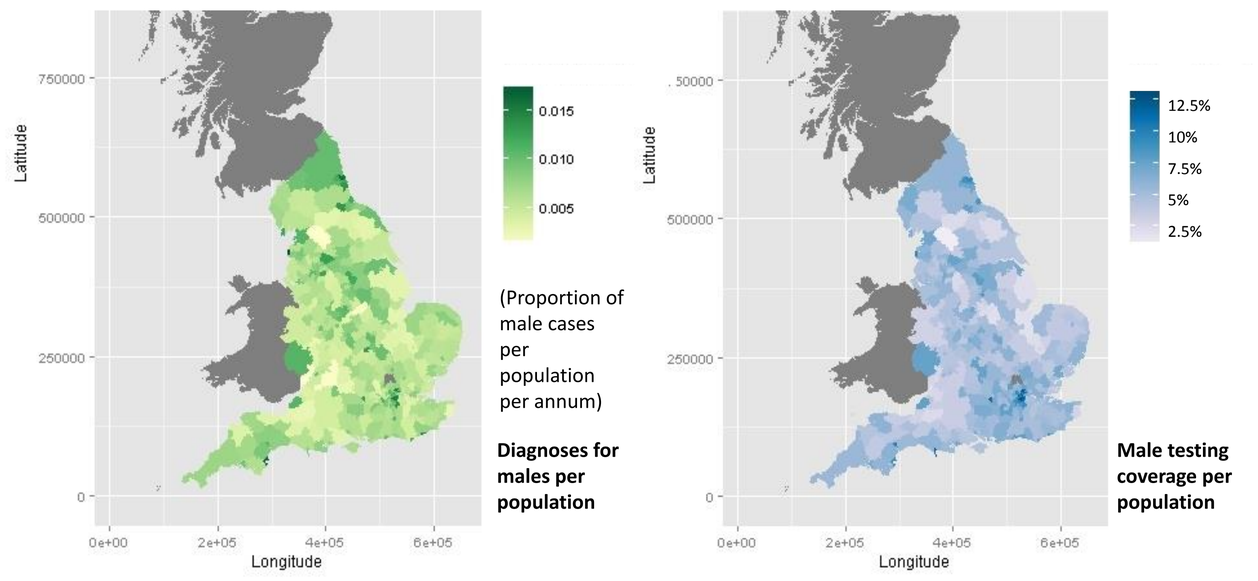


**Figure 2**: Heterogeneity in chlamydia testing coverage (percentage of population tested per year) and diagnoses (number of diagnoses per capita per year) for 15-24 year old males in 2011 indicating that the model must be adaptable to a range of testing coverage and diagnoses

## THE TOOL: POCTiC www.poctic.uk.net

- The web-tool gives a mechanism to inform decision-making by providing information about the expected impact of introducing POCTs for chlamydia.
- A user group consisting of industry, sexual health facilitators, sexual health commissioners, clinicians, public health experts, and healthcare consultants, provided input throughout.
- The web-tool aims to offer users the ability to investigate how POCT implementation for chlamydia might impact their local area (e.g. Upper Tier Local Authority). This tool will not give a definitive answer but can help guide users toward sensible decisions (**Figure 4**).

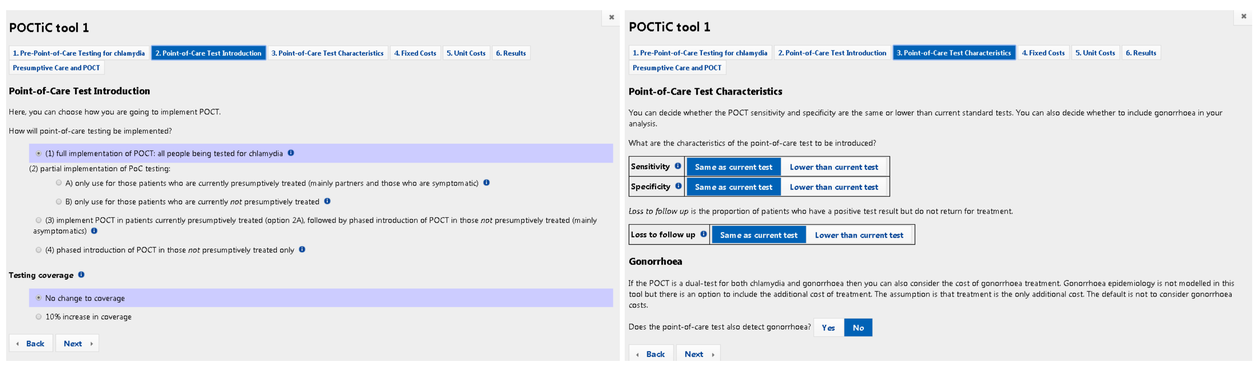


**Figure 4**: Example images of POCTiC : Users can describe different ways to implement the tool and explore costs

## FINDINGS

- Users can use the tool to determine the effectiveness and cost-effectiveness of implementing POCTs in a particular setting.
- Model results indicate that POCTs will reduce incidence, with the magnitude of the impact varying across different local settings. The amount of uncertainty in the model outcome also varies significantly between different local settings. Therefore, it might be cost-effective to implement POCTs in one local scenario but not in another.
- The effect of POCTs was dependent on both the test performance characteristics (sensitivity and specificity) and the assumptions about the implementation of the test across local services. The cheaper the POCT, the greater the cost-effectiveness provided sensitivity and specificity of the POCT match current tests (nucleic acid amplification tests, NAATs).
- Potential health impact of POCTs would be significant if their use led to improved screening rates.

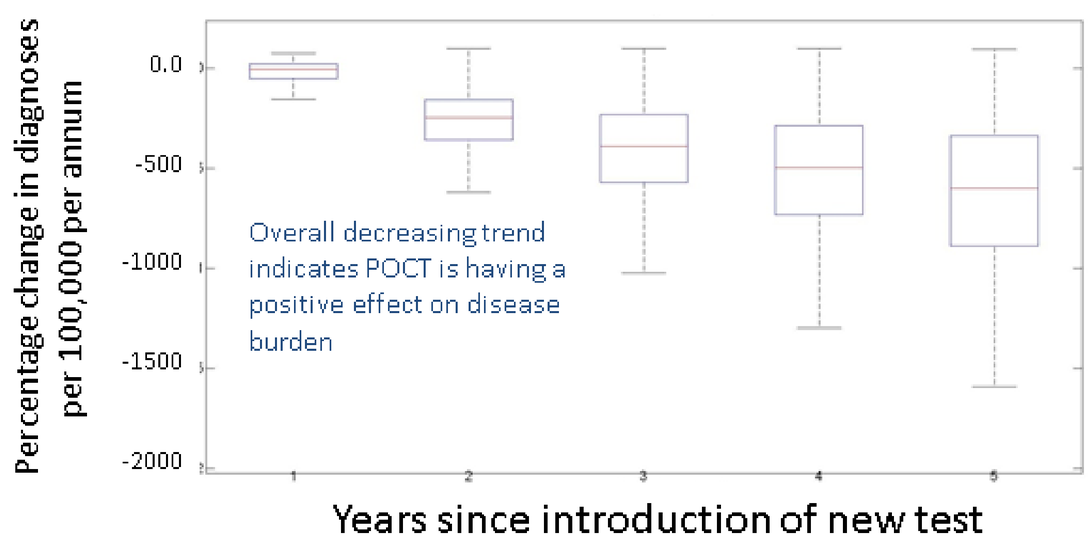


**Figure 5**: Web-tool output describing the expected change in diagnoses in the next 5 years for a scenario where full implementation of a hypothetical POCT was employed nationally; sensitivity and specificity of the POCT is as good as standard tests (NAATs)

- Potential changes in sexual behaviour between test and treatment could determine the relative contribution of increased treatment rates and reduced treatment delay to the reduction in prevalence as a consequence of POCT introduction.
- Exploration of many uncertainties surrounding chlamydia epidemiology and screening implementation is possible with this model. This method can complement local and national knowledge, and contribute to local-level management of chlamydia infection.
- POCTs will have benefits but must be considered carefully at a local level because the potential consequential changes to sexually transmitted infection management pathways, policy and guidance[11] are substantial.

## REFERENCES

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