Kirby Institute

The impact of screening on chlamydia transmission in Australia – a mathematical modelling study

Ben Hui, Jane Hocking, Nicola Low and David Regan

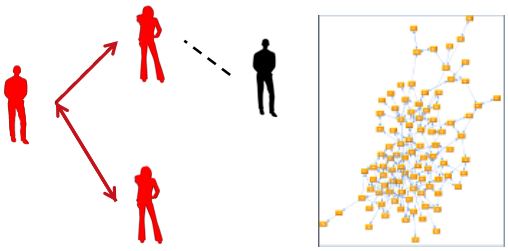
On behalf of the ACCEPt investigator team

Chlamydia transmission model

• We developed an individual-based model to represent the sexual network and the transmission of chlamydia in the general Australian heterosexual population.

• Aims:
- To assess the impact of the ACCEPt trial and other testing strategies on the prevalence of chlamydia infection over time
- To estimate the impact of the strategies should they be carried out for the whole population

Individual based model



Model calibration and validation : data sources

• Sexual behaviour
- ACCEPt baseline survey
- Second Australian Study of Health and Relationships (ASHR2, Rissel et al. 2014)
- British National Survey of Sexual Attitudes and Lifestyles, (Natsal-2, Althaus et al. 2012)

• Testing rate
- ACCEPt data during trial
- Medicare – Australian public medical insurance scheme that funds most chlamydia testing within Australia

• Duration of chlamydia infection, transmission probability, …
- Published literature
- Other modelling studies

Repeated chlamydia infection

• Could increase the incidence of serious adverse reproductive health outcomes such as pelvic inflammatory disease (PID), ectopic pregnancy, infertility

• In Australia, a cohort study on young women attending primary care clinics found 22% of those diagnosed with chlamydia had a repeat positive test within 12 months (Walker 2012)

• We are interested in two strategies that can reduce repeated chlamydia infection: retesting and partner treatment.

Reducing re-infection from current partners

Retest index case

• Pros
- Reduce transmission to partners
- Detect repeat/persisting infection

• Cons
- Loss to follow up
- Susceptible again after treatment, if positive

Partner treatment

• Pros
- Reduce transmission from partners
- Detect undiagnosed infections in partners

• Cons
- Difficult to do well
- Effected by partnership splits
- Negative consequence for relationships

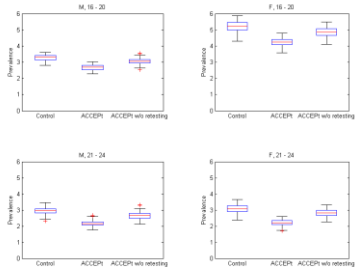
Method

• A proportion of the modelled population is tested for chlamydia and treated annually according to preliminary data on the testing coverage achieved in ACCEPt

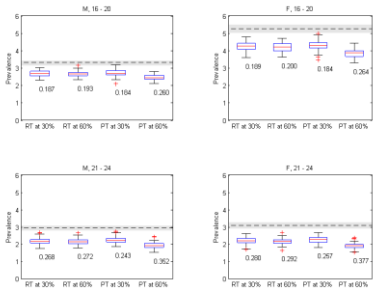
• We investigate the reduction in chlamydia prevalence achieved through:

- Retesting a proportion of individuals who were infected with chlamydia within 3 months of receiving treatment
- Treating a proportion of the partners of infected individuals

Modelling the impact of testing and retesting

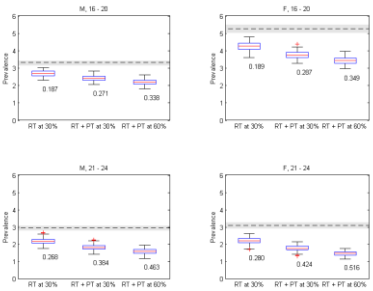


Retesting or partner treatment



RT = retest; PT = partner treatment

Retesting and partner treatment



Findings

• Both retesting and partner treatment would yield incremental reductions in chlamydia prevalence over simple screening of index cases.

• Retesting at around the rate achieved in ACCEPt is predicted to yield similar reductions in prevalence as would be achieved through partner treatment (in the absence of retesting).

• Partner treatment (with no retesting) at 60% is predicted to yield greater reductions in prevalence than retesting (with no partner treatment) at 60%.

Future work

• Our mathematical model will be used to investigate the potential population-level impact of chlamydia testing uptake, as achieved in ACCEPt, on chlamydia transmission in the Australian population.

• Other strategies to be considered
  - Increase clinic attendance/coverage
  - Changes to sexual behaviour, awareness
  - Different mix of testing and partner treatment rates

• Economic evaluations
  - Output from our model will inform an economic evaluation of ACCEPt to determine the cost-effectiveness of the chlamydia screening intervention.

References

Althaus CL, Heijne JC, Low N. Towards more robust estimates of the transmissibility of Chlamydia trachomatis. Sex Transm Dis. 2012;39(5):402-4

Althaus CL, Turner KM, Schmid BV, Heijne JC, Kretzschmar M, Low N. Transmission of Chlamydia trachomatis through sexual partnerships: a comparison between three individual-based models and empirical data. J R Soc Interface. 2012;9(66):136-46.

Batteiger BE, Tu W, Ofner S, Van Der Pol B, Stothard DR, Orr DP, et al. Repeated Chlamydia trachomatis genital infections in adolescent women. Journal of Infectious Diseases. 2010;201(1):42-51

Davies B, Ward H, Leung S, Turner KME, Garnett GP, Blanchard JF, et al. Heterogeneity in Risk of Pelvic Inflammatory Diseases After Chlamydia Infection: A Population-Based Study in Manitoba, Canada. Journal of Infectious Diseases.

Guy R, Wand H, Franklin N, Fairley CK, Chen MY, O'Connor CC, et al. Re-testing for chlamydia at sexual health services in Australia, 2004-08. Sexual Health. 2011;8:242-7

Heijne JCM, Althaus CL, Herzog SA, Kretzschmar M, Low N. The role of reinfection and partner notification in the efficacy of Chlamydia screening programs. J Infect Dis. 2011;203(3):372-7

Hillis SD, Owens LM, Marchbanks PA, Amsterdam LF, Mac Kenzie WR. Recurrent chlamydial infections increase the risks of hospitalization for ectopic pregnancy and pelvic inflammatorydisease. Am J Obstet Gynecol. 1997;176(1 Pt 1):103-7

Hocking JS, Lewis D, on behalf of the ACCEPt Consortium. Australian Chlamydia Control Effectiveness Pilot (ACCEPt). Interim Evaluation Report. 2013

Johnson LF, Alberma L, Dorrington RE. A Bayesian approach to uncertainty analysis of sexually transmitted infection models Sexually Transmitted Infections. 2010;86:169-74.

Lewis D, Newton DC, Guy RJ, Ali H, Chen MY, Fairley CK, et al. The prevalence of Chlamydia trachomatis infection in Australia : a systematic review and meta-analysis. BMC Infect Dis. 2012;12(1):113.

Liu B, Guy R, Donovan B, Kaldor J. Chlamydia trachomatis re-infections in a population-based cohort of women. Sex Transm Infect. 2011

Rissel C, Badcock PB, Smith AMA, Richters J, de Visser RO, Grulich AE, et al. Heterosexual experience and recent heterosexual encounters among Australian adults: the Second Australian Study of Health and Relationships. Sexual health. 2014;11(5):416-26

Walker J, Tabrizi SN, Fairley CK, Chen MY, Bradshaw CS, Twin J, et al. Chlamydia trachomatis incidence and re-infection among young women--behavioural and microbiological characteristics. PloS one. 2012