Seroprevalence of antibodies to urogenital *Chlamydia trachomatis* PGP3 protein in 13 to 15 year olds in England 2009 to 2014

Catherine E. Winstanley¹, Ian N. Clarke¹, Ezra Linley², and Peter Marsh³

¹University of Southampton, UK; ²Public Health England, Manchester, U.K; ³Public Health England, Southampton, UK.

Background

A significant number of British 16-19 year old report heterosexual intercourse debut at under 16 years of age with less contraceptive usage than older adolescents. In 2013, over 21,000 young people under 15 were screened for chlamydia infection and nearly 1,000 (4.76%) of these tests were positive, representing 0.2% of this population (PHE STI data tables). Although screening and seroprevalence surveys provided some data on the epidemiology of *Chlamydia trachomatis* in adults 16 years of age and older, there is a gap in the knowledge of the epidemiology of the younger but sexually mature 13 to 15 year olds. The heightened risk of early adolescent unprotected sexual intercourse leads to the question: when does a putative increase in consensual sexual activity lead to an increase in exposure to *C. trachomatis*? Our hypothesis was that in the UK population of sexually active adolescents, there is a range inclusive of 13 and 15 years of age during which there will be an observable increase in antibodies to *C. trachomatis*. This would reflect exposure to *C. trachomatis* due to increased in sexual activity.

Materials & Methods

The *pgp3* gene selected for generating the recombinant antigen was from urogenital *ompA* genotype E. This was to ensure coverage of urogenital prevalence specifically for this study. Dissimilarities in PGP3 amino acid sequence are evident between urogenital genotypes and others *e.g.* LGV genotype L1 (Fig. 1).

PGP3 Amino Acid Sequence	Genotype
MGNSGFYLYNTQNCVFADNIKVGQMTPELKDQIILGTTSTPVAAKMTASDGISLTVSNN 60	L1
MGNSGFYLYNTENCVFADNIKVGQMTPELKDQIILGTTSTPVAAKMTASDGISLTVSNN 60	E
PSTNASITIGLDAEKAYQLILEKLGDIQIIGIADTIVDSTVQDILDKIITDPSLGLLKAF 120	L1
SSTNASITIGLDAEKAYQLILEKLGDIQIIGIADTIVDSTVQDILDKIITDPSLGLLKAF 120	E
NNFPITNKIQCNGLFTPRNIETLLGGTEIGKFTVTPKSSGSMFLVSADIIASRMGGVVL 180	L1
NNFPITNKIQCNGLFTPSNIETLLGGTEIGKFTVTPKSSGSMFLVSADIIASRMGGVVL 180	E
ALVREGDSKPYAISYGYSSGVPNLCSLRTRIINTGLTPTTYSRLVGGLESVGVVWNALSN 240	L1
ALVREGDSKPCAISYGYSSGIPNLCSLRTSINTGLTPTTYSRLVGGLESVGVVWNALSN 240	E
GNDILGITNTSNVSFLEVIPQTNA 264	L1
GNDILGITNTSNVSFLEVIPQTNA 264	E

Figure 1: Amino acid alignment of PGP3 sequences expressed from plasmid coding sequence five (CDS5) of *C. trachomatis* genotypes L1 and E. Amino acid dissimilarities highlighted in red.

The sera (Collected by the Public Health England (PHE) Sero-Epidemiology Unit (SEU) during 2009-2014) were blinded and tested for the presence of antibodies to PGP3 using indirect ELISA based on N-terminal glutathione s-transferase (GST) recombinant fusion tagged urogenital PGP3 antigen: the ELISA includes the GST fusion tag as a negative control (Fig. 2 and Winstanley et al. J. Immunol. Methods. 2017 Jun;445:23-30)

Results

Different seroprevalence rates were found between serum groups collected from 13- and 15-year-old males from non-GUM sources ($p = 0.0274$).

Figure 2: Protocol for assaying serum samples collected from 13-15-year-olds (SEU collection) in England against GST-PGP3 derived from *C. trachomatis* genotype E using indirect ELISA.

Seroprevalence of PGP3 antibodies from 13, 14 and 15 year olds generally increased between ages 13 to 15, but with overall trends of higher prevalence in GUM clinic attending adolescents compared to non-GUM (Fig. 3). The net seroprevalences (in all sera including GUM, non-GUM and unknown source) from 13, 14 and 15 year olds were 7%, 7% and 11% respectively.

Figure 3: Seroprevalence of anti-PGP3 antibodies in 13 to 15 year olds in England by age group and serum source.

Conclusions

Seroprevalence across all ages groups based on GUM clinic samples was higher than in the non-GUM sourced sera. Seroprevalence in 15 year olds is similar to that in 16 year olds. Seroprevalence rose from 7% in the 13-14 year olds to 11% in the 15 year olds indicative of sexual debut and exposure to *C. trachomatis* before the legal age of consent. We suggest that chlamydia screening programmes should be extended to under 16 year olds, and at least to 15 year olds in order to reduce prevalence and onward transmission.