Background Increasing reports of Neisseria gonorrhoeae *in vitro* decreased susceptibility and resistance, and treatment failures with third generation cephalosporins are of major concern as these drugs are the last remaining options for effective antimicrobial therapy in many settings.

Methods The European Gonococcal Antimicrobial Surveillance Programme (Euro-GASP), a sentinel surveillance programme funded by the European Centre for Disease Prevention and Control since 2009, monitors antimicrobial susceptibility patterns across the European Union (EU/EEA). Participating laboratories performed susceptibility testing by Etest or agar dilution breakpoint method, or sent isolates to reference laboratories in Denmark, Sweden or the United Kingdom for testing. Euro-GASP validated proficiency and result accuracy through an external quality assessment scheme.

Results In 2011, 1902 isolates from 21 countries were collected and tested. The percentage of tested isolates with decreased susceptibility to cefixime (8.0%) remained stable compared to 2010 (8.7%), but was still significantly higher than in 2009 (5.1%, $p < 0.01$). Isolates with decreased susceptibility to cefixime were reported from 17 countries in 2011, the same as in 2010; however three countries reported such isolates for the first time in 2011. For the first time, ten isolates with decreased susceptibility to ceftriaxone were reported from two countries. Rates of ciprofloxacin (49%) and azithromycin (5.3%) resistance remained high. Minimum inhibitory concentration of gentamicin remained low (MIC50: 4 mg/L; MIC90: 8 mg/L).

Conclusions Although the rapid increase and spread of decreased susceptibility to cefixime in 2010 has not continued, the detection of isolates with decreased susceptibility to ceftriaxone is concerning. ECDC has published a response plan which aims to strengthen surveillance of gonococcal antimicrobial susceptibility in the EU/EEA; ensure that capacity for culture and susceptibility testing is maintained; establish a system for collection and verification of data on clinical treatment failure; and to recommend public health actions at national and European level.

003.3 MAXIMISING THE EFFICIENCY OF GONORRHOEA TREATMENT BY TARGETING THE USE OF PREVIOUS FIRST LINE THERAPIES TO SUSCEPTIBLE PATIENTS

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Background Gonorrhoea treatment guidelines change when less than 95% of the infected population is successfully treated with the recommended antimicrobial. Isolates with decreased susceptibility to ceftriaxone, the current recommended therapy, have been identified and if treatment failure becomes problematic there are no new antimicrobials approved. However, *Neisseria gonorrhoeae* remains susceptible to penicillin, ciprofloxacin and cefixime in at least two thirds of patients (82%, 68%, and 98% respectively) so it may be possible to target previously recommended antimicrobials to specific population sub-groups.

Methods Descriptive data from the Gonococcal Resistance to Antimicrobials Surveillance Programme (GRASP) were analysed for trends in penicillin, ciprofloxacin and cefixime susceptibility across patient sub-groups. Patient characteristics associated with antimicrobial susceptibility were identified using univariate and multivariable analyses. All analyses were performed separately for heterosexuals and men who have sex with men (MSM).

Results Heterosexual patients whose infection was susceptible to penicillin, ciprofloxacin or cefixime were of black ethnicity, penicillin: 94%, adjusted odds ratio (OR) 3.52 (95% confidence interval (CI) 2.62–4.72), ciprofloxacin: 92%, OR 5.35 (CI 4.08–7.0), cefixime: 99%, OR 3.62 (CI 1.91–6.84), or with concurrent chlamydia infection (penicillin: 94%, 2.34, 1.75–3.13, ciprofloxacin: 92%, 3.37, 2.59–4.38, cefixime: 99%, 2.32, 1.23–4.39). Additionally isolates susceptible to penicillin were found in patients aged 13–24 years (92%, 3.54, 2.63–4.77) or without symptoms (92%, 1.75, 1.28–2.4). All isolates from heterosexuals were fully susceptible to cefixime. In all sub-groups of the MSM population the proportion of isolates susceptible to penicillin, ciprofloxacin or cefixime was below 90%.

Conclusion The efficiency of gonorrhoea treatment could be maximised by targeting the use of previous first line therapies to specific heterosexual population sub-groups if the treatment threshold is reduced to 90%. Treatment of any MSM with penicillin, ciprofloxacin or cefixime would not be appropriate, as the proportion susceptible to these antimicrobials is much less than for the heterosexual population.

003.4 GENOMIC EPIDEMIOLOGY OF NEISSERIA GONORRHOEAE WITH REDUCED SUSCEPTIBILITY TO CEFIXIME IN THE UNITED STATES

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Background Genome sequencing of pathogens has yielded insights into transmission networks and the spread of antibiotic resistance. Here, we report a large-scale genomic epidemiology study of *Neisseria gonorrhoeae* to investigate the emergence and spread of isolates with reduced susceptibility to cephalosporins.

Methods We sequenced the genomes of 242 gonococcal isolates collected by CDC's Gonococcal Isolate Surveillance Program (GISP). These isolates comprise all 141 isolates from GISP in 2009–10 with reduced susceptibility to cefixime (cef^{RS}; cefixime MICs ≥ 0.25 μg/ml) and 141 susceptible isolates matched by location, collection date, and sexual orientation of the infected individual. We assessed diversity and association of genes known to contribute to antibiotic resistance, correlated location and phylogenetic clustering to determine sexual networks, and characterised the extent of recombination.

Results Phylogenetic analysis of single nucleotide polymorphisms (SNPs) within the core genome (34959 SNPs) demonstrates that most cef^{RS} isolates in the US fall into two distinct lineages. We identify several independent acquisitions of a mosaic *penA* allele, including evidence of a partial mosaic in an isolate with cef^{RS} and of reversion to an allele conferring cephalosporin susceptibility. Correlating the phylogeny with sexual orientation and geographic location provides evidence for clones circulating in sexual networks, some of which appear geographically restricted and others widespread. Analysis of predicted recombinant regions shows evidence of exchange with other *Neisseria* spp., consistent with prior observations of interspecies mosaicism.

Conclusions Cef^{RS} isolates in the US predominantly derive from two lineages that share the same mosaic *penA* sequence, and reflect sexual networks at local and regional scales. Additionally, we quantify the extent of recombination and the correlation of selected alleles with resistance phenotypes. Genomic methods offer detailed insights into the spread of resistant infections, with potential for enhanced surveillance and improved diagnostics.

003.5 RECENT INCREASES IN GONORRHOEA IN EUROPE

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