The emergence of antimicrobial resistance (AMR) among sexually transmitted infections (STI) is a cause for global concern, and is epitomised by the fact we are now running out of treatment options for gonorrhoea. The role of AMR surveillance is now more important than ever. Ideally, AMR surveillance should be fast, easy, inexpensive, accessible, reproducible across testing methods, and provide clinically meaningful information to inform treatment strategies. In reality this is not the case, with AMR surveillance activities for STIs typically weak or non-existent in many parts of the world. Molecular methods have the potential to enhance AMR surveillance, particularly for organisms that cannot easily or readily be characterised phenotypically; which is the case for most STIs. The challenges for molecular surveillance are however many and include factors such as; the mechanisms of resistance may be many or otherwise unknown, they may miss novel mutations, the technology can be expensive, they need specialised laboratories and trained staff, and that their specificity can be undermined where target sequences are shared across different species. Despite these challenges, such methods are being developed and are now finding their way into routine settings. Advances in molecular technology and expanding knowledge of resistance mechanisms continue to pave new directions in this important area.

S09.2 *NEISSERIA GONORRHOEAE*: ARE WE EXERTING THE SELECTIVE PRESSURE?

doi:10.1136/sextrans-2013-051184.0048

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Treatment of gonorrhoea has historically been delivered by a single dose of a highly effective antimicrobial agent, to which resistance is not documented, to aid compliance and break transmission. Resistance in *Neisseria gonorrhoeae* compromises this approach and occurs both by acquisition of plasmids or chromosomal DNA from other bacteria or *Neisseria* spp or by selection of mutants resulting from misuse or overuse of antimicrobial agents, such as long term use of a single agent.

Resistance to ciprofloxacin, a fluoroquinolone, illustrates the effect of both misuse of earlier generations of quinolones and of suboptimal doses, as well as overuse. Quinolones target the DNA gyrase and topoisomerase enzymes that are responsible for DNA supercoiling and any interference with this process is bactericidal. Ciprofloxacin was widely used, often at low doses because of its high efficacy, but resistance emerged quickly resulting from selection of mutants, altering the target site and giving increasing drifts to resistance. Azithromycin, a macrolide which binds to 23S rRNA component of the 50S ribosome and interferes with protein synthesis, is effective against multiple STIs and therefore the selective pressure for resistance has been considerable. Although low-level resistance emerged quickly, high-level resistance in *N. gonorrhoeae*, resulting from a single point mutation in the peptidyltransferase loop of domain V of the 23S rRNA gene, was only reported in recent years and threatens to compromise its use. Sporadic use of spectinomycin selected for high-level resistance in a single step, which appears clonal and has not spread widely. Limited use of the aminoglycoside, gentamicin, for which the efficacy data is weak, appears to remain clinically active.

In this era of multi-drug resistant gonorrhoea it is imperative that the selective pressure exerted by continual use of a single agent is understood and clinical practise modified, where necessary, to prevent gonorrhoea becoming untreatable.

S09.3 HERPES SIMPLEX VIRUS

doi:10.1136/sextrans-2013-051184.0049

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The more and more frequent and widespread use of acyclovir (ACV), but also the increasing number of immunocompromised patients might induce an increase in HSV (Herpes Simplex Virus) resistance. HSV resistance to ACV is mainly associated with mutations in the thymidine kinase (TK) gene although mutations in the DNA polymerase can be observed. Up to now, resistance of HSV to ACV was a major concern for immunocompromised patients with a frequency between 2.5 and 10%. This study aimed to reassess HSV resistance to ACV, during a ten year period, in immunocompetent and in immunocompromised patients (bone marrow transplant patients, solid organ transplant, HIV positive patients, cancer patients). From 2002 to 2011, 1538 patients positive for HSV were tested for the susceptibility of their virus to ACV (1044 immunocompetent and 494 immunocompromised). In immunocompetent patients, prevalence of resistance remains under 0.5%, whatever the period studies. In immunocompromised patients, a significant increase can be observed, from 4.3% during 2002–2006 (11/255 patients) to 13.4% during 2007–2011 (32/239) ($p = 0.0002$). This significant increase is mainly observed among bone marrow transplant patients in which the prevalence is 10% (5/52) during 2002–2006 and 38% (30/79) during 2007–2011 ($p = 0.0002$), whereas other types of immune deficiencies do not show an increase (1.3% versus 2.9%, $p = 0.2$). New chemotherapy protocols (FLAMSA) and type of transplantation as blood cord transplant are part of the explanation. Genotyping of the resistant viruses (35 viruses) reveal mutations in the TK gene for 80% of them. Double population including resistant and susceptible viruses were recovered in 5 isolates (5/34 = 14%). Rapid diagnosis of HSV resistance, but also research on alternative treatment are more than ever of interest.

S09.4 MYCOPLASMA GENITALIUM

doi:10.1136/sextrans-2013-051184.0050

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M. genitalium infections explain 15–25% of symptomatic male NGU and causes sexually transmitted urethritis, cervicitis, and PID in women. The bacterium is extremely difficult to isolate by culture, and consequently, the knowledge about antimicrobial resistance and its underlying molecular mechanisms has been slow to accumulate.

In the few randomised trials of *M. genitalium* conducted to date, doxycycline has been compared with a 1 g single dose of azithromycin, and together with results from open trials, it is evident that doxycycline is inefficient in eradicating *M. genitalium* with eradication rates around 35%. The eradication rate after azithromycin 1 g single dose has most often been significantly higher, but differs greatly between studies. Remarkably, older studies appear to have higher eradication rates than the more recent ones, and in the latest study from the US, no significant difference between doxycycline and azithromycin efficacy could be detected.

Although several mutations have been associated with increased macrolide MIC in strains selected by passage in the presence of macrolides, only mutations in the 23S rRNA gene at position 2058 and 2059 (*E. coli* numbering) have been detected in patients failing azithromycin treatment.

A number of rapid methods for detection of such mutations directly from clinical samples have been developed and have proved to be clinically useful in directing treatment. Pre-treatment mutations have been found in between 10–15% of contemporary samples where doxycycline is used as the primary NGU treatment and is most commonly around 40% in settings where azithromycin is the

primary drug. However, in Greenland where chlamydial infections are extremely common and azithromycin is used liberally, mutations have been found in nearly 100% of the specimens tested.

At present, moxifloxacin is the only second line antibiotic that has a proven high efficacy against macrolide resistant *M. genitalium*. However, price and safety profile as well as the emergence of multidrug resistant strains emphasises the urgent need for clinical trials with alternative drugs.

S.10 - HIV treatment as prevention

S10.1 PREDICTING THE SOCIAL AND BEHAVIOURAL CONSEQUENCES

doi:10.1136/sextrans-2013-051184.0051

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Recent data from HIV prevention trials conducted with sero-discordant couples suggest that HIV transmission drops when the infected individual is taking anti-retroviral medications (ARV). However, there is potential for unintended social and behavioural consequences of this and other interventions. Using the HIV treatment cascade as a lens, the review will cover individual and population-level data in HIV and STD prevention research with a view to identifying such consequences of intervention. Although the focus will be upon risk compensation as a potential consequence of HIV treatment, the review will also attend to potential positive social and behavioural consequences.

With respect to data from which to predict social and behavioural consequences, the majority of HIV and STD prevention interventions are conducted through small groups or on a one-to-one basis (e.g., in clinical settings), rather than at the population level. Most are concerned explicitly with risk reduction behaviours or address the behaviours essential to successful biomedical intervention. Population-level interventions are rarer, but do include communication campaigns and efforts to affect HIV or STD through social determinants. With respect to risk compensation, some studies explicitly address risk compensation, while others have sufficient behavioural follow-up data from which to measure it - the unintended measurement of unintended consequences. Fewer studies permit one to attribute effects to different potential *causes* of risk compensation, including risk homeostasis, overestimation of protection, or the intentional resumption of previous behaviour patterns.

The final part of the review is devoted to approaches that seek to minimise negative consequences or to maximise positive consequences, the latter arising when an intervention gives people hope where they once had little or none, and leading to further individual efforts to protect themselves and others (including changes in risk homeostasis). Positively-framed communication campaigns in particular may accelerate efforts and further population-level protective action and health promotion.

S10.2 DETERMINING UPTAKE, ADHERENCE, & PATTERNS OF ART USE AS PREVENTION

doi:10.1136/sextrans-2013-051184.0052

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Selected antiretroviral treatment (ART) of HIV reduces the concentration of virus in genital secretions. In one randomised controlled trial and most (but not all) observational studies ART reduced the sexual transmission of HIV. Some (but not all) ecologic studies suggests that broader, earlier antiviral treatment of HIV may reduce incidence of HIV in some (but not all) at risk populations. A compelling long-term study from South Africa demonstrated a direct relationship between increased availability of ART in communities and decreased incidence of HIV. However, the maximal benefit of HIV "treatment for prevention" will likely require a programme of universal "test and treat", where most HIV infected patients are identified, linked to care, and treated very early in disease and for life. It seems likely that for maximal public health benefit ART must be started immediately regardless of CD4 count, and so the personal benefit and safety of immediate ART must be transparent. In some settings (especially where MSM are most likely to be infected) it may be necessary to find and treat people with acute and early HIV infection, a difficult challenge. To better understand the maximal benefits of this approach the early treatment of IDU and sex workers are also being studied, since these populations contribute to the spread of HIV. Community randomised trials designed to examine the feasibility of the implementation of treatment for prevention are underway. Treatment of a far greater number of people early in disease will be cost effective or cost saving in most settings, and can offer macroeconomic benefit as well. The mass treatment of HIV-the current centrepiece of HIV prevention- is best seen as a bridge to ever simpler therapy or a cure.

S10.3 MODELING THE EFFECT OF TAP ON THE HIV/AIDS EPIDEMIC

doi:10.1136/sextrans-2013-051184.0053

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Background The efficacy of ARV treatment that achieves viral suppression in dramatically reducing HIV infectiousness is proven. What is less clear is the implications for the best use of treatment in programmes, how treatment should and could be scaled up and wheat the effectiveness of treatment use in programmes will be across populations.

Methods Review of observational data on the impact of treatment programmes on HIV incidence and deaths and mathematical models exploring the impact of existing and proposed programmes.

Results Mathematical models show that HIV treatment can reduce HIV incidence, but this reduction depends upon who is treated, the success of the programme maintaining viral suppression in those treated and on patterns of risk behaviour. Observations of the impact of treatment programmes on the spread of HV at a population level show mixed impacts with competing interpretations and implications for future programmatic development. Treatment guidelines emphasise the treatment of those who probably contribute least to onward transmission of HIV and more work is required to understand local epidemiology and design treatment programmes accordingly.

Conclusions Future, studies of the impact of treatment as prevention should concentrate on how to implement at scale treatment programmes and maximise reductions in incidence. Using HIV treatment as an HIV prevention intervention promises a major step forward in responding to the HIV pandemic, but taking success for granted could generate unsustainable programmes with perverse outcomes.

S.11 - National trends in sexual behaviour: USA, UK and Switzerland

S11.1 SEXUAL BEHAVIOUR IN BRITAIN IN THE NEW MILLENNIUM: A NEW ERA?

doi:10.1136/sextrans-2013-051184.0054

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Background In 2001, Britain's second National Survey of Sexual Attitudes and Lifestyles (Natsal-2) demonstrated increased sexual risk behaviour in contrast to Natsal-1, undertaken a decade earlier. STI diagnoses also increased between the mid-1990s and the