Results The impact of different vaccination strategies on chlamydia population prevalence depends on the characteristics of the vaccine. In the best case scenario, where the vaccine coverage and efficacy is 100% and duration of protection lifelong, it takes about 7 years to half the prevalence. With an average duration of protection of 10 years, a vaccine coverage or vaccine efficacy of around 70% or higher per year was needed to half the chlamydia prevalence in 10 years. For high vaccine coverage levels, the impact of vaccinating women alone on population prevalence was greater than vaccinating both men and women. The potential impact of a vaccine on chlamydia population prevalence was sensitive to the duration of protection of the vaccine and the vaccine efficacy.
Conclusion The model suggests that the impact of vaccination strategies on chlamydia prevalence highly depends on characteristics of future vaccines. Current efforts in vaccine development should be accompanied by mathematical models to investigate the optimal strategies.

P1-S4.23 DESCRIBING THE PROGRESSION FROM *CHLAMYDIA TRACHOMATIS* TO PELVIC INFLAMMATORY DISEASE: SYSTEMATIC REVIEW OF MATHEMATICAL MODELS

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Background *Chlamydia trachomatis* (chlamydia) is an important cause of pelvic inflammatory disease (PID). Preventing PID is a main objective of chlamydia screening. There are many uncertainties about how and when bacteria spread from lower to upper genital tract. The potential impact of screening and treatment, which could interrupt ascending infection, might be affected by the timing of development of PID. Models are often used to investigate the potential impact of screening strategies on PID and should therefore include information about the timing of progression. We conducted a systematic review to determine how the progression from chlamydia to PID is described in mathematical models.
Methods We searched four electronic databases using search terms related to mathematical models and PID from the earliest date to 19 October 2009 without language restrictions. Eligible publications included progression from chlamydia to PID either using a decision tree or a mathematical model. We extracted information about how authors conceptualised the dynamics of chlamydia infection and the development of PID, and assumptions about rates of progression.
Results We identified 41 unique publications about chlamydia infection; 28 of these included PID in a static decision tree. The average percentage of women developing PID in decision analyses was 22.9% (range 10–35%, n=26). For five publications it was not clear how the described model worked. The other eight publications described progression from chlamydia infection to PID dynamically. Of these, two models incorporated PID as a state in a Markov-chain model, four used compartmental models and two used individual-based models. Explicit statements about model structure included the possibility that PID can occur uniformly during a woman's infection, that tubal damage occurs in the second half of the chlamydia infection, and that the model had the ability to vary PID development time. Twenty-eight publications did not mention the stage during a chlamydia infection that progression to PID happens.
Conclusion Most modelling studies do not consider dynamic aspects of *C trachomatis* transmission and the timing of progression to PID. The mechanisms proposed in studies that made explicit statements could be compared to examine the impact of screening. We suggest that explicit statements about the timing and rates of progression would help improve understanding of the pathogenesis of chlamydial complications and the potential effects of screening.

P1-S4.24 BALANCING THE "SUPPLY AND DEMAND" OF SEX ACTS: IMPLICATIONS FOR MODELLING THE HIV EPIDEMIC AMONG MEN WHO HAVE SEX WITH MEN IN SOUTHERN INDIA

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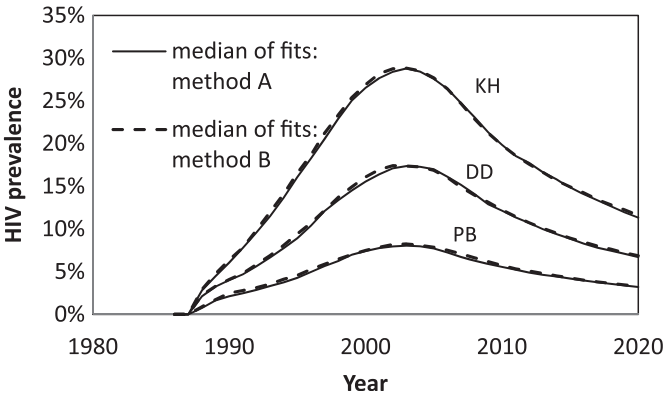
Background In India, men who have sex with men (MSM) have distinct identities related to the role taken in anal sex (Panthi/Bisexual (PB): mostly insertive, Kothi/Hijra (KH): mostly receptive, Double Deckers: both). Wide discrepancies are found between the supply and demand for sex acts estimated for each group using data on reported frequency of anal sex, role taken and estimated group population sizes.
Methods Two methods for balancing the number and type of sex acts between different groups were compared. They were used in a deterministic HIV transmission model to estimate mixing patterns and HIV prevalence over the first 20 years of the epidemic (including reported condom use trends) and a subsequent 10-year intervention (10% absolute increase in condom use). Data collected from Bangalore for the evaluation of Avahan (the India AIDS initiative) on the mean reported frequency of sex acts per individual, role taken in anal sex and population sizes for each group were used to construct a mixing matrix. In method A, the PB group size was set to balance the total number of insertive and receptive acts, and receptive acts for each group were distributed among the three groups in proportion to the number of insertive acts offered. In method B, the proportion of receptive acts KH had with other KH was an additional input parameter, with remaining receptive acts distributed as in method A. The number and type of contacts for all groups were adjusted to achieve balancing. The model was run using 300 000 randomly sampled parameter sets drawn from the data and multiple fits were found to group-specific HIV prevalence data.
Results Model fits for method B had more assortative (like-with-like) mixing than method A, particularly for PB (median number of acts PB have with other PB: 48.5% (IQR 33.3–63.3%) in A, 63.3% (IQR 47.3–74.1%) in B), related to larger PB group sizes and PB taking the insertive role less often in B. Despite these differences, the fitted epidemic curves were very similar for all three groups across the two methods (Absrtact P1-S4.24 figure 1), as was the predicted



Abstract P1-S4.24 Figure 1 MSM.

intervention impact (relative reduction in MSM HIV prevalence after 10 years: A: 18.2% (95% CI 11.0 to 29.2%), B: 18.1% (10.6 to 29.7%)).
Conclusions The choice of method used to balance insertive and receptive contacts in an HIV transmission model affected the estimates for the amount of like-with-like mixing within different MSM groups, but the estimated impact of an intervention was robust to the method used.

P1-S4.25 USING MATHEMATICAL MODELS TO UNDERSTAND THE CAUSES OF THE ECOLOGICAL ASSOCIATION SEEN BETWEEN HIV AND HSV-2 IN FEMALE SEX WORKERS IN SOUTHERN INDIA

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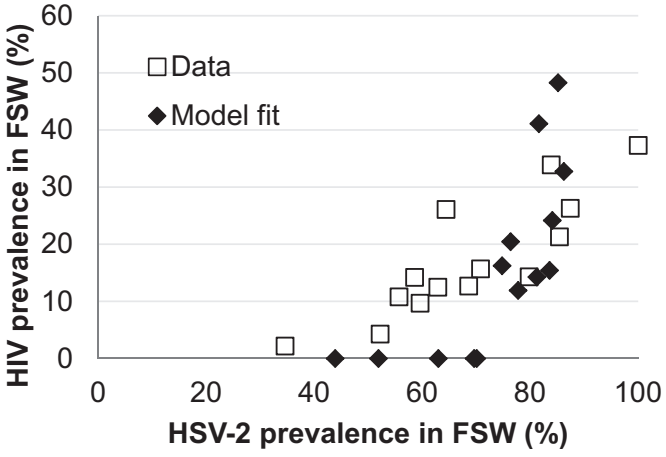
Background Cross-sectional surveys of female sex workers (FSW) in multiple districts in Southern India show a strong ecological association between HIV and HSV-2 prevalence. Modelling was used to determine if this association is primarily due to shared behavioural risk factors (such as partner change rate) or if biological interactions between the two viruses also play a major role.
Methods Linear regression was used to find significant predictors of FSW HIV prevalence in 17 districts in Southern India (using data from Avahan, the India AIDS Initiative). Explanatory variables investigated included prevalence of different STIs in FSW and clients, mean duration of being an FSW or client, and mean reported number of clients per FSW or FSW visited per client. A deterministic HIV/HSV-2 transmission model without behavioural heterogeneity or transmission co-factors was parameterised using district-specific FSW and client behavioural data and fitted to HIV and HSV-2 prevalence data for each district by varying the per partnership HIV and HSV-2 transmission probabilities. The model was firstly fit to all districts simultaneously assuming a constant HIV and HSV-2 transmission probability to see whether district-level variations in behaviour were sufficient to explain the trends seen, and then fit separately for each district to test for trends in the estimated transmission parameters in different settings.
Results FSW HSV-2, syphilis, gonorrhoea and chlamydia prevalence, client HIV prevalence and mean number of clients per FSW per week were all correlated with FSW HIV prevalence, but only FSW HSV-2 prevalence remained a significant predictor in multivariate analysis. The dynamic model reproduced the HIV/HSV-2 association when simultaneously fit to all districts, but was a poor fit to data (Abstract P1-S4.25 figure 1). When individual transmission probabilities were fit for each district positive correlations were seen between the HSV-2 transmission probability and both the HIV transmission probability and HSV-2 prevalence, but not between the HIV transmission probability and HSV-2 prevalence or vice versa.
Conclusion These results suggest that differences in mean reported partner change rate or duration of commercial sex are not sufficient to explain the association between HIV and HSV-2 prevalence in FSW in Southern India. However, initial analyses do not show clear evidence for a biological interaction. More detailed models will be used to further investigate the association.



Abstract P1-S4.25 Figure 1 FSW.

P1-S4.26 DURATION, INCIDENCE AND PREVALENCE OF *CHLAMYDIA TRACHOMATIS* IN WOMEN: ESTIMATION BY MULTI-PARAMETER SYNTHESIS

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Background An understanding of the prevalence and incidence of *Chlamydia trachomatis* (CT) infection is needed to assess the potential value of screening. Typically, the estimation of incidence, prevalence and duration are seen as distinct exercises. Here we estimate them simultaneously from the available data subject to the well-known relationship prevalence = incidence times duration.
Methods We re-examine studies of duration of asymptomatic CT, based on recent reviews, and propose a model. Information from a recent synthesis of UK prevalence studies, and data on infection and re-infection rates in UK clinic settings, are used to generate estimates of incidence of infection in the general population, taking account of the effect of duration of infection on observed incidence. We use Bayesian multi-parameter evidence synthesis to check the consistency of the evidence and to produce internally coherent estimates of duration, incidence and prevalence in women.
Results The three sets of evidence sources that directly inform incidence, prevalence and duration respectively were consistent with each other. Our estimates are: duration of asymptomatic infection 1.25 years (1.04, 1.50), average incidence and prevalence in 16–44 year olds 2.2% (1.7, 2.9) per year and 2.1% (1.7, 2.6) respectively.
Conclusions The apparently heterogeneous estimates of duration of asymptomatic CT in the literature are explained by the different study designs. Adapted appropriately, they agree with UK prevalence and incidence data.

Epidemiology poster session 4: Tests evaluation

P1-S4.27 QUALITY ASSURANCE OF SYPHILIS SEROLOGICAL TEST IN GUANGDONG, CHINA, 2004–2009

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Background Syphilis has made a major comeback in China, now representing the most common communicable disease in many cities and regions. A total of 327 433 cases of syphilis were reported