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Mathematical modelling of the potential impact of a vaccine on gonorrhoea prevalence in a population with bridging between sexual networks

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Background

N. gonorrhoeae (NG) can be transmitted between heterosexual and homosexual networks through bridging between these networks. The impact of an NG vaccine could be under- or over-estimated if differences in partnership acquisition and testing rates within sexual networks and the interconnectedness of sexual networks are not considered. We use mathematical modelling to investigate the potential impact on the prevalence of an NG vaccine in a population with bridging between sexual networks

Aim/Methods

We developed an individual-based model to capture sexual contacts and NG transmission within a population that includes heterosexual females and males, men who have sex with men only, and men who have sex with men and women. We examine the impact on NG prevalence of an NG vaccine that is made available at the time of STI testing, and compare scenarios where we consider various vaccine efficacies, uptake rates and target populations.

Results

Our model predicts that a NG vaccine of 60% efficacy can reduce overall population prevalence by 17% (17% reduction among MSM; 38% reduction among heterosexuals) within 10 years if 60% of all unvaccinated patients are vaccinated when attending for STI testing. This reduction doesn't increase markedly if the uptake rate is increased from 60% to 90%. The predicted reduction is lower at 13% if only 30% of unvaccinated patients are vaccinated. The predicted reduction in population prevalence does not change notably if vaccine availability is restricted to MSM only

Conclusions

Our modelling indicates that an STI testing-based NG vaccination program can deliver a decrease in NG population prevalence within 10 years. The main driver of the reduction is the vaccination of MSM. This is because a testing-based program only reaches a small proportion of the heterosexual population. In order to gain additional benefits from vaccinating heterosexuals, a different approach will be required to achieve greater uptake of vaccination.