

The resurgent HIV epidemic among men having sex with men in Switzerland: a mathematical model approach

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Background

In recent years, increases in HIV diagnoses amongst men who have sex with men (MSM) have been observed in Switzerland and other high-income countries.

Also, levels of unprotected anal sex have increased, as well as syphilis and gonorrhoea diagnoses.

Is HIV transmission increasing and, if so, is increasing risk behaviour the most likely explanation?

Objectives

To understand the dynamics of the HIV epidemic in MSM in Switzerland.

To examine the impact on the epidemic of changes in sexual risk behaviour, HIV testing behaviour, and use of combination antiretroviral treatment (cART).

To explore how the epidemic could develop in the future under various hypothetical scenarios.

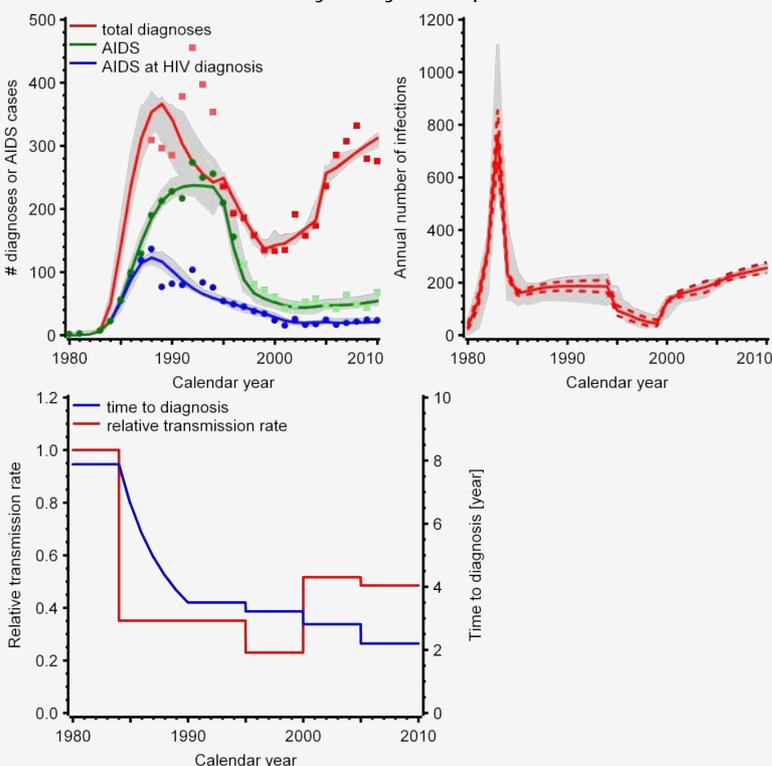
Mathematical model

A mathematical model based on Bezemer *et al.* was used to describe HIV transmission amongst MSM in Switzerland.

Model parameters were obtained from literature or derived from data from the Swiss HIV Cohort Study.

Changes in transmission rates (\approx risk behaviour), time to diagnosis, and annual number of infections needed to explain observed national data on HIV and AIDS diagnoses up to 2010 were estimated by fitting the model to these data (Figure 1).

Figure 1: Model fits to observed HIV and AIDS diagnoses and estimated changes in number of infections, time to diagnosis, and transmission rates; dashes: 95% confidence interval; gray area: multivariate sensitivity analysis on parameter values.



Hypothetical scenarios

We explored 3 interventions that started in 2011 and could potentially control the epidemic (Figure 2; Table 1):

- 'test and treat': average time from infection to diagnosis of 1 year and subsequent viral suppression within one month after diagnosis.
- reduce sexual risk behaviour to levels attained in 1984-1995 (I) or 1996-2000 (II).
- 'Mission Possible' (based on a safe sex campaign in 2008): every year 3 months of safe sex in 50% of sex acts.

Figure 2: Effect of hypothetical scenarios on the expected annual number of new infections. Interventions start in 2011 assuming that all other conditions remain the same as in 2011. N is the number of new infections expected in 2021.

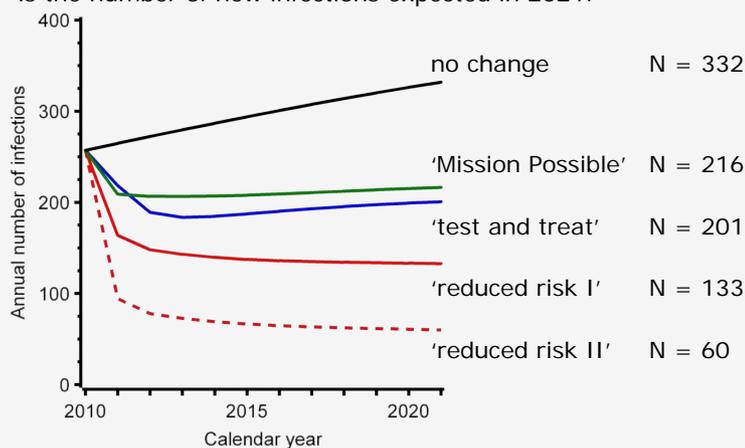


Table 1: Number and percentage of infections averted compared to the 3298 new infections that would have occurred in the period 2011-2021 without any change. Ranges are based on the multivariate sensitivity analysis.

scenario	infections averted	% averted
'test and treat'	1159 (557-1969)	35 (19-49)
'Mission Possible'	984 (850-2254)	30 (26-60)
reduced risk I	1761 (1121-3753)	53 (37-91)
reduced risk II	2545 (1929-3842)	77 (66-93)

Conclusions

The HIV epidemic amongst MSM in Switzerland has been increasing since the year 2000, predominantly due to an increase in risk behaviour.

Testing rates have increased steadily over this period but this fact alone cannot explain the steep increase in the number of new HIV diagnoses from 2000 to 2010.

A major change in risk behaviour is the most effective way to control the HIV epidemic in Swiss MSM.

Literature

Bezemer *et al.*, A resurgent HIV-1 epidemic among men who have sex with men in the era of potent antiretroviral therapy. *AIDS* 2008, 22: 1071-1077.

Bezemer *et al.*, 27 years of the HIV epidemic amongst men having sex with men in the Netherlands: An in depth mathematical model-based analysis. *Epidemics* 2010, 2: 66-79.