

BEHAVIOURAL AND TREATMENT INTERVENTIONS TO REDUCE HEPATITIS C VIRUS TRANSMISSIONS AMONG HIV-INFECTED MSM:

A COHORT-BASED MODELLING STUDY

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BACKGROUND

- The incidence of hepatitis C virus (HCV) infections among HIV-infected men who have sex with men (MSM) has increased in western countries¹
- Transmission of HCV is associated with high-risk sexual behaviour including condomless traumatic anal intercourse, fisting, use of recreational drugs and group sex^{2,3,4}
- HCV treatments with second generation direct-acting antivirals (DAAs) are well tolerated and achieve high cure rates, which may prevent HCV transmissions
- The impact of behavioural and treatment-as-prevention interventions on the HCV epidemic among HIV-infected MSM is uncertain

¹Wandeler G. et al. *Clinical Infectious Diseases* 2012; 15;55(10):1408-16
²Daskalopoulou MR. et al. *The Lancet HIV* 2014;1: e22 - e31
³Danta M, Rodger AJ. *Curr Opin HIV AIDS* 2011;6:451-458
⁴Schmidt AJ. et al. *PLoS One* 2011;6:e17781

OBJECTIVES

To develop a mathematical model of HCV transmission among MSM who do not inject drugs based on data from the Swiss HIV Cohort Study (SHCS) to then:

- Reproduce the incidence of sexually transmitted HCV among MSM in Switzerland and determine the basic reproduction number R_0
- Estimate the effect of behavioural interventions and of treatment-as-prevention on the incidence of HCV infections

METHODS

- We adopted a system of ordinary differential equations to model HCV transmission among HIV-infected MSM who do not inject drugs
- We parameterised the model with data from the SHCS and fitted the model to the observed incidence data using a Maximum Likelihood formalism. Model outcomes uncertainty were estimated using Latin Hypercube sampling
- We projected the future incidence of HCV infections based on combined interventions to reduce high-risk sexual behaviour and to increase treatment uptake and/or efficacy

We considered

- Three behavioural interventions :
 - No intervention** leading to **further increase** in high-risk sexual behaviour
 - Health promotion leading to **stabilisation** of high-risk sexual behaviour
 - Health promotion leading to **substantial reduction** in high-risk sexual behaviour
- Two treatment uptake interventions: **Current** treatment uptake (22% per year), **increased** treatment uptake (100% per year)
- Two alternatives for therapy: **Interferon-based** standard of care, and treatment with second generation **DAAs**

RESULTS

HCV Transmission dynamics

- Observed and modelled HCV incidence curves were very similar (Figure 1). The incidence increased from 0.20 per 100 person-years (py) in 2000 to 1.2 per 100 py in 2013
- R_0 slightly decreased in 2005 due to higher treatment uptake. After 2007, R_0 rose rapidly and reached the epidemic level ($R_0=1$) in 2010, increasing to 1.7 in 2013 (Figure 2)

Figure 1. HCV incidence observed in the SHCS (green dots and error bars) and corresponding model estimates (continuous blue line; shaded: 95% confidence intervals)

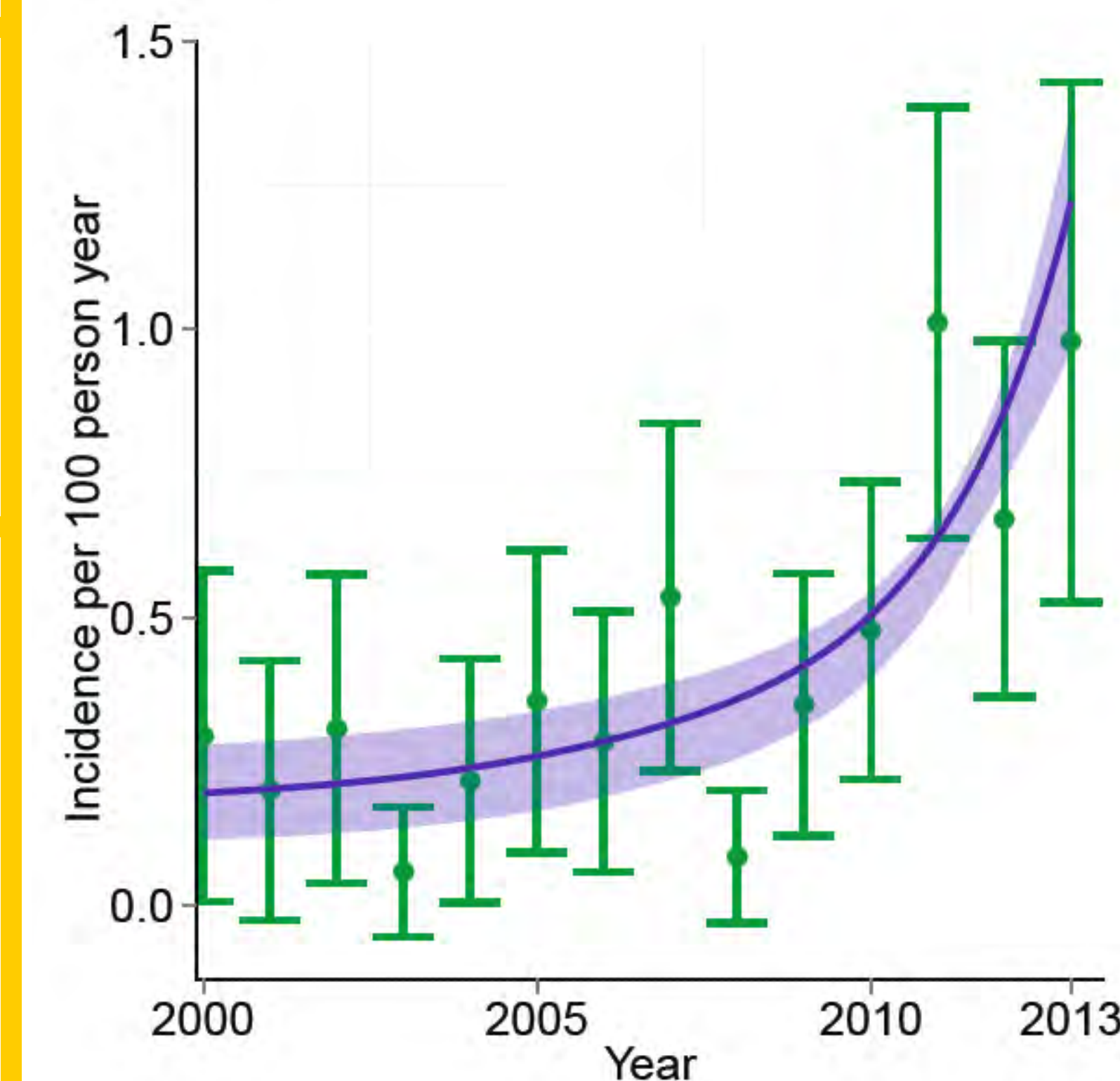
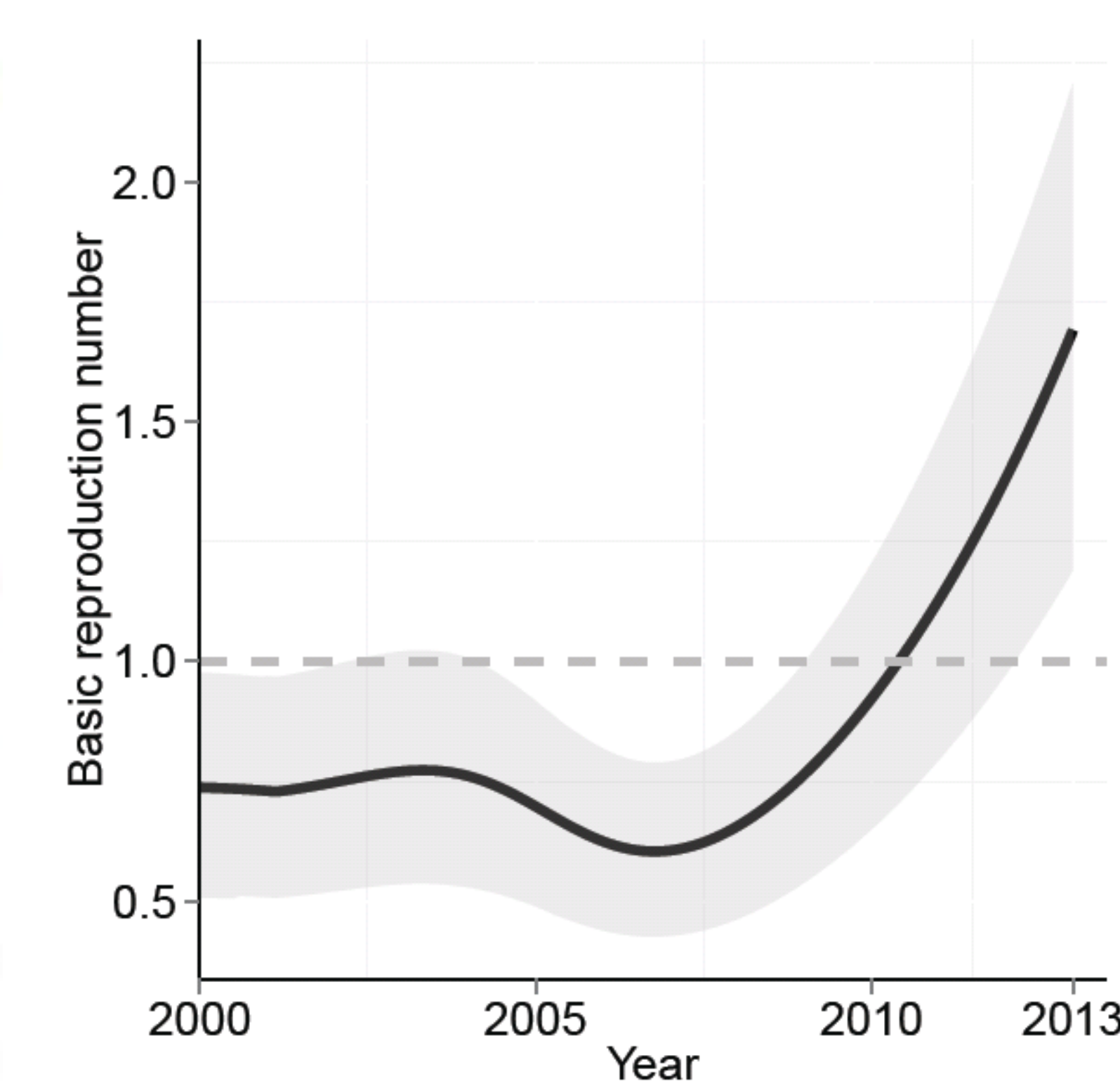


Figure 2. Estimates of R_0 for sexually transmitted HCV infections among HIV-infected MSM (shaded: 95% confidence intervals)

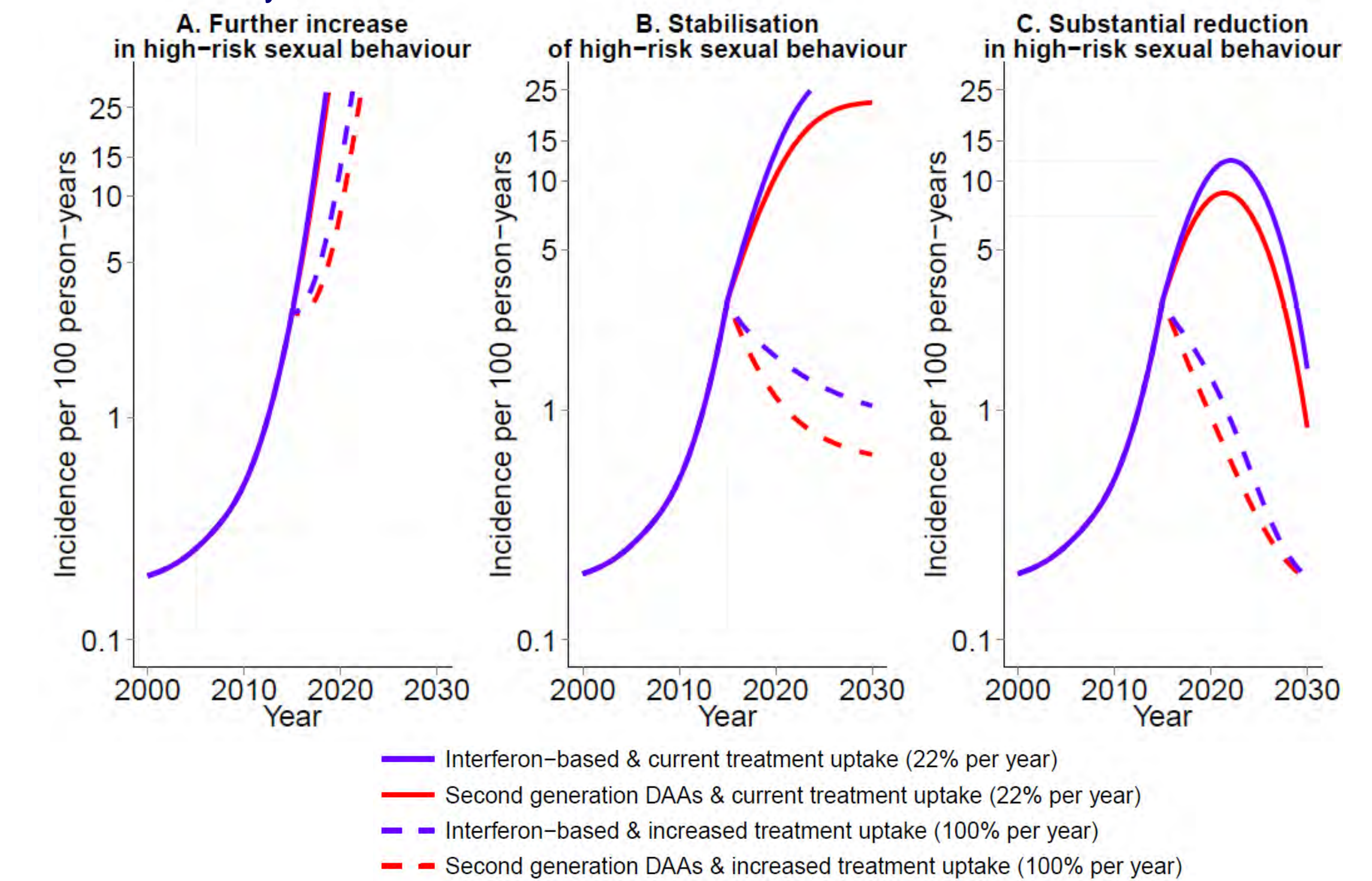


Effect of interventions on HCV infection incidence, 2015-2030

- A further increase** in high-risk sexual behaviour led to a steep increase in HCV incidence in all treatment scenarios (Figure 3A)
- Stabilisation** of high-risk sexual behaviour led to a decrease in HCV incidence only when treatment uptake **increased** considerably (Figure 3B)
- A substantial reduction** in high-risk sexual behaviour with **current** treatment uptake led to an HCV incidence that peaked in 2020 and sharply decreased thereafter regardless of the type of treatment (Figure 3C)

- A substantial reduction** in high-risk sexual behaviour with **increased** treatment uptake led to a rapid and steep decrease in the future incidence of HCV infections regardless the type of treatment (Figure 3C)

Figure 3. Projected HCV incidence in HIV-infected MSM with combined interventions to reduce high-risk sexual behaviour and to increase treatment uptake and/or efficacy



CONCLUSIONS

- Treatment interventions to reduce HCV transmissions among HIV-infected MSM are only effective if high-risk sexual behaviour does not increase further
- If high-risk sexual behaviour stabilises, increased treatment uptake and efficacy are predicted to curb the epidemic

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