

Valentina Cambiano<sup>1</sup>, Fiona Lampe<sup>1</sup>, Alec Miners<sup>2</sup>, Sheena McCormack<sup>1</sup>, O. Noel Gill<sup>3</sup>, Graham Hart<sup>1</sup>, Kevin Fenton<sup>4</sup>, Marc Thompson<sup>5</sup>, Gus Cairns<sup>6</sup>, Valerie Delpech<sup>3</sup>, Alison Rodger<sup>1</sup>, Andrew N. Phillips<sup>1</sup>

<sup>1</sup>University College London, London, UK; <sup>2</sup>London School of Hygiene & Tropical Medicine, London, UK; <sup>3</sup>Health Security Agency, London, UK; <sup>4</sup>Department of Health and Social Care, London, UK; <sup>5</sup>The Love Tank CIC, London, UK; <sup>6</sup>NAM Publications, London, UK;

## BACKGROUND

In the UK, HIV incidence among gay and bisexual men (GBM) has decreased substantially<sup>1</sup>. The government is committed to achieving zero new HIV infections, AIDS and HIV-related deaths in England by 2030<sup>2</sup>. Our aim was to understand the contribution to this of the different components of combination prevention, and to estimate the impact on HIV incidence of continuing current policies.

## METHODS

We calibrated a dynamic, individual-based stochastic model, the HIV Synthesis Model<sup>3</sup>, to multiple sources of data on HIV among GBM in the UK (this is referred to as "Reference"). We compared HIV incidence in 2021 with the counter-factual incidence if:

- from 2012 condom use was low, i.e. at levels similar to those observed in 1980;
- the HIV testing rate had remained stable from 2012;
- the policy of antiretroviral treatment (ART) at diagnosis (as opposed to CD4 count < 350/mm<sup>3</sup>) was not introduced in 2015,
- a Pre-exposure Prophylaxis (PrEP) strategy had not been introduced since 2013 (through the PROUD and IMPACT trials, self-sourcing, and lately commissioning) with consequent lower levels of testing (recommended three monthly on PrEP) and ART initiation.
- No increment in prevention use since 2012 (i.e. low condom use, no increase in HIV testing, no ART at diagnosis, no PrEP)

We also projected future outcomes under the assumption of continuation of current policies.

**Table 1. Characteristics of the HIV epidemic among GBM living in the UK in 2021 estimated by the Synthesis Model**

	Median (90% range)
Number of GBM (15+)	738,800 (734,700 - 742,500)
Number living with HIV (15+)	51,750 (41,300 - 59,460)
Number of new HIV infections (per year, age 15-64)	670 (250 - 1,230)
HIV incidence rate (per 1000 person-years, age 15-64)	1.2 (0.5 - 2.3)
% of people living with HIV diagnosed	91% (87% - 96%)
% on ART of those diagnosed	99% (98% - 99%)
% virologically suppressed of: those on ART	96% (95% - 97%)
those living with HIV	86% (82% - 91%)

Combination prevention led to a very large reduction in HIV incidence among GBM in the UK from around **2,600 in 2011** to around **670 in 2021**. Condom use, the PrEP strategy, a boost in HIV testing and ART played a key role. Continuation of current prevention policies is likely to lead **virtual elimination** (defined as <1/1000 person-years) of HIV transmission among GBM in the UK in **~25 years time**.

## RESULTS

In 2011 the annual number of new HIV infections was estimated to be 2,630 (90% range: 1,530 – 3,560). All the combination components played a significant role (see Figure 1): if condom use was at the level in 1980 (for the period 2012-2021) the HIV incidence in 2021 would have been double (RR=2.1; IQR: 1.4 – 3.3) than estimated in the scenario with the implementation of all components of combination prevention; similarly if PrEP had not been introduced (RR=2.0; IQR: 1.4 – 3.3); 80% higher if HIV testing had not increased since 2012 (RR=1.8; IQR: 1.4 – 2.4) and 20% higher if ART at diagnosis (as opposed to CD4 count < 350/mm<sup>3</sup>) was not introduced in 2015 (RR=1.2; IQR: 0.9 – 1.5). All these components had a synergistic effect; in fact if condom use was at the level of use in 1980 and the other components had not increased/introduced since 2012, the HIV incidence in 2021 would have been 11 times the incidence estimated in the reference scenario (RR=11; IQR: 6.2 – 19).

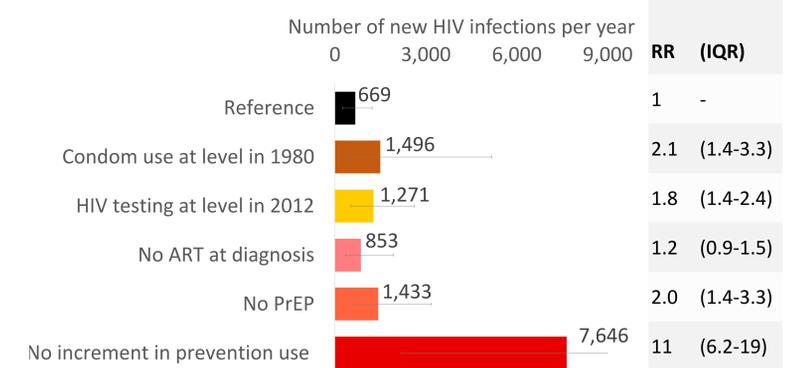
Our results suggest that the HIV epidemic among GBM in the UK is on course to virtual elimination of HIV transmission (defined as <1/1,000 person-years) with an incidence rate of 1.2/1,000 person-years in GBM aged 15-64 (90% range: 0.5 – 2.3/1,000 person-years) in 2021, declining to 0.40 (90% range: 0.16 -0.64) per 1,000 person-years in 2030 and to 0.21 (90% range: 0.07 - 0.42) per 1,000 person-years by 2040. Virtual elimination is likely to be reached in around 25 years (2048; 90% range: 2039-2055)

## ACKNOWLEDGEMENTS

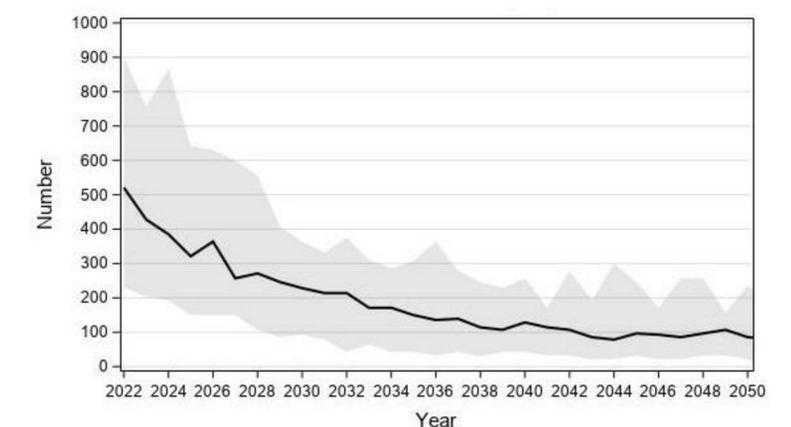
This study is funded by the NIHR (under its Programme Grants for Applied Research Programme (Grant Reference Number RP-PG-1212-20006). The views expressed are those of the author(s) and not necessarily those of the NIHR or the Department of Health and Social.

We gratefully acknowledge all the Public Health England (PHE) HIV surveillance team, and Catherine Mercer for providing unpublished data on sexual behaviour from Britain's Natsal-3 (www.natsal.ac.uk), the UCL Legion High Performance Computing Facility (Legion@UCL) and associated support services for critical computing support, Caroline Sabin and Hajra Okhai for providing the distribution of treatment regimen among GBM in the UK CHIC cohort in 2018.

**Figure 1. Median (and 90% range) annual number of new HIV infections in 2021 under the different counterfactual scenarios**



**Figure 2. Median (and 90% range) annual number of new HIV infections from 2022 (starting from 50 simulations with best fit)**



## CONCLUSIONS

Since 2012, combination prevention, including widespread availability of PrEP played a major role in the reduction in HIV incidence observed in the UK among GBM. Continuation of current prevention policies should lead to virtual elimination of HIV transmission among GBM in the UK within the next 17 – 33 years.

## REFERENCES

- O'Halloran C, Sun S, Nash S, Brown A, Croxford S, Connor N, et al. HIV in the United Kingdom: Towards Zero 2030. 2019 report. Dec 2019, Public Health England, London.
- <https://www.gov.uk/government/publications/towards-zero-the-hiv-action-plan-for-england-2022-to-2025/towards-zero-an-action-plan-towards-ending-hiv-transmission-aids-and-hiv-related-deaths-in-england-2022-to-2025>
- Cambiano V, Miners A, Dunn D, McCormack S, Ong KJ, Gill ON et al. Cost-effectiveness of pre-exposure prophylaxis for HIV prevention in men who have sex with men in the UK: a modelling study and health economic evaluation. Lancet Infect Dis. 2018 Jan;18(1):85-94. doi: 10.1016/S1473-3099(17)30540-6.

E-mail contact:  
v.cambiano@ucl.ac.uk

