

Transmission dynamics and risk assessment of mpox clade IIb and Ib within men who have sex with men

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Conflict of Interest Disclosure:

The presenter declares no conflicts of interest.

Clade IIb and Ib mpox global outbreaks

For both MPXV clades, WHO declared a *Public Health Emergency of International Concern (PHEIC)* due to potential international spread.

Clade IIb global outbreaks

- Primarily spread among MSM (men who have sex with men) globally since 2022.
- Initial rapid surge but did not reach a large proportion of the MSM population.
- Outbreak gradually subsided, with behaviour change, public health measures and possibly immunity slowing transmission.

Clade Ib outbreaks

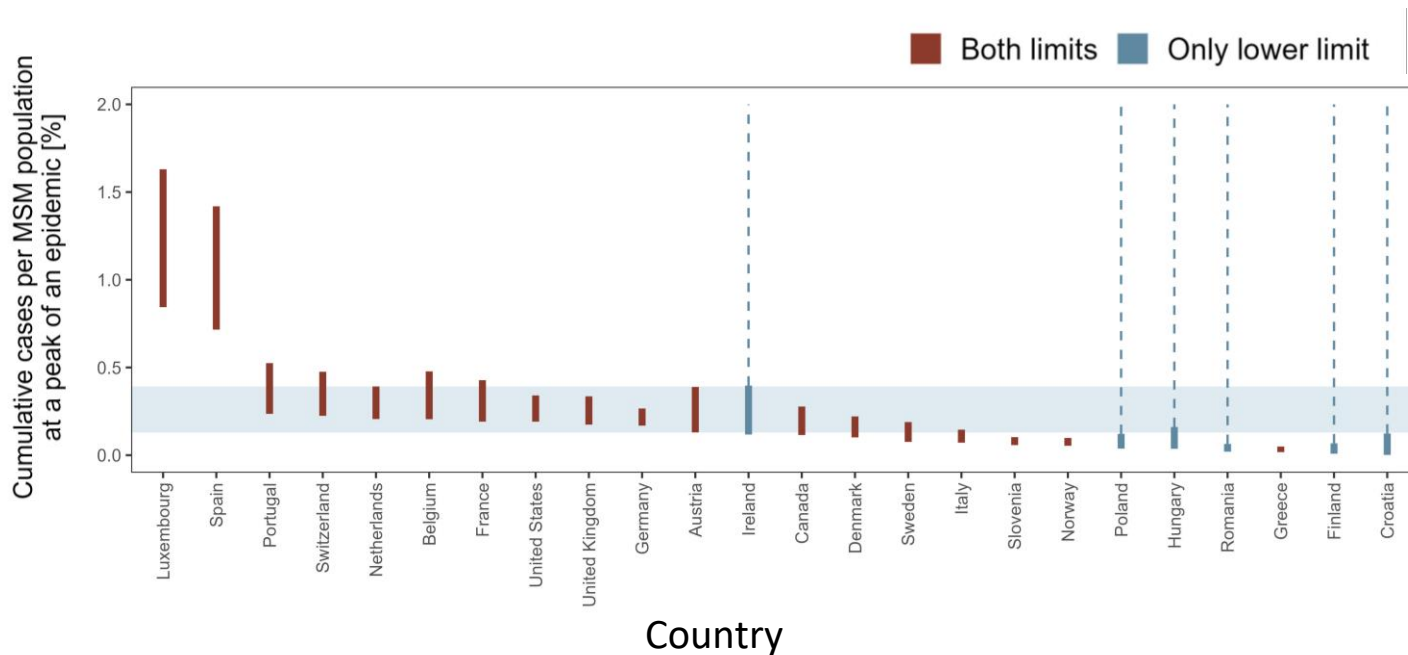
- Emerged in the Democratic Republic of the Congo (DRC) since 2024.
- Transmission driven by community contact and sexual activity, notably involving female sex workers.

Question

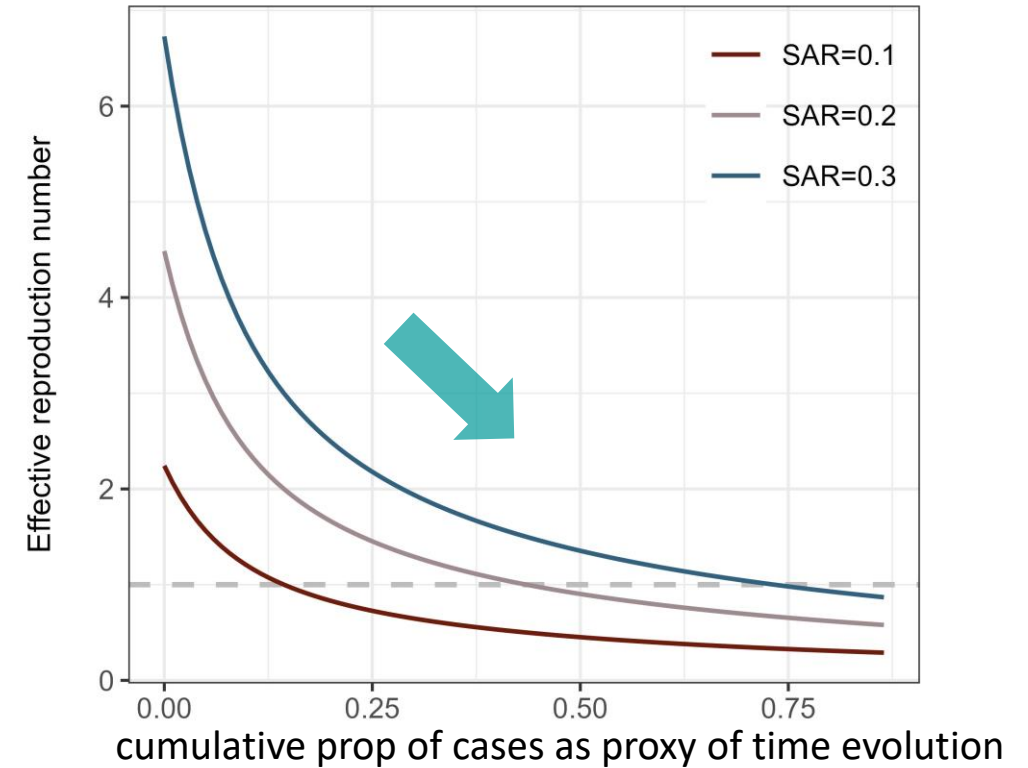
How likely is it that a different clade (clade I) could circulate again within the MSM community that experienced clade IIb 2022 outbreaks?

Characteristics of clade IIb outbreaks

Peak size per MSM population size by country



Sharp decline in effective reproduction number



Clade I transmission model with immunity established in 2022 clade II outbreaks

- We ignored the impact of vaccination on the previous clade IIb outbreak since it would have been minimal, as suggested by previous studies (*Brand et al. Nat comm. 2023; Zang et al. Lancet Inf Dis. 2024*)
- Assume that immunity from clade IIb confer immunity against clade I
- Assume that the clade IIb outbreak reached its final size

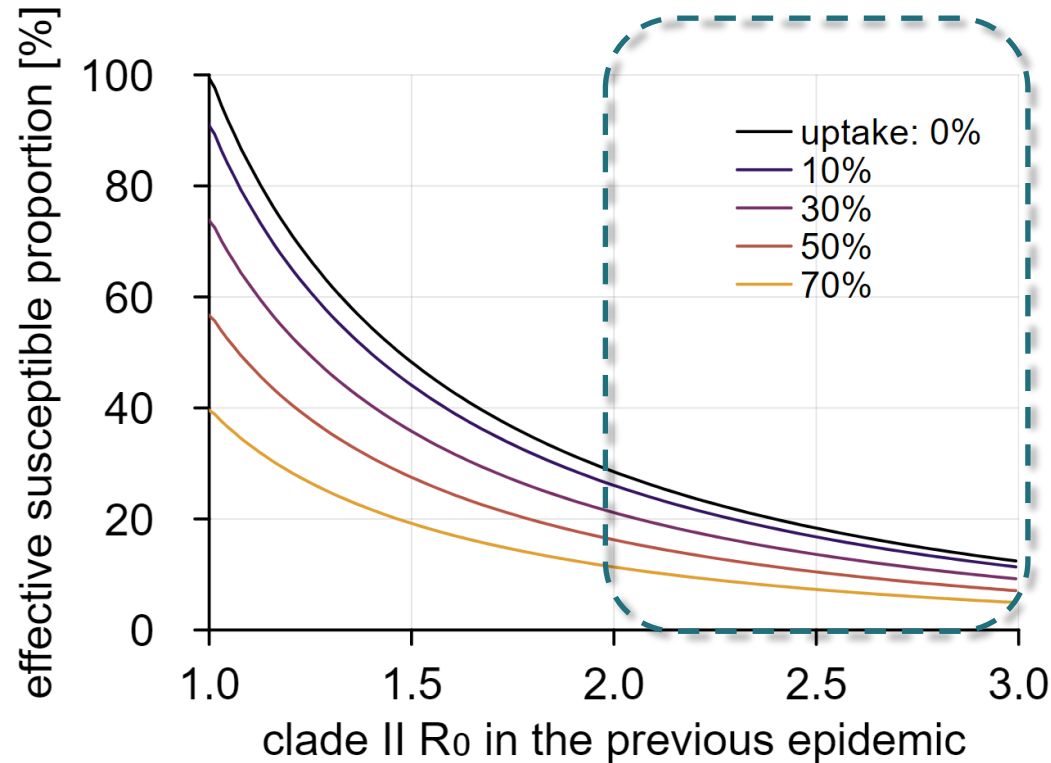
$$R_{\text{eff}}^{\text{new}} = \frac{\beta_{\text{new}} \int_1^{\infty} x(x-1)S_{\text{final}}(x)dx}{\langle x \rangle}$$

- For a clade I major outbreak to occur, the initial effective reproduction number ($R_{\text{eff}}^{\text{new}}$) needs to meet the condition of $R_{\text{eff}}^{\text{new}} \geq 1$
- This gives us the threshold for β_{new} and thus the basic reproduction number (R_0^{new}) required for the epidemic takeoff.
- We defined the effective susceptible proportion as the ratio between $R_{\text{eff}}^{\text{new}}$ and R_0^{new} in a fully-susceptible population:

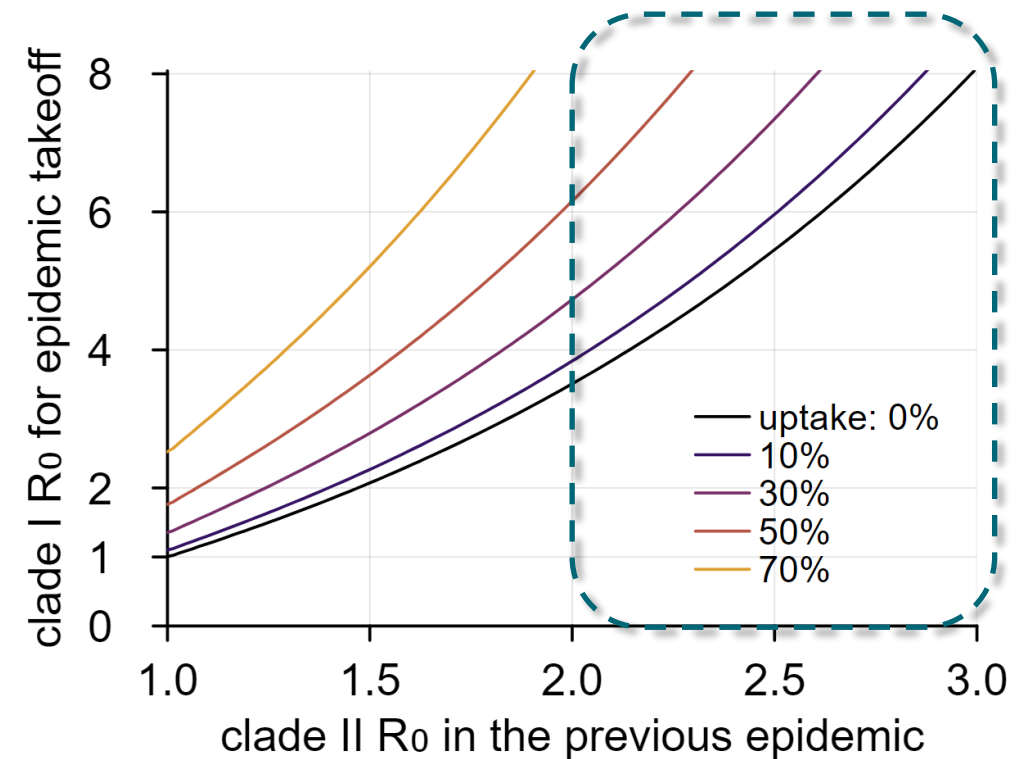
$$S_{\text{eff}} = \frac{R_{\text{eff}}^{\text{new}}}{R_0^{\text{new}}} = \frac{\int_1^{\infty} x(x-1)S_{\text{final}}(x)dx}{\langle x(x-1) \rangle}$$

Clade I outbreak potential within MSM

Effective susceptible proportion ($R_{\text{eff}}^{\text{new}} / R_0^{\text{new}}$) and $R_0^{\text{clade IIb}}$



R_0^{new} for clade I epidemic to takeoff and $R_0^{\text{clade IIb}}$



Summary

- Our model shows that clade Ib requires an R_0 of 3–8 to spread significantly within MSM populations in countries previously affected by clade IIb
- In countries with approximately 50% vaccination coverage, clade Ib would need an R_0 of at least 6 to cause a major outbreak, which exceeds current R_0 estimates (~ 1.5)
- These findings suggest a low likelihood of a major mpox outbreak within MSM in previously affected regions, underscoring the importance of vaccination to prevent future potential clade Ib spread
- Future direction: optimal vaccine allocation given key populations including FSWs, children, MSM, etc.

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This presentation is part of our ongoing project on mpox, with further details available in our latest preprint below:



Roles of community and sexual contacts as drivers of clade I mpox outbreaks

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