Adaptive behavior in response to the 2022 mpox epidemic in the Paris region

Keywords: sexual contact networks, epidemic, mpox, vaccination, behavior

Extended Abstract

The 2022 global outbreak of mpox marked an international public health crisis[1]. It led to a rapid case surge among men-who-have-sex-with-men (MSM) in previously unaffected regions, followed by a sudden decline, whose drivers remain unclear. We developed a network model of mpox transmission among MSM based on sexual behavior data from the PREVAGAY survey[2,3] and fitted it to the Paris region epidemic[4]. Our analysis tested three drivers for the decline (Figure 1): post-exposure prophylaxis (PEP) vaccination, immunity among highly active MSM, and behavioral adaptations, either uniform in the population or based on individual risk factors. Behavioral changes adopted by 49% (95% CI 47-51%) of MSM regardless of risk factors best explained the decline, preventing an estimated 68% (15-99%) of potential cases in summer 2022. To validate model predictions, we analyzed data from the 2023 ERAS survey[5] and found that 46% (45-48%) of MSM in the region reported reducing their number of sexual partners during that period—closely matching our model estimates (Figure 2). In contrast, PEP vaccination and immunity among highly active MSM were insufficient to halt the outbreak. Both model predictions and survey results underscore the key role of widespread, spontaneous behavioral adaptations—regardless of risk profile—in driving the epidemic downturn. These findings highlight the importance of effective risk communication and community engagement in outbreak management.

Ethics statement. All surveillance data were anonymized before use. Surveillance was considered as non-interventional research only requiring the non-opposition of the patient (article L1211 of the French public health code). The PREVAGAY study was authorized by the Comité de protection des personnes Île-de-France IX (n°2014-A01605–42). The ERAS study was approved by Inserm's Ethics Evaluation Committee (IRB00003888 avis n°23-989). Participants in both studies gave their informed consent.

References

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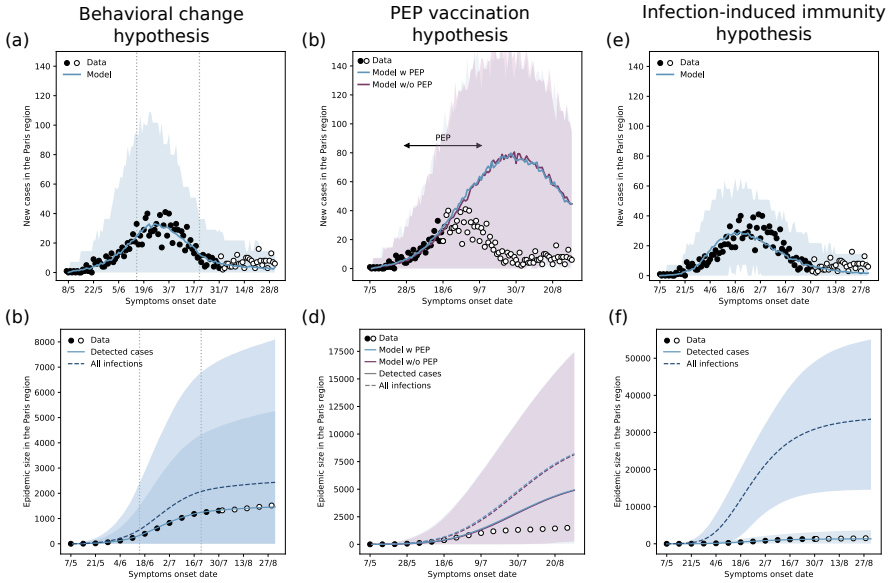

Figure 1. Model predictions for the three hypotheses. a,b: Mpox cases in the Paris region (filled points refer to the data used for inference) and model predictions with 95% prediction intervals under the behavioral change hypothesis, assuming homogeneous change of behavior across MSM (best-fit model). The top panel (a) reports incident cases, and the bottom panel (b) the epidemic size. **c,d:** As in (a,b), data vs. model predictions under the PEP vaccination hypothesis, scenarios with and without PEP vaccination. **e,f:** As in (a,b), data vs. model predictions under the infection-induced immunity hypothesis.

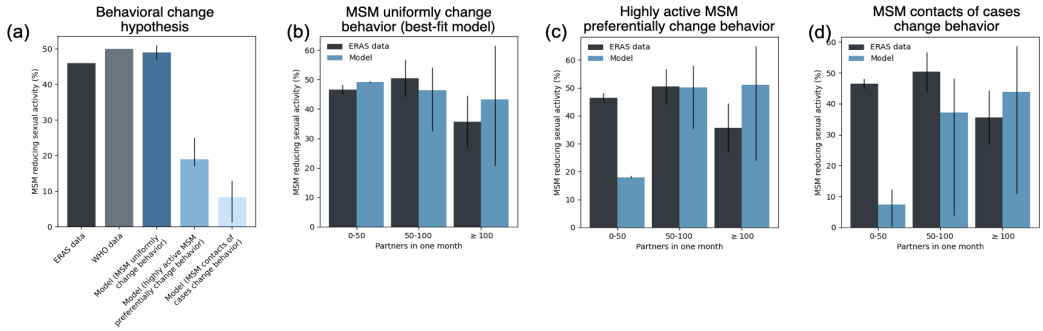

Figure 2. Change of behavior. a: Percentage of MSM reducing sexual activity: survey data vs. model estimates with 95% confidence intervals. **b:** Percentage of MSM reducing sexual activity stratified by the monthly number of partners: survey data vs. model predictions with 95% prediction intervals in the assumption of uniform change of behavior across MSM (best-fit model). **c:** as in (b) in the assumption of a change of behavior based on sexual activity. **d:** as in (b) in the assumption of a change of behavior based on recent exposure to a diagnosed case.