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Projected burden and duration of the 2022 Monkeypox outbreaks in non-endemic countries

As of June 8, 2022, more than 1250 confirmed monkeypox cases have been reported from 28 countries considered as non-endemic, including Canada, Portugal, Spain, The UK, and the USA.[1] Using an individual-based mathematical modelling framework, which has been applied to investigate the transmission of measles, Ebola, and SARS-CoV-2,[2] we modelled a monkeypox outbreak in a simulated population of 50 million people with socioeconomic and demographic characteristics typical of a high-income European country. The model accounts for the high heterogeneity of people's contacts and mobility over short and long range, which are key factors in the transmission dynamics and spread of infectious diseases—such as monkeypox. Outcomes of the model were the median number of monkeypox cases and the median duration of the outbreak. We modelled three baseline scenarios, with outbreaks seeded by the introduction of three, 30, and 300 primary monkeypox cases in the simulated population. Baseline scenarios in which no public health emergency interventions were done were compared with two intervention scenarios: (1) isolation of primary cases and contact tracing of individuals exposed to the primary case and isolating in case of symptom onset and (2) isolation of primary cases and contact tracing and vaccination of those exposed to primary cases (ie, ring vaccination). A comprehensive model description, including model parameters used, is outlined in the appendix (pp 2–6).

Our baseline scenarios project that—with no public health emergency interventions—the introduction of people with monkeypox could lead to small national outbreaks of moderate duration; ultimately, the outbreaks would all subside (appendix pp 12–13). We estimate that without interventions the introduction of three cases could cause 18 secondary cases, 30 could cause 118 secondary cases, and 300 cases could cause 402 secondary cases. The median duration of these outbreaks for the three scenarios would range from 23 weeks (95% CI 4–77) following the introduction of three cases to 37 weeks (20–99) following the introduction of 30 cases, and 37 weeks (19–121) following the introduction of 300 cases. Contact tracing with isolation of symptomatic cases would reduce the number of secondary cases by 72·2% following the introduction of three cases, 66·1% after 30 cases, and 68·9% after 300 cases. Adding ring vaccination to contact tracing would reduce the number of secondary cases by 77·8% following the introduction of three cases, 78·8% after 30 cases, and 86·1% after 300 cases. The two intervention scenarios showed that interventions targeting contacts of primary cases could reduce the median duration of monkeypox outbreaks by between 60·9% and 75·7% (appendix p 11).

Our model results align with previous research on monkeypox outbreaks, in endemic and non-endemic countries, that showed the low human-to-human transmissibility of the monkeypox virus and its low potential to result in large-scale heavy-burden outbreaks.[3] An unusual feature of the current outbreak is that a disproportionate number of confirmed cases were reported in men who have sex with men: to date less than 50 women are included within a population of more than 1250 people confirmed disease).[4] As of June 16, 2020, no evidence suggests that monkeypox is transmitted sexually; the cases were probably coincidentally introduced into one or more communities of men who have sex with men, with various individuals then subsequently exposed during mass gatherings through the close contact with lesions, body fluids, respiratory droplets, and contaminated materials. In countries currently reporting monkeypox cases, our model suggests that a strong public health response—specifically contact tracing and surveillance, isolation of symptomatic cases, and ring vaccination—would substantially reduce the number of secondary cases by up to 86·1% and duration of the outbreak by up to 75·7%.

In conclusion, our findings align with WHO's assessment that the overall public health risk at a global level is currently moderate.[1] Observed outbreaks in non-endemic countries should be contained quite quickly, particularly when adequate mitigation measures are implemented.

We declare no competing interests.

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See **Online** for appendix