

Modeling the future rate of laboratory biosafety breakdowns involving rinderpest: uncertainty in the post-eradication era

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Now we are in the rinderpest post-eradication era, attention is being focused on the risks of re-introduction. There is little data on the rates of laboratory biosafety breakdowns and any predictions based on past events are subject to uncertainty. The aim of this study was to model the future rate of biosafety breakdowns involving rinderpest (defined as accidental or malicious exposure of a susceptible animal) according to different assumptions, taking account of uncertainty and stochasticity. Data was collected from a global online survey of laboratories, a structured search of ProMED reports and discussion with experts. A spreadsheet model was constructed and Monte Carlo simulation was used to simulate the number of biosafety breakdowns involving rinderpest that may occur over the next 10 years according to different assumptions, such as a reduction in the number of laboratories with rinderpest virus. There was a high degree of uncertainty in the number of rinderpest biosafety breakdowns that will occur, even when assumptions were made. The search identified no breakdowns during the last 10 years. The most optimistic set of assumptions – that the search was 100% sensitive and the number of laboratories working on rinderpest is decreasing as suggested by our survey – therefore resulted in a prediction of no biosafety breakdowns over the next 10 years. When the last 40 years (during which five breakdowns were reported) were considered as a basis for making future predictions, the most likely number of breakdowns was still zero however the probability of having at least one breakdown was greater than 0.4. Assuming a search sensitivity of 1% resulted in a 90% chance of 32 to 156 breakdowns occurring. Although a highly simplified model, it is hoped that this is a useful tool for discussion. Even fairly optimistic predictions suggest there is a non-negligible risk of future biosafety breakdowns involving rinderpest.