

Modelling the field personnel resources to control foot-and-mouth disease outbreaks in New Zealand

Robert Sanson¹, Thomas Rawdon², Mary van Andel³, and Zhidong Yu³

¹AsureQuality New Zealand

²National Centre for Biosecurity and Infectious Diseases

³New Zealand Ministry for Primary Industries

August 24, 2022

Abstract

The objective of the study was to simulate New Zealand's foot-and-mouth disease (FMD) operational plan to determine personnel requirements for a FMD response and understand how the numbers of frontline staff available could affect the size and duration of FMD outbreaks, when using stamping-out (SO) measures with or without vaccination. The model utilized a national dataset of all known livestock farms. Each simulation randomly seeded infection into a single farm. Transmission mechanisms included direct and indirect contacts, local and airborne spread. Prior to each simulation, the numbers of personnel for front-line tasks were set randomly. In a random subset of simulations, vaccination was allowed to be deployed as an adjunct to SO. Front-line tasks included contact tracing, surveillance of at-risk farms, depopulation and vaccination using teams comprising personnel of the different types required by New Zealand's operational plans. The effect of personnel numbers on the size and duration of epidemics were explored using machine learning methods. In the second stage of the study, using a subset of iterations where numbers of personnel were unconstrained, the number of personnel used each day were quantified. When personnel resources were unconstrained, the 95th percentile and maximum number of infected places (IPs) were 78 and 462 respectively, and the 95th percentile and maximum duration were 69 and 217 days respectively. However, severe constraints on personnel resources allowed some outbreaks to exceed the size of the UK 2001 FMD epidemic which had 2026 IPs. The number of veterinarians available had a major influence on the size and duration of outbreaks, while the availability of other personnel types did not. A shortage of veterinarians was associated with an increase in time to detect and depopulate IPs, allowing for continued transmission. Emergency vaccination placed a short-term demand for additional staff at the start of the vaccination programme, but the overall number of person days used were similar to SO-only strategies. This study determined the optimal numbers of front-line personnel required to implement the current operational plans to support an FMD response in New Zealand. A shortage of veterinarians was identified as the most influential factor to impact disease control outcomes. Emergency vaccination led to earlier control of an FMD outbreak, but also resulted in a short-term spike in demand for personnel. A successful response needs to have access to sufficient personnel, particularly veterinarians, trained in response roles and available at short notice.

Hosted file

Sanson_et_al_TBED_Personnel_resources_manuscriptb.docx available at <https://authorea.com/users/335823/articles/583092-modelling-the-field-personnel-resources-to-control-foot-and-mouth-disease-outbreaks-in-new-zealand>

















