

**Quantifying economic losses of FMD based on data obtained during an outbreak: a simulation study**  
*Niemi, J.K.<sup>1</sup>, Lyytikäinen, T.<sup>2</sup>, Lehtonen, H.<sup>1</sup>, Sahlström, L.<sup>2</sup> and Virtanen, T.<sup>2</sup>, <sup>1</sup>MTT Agrifood Research Finland, Economic Research, Finland, <sup>2</sup>Finnish Food Safety Authority Evira, Risk Assessment Research Unit, Finland; [jarkko.niemi@mtt.fi](mailto:jarkko.niemi@mtt.fi)*

Decisions to mitigate foot and mouth disease (FMD) are taken under imperfect information, since the actual size of outbreak is unknown until all infected farms have been detected. Our goal was to estimate whether data obtained in the beginning of an outbreak could signal the potential for economic losses and help to target prevention. An epidemiological Monte Carlo simulation model was used to produce 100,000 FMD outbreaks. There were data about each cattle and pig farm in Finland. The model used large datasets to describe farm population and farm networks such as animal transportation registry to describe the spread of FMD via animal contacts. Outbreaks were started from each farm. A partial-equilibrium model simulated economic losses of FMD to Finnish producers, consumers and taxpayers. It took into account foreign trade distortions and their price effects. Regression models estimated which characteristics of an outbreak explained losses the most. Explanatory characteristic included the properties (size, location, local herd density) of the primary infected farm (PIF) and outcomes of an outbreak (size, spatial spread, duration). Data about outbreak magnitude and duration was more informative than the data about PIF. For instance, outbreak duration was important, because foreign trade and business interruption losses were related to it. The properties of PIF were associated with losses. Infections in dairy farms resulted in the most costly outbreaks. To anticipate losses caused by an outbreak, higher economic weights per observation must be used in the very beginning of an outbreak than at later stages. Since losses could be mitigated only partly after the detection of FMD, it is important to identify the cases where further losses are accumulated. In practice the potential to reduce losses by adjusting mitigation policy after PIF has been detected is very limited.