

Effect of mixed livestock production types on foot and mouth disease outbreaks and interventions

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The central United States (U.S.) has a large livestock population including cattle, swine, sheep and goats. Simulation models were developed to assess the impact of livestock herd types and vaccination on Foot and Mouth Disease (FMD) outbreaks using the North American Animal Disease Spread Model (NAADSM), a spatially explicit, stochastic infectious disease model. Based on data from the U.S. Department of Agriculture National Agricultural Statistic Service, a simulated population of livestock operations was generated. The population included 151,620 herds defined by latitude and longitude, production type, and herd size. For the simulations, a single 17,000 head feedlot was selected as the initial latently infected herd in an otherwise susceptible population. Contact rates between herds were based on survey data of livestock producers in Kansas and Colorado or estimated from expert opinion. The livestock producer survey indicated a significant proportion of mixed beef-swine herds (approximately 8% of herds) not accounted for in previous models. As such, scenarios were simulated in two populations, one without beef-swine herds and one with beef-swine herds. Scenarios were simulated in each population with either no vaccination or a vaccination ring around each infected premise. The results of the scenarios were compared to assess the effect of mixed beef-swine herds on the impact of the outbreak and the effect of vaccination. Results demonstrated that the inclusion of mixed beef-swine herds had minimal impact on the median duration of disease, and the total number of herds and animals destroyed. While, inclusion of mixed production types could increase the contact rates between different livestock production types this did not seem influential for the modest proportion of mixed production types in these scenarios. Modeling of FMD outbreaks may be robust to small misspecification of production types.