Spatial model of foot-and-mouth disease outbreak in an endemic area of Thailand

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Abstract

Foot-and-mouth disease (FDM) is a disease of cloven-hoved animals with high costs in animal welfare and for production of animal products. Up to now transmission between farms in FMD-endemic areas has been given little attention. Between farm transmission can be quantified by distance independent transmission parameters and a spatial transmission kernel indicating the rate of transmission of an infected farm to susceptible farms depending on distance. The spatial transmission kernel and distance-independent transmission parameters were estimated from data of an FMD outbreak in Lumpayaklang subdistrict in Thailand between 2016 and 2017. The spatial between-farm transmission rate in Lumpayaklang subdistrict was higher compared with spatial between-farm transmission rate from FMDV in epidemic areas. The result can be explained by the larger size of within-farm outbreak in endemic area due to no culling. Inclusion of distance-independent transmission parameters improved the model fit, which suggests the presence of transmission sources from outside the area and spread within the area independent of distance between farms. The remaining distance dependent transmission was mainly local and could be due to over-the-fence transmission or other forms of contact between nearby farms. Farm size on the kernel positively effects the transmission rate, by increasing both infectivity and susceptibility with increasing farm size. From the results, we suggested more strict outbreak responses, as well as the outbreak communication to the farmers to reduce the between-farm transmission. Movement restrictions and enforced by checkpoints during the outbreak can prevent the transmission from outside and the distance-independent transmission within an area.

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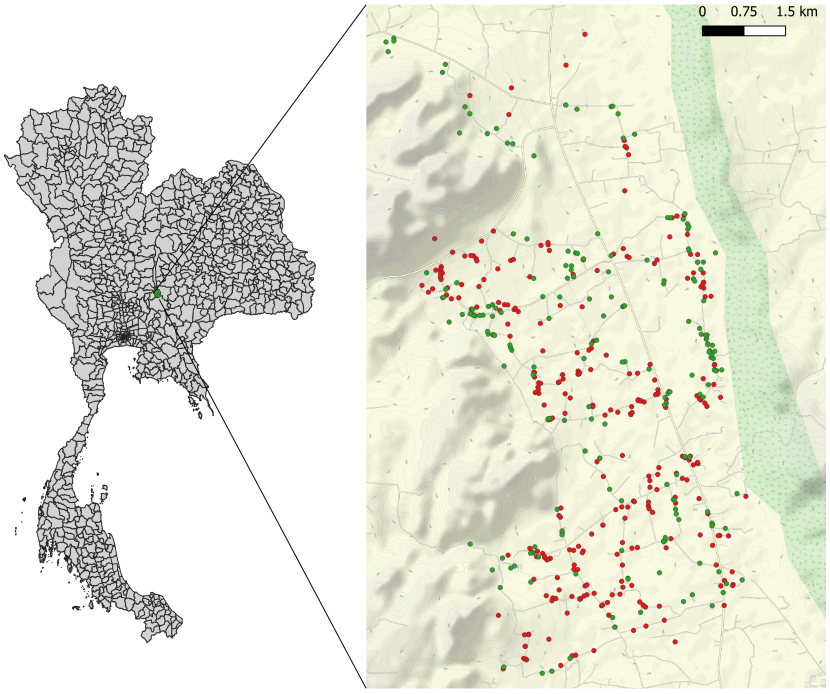

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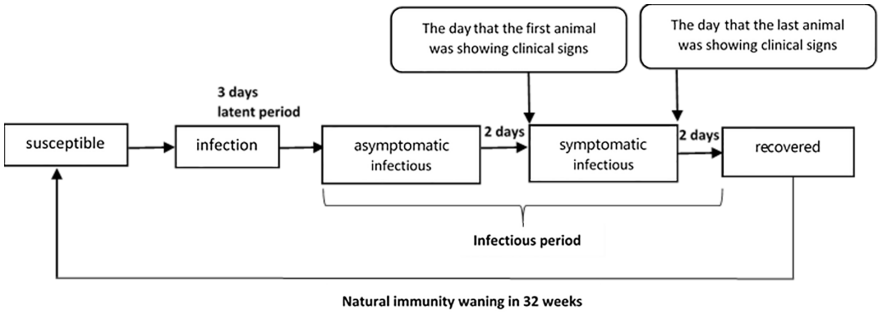

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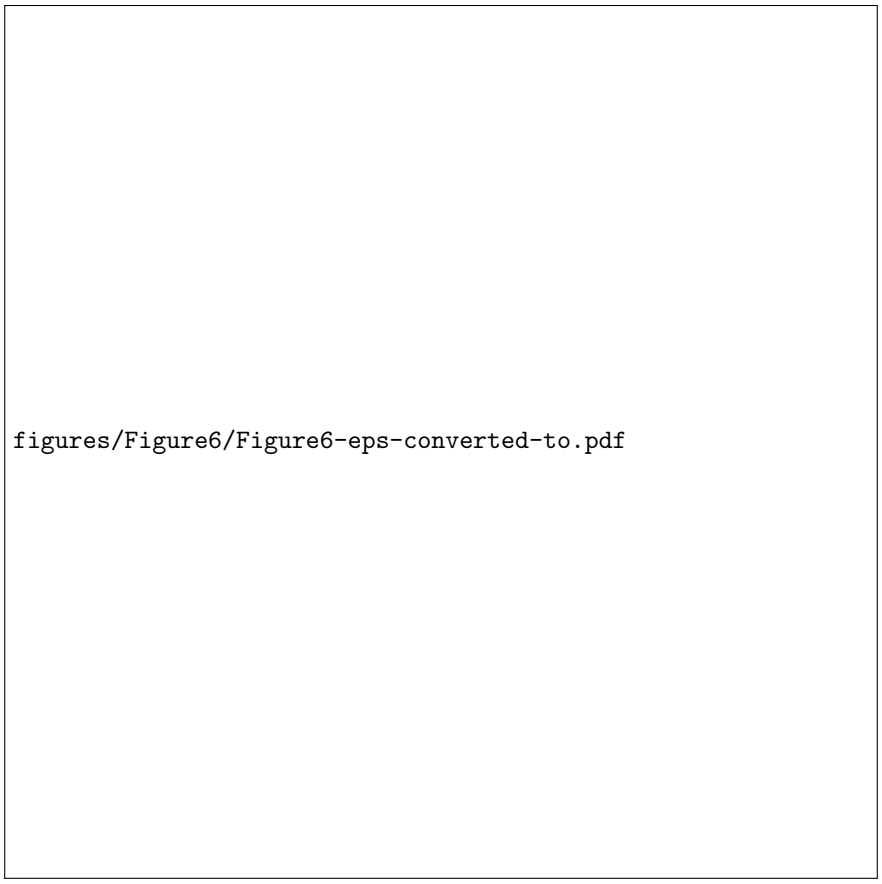

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