POLICY BRIEF: **Providing more reliable disease transmission risk estimates using data from small historic outbreaks.**

Reference No: **EPIC_201819_PB_005v1**

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1. KEY MESSAGE

We have created a tactical tool that helps inform scientists about the appropriate choice of model and parameters to predict disease spread, widening the usable evidence base to include smaller incursions. This will enable scientists to provide policy-makers with better information on the most likely patterns of disease spread between farms based on data from small historic disease incursions, improving the supply of critical information for the assessment of risks associated with future disease incursions.

2. MAJOR FINDINGS

Using this tool, we can make useful inferences from small data sets about key properties of disease spread, including the total number and likely position of infected farms. This would provide a clearer picture of any variability in outbreak behaviour over time, whilst reducing reliance on expert opinion or more remote historical precedent. By making the most efficient use of the data available, the tool enabled us to distinguish between different models for disease spread. Our assessment of the tool has found that:

1) The tool is accurate approximately 90% of the time, even when as few as about 20 premises have been identified as positive.

2) The ability to distinguish between models diminishes as data size decreases. However, by assuming a given model structure based on expert judgement, we can still obtain statistically rigorous prediction of risks even with as few as 6 or 7 premises identified as positive.

3. OBJECTIVES

i) To develop a statistical tool to infer maximum information about disease outbreaks from small historic data sets.

ii) To investigate the possibility of distinguishing between different underlying models for disease dynamics.

iii) To determine the relationship between the size of epidemic outbreak and the ability of the tool to distinguish between different underlying models for disease dynamics.

4. POLICY IMPLICATIONS

We now have an additional tool to support better modelling and policy decisions concerning incursion of disease when based on past outbreak data. The resulting model outputs contain more accurate information on the likely scale and spread of disease and the probability of infection at different locations, which will be useful for policy-makers in identifying high risk areas and prioritising strategies for disease surveillance.

5. IMPORTANT ASSUMPTIONS AND LIMITATIONS

- This tool builds on the work of a number of scientists within EPIC; it has been tested using data from the Classical Swine Fever outbreak in England during 2000[a].
- It is a work in progress; however, we believe that this tool can already provide useful additional support for tactical decision-making in response to incursion risks. For small data sets, the utility of the tool depends on the appropriateness of modelling assumptions based on expert judgement. However, where past outbreak data involves 20 or more infected premises this tool can be used to support model selection, allowing better assessment of key components of the model than was previously possible.
- Further work to support operational risk assessment during the early phases of outbreaks is in progress. We have implemented a number of methods which have been tailored to specific data types and structures such as farm location, time of disease detection, and type of farm (species and production type). As such, we are not in a position to release generic software which could be applied without adaptation to any future incursion. We can, however, code our methodologies so as to be appropriate to any specific situation in a reasonably short period of time.

6. FIGURE OR TABLE (Optional)

7. LINKS TO EXISTING PUBLICATIONS OR REPORTS

[a]Gamado, K.M., Marion, G. and Porphyre, T. (2017). Data-driven risk assessment from small scale epidemics: estimation and model choice for spatio-temporal data with application to a classical swine fever outbreak. Frontiers in Veterinary Science 4, 16. Frontiers. https://doi.org/10.3389/fvets.2017.00016

8. POLICY COMMENTS/RESPONSE (Has this scientific research had a beneficial impact on policy. Please give examples)