Implementation of an Early Detection System for *Salmonella* in livestock production in Great Britain

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INTRODUCTION

A system for the early detection of outbreaks of *Salmonella* in livestock in Great Britain was implemented within VLA in September 2006. The system was developed in order to detect changes in disease reporting for a specific time period and in particular for serotypes associated primarily with human infections & public health.

METHODS

Data are derived from incidents of *Salmonella* originating from clinically diseased domestic livestock species and from reports received from poultry monitored as part of a mandatory control programme for *Salmonella* under the Poultry Breeding Flocks and Hatcheries Order (PBFHO).

Samples submitted from livestock for investigation of clinical disease:

i. *S.* Dublin in cattle
ii. *S.* Typhimurium in cattle
iii. *S.* Typhimurium in sheep
iv. *S.* Typhimurium in pigs
v. *S.* Typhimurium with the pentavalent resistance pattern (ACSSuT)
vi. *Salmonella* serotypes other than *S.* Typhimurium with the pentavalent resistance pattern (ACSSuT)
vii. *Salmonella* serotypes resistant to nalidixic acid

Samples submitted from domestic fowl under the Poultry Breeding Flocks & Hatcheries Order:

i. Top 5 serotypes reported
ii. *Salmonella* serotypes of designated public health significance in the EU (Enteritidis, Typhimurium, Hadar, Infantis, Virchow)
iii. All *Salmonella* serotypes

A Poisson regression model compares the number of observed incidents with an expected value, accounting for seasonality and past outbreaks.

$$\log(\mu_i) = \beta_0 + \beta_1 t_i$$

$$y_i \sim Poisson(\mu_i) \quad E(y_i) = \mu_i \quad V(y_i) = \varphi\mu_i$$

A threshold value is calculated for each month. If the current observed count is above the estimated threshold value, a warning is implemented indicating that a potential outbreak is occurring in the field.

This model is complemented by a monthly tool which screens data for certain new or unusual *Salmonella* serotypes reported from animals.

Salmonella EDS additional "tool":

i. strains resistant to cefotaxime or ceftazidime
ii. strains resistant to ciprofloxacin
iii. *S.* Newport strains resistant to A(C)SSuT
iv. strains resistant to amoxicillin/clavulanic acid

Monthly EDS model & "tools"

EDS REPORT

- Investigations
- Examination of raw data
- Consultation with experts
- On farm investigations
- Preparation of additional reports
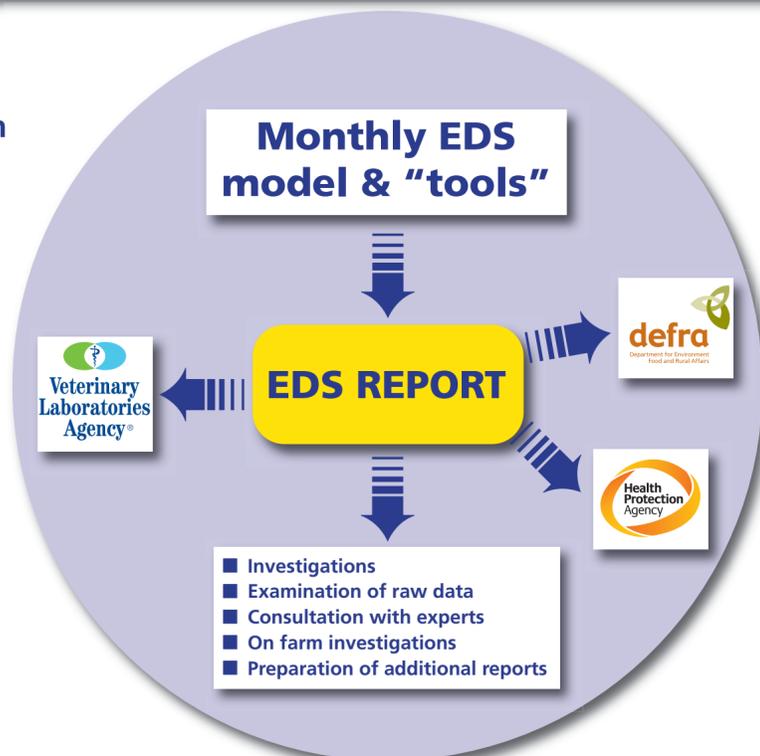
RESULTS

"Flag" for *S.* Typhimurium DT104 (5 years of historical data is used)
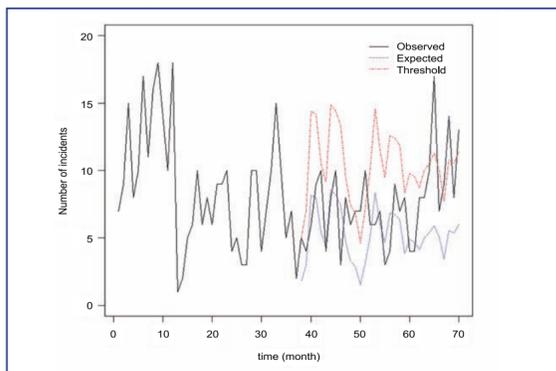
"Flag" for *S.* Typhimurium non DT104 in cattle (12 years historical data is used)
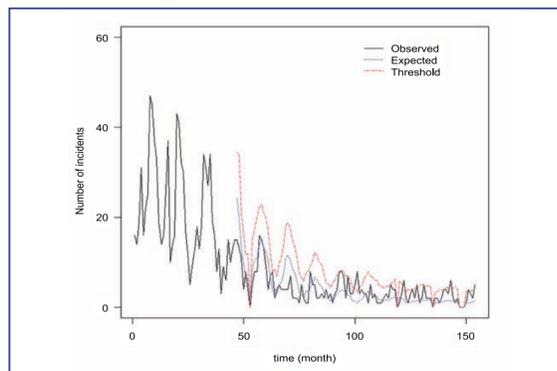
"Flag" for *S.* Enteritidis in poultry
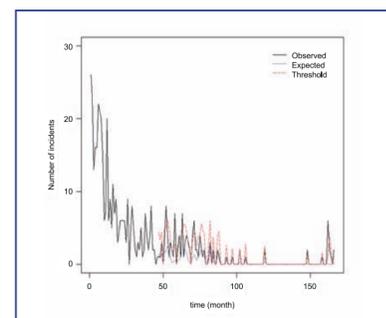
Follow up action:
- Examination of raw data
- Related to increase of reports linked to investigation of *S.* Enteritidis in a chicken breeding flock

Follow up action: Data retrieval and analysis, preparation of additional reports

Reported incidents of *S.* Typhimurium in cattle (1986-2006)
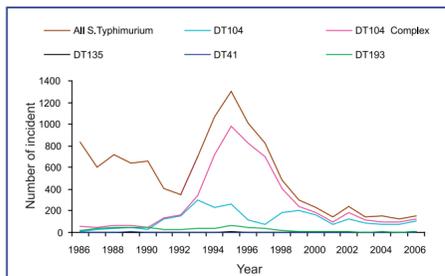
S. Typhimurium DT104 incidents in cattle & cattle population density by county in GB (2004-2006)
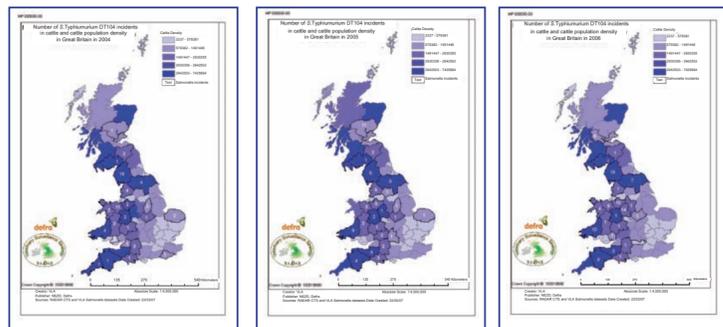
"Flag" for *Salmonella* strains resistant to nalidixic acid (5 years of historical data is used)
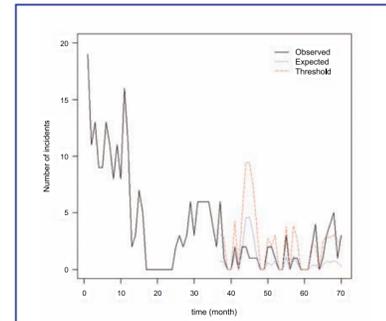
**Follow up action:**
- Examination of raw data
- On farm epidemiological investigations conducted

DISCUSSION AND CONCLUSIONS

- Seven flags were triggered by the EDS model in September 2006 to September 2007. Four of these were due to true increases in reports, but none due to emerging outbreaks.
- The warning could potentially be a false alarm, probably related to changes in the reporting procedures over time, or to an increase in reports, as a result of extensive investigations of an already known incident (i.e. *S.* Enteritidis flag in October 2006)
- The EDS does not predict future outbreaks, but alerts as soon as possible to increases that have just happened.

REFERENCES

Kosmider R, Kelly L, Evans S, Gettingby G. (2006) A statistical system for detecting Salmonella outbreaks in British livestock. Epidemiology and Infection **134(5)**: 952 – 960.