



## Observations on the incidence and seasonality of uterine torsion and left displaced abomasum following the 2001 outbreak of foot-and-mouth disease in the UK

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### ABSTRACT

Time-series impact analysis was used to compare differences in the rate of reporting of left displaced abomasum (LDA) and uterine torsion by veterinarians in the UK before and after an outbreak of foot-and-mouth disease (FMD) in 2001. There were 150% and 35% increases in the reported incidences of LDA and uterine torsion, respectively, following the outbreak. Changes to feeding practices are likely to have been a major contributor to the increased incidence of LDA, but this factor is unlikely to have influenced the changed incidence in uterine torsion. Given that abdominal size and shape of dairy cows are recognised risk factors for both disease processes, the findings of this study suggest changes in these parameters may have a role in the altered incidences. Additional research is required to further elucidate the risk factors contributing to the increased incidence of LDA and uterine torsion in dairy cows under UK conditions.

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### Introduction

The outbreak of foot-and-mouth disease (FMD) in the UK in 2001 was the single largest epidemic of this disease reported globally to date (Rossides, 2002). The outbreak resulted in the slaughter of more than four million animals in support of the control strategy and a further 2.5 million animals on welfare grounds (Kitching et al., 2005). The economic impact of the epidemic in terms of direct costs to agriculture and tourism has been estimated at £6 billion<sup>1</sup> (Thompson et al., 2002).

Inevitably a disease outbreak of this magnitude ushers significant changes in cattle farming practices including changes to: herd size; breeds/pedigree of animals; and type of farming system (from pasture-based to housed), and it is likely that such modifications would have an impact on animal health. The number of reports of lameness and mastitis treatment by veterinarians in the UK changed after 2001 (Laven et al., 2007; Lawrence et al., 2010). In the case of lameness, there was a continued downward trend in veterinary treatments, while for mastitis there appeared to be a short term increase in veterinary involvement. Over the longer-term however, there does not appear to have been a long term effect in the case of either condition. Two conditions that have changed markedly in prevalence since the FMD outbreak are

uterine torsion (up from 5.5% to 10.7% between 1997 and 2004), and left displaced abomasum (LDA) (doubled between 1997 and 2003) (Laven and Howe, 2004, 2005). For both conditions there appears to have been a discontinuity in the pattern of disease before and after 2001.

These analyses were simple, single timepoint comparisons that require further confirmation and characterisation. The aim of this study was to use impact analysis, which assesses the response in a time-series to a discrete event or intervention input (Makridakis and Wheelwright, 1987), to evaluate whether the 2001 UK FMD outbreak had an effect on the incidence and/or seasonality of LDA and uterine torsion, as reported by the National Animal Disease Information Service (NADIS) network in the UK.

### Materials and methods

#### The NADIS database

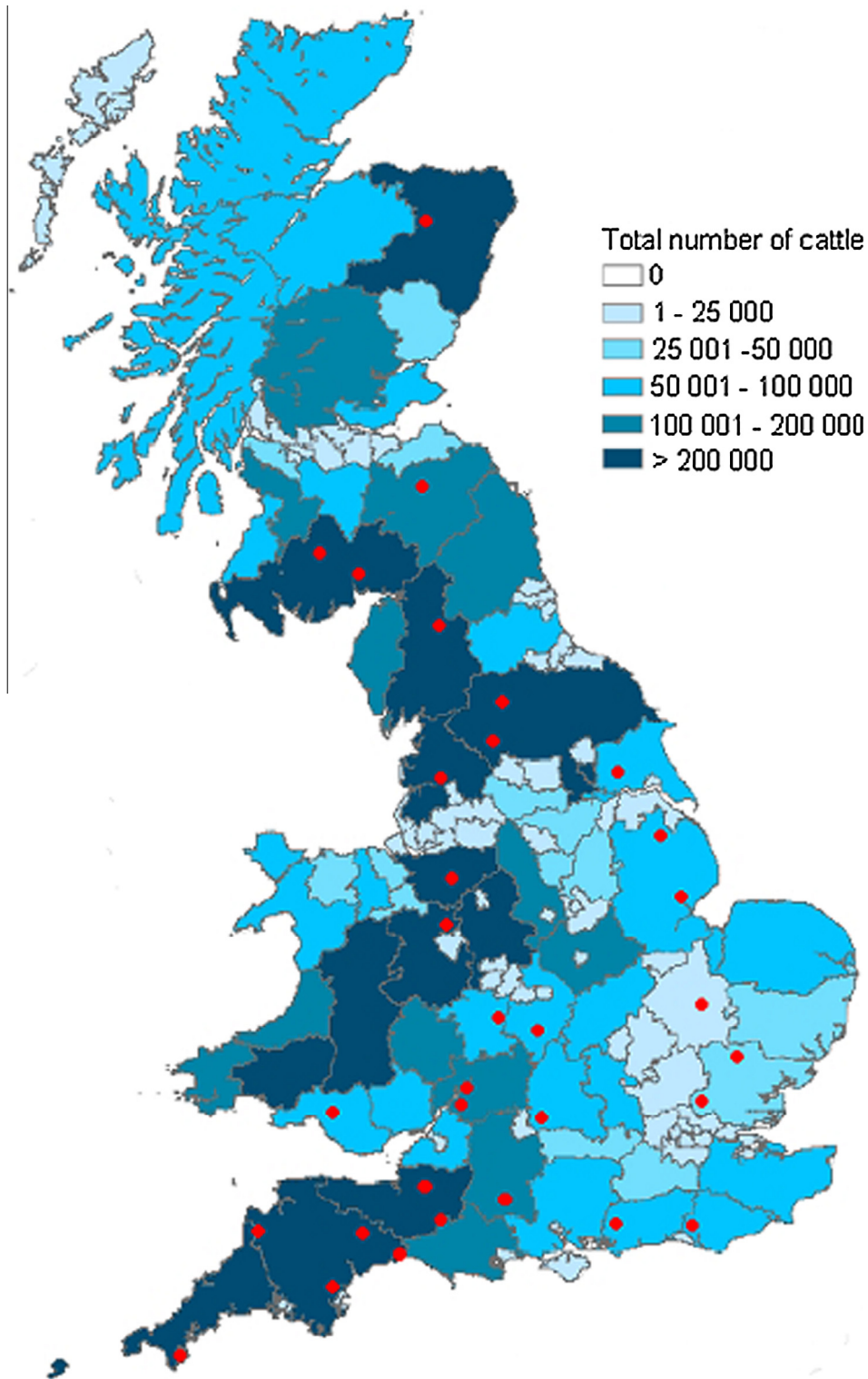
NADIS was established in 1995 and since 1997 has consisted of a network of 40 private veterinary practitioners and the veterinary practices associated with the six UK veterinary schools. The veterinarians involved in NADIS are all farm animal practitioners selected on the basis of demonstrated expertise in cattle, sheep or pig medicine. The practitioners are based in separate practices except in two cases where the individuals concerned cover completely different areas of the same practice. The distribution of NADIS practices relative to the UK cattle population (as of 2005) is shown in Fig. 1.

From January 1997 to December 2007 the number of veterinarians recording data for NADIS remained stable, as did the number of dairy cows under their care (approximately 100,000) (M. Howe, personal communication). Over the period of this study, NADIS veterinarians recorded a 'field' diagnosis for each condition they

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<sup>1</sup> £1 = approx. \$1.56, €1.24 at 25 June 2012.



**Fig. 1.** Map illustrating the distribution of the UK National Animal Disease Information Service (NADIS) practices (red spots) which report data from dairy herds and the population density of dairy cattle (blue shading) (DEFRA, 2005).

encountered and the number of cattle affected. The NADIS data analysed in this paper straddled the 2001 UK FMD outbreak, which occurred between the 19th of February and the 30th of September 2001.

#### Time-series model

A general model for a time-series with a single intervention is given by the following formula:

$$Y_t = m_t + N_t$$

where  $Y_t$  represents diagnoses at time  $t$ ,  $m_t$  the change in the mean function attributable to the intervention, and  $N_t$  the underlying, unperturbed time-series usually modelled on pre-intervention data using an autoregressive integrated moving-average (ARIMA) process (Cryer and Chan, 2008). There are two types of intervention: a 'pulse intervention' for a one-time event such as a strike where the input variable has a value of '1' for the period of the strike and '0' otherwise; or a 'continuing intervention' such as a law change that assigns a value of '1' to the input variable after the date of

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