An Exploratory Assessment of Targeted Surveillance for Bovine Spongiform Encephalopathy in Great Britain

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Context

Overview of Bovine Spongiform Encephalopathy Surveillance

Transmissible Spongiform Encephalopathies (TSEs) are a group of neurodegenerative zoonotic diseases. Bovine Spongiform Encephalopathy (BSE) affects bovines and is categorised into two distinct forms: Atypical (H-BSE or L-BSE) which is sporadically occurring, and Classical (cBSE) which is a food-borne prion disease transmissible by the prion protein (1). The first confirmed case of cBSE in Great Britain (GB) was identified in 1986, and the first case epidemiologically linked to contaminated feed was confirmed in 1988. This marked the beginning of the BSE epidemic in cattle and had substantial social, economic and biosecurity impacts within the GB cattle industry. BSE posed a significant global risk for countries that had imported cattle and cattle products from GB, due to the long incubation period of BSE. In response to the outbreak, strict regulations were implemented. The 'Ruminant Feed Ban' was introduced in July 1988, followed by the 'Reinforced Feed Ban' in August 1996, which banned all use of mammalian protein in animal feed. Cattle born after the reinforced feed ban (BARB) became essential for surveillance by providing evidence on the effectiveness of regulations.

Development of GB BSE Surveillance

Regulations introduced to comply with EU Laws (EC999/2001) (now UK regulations) served as the foundation of the BSE Surveillance System in GB. Surveillance aimed to identify and remove BSE-infected cattle, to prevent infected tissues from entering the food chain and to rebuild global confidence in GB beef trade. The Department of Environment, Food and Rural Affairs (DEFRA) and the Animal and Plant Health Agency (APHA), implemented surveillance and restrictions in GB which operated through two streams of statutory surveillance:

Passive **–** introduced in 1986; requires any cattle displaying clinical signs suspicious of BSE to be reported by stakeholders to APHA for investigation.

Active **–** introduced in 2001; current testing requires all eligible fallen stock cattle over 48 months that were born in UK and EU (except for Bulgaria and Romania); and cattle over 24 months born in Bulgaria, Romania, and non-EU states. All cattle from abattoirs over 48 months that are subject to emergency slaughter or sick at ante-mortem must be tested. Fallen stock cattle are reported by keepers to sampling sites, who are responsible for organising the collection, sampling and disposal of the carcase. Brainstem samples are submitted for BSE testing at designated testing laboratories using IDEXX HerdChek BSE-Scrapie. Key information is captured by sampling sites on submission forms, either by hand or populated using specialist software, including farm details, animal information (eartag, cable tie reference, date of birth, date of death, reason for death and clinical signs observed) and sample details. An annual average of 103,284 cattle were tested through Active Surveillance (2020-2025) (2).

Since the introduction of regulations, the incidence of BSE has significantly reduced in GB, from a peak of over 36,000 cases in 1992 to just over 1,000 cases in 2002, decreasing to only single sporadic cases of cBSE in 2018, 2021 and 2024. A total of 181,142 BSE cases have been confirmed, of which 179,183 were detected through Passive Surveillance and 1,959 through Active Surveillance. Following the Reinforced Feed Ban, only 179 cBSE and 10 Atypical BSE BARB cases were detected demonstrating the effectiveness of control measures (2).

Alignment with World Organisation of Animal Health Standards

Since joining the Office International des Epizooties (OIE) in 1924, now known as the World Organisation for Animal Health (WOAH), GB have striven to align surveillance practices with regular recommendations provided by WOAH. The GB BSE surveillance programme has promoted ongoing awareness and training programmes to stakeholders to ensure long-term statutory compliance and collaboration. Stakeholders include those involved in the management, rearing and production of cattle including: breeders, owners and keepers, veterinarians, transporters, slaughterhouses, abattoirs, disposal sites, software providers, unions and clubs. The robust surveillance system enabled GB to achieve WOAH BSE-Risk status of Negligible in 2025. This was awarded following consideration of eight years of surveillance data that highlighted GB had met strict criteria, including effective feed controls, suitable surveillance provisions, full investigation of BARB BSE positive cases, and comprehensive risk assessment (3).

In 2023, WOAH published new recommendations for BSE surveillance under Article 11.4.20 (3). Recommendations encourage a shift from high-volume, prescriptive testing (GB's current Active Surveillance

strategy) towards a more flexible, risk-based approach. This aims to target animals that are epidemiologically justified, that are more likely to be infected. This is based on presence of known clinical signs associated with BSE which include: aggression or apprehension; hyperaesthesia (increased sensitivity to touch, light or sound); and ataxia (changes in posture and movement) (4). WOAH have classified four targeted groups:
A) Bovines displaying progressive BSE-like clinical signs.
B) Bovines displaying neurological or behavioural signs at slaughterhouses or abattoirs.
C) Bovines unable to rise or walk without assistance with appropriate clinical history that rules out other causes of recumbency.
D) Bovines found dead with appropriate clinical history that rules out other common causes of death.

Existing Surveillance
Cattle in Group A are currently captured through BSE Passive Surveillance in GB, which provides a rich clinical history through investigation of the animal and associated holdings (both natal and rearing). Therefore, continued engagement with stakeholders to promote awareness of BSE-like signs is essential to ensure all suspect cases are reported.
Cattle in Group B are captured through BSE Active Surveillance in GB slaughterhouses and abattoirs during ante-mortem inspection, which would not be slaughtered for human consumption. However, no data are currently collected on clinical signs in existing data capture methods.
Cattle in Groups C and D are partly captured in the current BSE Active Surveillance programme in GB as submissions to veterinary investigation centres and postmortem providers, however this was not originally consolidated for reporting purposes. For all fallen stock submissions, limited data are collected on clinical history, which limits the ability to distinguish between BSE-like reasons for death and other reasons for death.
Therefore, this case study explores the required work to address the gap of clinical history for fallen stock cattle. This will be necessary if GB adopt the move towards risk-based surveillance, to meet the new WOAH recommendations.

Feasibility Work and Outcomes for New WOAH Recommendations
Cattle Fallen Stock Postmortem Data
Keepers organise postmortem examinations of fallen stock cattle, which is shared to provide clinically validated data including observed signs and final diagnosis. It was identified these data could be used to address Groups C or D of the above WOAH reporting requirements. Analysis initially extracted data from the TSE Surveillance System database (TSESS) to identify eligible animals tested, which was cross-referenced against laboratory systems to identify relevant submissions containing postmortem information. Data were cleaned, consolidated and categorised into Group C or D (of the WOAH reporting groups above) if relevant clinical history was provided, using PowerBI and SQL. Missing data points were identified, such as corresponding references across both systems, however this was resolved and clarified with the postmortem facilities, and the importance of inclusion was conveyed.
This new data processing and reporting approach successfully utilised existing data capture infrastructure, enabling the routine inclusion of clinical signs data from postmortem submissions in the annual reporting to WOAH.

Cattle Fallen Stock BSE Clinical Signs Data Capture
In March 2025, additional questions were introduced to the GB cattle fallen stock submission forms, to record the presence of BSE-like clinical signs. These were defined from clinical signs provided by WOAH and terminology adapted for stakeholders with a non-veterinary background, including: Changes in behaviour (Apprehension); sensitive to touch and sound (Hyperaesthesia); uncoordinated (Ataxia); and other neurological signs (4). As these are reported by the keeper and recorded by the sampling sites, a tick-box option (Yes, No or Not Known) was implemented for consistency and accuracy. This aligned with the WOAH recommendation to provide clinical history for fallen stock and offers a possibility to use new fields to introduce targeted surveillance of high-risk groups.
From July 2025, the new cattle fallen stock submission form containing BSE clinical signs data capture was circulated for mandatory completion amongst stakeholders. Where no information was provided on the submission forms, clinical signs were completed as ‘Not Known’ during data entry by the testing laboratory. During uptake and compliance monitoring, a high return of ‘Not Known’ responses were identified (94%) due to behavioural and operational barriers. These included the absence of keepers during the carcase collection processes, non-statutory requirement to provide additional information, uncertainty of responsibility to provide data (keeper or sampling sites) and the default completion of unanswered clinical sign fields as ‘Not Known’. To address this, the ownership and importance of completing the new clinical history fields was communicated to stakeholders by engaging through articles, conferences, training and meetings. Communications highlighted incentives for keepers to participate regarding improvement for GB trade and animal health reporting. Further

work is being actioned by the testing laboratory to no longer record missing data as ‘Not Known’, to better identify sites where forms are not being completed.
This engagement resulted in a three-fold increase in response rates providing a definitive ‘Yes’ or ‘No’ response, opposed to ‘Not Known’, increasing from 6% in July 2025 to 19% in December 2025. This indicates that sampling sites are increasingly asking keepers about the presence of clinical signs. Overall, the BSE clinical signs data provided were useful to support the WOAH annual reporting requirements and exploratory work into risk-based surveillance. However, continued collaboration is required to improve data quality and completion rates.

Cattle Fallen Stock Reason for Death Encoding
Currently, the reason for death of fallen stock cattle is captured on the cattle submission forms as a free-text field, which often provides clinical signs observed at the time of death. These data are provided by the keeper and captured during notification and collection of the carcases by sampling sites. To further support WOAH reporting of clinical signs, historical reason for death data were extracted from TSESS from a total of 893,362 cattle fallen stock between 2016 and 2023. Following data cleaning, text mining and manual coding in RStudio Software, 156 broad groups of reasons for death were initially identified. These groups were combined into 11 categories based on: the clinical syndrome, the body system affected, or the aetiology (Table 1). Categories that included BSE-like clinical signs, and categories that included syndromes with non-specific signs that could be associated with BSE, were identified.
To determine whether the 11 newly defined reason for death categories distinguish between BSE-like syndromes and non-BSE-like syndromes, data on the reason for death of 56 cBSE and Atypical BARB BSE cases, diagnosed between 2000 and 2023, were extracted from TSESS. It identified that over 70% of BSE cases would have been categorised as Recumbent/downer cow, Other, or Unknown. Based on this analysis, further categories may be required to distinguish frequently reported reasons for death in ‘Other’.
Reason for Death analysis was successful in identifying and defining 11 categories, with classification into BSE-like clinical signs. The reduction of categories from 156 broad groups was essential to integrate data capture fields with current cattle fallen stock forms, for potential future use in targeted surveillance. Further R scripts are being developed to classify real-time submission data into the new categories to support preparation of annual reports to WOAH for Groups C and D. This will enable additional data to be reported to align with WOAH recommendations, prior to surveillance strategy amendments. The outcome of this work highlighted the importance of having a high-quality dataset to conduct retrospective analysis, to successfully provide evidence for potential future practices.

Relevance and Recommendations for Wider Groups
Acknowledgement of the amendment to WOAH recommendations and response strategies are key for countries working towards negligible risk status. By aligning BSE surveillance with WOAH, the global approach ensures collective research and control measures for animal diseases. The benefits of negligible risk status include financial incentives such as expanded geographical trade opportunities, reduction of operational processes for stakeholders, and enhanced global confidence in biosecurity. Adherence to WOAH guidelines has enabled 53 countries to achieve BSE Negligible Risk Status (5), demonstrating robust surveillance systems can be implemented on varying scales, dependent on bovine populations, disease threat or economy, to aid animal health surveillance.
Existing GB surveillance data used for exploratory analyses assessed and evidenced the potential impact of changes required to align with WOAH recommendations. Whilst this work is preliminary, early engagement has been key to ensure surveillance infrastructure is suitable and stakeholders are consulted to identify and address potential barriers. Strong engagement with stakeholders is recommended through a range of methods, including meetings and phone calls, articles promoting awareness and guidance documentation. Engagement has promoted trust, credibility and highlights a shared commitment with the cattle industry to maintain GB’s negligible risk status.

Future Work
Further work is continuing to refine the reason for death categories required based on analysis outputs. In addition, work to quantify the total cattle fallen stock records to the categories using RStudio software is underway, to rapidly analyse live data and support discussions regarding risk-targeting surveillance. Prior to the public implementation of the categorisation framework, a limited number of sampling sites will be involved in a pilot study to assess operational feasibility, ensure categories are intuitive and consistently applied, and identify any practical issues prior to wider implementation.
During discussions with stakeholders, a move towards paperless systems was identified, therefore digital data solutions are being developed aiming to reduce administrative burden, improve accuracy and increase timeliness of reporting. Initial consultations with private livestock software providers have identified

requirements, timelines and suitable approaches to ensure all changes are successfully implemented. Potential impacts on stakeholders and management strategies will need to be discussed ahead of implementation.

This exploratory work has successfully outlined current projects underway to align with WOAH recommendations, including the collation and reporting of postmortem data, and addition of clinical signs questions to submission forms. Further engagement with stakeholders is required to promote awareness of the clinical presentation of BSE-like clinical signs, to ensure stakeholders can accurately and consistently identify and report BSE suspects. Analytical work to identify potential changes to shift towards a risk-based surveillance system include categorisation of reason for death, with the aim to encode categories to ensure accurate and efficient data capture. However, prior to amendment of surveillance, European Food Safety Authority (EFSA) work will be reviewed, and risk assessments conducted to assess potential implications of proposed changes to ensure animal health security for GB and their trading partners. All suggestions will be evidenced and shared with DEFRA, to factually support any proposed changes. If changes are implemented, continued stakeholder engagement with enable the promotion of new processes, and annual monitoring will be instated to ensure GB's surveillance system remains robust.

To conclude, Active Surveillance, rather than targeted surveillance, will continue until GB are confident with proposed approaches to risk-based surveillance. Early findings indicate the importance of a robust surveillance system to analyse and provide strong evidence for proposed changes to surveillance strategies. Collaboration and early communication with stakeholders will be essential to ensure data-driven evidence is complemented by industry insights, to support the continued success of BSE surveillance within GB.

Code	Code Name	Likely to include cattle with BSE-like clinical signs
1	Neurological and behavioural Disorders	Yes
2	Gastrointestinal & Poisoning	No
3	Respiratory and cardiovascular disorders	No
4	Recumbent/ Downer cow	Yes
5	Reproductive system issues	No
6	Milk Fever/ nutritional metabolic disorders	Yes
7	Found dead/ sudden death	No
8	Generalised infectious diseases	No
9	**Other,** including euthanasia, old age, accident, trauma, Musculoskeletal issues	No
10	APHA Bovine Tuberculosis reactor/ welfare	No
11	Unknown	Yes

Table 1. Proposed categories for reasons for death.

Keywords: Bovine Spongiform Encephalopathy (BSE), World Organisation of Animal Health (WOAH), Targeted Surveillance, Risk-based Surveillance.

References:

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