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Distribution of cow–calf producers' beliefs about reporting cattle with clinical signs of foot-and-mouth disease to a veterinarian before or during a hypothetical outbreak

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ABSTRACT

Understanding the prevalence of cattle producers' beliefs regarding disease reporting can help officials improve surveillance programs with passive data collection. A cross-sectional survey was conducted in Texas in 2008 and 2009 to determine beliefs about reporting cattle with clinical signs consistent with foot-and-mouth disease (FMD) either prior to (scenario 1) or during an on-going outbreak of FMD (scenario 2). Two questionnaires were developed and distributed to Texas cow–calf producers in order to evaluate their behavioral, control, and normative beliefs related to disease reporting. The context for each behavior was provided through the use of scenarios, and belief strength was measured using a 7-point Likert-like scale. Beliefs were compared across scenarios and demographic categories, and the effect of scenario on belief examined using ordinal logistic regression. Respondents agreed that reporting clinically suspect cases would have positive economic and emotional consequences; however, when an outbreak was known to be present, producers were less likely to agree with many of the positive outcomes of reporting. Important barriers to disease reporting indicated by producers included a lack of knowledge related to clinical signs of highly contagious cattle diseases and which cattle are at risk of contracting FMD. In general, beliefs about barriers to reporting did not differ based on scenario. Veterinarians and regulatory authorities were the groups perceived to most strongly expect disease reporting, regardless of the scenario. Risk education for producers related to clinical signs of reportable livestock diseases, post-reporting procedures, and an understanding of FMD introduction and spread may improve the reporting of cattle with clinical signs consistent with FMD.
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1. Introduction

Foot-and-mouth disease (FMD) was eradicated from the United States in 1929 (McCauley et al., 1979). Since then, cattle in the United States have had no exposure to FMD

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virus or FMD vaccines, rendering them highly susceptible to infection. Although clinical disease associated with FMD virus can vary greatly, introduction and establishment of the virus in the U.S. cattle population could result in severe illness followed by poor productivity, including long-term weight loss, poor growth, permanent hoof damage, and chronic mastitis (Kitching, 2002; Thomson and Bastos, 2004). In addition to losses in animal health and productivity, an outbreak of FMD in the United States would result in immediate international trade embargoes for all susceptible species and related products (Thomson and Bastos, 2004). To help mitigate these consequences, any introduction of FMD into the United States must be quickly identified and control and eradication measures immediately put into place.

The effective detection and control of an outbreak of FMD in the United States will require a strong partnership between the animal agricultural industry, private veterinarians, and U.S. state and federal governments. U.S. response plans for highly contagious diseases rely heavily on the willingness of livestock producers to serve important roles in the prevention, detection, response, and eventual eradication of disease. For example, a significant component of the surveillance for FMD in the United States rests on livestock producers recognizing that something is wrong with their livestock and requesting that a veterinarian examine their animals (TAHC, 2014). This method of detecting the presence of FMD is commonly used in countries which are free of the disease, and one of the benefits of this type of surveillance with passive data collection is that it allows for the coverage of the entire susceptible animal population under owner or veterinary observation at a low cost (Doherr and Audige, 2001). However, when the disease has been absent from a country for a lengthy period, passive surveillance may not be effective in identifying a disease outbreak, especially as owners' and veterinarians' familiarity with clinical signs declines (Bates et al., 2003). In an analysis of all outbreaks of FMD in non-endemic countries from 1992 to 2003, the authors found that of the outbreaks for which detailed information could be obtained regarding how the outbreak was detected, 53% were discovered as a result of a producer alerting a private veterinarian or the authorities to a problem in their herd (McLaws and Ribble, 2007). Reasons for delayed detection during these outbreaks ranged from misdiagnosis or a failure to detect mild clinical signs to concealment of sick livestock by producers. Carpenter et al. (2011) modeled the economic and epidemic impacts of a delayed diagnosis of FMD following introduction into a large dairy herd in California using a spatial, stochastic, individual-animal-based model. They found that as the delay in detection increased from 7 to 22 days, the median number of herds under quarantine increased from 680 to 6200 and the number of animals slaughtered went from 8700 to over 260,000. The median economic impact increased from $2.3 billion to $69.0 billion in national agricultural welfare losses. Assuming a 21-day detection delay, the authors found that each additional 1 h delay in detection led to the slaughter of an additional 2000 animals and an additional economic loss of $565 million. Given the interconnected nature of U.S. cattle production, the early detection of FMD is essential to avoid dramatic losses in both livestock numbers and the economy (Carpenter et al., 2011).

More recently, socio-psychological factors have been explored and identified as possible predictors of delayed reporting. A study examining the reporting of pigs with clinical signs of classical swine fever in the Netherlands found that factors such as a lack of knowledge of early clinical signs of the disease were important; however, additional factors such as producers' negative opinions of disease control measures, negative emotions associated with going through the reporting process, such as guilt or shame, and a lack of trust in government bodies also appeared to play an important role in influencing reporting (Elbers et al., 2010). A qualitative study of Australian sheep producers found that farmers' decisions regarding reporting and biosecurity measures were often based on the perceived risk to their operation, and that trust in others contributed significantly to perceived risk (Palmer et al., 2009). Garforth et al. (2013) developed an analytical framework linking social and psychological factors to producers' disease risk management behavior based on a literature review. In their framework, they posited that intentions to implement practices are influenced by knowledge, attitudes to the practices including perceived efficacy, and social influences. These factors are in turn influenced by attitudes to disease risk, previous experience, and exposure to information sources. Subsequent, semi-structured qualitative interviews with pig and sheep producers in three areas of England revealed that producer's willingness to implement biosecurity, including training staff for disease awareness and identification, was influenced by attitudes toward the measure, perceptions of efficacy, and risk perception (Garforth et al., 2013). An interview-based, qualitative study conducted among pig producers in the UK identified financial reasons as the most important motivators for disease control followed by animal welfare concerns and fear of disease spread. Pressure from veterinarians, abattoir staff, and contractors were also significant influences on producers' decisions to control disease (Alarcon et al., 2014). While a great deal of progress has been made in beginning to understand influences of producer behavior related to disease reporting and control, further work is needed to understand the distribution of these beliefs within the population and the possible implications for producer cooperation with disease reporting.

Strengthening disease reporting for highly contagious diseases such as FMD requires an understanding of not only the behaviors to be encouraged, but also the underlying social and psychological processes influencing those behaviors (Wynne, 1989; Covello et al., 2001; Ajzen and Manstead, 2007). One theory which has been widely used to explore determinants of behavior is the Theory of Planned Behavior (TPB). Within the TPB, behavioral intentions are regarded as the proximal determinant of behavior. A person's intention to perform a behavior is in turn determined by their attitudes, subjective norms, and perceived behavioral control (Ajzen, 1991). Following on Fishbein's summative model of attitudes, subjective norms, and perceived behavioral control are determined by their salient underlying beliefs (Fishbein, 1967). Behavioral beliefs are beliefs about the advantageous and