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Invited review: Determinants of farmers' adoption of management-based strategies for infectious disease prevention and control

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ABSTRACT

The prevention and control of endemic pathogens within and between farms often depends on the adoption of best management practices. However, farmers regularly do not adopt recommended measures or do not enroll in voluntary disease control programs. This indicates that a more comprehensive understanding of the influences and extension tools that affect farmers' management decisions is necessary. Based on a review of relevant published literature, we developed recommendations to support policy-makers, industry representatives, researchers, veterinarians, and other stakeholders when motivating farmers to adopt best management practices, and to facilitate the development and implementation of voluntary prevention and control programs for livestock diseases. Farmers will make management decisions based on their unique circumstances, agricultural contexts, beliefs, and goals. Providing them with rational but universal arguments might not always be sufficient to motivate on-farm change. Implementation of recommended management practices is more likely if farmers acknowledge the existence of a problem and their responsibility to take action. The perceived feasibility and effectiveness of the recommended management strategy and sufficient technical knowledge further increase the likelihood of adequate adoption. Farmers will also weigh the expected advantages of a proposed change against the expected disadvantages, and these considerations often include internal drivers such as pride or the desire to conform with perceived standards. Extension tools and farmers' social referents (e.g., veterinarians, peers) not only provide technical information but also influence these standards. Whereas mass media have the potential to deliver information to a broad audience, more personal approaches such as participatory group learning or individual communication with farm advisors can enable the tailoring of recommendations to farmers' situations. Approaches that appeal to farmers' internal motivators or that unconsciously elicit the desired behavior will increase the success of the intervention. Collaboration among stakeholders, assisted by social scientists and communication specialists, is necessary to provide a context that facilitates on-farm change and transfers consistent messages across extension tools in the most effective way.

Key words: prevention and control program, farmer compliance, motivation, communication, behavior change

INTRODUCTION

Livestock farmers worldwide face endemic disease challenges that threaten animal health and welfare. These diseases can have a substantial economic impact on individual enterprises and on the farming industry as a whole (Wierup, 2012). Therefore, although the relevance of specific diseases might vary by country, the prevention and eradication of infectious animal diseases [i.e., diseases that can be spread directly or indirectly between animals (and potentially to humans)] has become an increasing focus for many nations. Despite huge advances in the development of livestock vaccines and treatment options, the implementation of best management practices is still the most effective way to prevent and control many infectious diseases on farms. Farmers are encouraged to implement specific strate-

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gies to mitigate the risk of disease transmission, not only for the sake of their animals' health and welfare, but also to protect humans from zoonotic pathogens (OIE Animal Production Food Safety Working Group, 2006). However, poor on-farm adoption of recommendations to enhance general biosecurity practices, or of strategies to decrease transmission of specific diseases, is common (Bell et al., 2009; Brennan and Christley, 2013; Sayers et al., 2013). Furthermore, participation rates in voluntary disease prevention and control programs are often below 30% (Hoe and Ruegg, 2006; Hop et al., 2011; Nielsen, 2011). These experiences suggest that the methods used to motivate participation in control programs and adoption of recommended practices have been suboptimal.

Agricultural extension refers to activities and communication channels that facilitate changes in farmer knowledge, attitudes, and behavior by synthesizing, exchanging, and applying information (Black, 2000; Anderson and Feder, 2004). Although agricultural extension differs depending on the context, traditional "top-down" tools such as newsletters or magazines are often the primary routes of knowledge transfer, and they assume that farmers make decisions based purely on scientific rationale (Roche, 2014). However, it is widely accepted that farmers' decision-making varies, influenced by factors that are not solely based on policy, economic considerations, or rational judgment (Edwards-Jones, 2006; Noordhuizen et al., 2008b). Some variability can be explained by individual farmer traits (e.g., personality, attitudes, beliefs, intentions, values, skills, and knowledge). Remarkably, these socio-psychological variables often explain more variation in farm performance than farmers' measurable management practices (Bigras-Poulin et al., 1985; van den Borne et al., 2014). To account for these factors, different theoretical frameworks have been applied in the agricultural context. Two of the frameworks most commonly used to investigate the effects of socio-psychological variables on farmers' decision-making and better understand farmer behavior, are the Health Belief Model (Janz and Becker, 1984) and the Theory of Planned Behavior (Ajzen, 1991).

In addition to socio-psychological factors, external influences such as input from social referents (e.g., herd veterinarians, colleagues, or family) and agricultural extension conduits (e.g., printed media or discussion groups) can also affect farmers' management decisions (Ritter et al., 2015; Roche et al., 2015).

The objective of this narrative review was to describe the available information on (1) the factors that contribute to farmers' adoption of recommended management strategies; and (2) the influence of social referents and extension tools on farmers' management decisions.

Our focus was farmer behavior related to improving animal health, but where applicable, we have included a selection of findings on animal welfare to add relevant information from other contexts. Furthermore, the scope of this review was voluntary management-based prevention and control of endemic infectious livestock diseases (i.e., farmers' decision-making in the absence of compulsive regulations) on commercial farms in economically developed countries. To meet the second objective, we discussed the main communication channels used to provide information and support farmers in adopting recommended management practices.

Based on the evidence as it pertains to the delineated scope, we provide recommendations to policy-makers, industry representatives, researchers, veterinarians, and other stakeholders to facilitate the adoption of on-farm management practices and assist in the development and implementation of voluntary control programs for endemic infectious livestock diseases.

SOCIO-PSYCHOLOGICAL INFLUENCES

Every farmer has their own unique combination of demographic factors (e.g., age, sex, education), personality, previous experiences, routines, and goals, as well as economic, cultural, and family influences (Wilson et al., 2015; Frössling and Nöremark, 2016). These individual characteristics contribute to farmers' views about animal health, prevention and control strategies, and influence their decision-making (Figure 1). Not every management decision a farmer makes might appear logical from an outside perspective (Kristensen and Jakobsen, 2011a). An understanding of a farmer's mindset and the specific factors that combine to influence that mindset is crucial for motivating them to change. The socio-psychological influences on farmers' adoption of recommended management practices described in the first part of the review were considered the most relevant and were often derived from constructs described in the Health Belief Model or the Theory of Planned Behavior (Figure 1). It is particularly important to consider these factors when formulating voluntary prevention and control programs, and we have provided related recommendations (Tables 1 to 4). However, interventions to change farmer behavior must acknowledge that farmers are not a homogeneous group and cannot be convinced by relying only on educational arguments (Jansen et al., 2010b,c). Furthermore, farmers' context (e.g., laws and regulations, market prices, or quality programs) can affect decision-making by inhibiting or facilitating the recommended management changes. Because of the influence of farmers' internal logic and context on their decision-making, it is impossible to provide a "one-size-fits-all" solution (Kristensen and Jakobsen, 2011a).