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Using farmers' attitude and social pressures to design voluntary Bluetongue vaccination strategies

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ABSTRACT

Understanding the context and drivers of farmers' decision-making is critical to designing successful voluntary disease control interventions. This study uses a questionnaire based on the Reasoned Action Approach framework to assess the determinants of farmers' intention to participate in a hypothetical reactive vaccination scheme against Bluetongue.

Results suggest that farmers' attitude and social pressures best explained intention. A mix of policy instruments can be used in a complementary way to motivate voluntary vaccination based on the finding that participation is influenced by both internal and external motivation. Next to informational and incentive-based instruments, social pressures, which stem from different type of perceived norms, can spur farmers' vaccination behaviour and serve as catalysts in voluntary vaccination schemes.

1. Introduction

Bluetongue (BT) is a World Organization for Animal Health (OIE)-listed animal disease. An outbreak of an OIE listed disease has major implications for livestock production, policy and trade in the country or region affected (Burrell, 2002). All these impacts were experienced during the Bluetongue virus serotype 8 (BTV-8) epidemic from 2006 to 2009 in the Netherlands. The virus caused clinical disease in ruminants, thereby affecting dairy as well as other farm types in cattle, sheep and goat sectors (see Elbers et al. (2008) for an overview). Financial consequences of the epidemic in 2006 and 2007 in the Netherlands have been estimated around 200 million Euros, of which about 140 million Euros relating to the dairy cow sector (Velthuis et al., 2010).

A reactive vaccination programme at transnational level was adopted in 2008 since the direct control measures and the ban of animal movements failed to stop the spread. The Dutch government offered farmers a vaccination scheme on the basis of voluntary participation with subsidy as a financial, incentive-based policy instrument. It fits in with a neoliberal governance style of cost and responsibility sharing (*e.g.* Maye et al., 2014) and is based on economic theory postulating that self-regulation may result in successful interventions at lower public cost (*e.g.* Oude Lansink, 2011). The *ex-ante* transaction costs of lobbying and legislation and *ex-post* transaction costs of surveillance and enforcement are minimized (Furubotn and Richter, 1998).

Since the implementation of the vaccination scheme, only a few Dutch farms got infected in 2008 and 2009. However, it is difficult to judge *ex-post* whether the voluntary approach was a success or a failure while many farms were already immunized via natural infection (Wilson and Mellor, 2009), which in combination with a low uptake could already be sufficient to control the spread. Actual

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uptake by dairy farmers have been estimated at 71% in 2008 (with subsidy) (Elbers et al., 2010).

After the BTV-8 epidemic, Elbers et al. (2010), in an exploratory survey among Dutch farmers, showed that (1) prevention of production losses and (2) subsidization of vaccination were perceived as the main motives to vaccinate against BT. Other important motives mentioned were: (3) welfare concerns, (4) contribution to the eradication campaign and (5) recommendation by the practitioner.

To understand and predict individual vaccination decisions, rational choice models, *i.e.* expected utility theory (EUT) models are often applied (Hardaker and Lien, 2010; Rat-Aspert and Fourichon, 2010; Sok et al., 2014). In these models, the motives 1 and 2 are considered. It is often argued that governments should increase the expected utility (profits) by utilizing financial, incentive-based policy instruments to make voluntary disease control interventions effective.

Considering the motives 3–5 however, it might be that additional self-regulatory or motivational mechanisms exist that drive the decision to vaccinate, which cannot directly be inferred from rational choice models. Some of these mechanisms are embedded in different types of norms. Social psychological decision models emphasize the effect of social pressures on decision-making, such as the Reasoned Action Approach (RAA) (Fishbein and Ajzen, 2010). The RAA predicts that a given behaviour is determined by the strength of a person's intention to perform that behaviour. The intention is a function of three social-psychological constructs: attitude, perceived norms and perceived behavioural control. Nowadays different dimensions are captured within these constructs, also prompted through the use of multivariate statistical techniques (Thompson, 2004). Within attitude, an instrumental and experiential dimension are distinguished. Factors considered in a typical EUT model are similar to this instrumental dimension. Within perceived norm, an injunctive and descriptive dimension are distinguished. Within perceived behavioural control, a capacity and an autonomy dimension are distinguished (see Fishbein and Ajzen (2010) for an overview). In this study, only the construct of perceived norms is disentangled into an injunctive and descriptive dimension to investigate in more detail the social pressures operating on farmers.

Next to information and incentive-based instruments is the effectiveness of disease control interventions also dependent on reflecting, re-enforcing and shaping attitudes and norms within a community (Collier et al., 2010). Therefore an understanding of which of these constructs drive farmers' compliance with a policy intervention is critical for an efficient and effective design. The aim of this research is to assess which of the socio-psychological constructs and underlying dimensions drive farmers' intention to participate in a hypothetical reactive vaccination scheme against BT.

2. Material and methods

2.1. Framework and statistical method

The RAA model identifies the social-psychological constructs that may influence intention to carry out particular behaviours, so that statistical modelling can be used to estimate the nature and significance of these relationships.

The model can mathematically be represented as follows:

$$B \sim I = f(A, PN, PBC), \quad (1)$$

$$\text{where} \quad PN = f(N_I, N_D), \quad (2)$$

B given behaviour
I intention to perform the behaviour
A attitude – the farmer's positive or negative evaluation of performing that behaviour
PN perceived norms – the social pressures one feels to perform that behaviour
N_I injunctive norm – the perceptions of what referents think he or she should do
N_D descriptive norm – the perceived behaviour of others (farmers)
PBC perceived behavioural control – the perceived own capability to perform that behaviour.

In this study, structural equation modelling (SEM) was used to estimate the entire RAA as a set of simultaneous equations. It models correlational and causal relationships among constructs and corrects for measurement errors of the observed variables that represent these constructs in the estimation procedure. A construct is a latent variable that can be defined in conceptual terms but cannot directly be measured or be measured without error. Therefore, a construct is represented by multiple variables that, in combination, give a reasonably accurate measure of the construct using factor analytic approaches (Hair et al., 2010).

The commonly applied two-step modelling approach in SEM, developed by Anderson and Gerbing (1988), was used. First step was to estimate a measurement model in which the variables were assigned to their constructs, using confirmatory factor analysis. Thus, based on the RAA model, it was *a priori* specified which variables make up which of the five constructs. Based on tests assessing the score reliability, score validity and overall model fit (*e.g.* see Fornell and Larcker, 1981), the measurement model was evaluated on its specification and consistency with the data. The second step was to estimate a structural model in which the causal relationships were tested to investigate the impact of the exogenous constructs attitude, injunctive norm, descriptive norm and perceived behavioural control on the endogenous construct intention. As constructs are often highly correlated, different model specifications were run to assess the presence of multicollinearity.

2.2. Questionnaire and sample

In Table 1 a description of the variables measured is given, with these elements being based on the standard questionnaire format provided by Fishbein and Ajzen (2010). In defining the action that respondents were to undertake (or rather, express their intention to undertake) Ajzen's TACT principle has been used, with actions defined in terms of target, action, context and time. For example, 'If Bluetongue (target) were to occur in the environment (context) this year (time), and a voluntary vaccination programme was to be announced (context), I am going to vaccinate my herd preventively (action). All questions were preceded with the phrase: "If Bluetongue were to occur in the environment this year", and for the questions related to the constructs perceived behavioural control and intention the words "and a voluntary vaccination programme was to be announced" were added to emphasize the voluntary nature of the vaccination scheme.

A 5-points semantic differential scale with five different bipolar adjective pairs (*e.g.* unsatisfying and satisfying) was used to measure attitude. The other variables were measured with 5-point bipolar Likert-type scales with endpoints "disagree" to 'agree'.

A random sample of 1500 Dutch dairy farms was drawn from the National Cattle Identification and Registration Database. The sample was restricted to farms with a herd size of at least 40 dairy cows, which is about 80 to 85% of the whole dairy farm population (LEI, 2016). These are more likely to be professional dairy farmers rather than hobby farmers. The latter type of farmers were excluded because it was felt that their decision-making process for vaccination decisions, in the face of a threat of a BT infection, could be made in a very different decision context (*e.g.* Gethmann et al., 2015).

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