SHORT TERM SCIENTIFIC MISSION (STSM)
SCIENTIFIC REPORT

This report is submitted for approval by the STSM applicant to the STSM coordinator

Action number: CA17110
STSM title: Considering the application of a systems / socio-ecological approach to a disease control output-based framework
STSM start and end date: 30/09/2019 to 25/10/2019
Grantee name:

PURPOSE OF THE STSM:

The cattle farming industry is still facing economic losses due to health issues of their animals, even though enough scientific evidence is available with regard to disease prevention. Researchers emphasize the importance of risk factors related to a numerous cattle diseases, but on-farm implementation of disease control seems sometimes poor (Ritter et al., 2017). A similar problem has been noticed within human health, 'If people know what behaviours are good for their health, why don't they do them? Although a lot of information is available, people, as well as farmers, keep on showing risky behaviour. Our current traditional epidemiological models are assuming behaviour to be homogeneous over time and between persons, but more recent research show that this is actually not the case. Different disciplines such has sociology, anthropology, health psychology and economics provide insights to the how to impact behaviour. In the past five years although there has been increase in appreciation of social science approaches in veterinary epidemiology to understand impact of stakeholders' behaviour on disease control, still knowledge is largely lacking on a) key determinants that impact farmer disease control behaviour for cattle diseases b) what theoretical underpinnings have been used to understand farmer behaviour.
Before recommendations can be made for how to better include stakeholder behaviour in any infectious disease models or STOC -Free Model, it's important to understand these aspects.
Thus the aim of this STSM was fourfold and described as follows:

- To identify what is known about famer behaviour with relation to disease control for cattle diseases in European countries, including the applied theories, methods and the described socio-ecological determinants (barriers and facilitators) for each country.
- To use COM-B framework to describe farmer behaviour in relation to biosecurity and to identify to what layers determinants are available and to what layers determinants are missing.
- Identify knowledge gaps
- Make recommendations and condsider next steps

DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS

By carrying-out a literature review an overview of what each European country know about their farmers' behaviour is gained. A PubMed search was performed containing the words:

farmers *OR* farmer *OR* veterinarian *OR* veterinarians *OR* veterinary *OR* vets *OR* vet *AND* behaviour OR behavior *OR* perception *OR* perceptions *OR* attitude *OR* attitudes *OR* belief *OR* believe *OR* beliefs *AND* disease control *AND*/*OR* cattle
This resulted in a total number of 3772 papers. Only when the data was gathered from an European country, when the subject of the paper was related to cattle disease control and the key focus was on behavioural barriers and/or facilitators of farmers and veterinarians, the paper was included in the review. After scanning the papers, 42 papers were found related to our topic.

For each paper, it was determined from which country it originated, which behavioural theory was applied, whether a quantitative or qualitative approach was used to gather data and the topic. It was possible that multiple theories were used in the same paper. Additionally, for each paper all socio-ecological determinants which were either mentioned as a facilitator or a barrier were summarized, it was counted per country how often these determinants were found and to which layer of the socio-ecological model (SEM) the determinant belongs (personal, interpersonal or contextual). These determinants according to the SEM were compared to the determinants described in biosecurity papers according to the COM-B method (Michie et al., 2011), which will identify to what layers determinants are available and to what layers determinants are missing.
Furthermore, the complexity of the farmer-vet relationship was described and visualised.

Finally, different methods of modelling behaviour with respect to incorporating into modelling spread of infectious diseases were explored with the main focus being on game-theory. The basic principles of game-theory were discovered and it was determined which type of behaviours have been modelled and which behaviours have not been modelled yet, but could be important based on the results of farmer behaviour studies.

The STSM ended with formulating recommendations.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

The results of this STSM give an overview about why taking into account farmer behaviour in disease control is important. It highlights that multiple health psychology theories are available, but that these are mainly focussing on the intention towards a behaviour based on individual components. However, it is not just individual behaviour that drives dynamics of infectious disease. Behaviour takes place in social and political environments and thus its quite important to take account of the social and political context including other contexual forces as they shape hugely our decisions regardless of any choices we may make about how we act. Therefore, it would be recommended to use more comprehensive and recent theories like the socio-ecological framework or the COM-B method (Michie et al., 2011). The latter is especially used for making links to interventions for changing behaviour (behavioural change wheel). To be able to successfully link intervention strategies, it is important to really understand complex behaviours and process of decision making, which are more likely to be detected by a qualitative data gathering design instead of a quantitative design. Example:by asking a farmer why he is not applying biosecurity measures, a questionnaire could ask on the 5-point Lickert scale whether the farmer has enough time to implement them. In this design, the farmer is likely to answer that there is a lack of time. However, it is impossible to determine whether this ‘lack of time’ is real or whether it is perceived. In depth discussions can be used to understand how ‘lack of time’ is framed by farmer (Shortall et al., 2016). For linking the right interventions, determining whether it is a real restriction in the time-schedule or whether the farmer is not motivated enough to make time, is very important.

From the literature review, most papers were found about biosecurity and mastitis. England published the most, followed by the Netherlands. In half of the paper, no theory was used, or the theory of planned behaviour, which indicates that most work has not been informed by a theoretical underpinning. Moreover, in half of the papers, data was gather quantitatively. The determinants found were mainly related to the personal components, which is not a surprise with regard to the theories that have been used. Therefore, it is not concluded that determinants related to interpersonal and contextual components are not important, but given the methodological approaches used in understanding farmer behaviour so far its quite likely that

influences of these components have been not fully explored. Interestingly, there is real lack of evidence as well as understanding of constructs such as habits and emotions in terms of how farmers make decisions. There is increasing evidence from human health psychology about the role these play in decision making and behaviour (Ferrer et al., 2015).

In the context of infectious disease transmission models, behaviour has been modelled primarily by using game-theory (originates from behavioural economics), where the key component is maximising utility of an individual thus modelling aspects of rational decision making (Weibull, 1995). Voluntary vaccination is a behaviour that have been modelled most commonly for infectious disease modelling using game theory. Although this approach has been widely used for incorporating human behaviour into infectious disease models, from this STSM we identified that behaviour is not only influenced by costs-benefits, but by many more behavioural constructs, including some contructs where influence is not fully understood/explored yet for farmer behaviour.

Therefore, from this STSM recommendation is that there is a need for using theoretical underpinnings to understand (farmer) behaviour and that knowledge is needed from wider EU countries on these factors. The farmer-veterinary relationship seems to play an important role in farmers' decision making. Finally, it is important to note that all health psychology theories and constructs are validated in human health, and not in animal health context. It is crucial to use a theory that fits with the characteristics of the target population, behaviour and the context, otherwise the potential benefit of any theory is going to be limited.

Literature

Ferrer, R., Klein, W., Lerner, J., Reyna, V., & Keltner, D. (2015). 4| Emotions and Health Decision Making. *Behavioral Economics and Public Health*.

Jörgen, W. (1995). Weibull. Evolutionary game theory.

Michie, S., Van Stralen, M. M., & West, R. (2011). The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implementation science*, *6*(1), 42.

Ritter, C., Jansen, J., Roche, S., Kelton, D. F., Adams, C. L., Orsel, K., ... & Barkema, H. W. (2017). Invited review: Determinants of farmers' adoption of management-based strategies for infectious disease prevention and control. *Journal of dairy science*, *100*(5), 3329-3347.

Shortall, O., Ruston, A., Green, M., Brennan, M., Wapenaar, W., & Kaler, J. (2016). Broken biosecurity? Veterinarians' framing of biosecurity on dairy farms in England. *Preventive veterinary medicine*, *132*, 20-31.

FUTURE COLLABORATIONS (if applicable)

Marit would like to submit an abstract to the ISESSAH conference in May 2020 in Copenhagen. Additionally, Marit and Jasmeet have the ambition to write a paper of this STSM.