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DECIDE

**Data-driven control and prioritisation of
endemic contagious animal diseases**

Deliverable 5.3

Evaluation of different implementation and information diffusion strategies for users

WP5 – Implementation and behavioural strategies for animal disease management

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Abbreviations

Abbreviation	Description
BRD	Bovine Respiratory Disease
UK	United Kingdom
WP	Work Package

Partner short names

Short name	Organisation
UU	University Utrecht
ETHZ	Eidgenössische Technische Hochschule Zürich
UoN	The University of Nottingham
IfA	Innovation for Agriculture
accelCH	accelopment Schweiz AG
HFP	HF Partners GmbH

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Executive Summary

This Deliverable is a report on how message framing and communication of uncertainty can impact decision making related to livestock health and welfare.

Objectives of the Deliverable

This deliverable will enhance the efficiency of our processes to:

- Communicate uncertainty of information to users of the DECIDE tools in an effective manner
- Use message framing to influence users' decision making

Activities

Three experimental studies were conducted with different stakeholders (farmers, vets, members of the public) to understand how message framing or communication of uncertainty impacted their decision making in relation to cattle health or welfare and consequently influence the implementation and diffusion strategies for decision support tools.

Outcome

The deliverable shows that communication of uncertainty of information impacts farmers' and vets' decision making, but ambiguity of information does not. Veterinarians' trust in decision support tools reduces when information changes. Additionally, when the welfare outcome was positively framed, members of the public were more accepting of practices that impact calf welfare.

Next steps

The results for the impacts of methods of communication will be shared with the DECIDE tool developers to incorporate the findings into information diffusion strategies for their tools.

1 Introduction and objectives

Farmers and veterinarians may receive risk information from decision support tools such as computer software and dashboards that shows trends in health and production data (Baldin et al., 2021; Doidge et al., 2024a). However, some farmers and veterinarians find it difficult to interpret outputs from technologies (Doidge et al., 2023), which has negative implications for the successful implementation and diffusion of data-based decision support tools. Furthermore, some farmers do not trust outputs from technologies due to previous negative experiences, such as excessive false alerts (Doidge et al., 2024b). Therefore, there is opportunity to improve the message delivery of outputs in decision support systems for farmers to ensure a successful diffusion (Baldin et al., 2021). As data on livestock health and welfare are becoming increasingly available to members of the public, it is also important to investigate how this information is communicated, public perceptions put pressures on the agricultural production system and may also influence the implementation and diffusion of data-based solutions.

This report describes the impact of various communication and education strategies to support the dissemination of the data tools. It does so by aiming to address the following research questions:

- How does change in certainty of information impact stakeholders' decision-making relating to livestock health and welfare?
- How does framing of information impact stakeholders' decision-making relating to livestock health and welfare?

Stakeholders refer to farmers, veterinarians, and members of the public in this context.

2 Review of implementation and information diffusion strategies

Message framing and perceived uncertainty have a significant impact on the diffusion and implementation of tools and technologies on farms. Message framing affects how farmers or veterinarians interpret information from tools, whereas perceived uncertainty affects how they act on it. The literature review below will therefore focus on how message framing and perceived uncertainty influence behavioural decisions among farmers, veterinarians, and other relevant stakeholders in the context of animal health and welfare.

2.1 Theoretical frameworks

Many theories that are used to understand farmers' and vets' decision-making (e.g., theory of planned behaviour) assume that farmers make rational decisions (Biesheuvel et al., 2021). Not all decisions are deliberative and analytical. Multiple studies have shown that farmers' decision-making is often automatic, intuitive, and routine (Ritter et al., 2017). For example, sheep and beef farmers in England and Wales drew on their situated knowledge and emotional ties to identify diseases in their animals (Doidge et al., 2020). Habit and emotion have also been shown to influence cattle farmers' decision-making around disease management in a range of studies (Biesheuvel et al., 2021). Similarly, habit has been shown to influence veterinarians' decision making and behaviours, such as antibiotic prescribing (Doidge et al., 2019). Therefore, attention should be drawn to intuitive decision making in relation to animal health and welfare.

2.1.1 Dual process model and heuristics

The intuitive and analytical decision-making can be referred to as two modes of thinking: System 1 and System 2, respectively (Kahneman, 2011). This is called the dual-process model. Some intuitions of System 1 arise from expertise and experience, whereas others are based on heuristics. Heuristics aim to swap a hard decision for an easy one, but this can lead to systemic errors in judgment. There are several forms of heuristics – one of which is loss aversion. Loss aversion is one of the central principles of Prospect Theory (Kahneman, 2011) which proposes that “losses loom larger than gains”. When people must make a choice between an outcome which gives a sure gain and an outcome which both gains and losses are probable, people will choose the sure gain as this is the risk averse choice. On the other hand, when people make a choice between a sure loss and an outcome in which losses are only probable, people will choose risk seeking behaviour.

Another heuristic that people may rely on is the affect heuristic, which has been shown to be used by members of the public when making judgements on animal health and welfare. The affect heuristic is where people rely on the affective meaning of objects or events to make a judgement (Finucane et al., 2000). Studies have shown that members of the public often have little knowledge of farming practices (Jackson et al., 2022; Sweeney et al., 2022). Therefore, they may rely on affect heuristics when generating their opinions and perceptions of farm animal welfare. It has been shown to be used by the public when considering different housing options for cows, where people displayed lower emotional tone when talking about cows that live indoors all year compared to cows who have outdoor access (Jackson et al., 2022).

2.1.2 Social norms theory

Social norms have been shown to be influential in various aspects of farmer and veterinarian decision making. Social norms can be split into two different types: injunctive norms and descriptive norms (Cialdini et al., 1990). Injunctive norms represent perceptions of what others approve or disapprove of. Whereas descriptive norms represent perceptions of whether other people carry out the selected behaviour. Normative messages that indicate the behaviour or expectations of most people have been shown to be more effective for behaviour change than persuasive messages that describe the impact of behaviour (Nolan et al., 2008).

Social norms have been shown to influence farmers' and veterinarians' decision making in relation to antibiotic use (Swinkels et al., 2015; Doidge et al., 2019). For example, perceived social approval from fellow farm-

ers and veterinarians (an injunctive norm) contributed to longer-than-recommended antimicrobial treatments for mastitis in dairy herds (Swinkels et al., 2015). This behaviour was further reinforced by a descriptive norm, as farmers believed that extended treatment was common practice among their peers (Swinkels et al., 2015). Beyond farm settings, social norms have also been identified as a promising intervention tool to promote more high animal welfare purchasing and consumption choices among the public (Vigors, 2018).

2.2 Message framing

Message framing is a communication technique aimed at motivation behaviour by highlighting specific aspects of information. The next section is a review of experimental studies that have investigated message framing with farmers, veterinarians, or members of the public. For members of the public, we have focused only on studies that relate to livestock health or welfare. For farmers, we included environmental studies as well.

2.2.1 Gain vs Loss

Grant et al. (2018) compared framing a sheep lameness intervention message as a gain or a loss but observed that there was no difference in prevalence of lameness as a result of the framing of messages. Similarly, framing uptake of environmental schemes as an environmental gain or loss had no direct effect on farmers' enrolment rates nor on the area enrolled (Alif et al., 2025). To the authors' knowledge, there are no peer-reviewed studies investigating the effect of gain-loss framing on veterinarians' decision making.

2.2.2 Negative vs positive

Kelly et al. (2025) conducted a vignette study in which participants, who were members of the public, viewed vignettes about precision dairy technologies that varied in their positive or negative valence for human-animal relationship, data transparency, and animal welfare. The valence of animal welfare information strongly predicted the direction of perception shifts, whereas valence of data transparency information did not change perceptions. This indicates that animal welfare is an important consideration for members of the public and we must take this into account when developing new innovations. This study was conducted with US citizens and there is a lack of positive/negative framing research related to livestock welfare in other countries.

2.2.3 Social norm

Social norm nudges have most often been investigated with farmers in relation to environmental interventions. For example, Chabé-Ferret et al. (2019), investigated the impact of a social norm nudge intervention on water-saving behaviour in agriculture. There was a small effect on reduction of water use, and this was mainly due to a reduction by high water users. Similarly, in an experimental game that investigated farmers' compliance with a water regulation, a social norm nudge was shown to reduce the share of non-compliant participants (Peth et al., 2018).

Alif et al. (2025) showed that descriptive norm framing had no significant effect on farmers' enrolment onto an environmental scheme. However, they found that the interaction effect of farmers that had higher livestock units per hectare and experienced the negative descriptive norm framing were significantly less likely to enrol, suggesting that the message backfired among more intensive farms. This boomerang effect also occurred in the study by Chabé-Ferret et al. (2019), where farmers who had not originally planned to use water ended up using some after receiving the social norm nudge. Furthermore, social norm nudges were found to increase the severity of non-compliance for deviant participants (i.e. those that deviate from the behavioural norm) in the study of compliance with a water regulation rule (Peth et al., 2018). Therefore, caution must be taken when using social norms as nudge interventions, as this may lead to unintended negative consequences.

To the authors' knowledge, there are no experimental studies investigating the impact of social norm message framing on veterinarians. There are a few studies that use social norm interventions with members of

the public, but these relate to attempts to reduce meat consumption, rather than perceptions of livestock health or welfare. These studies showed that the social norm intervention did not have a significant effect on meat consumption (Alblas et al., 2023; Wolfswinkel et al., 2025).

2.3 Perceived uncertainty

From an ethical perspective, the evidence supplied to people to support their decision making, for example through experts or decision support tools, should disclose any uncertainties and state the level of ambiguity (Han, 2013). Uncertainty is the probability or risk of an event occurring, whereas ambiguity is the reliability, credibility, or adequacy of probability information. In farming, evidence is often limited and data quality may be variable (Doidge et al., 2024b), which means that evidence may be highly ambiguous. How uncertainty and ambiguity impact people's behaviour is context dependent and in some cases the presentation of ambiguous information may increase the adoption of a behaviour whereas in other cases this will reduce adoption of a behaviour (Han et al., 2019).

In an experimental game, Merrill et al. (2019a) tested the effect of two uncertainty treatments with three levels each on participants biosecurity decision making for a pig farm. One of these uncertainty treatments was Social Uncertainty which reflected level of information sharing of biosecurity levels in the simulation-controlled facilities. The other treatment was Environmental Uncertainty which reflected level of information sharing of disease incidence in the simulation-controlled facilities. The levels were expressed as either complete, partial, or no information sharing. There was a decrease in the percent maximum biosecurity with increased information sharing and decreased social uncertainty, and an increase in the percent maximum biosecurity with increased information sharing and decreased environmental uncertainty. Another experimental game study investigated the effects of information uncertainty in relation to the infection and biosecurity status of neighbouring pig farms (Clark et al., 2020). A reduction in uncertainty in the number of infected sites resulted in an increase in risk averse behaviour whereas reduction in uncertainty in the amount biosecurity implemented throughout the system increased risk tolerant behaviours. Merrill et al. (2019b); Merrill et al. (2021) also studied the impact of different methods of communicating the probability of disease on the willingness to comply with biosecurity on pig farms. However, the participant sample for all these studies was the public (mostly students) and may not represent the decision making of farmers or veterinarians.

2.4 Synthesis and gaps

Overall, the use of gain/loss or positive/negative message framing is rare in relation to livestock health and welfare. However, in the limited research available, there is evidence that the gain/loss frame did not significantly impact farmers' decision making. There have been a larger body of research related to using social norm nudge interventions, albeit these tend to relate to environmental issues rather than animal health and welfare. Social norm interventions have been relatively unsuccessful for changing behaviour or opinions of farmers and members of the public. Therefore, message framing in terms of positive/negative valence appears to be the most promising area to explore in relation to livestock health and welfare.

There are several studies that indicate that communication of uncertainty has a significant impact on people's decision making related to livestock diseases. However, as these studies were conducted with a general public sample, the results may not be representative of the behaviours of farmers and veterinarians, who will be the main receivers of disease risk information and will generally be more informed about disease prevention strategies in livestock than the public. This should be investigated further with farmer and veterinarian specific samples.

3 Experimental studies of impact of communication strategies on stakeholders' decision making

3.1 Overview of experimental studies

The studies that were offer important insights for this deliverable are listed in Table 1. The detailed results of the latter two studies will be presented in Deliverable 5.4, as part of the recommendations for informational material and implementation measures of data-driven decision support tools.

Table 1: Overview of experimental studies performed for this deliverable.

Study title	Stakeholder focus	Time of data collection	N	Framing focus
Impact of communication of uncertainty on dairy farmers' decision making	Dairy farmers in UK	October 2024	60	Uncertainty and ambiguity of information
Impact of communication of uncertainty on dairy veterinarians' decision making	Dairy veterinarians in UK	July – October 2025	70	Uncertainty and ambiguity of information
Impact of welfare framing on public perception of cow calf separation	Members of public in UK	March – April 2025	503	Positive vs. Negative welfare framing
Impact of alert level and colour scheme used to communicate level of mortality and morbidity	Members of public in UK, veterinary students in UK, Norway and Ireland	August – October 2024	1580	Colour scheme, alert level
Impact of endemic disease maps and benchmarking tools on decision making	Members of the public in UK	January – February 2025	768	Infection rates on neighbouring farm and region, message format

3.2 Impact of communication of uncertainty on dairy farmers' decision making

Veterinarians and decision support tools are key sources of risk information for farmers when considering disease prevention strategies such as vaccination (Doidge et al., 2023; Doidge et al., 2024a). Farmers have suggested that there is scope to improve the communication of risk information by both veterinarians and decision support tools. From an ethical perspective, the evidence supplied to farmers to support their decision making, for example through veterinarians or decision support tools, should disclose any uncertainties and state the level of ambiguity (Han, 2013). Uncertainty is the probability or risk of an event occurring. Ambiguity is the reliability or adequacy of probability information. This study aimed to understand the impact of expressing different levels of uncertainty and ambiguity of risk information on farmers' decision to vaccinate their animals against infectious disease. In this study, we focus on the vaccination of calves for bovine respiratory disease (BRD).

A situational choice experiment (SCE) was conducted with 60 farmers in the UK between 9th and 19th October 2024. This is a stated preference approach in which respondents view one choice profile and then must choose between two or more fixed alternatives. At the beginning of the SCE, the respondents were asked to imagine that they were using a decision support tool to help them make a decision on whether to vaccinate their calves for the prevention of pneumonia (i.e. BRD). They were then shown a series of ten choice profiles,

which described risk information about pneumonia. After viewing each choice profile, the respondents were asked if they would vaccinate their calves for BRD within the next 12 months. They were able to select from three options: “Yes – I would vaccinate all of my calves”, “Yes – I would vaccinate some of my calves”, or “No – I would not vaccinate any of my calves.” The choice profiles had four attributes related to risk information for BRD: perceived likelihood, perceived susceptibility, perceived severity of BRD, and perceived harm of the vaccine. Each of these attributes had between 2 -3 possible levels which differed in their expression of ambiguity and/or uncertainty. In each choice profile, the order of the attributes remained the same, but the levels were experimentally varied. The data were analysed using a random-effects multinomial logistic regression model in Stata/SE 18.0. When the dependent variable was statistically significant, model-based marginal probabilities and confidence intervals were estimated to compute the risk differences between the levels of the attributes.

The results indicated that communication of different levels of ambiguity did not affect farmers’ decisions to vaccinate their calves. In contrast, communication of different levels of uncertainty did affect farmers’ decisions to vaccinate calves. Overall, our results suggests that communication of ambiguity of disease risk information to farmers may not be detrimental to their uptake of biosecurity practices. As some farmers have distrust in the information that technologies or their veterinarian provide (Svensson et al., 2019; Doidge et al., 2024b), transparent communication of the ambiguity of risk information may improve the perceived trustworthiness of the information provider. This is useful for tools in the DECIDE project that present risk information to farmers, such as the purchase assistant.

3.3 Impact of communication of uncertainty on dairy veterinarians’ decision making

Veterinarians have expressed issues with trusting the information precision livestock technologies provide due to problems with sensitivity and specificity of devices (Doidge et al., 2024b). Similar challenges with trust have been observed in human health communication. The Covid-19 pandemic was an example of how people lose trust in information providers when information changes. In many countries, people faced changes in information provided by public health officials about the effectiveness of masks and other protective measures. This is because the availability of evidence changed over time. These inconsistencies in public health messaging generated distrust toward health professions, scientists and government leaders (Zhang et al., 2021). Many authors suggested that being transparent about the ambiguity of information would improve trust in these health information communicators (Hyland-Wood et al., 2021; Malecki et al., 2021).

Since then, experimental surveys have shown that communicating uncertainty buffers against a loss of trust when evidence changes (Batteux et al., 2022; Dries et al., 2024). Furthermore, explaining uncertainty did not harm trust in the information provider (Dries et al., 2024). However, this work may not be transferable to our study population. Firstly, previous work focuses on communication of human diseases (e.g., COVID) that were emerging, but we focus on an endemic livestock disease. Secondly, previous work has members of the public as study sample. Veterinarians might have different responses to information because of their professional knowledge of disease and communicating this to farmers. Third, previous work uses government or public health officials as the source of information, but we use a decision support tool technology as the source.

The aim of this study was to investigate how communication of ambiguity of information impacts veterinarians’ perceptions of trust in decision support tools when information changes. The second aim was to understand whether communication of ambiguity of information impacts veterinarians’ decision to advise BRD vaccination to their clients.

To do so, an experimental survey was conducted with 70 dairy veterinarians in the UK between July and October 2025. The respondents were randomly assigned one of two survey variants (survey A and survey B). In both surveys there were 2 scenarios. In the scenarios the respondents were asked to imagine that they were using a decision support tool to help them make a decision on whether to vaccinate their calves for the

prevention of pneumonia (i.e. BRD). In scenario 1 for survey A, the respondents were told that “There is a 50% chance of the farm having a BRD outbreak in the next month”. In scenario 1 for survey B, the respondents were told that “There is a 20-60% chance of the farm having a BRD outbreak in the next month”. Both survey versions received the same information in scenario 2, which was “There is 20% chance of the farm having an outbreak in the next month”. Scenario 2 was always presented after scenario 1. After each scenario, the respondents were asked to rate how much they trust the information that the decision support tool provides (1 – 100 scale), how much they trust the information the farmer records (1 – 100 scale), the likelihood of recommending the client to vaccinate their calves against BRD (-5 - +5 scale), and how confident they were in this advice (1 – 100 scale). These were the outcome variables. The data were analysed using a mixed model in StataNow/SE 18.5 for all four of the outcome variables. The models tested an interaction effect between survey version (communication of ambiguity vs no communication of ambiguity) and scenario number (1 vs 2).

The results indicated that the rating for trust in information tool was significantly lower for the second scenario compared to the first scenario. The survey version did not have a significant effect on trust in the information tool. Similarly, the rating for likelihood to recommend vaccination was significantly lower for the second scenario compared to the first scenario, but survey version did not have a significant effect. Furthermore, the veterinarians’ confidence in their advice was significantly lower for the second scenario compared to the first scenario and the survey version did not have a significant effect. Overall, these results show that when information on disease likelihood changes on decision support tools, this reduces veterinarians’ trust in the decision support tool, their likelihood to advise vaccination, and their confidence in their decision. Communicating the ambiguity of information did not buffer against a loss of trust when evidence changed.

These results do not align with previous literature on members of the public’s trust in information providers when information changes (Batteux et al., 2022; Dries et al., 2024). This may be due to our focus on the information providers being a decision support tool rather than a scientist or policy maker. Additionally, our study sample were veterinarians instead of the general public. Veterinarians might behave differently because of their professional knowledge of disease and experience communicating this to farmers

3.4 Impact of welfare framing on public perception of cow calf separation

Insight into citizens’ perceptions of farming practices and understanding how decisions are made around their acceptance of these is integral in identifying measures that can be implemented to improve public trust in both farmers and the agricultural sector. Although much is known about the public’s perceptions of several farming practices, intervention studies that investigate how citizens’ decision-making behaviours change in different contexts are lacking. One such intervention method is message framing which, to date, has been explored limitedly in citizens’ decisions on farming practices. Achieving high standards of welfare in farming is one of the top priorities of the public (Alonso et al., 2020); therefore, understanding the influence of welfare message frames on the public’s acceptance of and attitudes towards different farming practices could be imperative in identifying measures that aid in alleviating the friction that exists between the public and the farming sector on the way in which farm animals are managed. This study aimed to assess the influence of welfare message framing on citizens’ decision-making on cow-calf separation, a highly contentious and frequently criticised practice of the dairy industry.

A 2x2x2x2 factorial survey was conducted with 503 citizens in the United Kingdom between 28th March and 1st April 2025. A quota was used to ensure a representative sample in terms of age, gender, and region in the UK. Respondents were presented with a series of eight vignettes which mimicked the potential aftermath of a calf’s life following its separation from the cow. Each vignette consisted of five factors, and each factor had two possible levels. The vignette factors were representative of the Five Domains Model, a widely accepted framework for assessing animal welfare (Mellor et al., 2020). These are: Nutrition, Physical Envi-

ronment, Health, Behavioural Interactions, and Mental State. The two levels for each factor outlined a positive and a negative welfare outcome that could occur following separation from the cow, as outlined in the literature, within each welfare domain. The factors appeared in the same order within the vignettes; however, the level that appeared was experimentally varied. After each vignette, respondents were asked two questions: 1) the extent to which they agree with the choice to separate the calf given the outcome; and 2) the extent to which they believe the calf's welfare has been affected (positively or negatively) by the separation given the outcome. Both questions were rated on a -5 to +5 scale. Respondents were also asked a series of demographic questions, as well as their awareness of cow-calf separation and their level of agreement with its occurrence prior to completing the vignette evaluations. The data was analysed using random intercept multilevel linear models using Stata 15.1, where a "bottom-up" building strategy was used (Douglas, 2020). Predictor variables that demonstrated significance ($P \leq 0.05$) during univariable analysis were selected for inclusion in the model.

The results indicated that, where the welfare outcome was positive, four of the five welfare domains had a positive influence on the respondents' level of acceptance of the separation and also their welfare impact rating. These four domains were Physical Environment, Health, Behavioural Interactions and Mental State. However, despite the influence of these welfare domains, the respondents' ratings were also influenced by their pre-survey level of agreement with the practice. Overall, our results provide insight into the welfare priorities of the public in relation to cow-calf separation which could be targeted using educational efforts and farmer-public engagement aimed to improve mutual understanding on this management practice. Furthermore, the influence of respondents' existing beliefs may help explain cases where information dissemination does not lead to changes in public perceptions.

3.5 Commentary on learnings on implementation and information diffusion strategies within DECIDE

Drawing on the insights generated from all engagement activities within WP5, we are currently preparing a commentary article that summarises the key learnings on the implementation of data-driven decision support tools, the success factors for the diffusion and training needs for end users. Early and systematic engagement and involvement of future users at the ideation and development of the tools was highlighted as a key success factor. The commentary article's content is rooted in an online workshop with core members of DECIDE, organised in summer 2025. The article will feature a summary of successes and limitations of the approaches taken within DECIDE, highlight core learnings on user needs, user training, on evaluating data-driven decision support tools and methodological learnings on interdisciplinary work, recruitment, study design and engagement with the community. Its target audience are researchers working on data-driven agricultural projects and data tool developers. The commentary article will be concluded in March 2026.

4 General insights and conclusions

Overall, the studies with farmers and veterinarians showed consistent results in that communication of uncertainty significantly impacted their vaccination decisions, but communication of ambiguity of information did not. Framing messages using positive valence significantly impacted public perceptions of calf welfare in relation to the practice of cow-calf separation. The next steps involve presenting these results to DECIDE tool developers to ensure that the tools deliver the most effective communication. In particular, we suggest that communication of ambiguity may not have a negative influence on biosecurity behaviour and could be incorporated into tools to enhance data transparency. These communication strategies may improve the implementation and diffusion of tools on farms, as they may enhance user trust in the tools, which is one of the key barriers to technology adoption.

4.1 Implications for other species and other countries

In this deliverable, we have focused on cattle as a case study for understanding different stakeholder behaviours and decision-making related to health and welfare. However, we believe that these findings could be transferable to other species included in the DECIDE project. In similarity with cattle, one of the most common ways to control respiratory disease in pigs is through vaccination. Therefore, our results from the farmer and veterinarian vaccination decision making studies may be applicable to the pig sector as well. Qualitative studies with pig farmers suggest that perceived risk of disease was an important factor in their decision to vaccinate (Garforth et al., 2013). Flock vaccination is also a common approach to control disease on European poultry farms (Souillard et al., 2024). Quantitative studies with poultry and pig stakeholders are required to confirm whether communication of uncertainty and ambiguity has similar effects on vaccination decision making to that of cattle stakeholders.

All the studies in this report were conducted with UK citizens. Therefore, we do not know if these results can be transferable to different countries. This is because the results may be affected by the citizens' cultural and social context, which differs by country. This report was originally planned to include studies with Swedish stakeholders; however, due to difficulties with recruitment and therefore extra costs associated with recruiting participants and staff changes, we focused on UK citizens. Nevertheless, the results reported here offer a useful starting point for future research in other countries.

4.2 Implications for other work packages

As the way in which uncertainty is communicated has an impact on how farmers and veterinarians make decisions, and thus the way in which decision support tools are used, this deliverable may have important implications for WP3. By generating empirical evidence on how farmers and veterinarians interpret disease information and how different communication approaches influence their willingness to vaccinate or recommend vaccination, these studies provide essential behavioural insights that inform the design and implementation of user-centred decision support tools. For example, we suggest that ambiguity of information could be communicated in the tool, helping WP3 to tailor the content of the tools being developed. We use the vaccination studies as an *example* that includes behavioural insights which could inform the design and implementation of data driven decision support tools as well as their dissemination strategies.

Furthermore, our study investigating the influences of positive or negative framings of the Five Welfare Domains on public perceptions of the welfare impacts of cow-calf separation may also be of use to WP3. We show how the valence of framings can shape stakeholder interpretation, trust, and acceptance of recommended practices. In particular, we demonstrate how welfare outcomes could be communicated to diverse audiences and that positive valence framing can increase support for a practice. Consequently, we will work closely with WP3 to ensure WP5 findings are incorporated into the tools being developed and implemented.

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