Assessment of a joint farmer-veterinarian discussion about biosecurity using novel social interaction analyses

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ABSTRACT

Veterinarians are trusted by farmers and play an important role in assisting them to implement biosecurity. More research is needed that particularly focuses on the impact of joint farmer-veterinarian discussions to further understand the role of communication in altering biosecurity behaviours. The aim of this study was to analyse joint dairy cattle farmer-veterinarian discussions about the adoption of on-farm biosecurity using novel social interaction methodologies. Farmer and veterinarian stakeholders were invited to take part in a face-to-face meeting. Introductory presentations were given, followed by separate facilitated veterinarian and farmer discussions. All stakeholders were brought together for a final facilitated group discussion which was audio recorded. Corresponding transcripts from the recordings were analysed via thematic and conversation analyses. Conversation analysis assessments such as turn taking, repair, sequence organisation, overlap and asymmetry were employed to investigate the nature of the conversation. Thematic analysis identified the negative repercussions of conflicting information or ineffective communication surrounding biosecurity implementation. The type of, and importance of, the relationship farmers had with veterinarians and other stakeholders was highlighted. The need to provide personalised biosecurity protocols on farms was identified. Four key factors were identified via conversation analyses. These included: 1) how the conversation facilitated agreement, 2) how the conversation allowed the farmer and veterinarian participants to learn from one another in real time, 3) how the discussion enabled participants to expand upon points they were making, and 4) how participants were able to obtain a greater understanding of the other participants' opinions, even without total resolution. Debate around the effective implementation of biosecurity measures on farms, explored using novel techniques, demonstrated the potential for utilising a discussive approach between veterinarians and farmers to lead to solutions not previously considered. Because of the nature of the discussion, conversation analysis resulted in an informative approach to encapsulating the nuanced dialogue between stakeholders, highlighting the potential of this analysis framework.

1. Introduction

Biosecurity is defined as the practices that control and prevent the spread of disease amongst animals (Shortall et al., 2017) with the aim of protecting the environment, economy and human health (Mankad, 2016). Disease has devastating effects on animal well-being (Tomley and Shirley, 2009) and with 60% of emerging infectious diseases in humans predicted to be of zoonotic origin (Robertson, 2020) there is a clear need to enforce effective preventative measures. Biosecurity is of profound importance within the cattle industry, for both veterinarians and farmers, as it acts to improve the efficacy of vaccines and decrease the prevalence of resistance to antimicrobials and anthelmintics, all of which contribute to improved animal welfare (Brennan and Christley, 2013). Despite its importance, evidence suggests that essential

biosecurity measures are inconsistently applied and is a significant issue amongst cattle farmers (Howarth and van Winden, 2021).

1.1. Reasons for non-implementation of biosecurity on cattle farms

Indications as to why there is an inconsistency in the application of biosecurity measures have been explored previously with economics (Mankad, 2016; Nöremark et al., 2016; Lahuerta-Marin et al., 2018), size and type of farm/production system (Sahlström et al., 2014; Renault et al., 2018, 2021; Shortall et al., 2018; Howarth and van Winden, 2021), lack of farmer and veterinarian knowledge (Pritchard et al., 2015; Shortall et al., 2016; Ritter et al., 2017), perceived substantial time commitment (Shortall et al., 2016) and the impractical nature of some measures (Shortall et al., 2017; Damiaans et al., 2018) all featuring heavily.

More recently, a few studies have been undertaken looking specifically at veterinarian-farmer communication (Bard et al., 2019; Howarth and van Winden, 2021). There have been links made between an increased level of involvement by veterinarians on farms influencing farmers to implement biosecurity practices with greater ability, and the better the level of biosecurity training of veterinarians, the better their ability to positively influence farmers' decisions (Moya et al., 2020). Information delivered in a positive manner is more likely to influence farmer uptake positively (Mankad, 2016) and it appears that poor communication can have detrimental effects with regard to trust (Svensson et al., 2018; Moya et al., 2021). More research is needed to understand how influential the veterinarian-farmer relationship is on the uptake of biosecurity practices on farms. To date, most studies have engaged veterinarian and farmer groups independently, and although some studies have focused on joint discussion between veterinarians and farmers (Svensson et al., 2020a, 2020b), more research is needed in this important area, particularly in relation to how the communication happens between these stakeholders.

1.2. Novel analysis techniques to investigate veterinarian-farmer interactions

Conversation analysis and discourse analysis are methods of analysing verbal communication (Wooffitt, 2005). Conversation analysis focuses on the structure of naturally occurring communications paying specific attention to how utterances relate to one another and the process of turn design and sequence organisation (Flick, 2013; Allen, 2017). A selection of different conversation analysis approaches is described in Table 1.

Conversely, discourse analysis explores how social context influences language (Allen, 2017) by observing themes and patterns regarding the construction and function of the dialogue (Flick, 2013).

Table 1
A selection of different types of conversation analysis and their function.

Type of analysis	Function	Reference
Turn design: Turn taking	Observes how speakers contribute to the conversation and take turns	Lester and O'Reilly (2018)
Sequence organisation: Adjacency pairs	Determines how turns are organised and how participants interact and respond to one another	Puchta and Potter (2004); Lester and O'Reilly (2018)
Overlap	Analyses competition for turns in talk between participants	Kurtić et al. (2013); Lester and O'Reilly (2018)
Repair	Demonstrates participants ability to identify errors in talk and provide corrections or adjustments	Puchta and Potter (2004); Lester and O'Reilly (2018)
Asymmetry	Identifies imbalances in the relationship between participants in relation to power and authority	Pilnick and Dingwall (2011)

These two techniques are additional to other approaches that have been employed more recently, such as thematic analysis, which focus on analysing the meanings behind what has been said as a way of understanding perceptions and viewpoints (Bard et al., 2019; Roche et al., 2019). By using techniques focusing on the nuances of verbal communication, researchers are able to concentrate not only on what is being said, but the manner in which it is being said. This then permits determination of how participants understand and respond to one another.

The aim of this study was to analyse joint discussions between veterinarians and dairy farmers about their perceptions on the adoption of on-farm biosecurity using a combination of different qualitative approaches (thematic analysis, conversation analysis and discourse analysis). By using novel techniques, further understanding can be gained on how best to support farmers and veterinarians to promote and undertake more biosecurity activities on cattle farms.

2. Materials and methods

This study was a component of a larger project focusing on veterinarian and cattle farmer perceptions of biosecurity and vaccination (Richens et al., 2015, 2016, 2018; Brennan et al., 2016; Ruston et al., 2016; Shortall et al., 2016, 2017, 2018). Prior to the commencement of this study, veterinarians and farmers in the UK took part in a series of studies obtaining data via questionnaires and interviews focused on biosecurity and vaccination. Participants who completed the prior biosecurity survey or interview components of the research, along with farmers recruited through personal contacts of veterinarians working at the institution, were invited via email to take part in a face-to-face meeting. The participants involved were not recruited based on any pre-existing participant relationships (i.e. the participants did not formally know each other when recruited). The structure of the meeting was developed by the research team (JK, MB, OS, WW) and the questions to be posed to the participants across the day were deliberated, drafted, and amended prior to the meeting.

Prior to the meetings commencing, veterinarians and farmers signed a consent form in person on the day which explained the purpose of the meeting, the topics that would be discussed, the number of participants expected and a request to audio-record the discussions. Presentations were given to the participants by the research team (IR, JK, MB, OS) about the findings from completed phases of the research, followed by facilitated separate veterinarian and farmer discussion groups before conducting a whole group discussion involving both veterinarians and farmers. It was decided that for the final whole group discussion, an unstructured facilitation approach would be taken; the beginning of the discussion involved the farmers and veterinarians reporting back their individual group discussion points to the wider group, providing an in-depth but unprompted starting point. The only prompts used related to asking the group about the interpersonal factors affecting the veterinarian-farmer relationship and how each stakeholder group could improve the use of biosecurity measures. All discussions were primarily facilitated by two experienced female researchers (JK – Clinical Assistant Professor; OS – Postdoctoral researcher), and were audio recorded, with additional notes made by a member of the wider research team or a nominated participant on flip charts at the front of the room. The audio recording of the whole group discussion (40 min in length) was interrogated, and a typed transcript created by one researcher (OS). The transcript was checked against the recordings for accuracy by another researcher (OC – Undergraduate veterinary student) and any amendments made along with the anonymization of the participants. The transcript was imported into qualitative data analysis software (NVivo 12, QSR international) for formal analysis by OC focusing on both the content (thematic analysis) and the way interactions occurred (conversation and discourse analysis).

2.1. Part one: Thematic analysis

Thematic analysis was undertaken using the steps outlined by Attride-Stirling (2001) and Braun and Clarke (2006) as a guideline. The transcript was coded within NVivo at a granular level in an attempt to identify any similarities, differences or patterns in the recorded dialogue, and this process of identifying codes was repeated multiple times until no new codes that derived from the data were generated. After analysis by OC, discussions were held with another researcher (MB) about the process of analysis and the codes created. RR (PhD student) performed a secondary 'sense-check' analysis of the content of the transcript information. Data aggregation was then performed, enabling the formation of data hierarchies consisting of codes grouped under sub-themes, known as organising themes, which, in turn, formed the foundations of overarching global themes. Thematic maps were then produced to visualise and identify links between global themes and their subsequent organising themes and codes which enabled refinement of the global themes. This process was repeated until global themes were as discrete as possible. Global themes were then named according to the main ideas represented by the coded data. Direct quotes from the transcripts were extracted to present the main themes.

2.2. Part two: Conversation analysis and discourse analysis

Conversation analysis approaches are usually employed to study interactions between pairs of people, although utilising conversation analysis for the assessment of interactions involving triads or larger groups of individuals is a relatively new approach (Ong et al., 2020). This involves looking at how individuals within a group interact but can also focus on how 'types' of individuals respond e.g. analysis of how children as a subgroup are reacted to in family therapy sessions (Ong et al., 2020). Additionally, a commonly documented underlying assumption for using conversational analysis is to study naturally occurring interactions (Bryman, 2012). However, the value of these approaches for analysing interactions that have been created and facilitated, such as focus groups, has been identified (Onwuegbuzie et al., 2009). The rebuttal against only using these techniques in naturally occurring interactions is that although the direction of the discussion may be facilitated, the interactions between individuals are naturally occurring, and therefore is a valid way of assessing exchanges between participants (Onwuegbuzie et al., 2009).

In the current study, the transcript generated from the discussion was assessed by one researcher (OC) for how the conversation was structured. This was carried out using conversation analysis techniques combined with a discourse analysis framework. The transcript was interrogated for evidence of adjacency pairs, repair, overlap and asymmetry, while discourse analysis methods were applied in order to identify resultant patterns and themes that emerged from the data set (specifics of these approaches are described in further detail below).

Adjacency pairs: Adjacency pairs are sequences of turns in which the initial utterance (the first-pair-part (FPP)), by one speaker, elicits a certain response (the second-pair-part (SPP)) from another speaker, one after the other (Lester and O'Reilly, 2018). For example, a question asked by one participant followed by an answer from another participant was noted as a question-answer pair. Other pairs identified included 'information' as the FPP and 'agreement', 'response', 'explaining' and 'disagreement' as SPPs. 'Information' refers to any piece of information provided by participants whether that be factual or opinionated. 'Agreement' indicates a response to a piece of information in which there was support and accordance for what had been said. This differs from 'disagreement' whereby an opposing argument or viewpoint is provided by other speakers in response to the information provided. 'Explaining' indicates that the SPP provided additional information or a potential explanation and expanded upon the information provided during the FPP. A 'response' SPP was allocated to sections of speech which neither agreed nor disagreed with the FPP point being made nor was an explanation provided. This process was repeated until all pairs had been assessed.

Repair: Repair sequences allow for speakers to establish shared understanding when challenged by errors (Schegloff et al., 1977), therefore providing the opportunity for speakers to correct their speech, solve misunderstandings and present a clearer message. Areas where speakers altered, corrected, or added to their utterances were highlighted and recorded in the results as evidence of repair.

Overlap: Overlap and interruptions of participants by one another was assessed. Further analysis was performed in order to distinguish the types of overlap present, paying specific attention to competitive and cooperative overlap. Competitive overlap signifies areas where participants compete for dominance of the conversation whereas cooperative overlap demonstrates support for the speaker (Kurtić et al., 2013). In order to decipher these types of overlap, participants' intonation and tone of voice were observed at the same time.

Asymmetry: Asymmetries within the discussion were also noted by recording the number of turns taken, the number of questions asked and the amount of time each group spoke for. Asymmetry in discourse can be informative of the presence of imbalances in relationships with respect to social factors (Hutchby and Wooffitt, 2008), indicating the potential for unequal status or dominance of one group over another. Methods taken from discourse analysis were used to identify emerging patterns. This involved summarising the relevant findings from the data and grouping them together into themes.

These specific conversation and discourse analysis approaches were identified after preliminary assessment by one author (OC) followed by discussion with a second author (MB) based around examples from the transcript. The analysis was performed consecutively and repeated a number of times to enhance accuracy. Interactions that took place between researchers and participants, or participants of the same group were not included in the assessment.

This study was ethically approved by the Committee for Animal Research and Ethics (CARE) at the School of Veterinary Medicine and Science, University of Nottingham. For the purpose of anonymity and protection of those involved, individual participants are portrayed as pseudonyms (e.g. Farmer 1) when quoted directly. Transcript quotations have been used to represent the main themes or examples of social interactions of note.

3. Results

Five veterinarians (all males) and six dairy farmers (four males, two females) agreed to participate in the meeting which was held on the 1st of April 2016. The veterinarians had been practicing for between 10 and 25 years and all conducted solely farm animal work. The farmers had been in farming for between 10 and 30 years and their education level varied (from level 3 to level 7). Participants were located in at least three different counties in England which related to the main cattle dense areas of the country.

3.1. Part one: Thematic analysis

Thirty-three codes were generated, leading to the identification of six global themes. The six global themes are outlined in the sections below (in no particular order) with italicised quotes included to support each theme's concept.

3.1.1. The role of economics in biosecurity implementation

Economics appeared to play a crucial role in encouraging uptake of biosecurity. Financial incentive and ensuring a cost-benefit was considered an important factor for motivating farmers to implement on-farm preventative measures.

"A farmer is a farmer to make money. So, in my personal experience the main thing a farmer wants to hear is how much money they're going to make if they change." (Farmer 2)

Alternatively, financial repercussions for non-implementation were also highlighted as a motivator for improving biosecurity behaviours.

"If you have a good [milk] contract and you're at risk of losing it because you haven't got good biosecurity measures then it does help to drive change in behaviours." (Veterinarian 1)

One veterinarian highlighted the differences between the biosecurity practices carried out overseas compared to the UK. Cost was identified as being an important factor with UK cattle farmers wanting to reduce their biosecurity expenditures.

"It's often a different discussion […] much more of 'how do we reduce the cost of that', *versus using it as a risk-based approach."* (Veterinarian 3)

Similarly, the cost of on-farm veterinary visits was expressed as a reason for farmers not engaging with their veterinarians regarding biosecurity implementation. It was suggested that if veterinarians altered their method of charging, farmers may be more likely to discuss biosecurity related topics.

"If you charge per the hour then you want the vet to do a practical job. But if they charge a set rate […] farmers might be more willing to engage with their vet […] to discuss disease prevention." (Farmer 1)

3.1.2. Communication

Ineffective communication, or lack thereof, amongst farmers and other professionals in the farming industry became apparent during the discussion. Farmers expressed concern regarding the conflicting information they received from veterinarians, consultants (advisors providing financial and/or technical agricultural advice), and nutritionists (advisors who make recommendations about animal feedstuffs and diets).

"A lot of what we [vets] do can be the outcome of what has happened at the nutritionist end. But we never talk. We never get them [nutritionists] around a table." (Veterinarian 3)"The nutritionist, vet and the consultant should all be on the same page." (Farmer 2)

The need to agree upon a definition of biosecurity and establish a common understanding was similarly emphasised by veterinarians in order to improve the effectiveness of conversations.

"Maybe we should agree on a definition of biosecurity because I could be talking to you as a client about biosecurity and we're talking about totally different things. You might think I'm talking about wellies [wellington boots] and I might think I'm talking about moving cows." (Veterinarian 2)

Proposals for engaging in effective conversations with farmers were explored, one veterinarian highlighted the need to ask the right questions in order to engage in discussions regarding biosecurity.

"If you ask farmers "what's your biosecurity like?" […] it's quite difficult to answer that question […] if you had dialogue such as "have you bought in" […] it leads you to a conversation. So, starting out with the right questions to start a conversation about biosecurity." (Veterinarian 1)

3.1.3. Professional relationships

Differences in the type of relationships between farmers and other professionals were discussed. Both veterinarians and farmers identified that farmers were more likely to listen to other professionals above their veterinarians and varying degrees of trust in these relationships was highlighted.

"Famers do trust their vets for advice, but they take most notice of their milk buyers." (Veterinarian 1)"They [farmers] would much rather listen to their nutritionist or someone than the vet." (Farmer 2).

Additionally, farmers recognised the type of relationship engaged in by veterinarians and farmers as a reason for veterinarians being unwilling to approach farmers with challenges relating to biosecurity.

"There was a feeling that because they [veterinarians and farmers] have a customer client relationship then vets may be potentially reluctant to challenge farmers as it might lead to farmers wanting to change their vet practice." (Farmer 1).

3.1.4. Tailoring for implementation

The need to provide personalised biosecurity protocols to farms was identified by veterinarians who expressed difficulties in generalising measures that would be beneficial to all in the farming industry.

"The message that we should all be closed herds, is probably the wrong message… it's a case of managing the risks in front of you on individual farms. And it is very difficult to give generic advice to farmers because all farmers are very different." (Veterinarian 1).

Incorporating biosecurity into the personal routine of farms was highlighted by one farmer in particular who identified ways of implementing biosecurity to achieve better uptake.

"Dairy farmers are very good at routine, that's how they work, so looking at ways of incorporating good biosecurity into the routine of the farm, instead of a separate job… if it's part of the routine it gets done." (Farmer 1).

3.1.5. Education

The need for everyone to be on the same page, as previously highlighted, was further supported by the observation that education among farmers is highly variable.

"I think farmers vary enormously. You've got university graduates and you've got people who've never been to London!" (Veterinarian 4).

Farmers identified the need for education of veterinarians with regard to delivery of information to ensure everyone has an equal understanding. This was supported by a veterinarian who agreed that there is limited education of undergraduate veterinarians with regard to time management and conversation skills relating to biosecurity.

"There is a skill set around how information is delivered, and discussions are held making sure everyone is on the same page." (Farmer 1)."It's not something you currently learn a huge amount about, as a new recruit, finding time to talk to the farmer." (Veterinarian 5).

3.1.6. Authority involvement in motivating implementation

The use of higher authority to motivate uptake of certain biosecurity measures by farmers was expressed by veterinarians.

"Having something from above, a milk buyer like Arla for example saying, "you have to use this dry cow therapy" that will drive people into the right behaviour." (Veterinarian 1).

Higher authority organisations such as the Agriculture and Horticulture Development Board (AHDB) and the Government were praised by farmers for having a positive effect on engaging farmers to learn about and discuss the topic of biosecurity.

"I think peer learning works quite well, they [AHDB] set up exemplars about good practice and get farmers to come and have discussion on those farms […] I think that's quite a good way of disseminating information to farmers." (Farmer 1).

In contrast, however, there were uncertainties around Government involvement with preconceptions related to previous failed attempts with regard to biosecurity.

"We talked about government involvement, in the past with things like brucellosis involvement. Did people really want the government involved? Or was there too much involvement? Like the association with bTB and the unsuccessful policies there." (Farmer 1).

3.2. Part two: Conversation analysis and discourse analysis

Four key factors determined by conversation analysis and discourse analysis demonstrated how the joint discussion between veterinarians and farmers was beneficial to communicating the issues around cattle biosecurity. The four key themes observed were 1) how the conversation allowed participants to learn from one another, 2) how discussion enabled participants to expand and develop upon their points, 3) how participants were able to gain an overall better understanding of the other participant's opinions, even if resolution didn't always occur, and 4) how the conversation allowed for agreement amongst veterinarians and farmers to take place. The specifics of the analysis that led to the development of these four key themes can be seen below.

3.2.1. Agreement

Analysis of adjacency pairs highlighted agreement between veterinarians and farmers on a number of issues. The data showed that agreement occurred amongst both parties and amongst several different participants.

> [FPP] Farmer 1 "[…] I think peer learning works quite well, they [AHDB] set up exemplars about good practice and get farmers to come and have a discussion […] I think it's a good way of disseminating information to farmers."
>
> [SPP] Veterinarian 2 "I think you're right […]"
>
> [FPP] Veterinarian 4 "It [knowledge] varies enormously with the person you're talking to."
>
> [SPP] Farmer 1 "Oh I absolutely agree!"

Information-agreement pairs were observed most frequently, with 13 out of 30 pairings indicating some form of agreement took place between veterinarians and farmers, with only 2 out of 30 pairs displaying disagreement (Table 2).

Thirteen out of 30 pairs were associated with utterances displaying agreement such as 'yeah', 'absolutely' and 'Mm'. These utterances were particularly evident during interruptions and overlapping speech, denoted by square brackets in the examples below.

Veterinarian 4 "When you talk about money, the guys who use the nutritionist, they get it as part of a package so they get it with everything else, the nutritionist out there for an hour or

Table 2
Occurrence of adjacency pair types identified during a farmer-veterinarian discussion group.

First pair part (FPP)	Second pair part (SPP)	Frequency of occurrence
Information	Agreement	13
	Response	4
	Explaining	3
	Disagreement	2
Question	Answer	9
Total		**30**

calling them in because their cows aren't milking well isn't, to them, [costing anything]"

Farmer 1 "[Mm]"

Veterinarian 4 "And if the vet says, 'can I come when the nutritionist comes?' and they've billed you £100 and made a couple of comments, you potentially don't feel you're getting value for that but [it has to be paid for somewhere]"

Farmer 1 "[Yeah, that's what we were talking about] how vets [charge for time]"

Veterinarian 4 "[Yes, yes] and that's the difficulty [of it]"

Farmer 1 "[Yeah]"

Veterinarian 4 "When the profession is changing and there aren't the margins on drugs propping these things up and it's got to be paid for somewhere"

Farmer 1 "[Oh absolutely]"

3.2.2. Building on each others points

Development of points by the other stakeholder was also demonstrated through analysis overlap. Cooperative overlap displayed in the following example indicates farmer agreement with the veterinarians' perspective whilst also portraying the ability to expand upon points by adding to the discussion with further supportive examples of the veterinarians perspective. For context, CHECS is a body that certifies and quality-controls licenced cattle health schemes in the UK and Ireland (https://checs.co.uk/).

Veterinarian 2 "If you're a pedigree beef farmer, if you're CHECS, you'll get more for your stock […] The driver was a clear economic [advantage]"

Farmer 2 "[That's] because part of their business is selling [replacements]"

Veterinarian 2 " [Yes] but a lot of dairy herds don't sell those"

Veterinarian 2 "Yes that's why dairy herds don't get involved in the CHECS scheme because a clear [benefit]"

Farmer 2 "[Well], the clear benefit would be reduced time to get (cows) back in calf"

Repair was used by participants in the conversation to alter or add to their utterances in order to portray a clear message and obtain a better understanding from listeners.

Farmer 2 "That's the difference between the vet and the consultant, the consultant would say "actually is there going to be an improvement, just change." But the vet might be worried to say, "I can't tell you what the improvement will be" […] it's about vet confidence."

Veterinarian 4 "Are you sure you don't want us to lie to you and say, "if you get rid of BVD your cows will get in calf better", when we don't know that's the case, whereas the consultant might tell you "This is your magic bullet." And they don't know it is."

Farmer 2 "It's about education in that respect […] you need to put the message across that there will be benefits."

Veterinarian 4 "But there might not be benefits […] the more you do these interventions you'll see [for example] you get a really big benefit [but when] you control BVD on another farm, you don't. There is uncertainty there."

Farmer 2 "I'm not talking about the vet saying, 'if you control this disease there will be a benefit', I'm more talking about the way the vet tries to convince a farmer to be more biosecure, [it] should be through talking about monetary gains in a more confident manner, because a farmer is a farmer to make money."

Veterinarian 4 "Oh absolutely."

3.2.3. Improved participant understanding

Despite few disagreements, where there was conflict the

conversation allowed for improved understanding by the other participants. The use of competitive overlap by participants allowed for progression of the discussion to provide more detailed reasoning on their views. Although initially there was some debate and competition for points to be heard where participants can be seen to interrupt one another before being able to complete their sentence, the discussion process allowed for improved understanding resulting in agreement overall.

Veterinarian 3 "I'm interested in who you think should be… who should provide support for farmers who don't engage? Because some farmers say, 'I've invested in that and you're going to use my money to help those who haven't [bothered]"

Farmer 1 "[I think with] government involvement […] if you want the country to go BVDV free for instance, if you haven't got government involvement, you haven't got that legislative stick to drive [that]"

Veterinarian 3 "[I'm] for that, but […] why is the government going to give these guys money who are at the [bottom?]"

Farmer 1 "[Well] because…., my biggest issue is that I'm free of BVD and if an animal escapes into my herd, and that animal has BVD, I'm no longer free of BVD. So it's worth my while having the country free of BVD, it reduces my risk of BVD. Not necessarily give them lots of money, just someone there to police it to make sure it happens"

Veterinarian 3 "I just find it interesting that we've got clients on both sides of that argument"

Farmer 1 "I think it depends a lot on the disease as well. Some diseases aren't very infectious… I'm not very concerned about"

Veterinarian 3 "Mm"

3.2.4. Opportunity to learn

The discussion also permitted participants to learn from one another. Analysis of adjacency pairs demonstrated the ability of participants to ask one another questions, in order to gain further information or clarification on points. Nine out of 30 pairs displayed interactions involving question and answer between veterinarians and farmers (Table 1).

Farmer 3 "In the French example, was that the farmer's cost or was that the government's cost?"

Veterinarian 1 "[…] most things in France are government driven, but they usually have a centralised scheme backed by the government and there's farmer contribution. It's usually a bit of both in France."

Farmer 4 "What was the aftermath of that French system if they then push for the lower level farmers to get up to scratch?"

Veterinarian 1 "If you're part of the club that can sell the cow it does have a bit of a cachet doesn't it? And if you're not there is a bit of a push to improve."

Farmer 4 "Is it up to the farmers to drive themselves or is there some support?"

Veterinarian 1 "I'm not sure about the details but being part of a club does motivate people to get better. Maybe more so than financial stuff […]."

Analysis of asymmetry identified more similarities than differences. Farmers had 40 'turns' whereas veterinarians had 38. Additionally, farmers asked six questions compared to five from veterinarians, and farmers and veterinarians spoke for approximately 12 and 18 min respectively. Tone remained mostly consistent throughout the discussion, but occasionally altered when there were areas of overlap and participants raised their voice in order to be heard over the disturbance (areas of inaudible speech due to participants talking over one another). Tone otherwise remained conversational.

4. Discussion

To the researchers' knowledge, this is the first study to explore not only the outcome, but the process of a group conversation between veterinarians and dairy farmers on their perceptions of biosecurity and the adoption of on-farm preventative measures. Discussions around the effective implementation of biosecurity measures, explored via thematic analysis, conversation analysis and a discourse analysis frame, demonstrated a novel approach utilising a co-creative methodology with veterinarians and farmers.

Cost-benefit was found to be very important to farmers when considering biosecurity implementation. This perceived barrier to biosecurity has been highlighted previously where farmers expressed the need for a financial return on expensive biosecurity measures as well as wanting economic incentives for their implementation (Nöremark et al., 2016). Although veterinarians were generally supportive and in agreement of farmers' business needs, there were clear disparities in communication with farmers requesting information on the cost-benefits from veterinarians and veterinarians being unsure of specific details. With money previously identified as being an important farmer priority (Hall and Wapenaar, 2012), and questions over whether veterinarians hold adequate knowledge about the costs of engaging in herd health management (Svensson et al., 2018), proactive informed discussions, particularly from veterinarians, about the cost-benefits of biosecurity implementation are required for improved biosecurity uptake.

Inconsistency of communication amongst professionals in the farming industry has been identified, with non-communication accompanied by the delivery of contradicting information being demonstrated as a source of confusion and disinterest amongst farmers regarding biosecurity implementation (Sayers et al., 2014; Moya et al., 2021). Although farmers have identified veterinarians as being their preferred source of biosecurity advice (Brennan and Christley, 2012), with a greater chance of action if advice is provided by a trusted source (Toma et al., 2013; Moya et al., 2021), farmers expressed being more likely to listen to the biosecurity advice of their nutritionist and milk buyer in the current study. Inconsistencies in communication between veterinarians and nutritionists could be identified as the cause for the lack of farmer compliance with veterinarians' advice, particularly where nutritionists portray a more appealing message that contains more 'certainty' and might not represent the risk-based approach to advice giving that veterinarians may be more likely to give. The importance of not only what the topic of discussion is, but what communication skills veterinarians possess (Svensson et al., 2018; Howarth and van Winden, 2021) and how veterinarians communicate with farmers (Ritter et al., 2019; Denis-Robichaud et al., 2020) have been previously highlighted as crucial to actuation of change. The engagement in joint conversation here allowed both veterinarians and farmers to achieve a better understanding of each other's points which could assist in gaining a deeper insight into this key issue.

Many studies state that a lack of farmer knowledge regarding biosecurity results in poor uptake (Toma et al., 2013; Nöremark and Sternberg-Lewerin, 2014) and therefore much research has focused on farmer education. However, veterinary professionals are not always the experts (Toribio and Rushton, 2012) and the results gleaned here show that there is scope for improvement regarding veterinary education as although communication skills teaching appears in the veterinary undergraduate curriculum in some institutions (Mossop et al., 2015; Shaw, 2019), it is clear that further training is required specifically in relation to veterinarian-farmer discussions on biosecurity (Svensson et al., 2020a, 2020b). The rapport built by participants during the joint discussion in the current study allowed both veterinarians and farmers to engage comfortably and confidently with one another, further developing their discussion, informing one another on unfamiliar concepts and gaining deeper insights. In this way, group conversation could be seen as an educational opportunity for participants, leading to better

uptake as well as being beneficial for research purposes if a similar co-creative approach is utilised.

4.1. Benefits of using a conversational methodological approach

There are few outputs focusing on the effectiveness of communication that occurs between veterinarians and farmers on the topic of biosecurity (Bard et al., 2017; Moya et al., 2021). The current results highlight the need for further investigation into whether these discussions do take place and if so, how effective they are in achieving improved uptake of on farm biosecurity practices. It was shown that engaging in a joint conversation allowed for discussion of key biosecurity related factors to occur with veterinarians and farmers mostly in agreement with one another. Further research in this area would be beneficial in improving biosecurity implementation by focussing on areas of conflict and understanding why they act as barriers to biosecurity. Further research aimed at engaging veterinarians and farmers in discussion on biosecurity could be beneficial for uptake of biosecurity measures where conversations allow for appreciation and potential agreement with others' perspectives. Analysis also revealed that engaging in group discussion allowed for participants to develop upon their points further and gain a better understanding of other's viewpoints. It has been shown in a study looking at the impact of African Swine Fever that when farmers and veterinarians engage more frequently, across a spectrum of communication opportunities (e.g. provision of training, visits etc.), trust improves and the exchange of key information increases (Berends et al., 2021).

There is evidence of conversation analysis being used in the veterinary sector to study consultation exchanges, indicating this approach could be beneficial for the assessment of veterinary professional-client interactions (MacMartin et al., 2018; Lynden et al., 2020). Within the current study, conversation analysis was used as a way of exploring the value of group discussions between stakeholders, assessing whether there is potential for this methodology to be employed as part of co-creative approaches to drive innovative solutions to complex problems. This methodology was also applied to a facilitated conversation as opposed to a naturally occurring conversation. Although conversational analyses have not traditionally been used in these circumstances (facilitated group discussions), they are starting to be used to study organised interactions by experts in this area (Onwuegbuzie et al., 2009; Ong et al., 2020); in the current study, this approach appears to have added value to the assessment of vet-farmer interactions. This was a small study and therefore these methods would need to be utilised across a larger range of discussions in order to be more definitive about the value of these approaches. Future work relating to implementation of biosecurity practices on cattle farms could be performed using a combination of both conversational methodologies and assessment of the specific topics within the communication, utilising thematic analysis or similar techniques to explore what was being communicated. Using a combined approach could be efficiently utilised for unpicking other contentious issues in animal health and welfare and may be more likely to identify solutions not appreciated using the analytical techniques that have traditionally been employed to date.

4.2. Study limitations

The nature of this study allowed for the involvement of a small number of veterinarians and dairy farmers. Some participants said very little and therefore not all participants contributed substantially to the overall results. Additionally, analysis was performed on conversations from one discussion. However, insights were gained during the discussion that would otherwise have been missed using other methodologies that permit data gathering from a larger group of individuals, such as surveys. Conducting mixed focus groups with a broader range of veterinarians and farmers across the UK would be beneficial, particularly when looking to explore further how conversation and discourse

analysis could potentially help to gauge opinion and openness for change. Additionally, there is a chance that responses from participants may be affected due to the involvement of the research team in the discussion (however minimal it was). These methods, however, allowed for an in-depth and detailed exploration of the attitudes towards a topic which could not be achieved via the use of other methodologies. The use of formal double-coding in thematic analysis, or coding of the same data set by two researchers could have been used to enhance the credibility of results. However, utilising conversation and discourse analysis approaches helped to support and triangulate agreement with the findings from the thematic analysis.

5. Conclusion

This study demonstrates that there is a clear advantage to veterinarians and farmers engaging in joint discussions with regard to biosecurity, with emphasis being placed on the importance of communicating the cost-benefit of implementation to farmers. There is also a need to evaluate the existing communication-specific training received by veterinarians to explore to what extent suboptimal communication skills negatively impact uptake of biosecurity practices. Future research should aim to focus on the relationships between farmers and other industry stakeholders, in addition to veterinarians. This will help to determine what their role is in implementation of biosecurity practices and how relationships can be improved across the industry to deliver a clear and consistent message to farmers. By identifying the importance of discussion-based communication with regards to its advantages on improved mutual understanding by participants, studies can be directed towards facilitating engagement with more veterinarians, farmers, and other industry stakeholders in this way.

Declaration of Competing Interest

The authors declare no conflict of interest. The funding sponsors had no role in the design of the study; in the collection, analysis, or interpretation of the data; in the writing of the manuscript, and in the decision to publish the results.

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