

## Research Article

# Perceptions of Risk-Based Trading among Dairy Farmers in the Republic of Ireland: An Interview Study

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**Abstract**

Cattle trading across Ireland is a longstanding farming practice that has been considered a critical factor in the spread of disease, including the spread of bovine Tuberculosis (bTB), the main disease of focus in this paper. bTB, caused by *Mycobacterium bovis*, is a chronic and infectious disease of cattle that is recognised as one of the most pressing animal health problems facing the Irish agricultural landscape. To better control bTB and manage risks posed by cattle trading, this study aimed to explore farmers views of (i) animal disease transmission when trading, (ii) the type of information they seek/provide when trading and (iii) whether the TB herd history and geographical location are considered when buying in new stock. Convenience sampling was used to employ the study participants and a total of 22 phone interviews were conducted with dairy farmers across five regions in Ireland. A Thematic analysis was employed to analyse the data, through which six key themes emerged, including Animal Health Matters When Trading, Perceived Disease Risk during Cattle Movement, TB Herd History Information Revealed and Concealed, Geographic Trade Considerations, Animal Class Profile is Relevant, and Buyer-Seller Information Preferences. By identifying and understanding the factors that were highlighted by farmers in this study, policymakers and other stakeholders can ensure that effective and sustainable future interventions and policies are developed to encourage dairy farmers' participation in responsible cattle trading practices, as well as other members of the farming community.

**INTRODUCTION**

In Ireland, Bovine Tuberculosis (bTB) is one of the main diseases of concern impacting on cattle. Bovine Tuberculosis (bTB) is a contagious bacterial disease of cattle [1] with zoonotic potential [2] caused by members of the *Mycobacterium tuberculosis* complex [3]. Of the members, *Mycobacterium bovis* is commonly associated with bTB cases [4]. Despite global research efforts examining the spread of bTB [5], several epidemiological aspects of bTB are still debated amongst academics [6]. Not only do ecological and technical limitations play a role in the persistence of bTB, but so do sociocultural and socioeconomic factors [7]. Technical constraints, such as the limited sensitivity of available tests as well as the practical difficulties of arranging national testing schemes could result in infected animals remaining in the herd for extended periods of time [8]. Ecological factors, such as the presence, density and contact rate between cattle and wildlife hosts complicate eradication efforts [8]. Risk perceptions and daily

operational choices of herd keepers can influence the risk of the herd contracting bTB by affecting how stringently biosecurity measures are enforced [8]. Lastly, dairy herd sizes in Ireland have increased in the last decade [8], with this expansion often facilitated by purchasing cattle, despite the disease risks posed by buying in cattle. Due to the complex entanglement of the aforementioned factors contributing to bTB persistence in cattle populations, an interplay of EU-level and national policy is required to better address local factors influencing bTB epidemiology [9]. Policy is dictated by the World Organization for Animal Health (WOAH) as bTB is a notifiable disease [3]. WOAH is tasked with ensuring transparency in global animal disease circumstances and publishing international health standards that enable its 182 member countries to safely trade animals and animal products [10]. Thus, adherence to WOAH policies on bTB was crucial to enable the 378,750 live cattle exported from Ireland in 2024 [11] and remains crucial for future trade.

Current national policy requires all cattle herds

and its bovids to be registered with the Department of Agriculture, Food and Marine (DAFM). Each registered bovine is annually subjected to a single intradermal comparative tuberculin test (SICTT). If a bovine in a herd is test-positive, the movement of cattle into or out of the herd is restricted. Test-positive cattle should be quarantined until removal for slaughter. Additionally, all cattle are monitored at slaughter for bTB lesions. Discovery of a lesion at slaughter can also result in the restriction of cattle movements from the herd. Once restricted, a herd is only derestricted after a follow-up test deems the herd bTB free (S.I. No. 58/2015 - Animal Health and Welfare (Bovine Tuberculosis) Regulations 2015). Market value compensation is paid to farmers for cattle culled due to a positive bTB test (TB Eradication Scheme). In addition to cattle focused controls, badger culling and vaccination is practiced when deemed appropriate (Wildlife and TB) as badgers are well established spill over wildlife hosts of bTB [6]. It is important to note that bTB infected animals can be missed by the tests. The skin test is no more than 80% sensitive, so even at a high standard of testing up to 20% of infected cattle may go undetected [6].

Despite eradication efforts dating back to the 1950's and a considerable reduction in the number of infected herds, bovine TB eradication has not yet been achieved in Ireland [12]. After reaching a historic low of 3.27% in 2016 [12] the herd incidence increased annually, reaching 6.04% in 2024 [13]. As herd incidence has risen, so has spending on bTB eradication efforts in Ireland. In 2015, €82 million was spent on bTB eradication efforts [14] reaching €108 million in 2023 [15]. As the eradication efforts continue, a need for new insights to better inform intervention policies is clear. Controlling bTB through controlling cattle movements has been highlighted as an intervention to aid Ireland in achieving OTF (officially bTB Free) status [16] as the introduction of an infected animal can seed infection into a previously uninfected herd [17,18]. Purchasing cattle is a well-established a risk factor for the introduction of various infectious diseases into a herd [19]. For example, a 2008 Welsh study comparing the presence of bovine viral diarrhoea virus and bovine herpesvirus type 1 antibodies in bulk milk samples of open and closed herds found that open herds had 10 (95% CI 1.7-59.4) and 16.7 (95% CI 2.0-49.7) times the odds compared to closed herds to have antibodies present in bulk milk samples [20]. Cattle movements into a herd has also been identified as a risk factor for bTB occurrence in a herd [21]. Thus, cattle movement controls have been previously utilised as interventions against the spread of infectious agents in cattle populations. For example, movement restrictions have been identified by the European Food

Safety Authority as a control measure if a Lumpy Skin Disease outbreak were to occur in Europe [22] and, where used in the 2001 Foot and Mouth Disease outbreak in The Netherlands, in order to help control the spread of the disease between herds [23]. Usually by preventing the introduction and inevitable contact between infected and uninfected animals the spread of a pathogen can be kerbed [24]. However, despite the known risks associated with cattle movements, cattle trade appears to be on the rise in Ireland. From 2013 to 2023 cattle sold annually increased from 2,823,105 to 3,305,769; which is almost a 20% increase in movements in that period (AIM 2013; 2023).

Risk based trading is defined as a voluntary national scheme that focuses on providing buyers with information on the bTB history of cattle they are intending to purchase, allowing buyers to reduce their risk of purchasing bTB infected cattle [25]. This scheme thereby enables trade whilst mitigating bTB risk (Bovine TB Risk-Based Trading: Empowering Farmers to Manage TB Trading Risks). Similar schemes have been utilised in Australia, New Zealand, the USA [26] and the UK (Bovine TB Risk-Based Trading: Empowering Farmers to Manage TB Trading Risks) with varying levels of success. Notably, Australia was declared OTF after 27-years of eradication efforts in 1997. The Australian eradication effort consisted of a test-and-slaughter program with cattle being tested with the single intradermal test, abattoir surveillance and trace-back and trace-forward if a bTB case was detected. Additionally, the wildlife host, the water buffalo (*Bubalis bubalis*) is classed as an invasive species [18] unlike the wild life host in Ireland, the European badger (*Meles meles*) protected under the Wildlife Act, 1976 [27]. Also, it was suspected that buffalo and cattle had very little interactions, making Australian wildlife less impactful in the maintenance of bTB in the Australian cattle population [18]. Industry commitment was highlighted as a contributor to the success seen in Australia [18], unfortunately the same industry involvement is not seen in Ireland [28].

Restriction on cattle trade is perceived as a threat to farmer livelihoods as the trading of live cattle is crucial to many types of cattle enterprises [29]. In addition, some dairy farms send calves off to be reared by a specialist calf rearer, in so called contract rearing arrangements [30]. Improving herd performance through breeding by buying in breeding bulls or replacement heifers of high genetic merit can be a way of improving efficiency [31]. The opposing needs of a farm from a business perspective and an epidemiological disease control perspective may be diametrically opposed and this can create considerable challenges from a disease control perspective.

Motivations and attitudes of farmers can affect the effectiveness of intervention policies [9]. It is important to recognise that bTB is only one potential stressor amongst a multitude of other considerations farmers are faced with when running a farming enterprise [7]. Thoughts and perceptions surrounding a risk can play a crucial role in dictating the behaviour of an individual when faced with decisions surrounding that risk, as well as their acceptance and compliance with policies meant to mitigate the risk [32]. Therefore, understanding how trade impacts on bTB is viewed by farmers within the greater demands of running a farm can be critical to policy success. In addition, due to the voluntary nature of the risk based trading scheme, its success relies on the willingness of sellers to provide information and the information seeking of buyers [25]. Therefore, understanding Irish dairy farmers' thoughts, considerations, motivations [33] and gaining insights into farmer risk perception [32] surrounding bTB and other animal health diseases when purchasing cattle through qualitative methods to inform policy could help better understand and ultimately address this complex issue [34]. To date, there is little knowledge of farmers' perceptions of how trade plays a role in the spread of animal disease in Ireland, specifically bTB. It is highly relevant for efficient disease control to understand how individuals in this group reason and act in relation to animal health and disease. Within veterinary epidemiology and animal health research in general, the value of qualitative research investigating attitudes and behaviours of farmers is increasingly recognised. Studies examining mastitis control in dairy farming [35], zoonotic disease control [36], attitudes to biosecurity in Johne's disease control [37], and the use of antibiotics [38] all found that farmer attitudes and behaviours had an effect on the intended outcomes of improved animal and human health. Therefore, the aim of this research was to employ a social science approach to explore dairy farmers views of (i) animal disease transmission when trading, specifically bTB; (ii) the type of information they seek/provide when trading and (iii) whether the TB herd history and geographical location are considered when buying in new stock.

## MATERIALS AND METHODS

### Design

A qualitative approach was used to investigate dairy farmers perceptions of the role of risk-based trading on animal health, particularly bTB, in Ireland. A qualitative design was deemed suitable for this study as there has been little social science research examining whether farmers believe animal trading poses a disease risk to overall animal health. Social science research can produce

richer and deeper understandings of motivations through the two-way interaction of interviewing, as participants are given time and space to discuss their thoughts at length with the use of open-ended questions. In the current study, dairy farmers were interviewed via telephone between January and February 2024, using a structured interview guide (**Appendix A**). All interviews were conducted by one researcher (UK) and lasted approximately 20-25 minutes. A question guide was used to ensure that the topics of interest to this study were covered (available to participants in advance, on request). Questions were open-ended and were developed through discussion between DAFM Veterinarians working in the Ruminant Animal Health Division, and a Social Scientist researcher working in the National Disease Centre for Control Division, as well as the research team's experience of qualitative research techniques. All interview data was audio-recorded, transcribed verbatim and thematically analysed. In accordance with national and institutional guidelines, ethical approval was not required as this study did not include samples or experiments on people or animals.

### Recruitment

Dairy farmers were recruited using a convenience sampling approach, which focuses on gaining information from participants (the sample) who are 'convenient' for the researcher to access [39]. On initial contact, the researcher introduced herself and the contacted person was informed on the study design and its objectives. The decision to participate in the study was solely up to each contacted dairy farmer and thus it was not deemed necessary to obtain written consent. All participants were orally informed about the elements of consent, and permission was verbally obtained before starting each interview. It was explained that their participation was voluntary and completely anonymous (data collection and analysis) and that an option to stop the interview at any stage was possible. It was also explained that there would be no expected risks associated with participation in the study. Permission to use direct quotes from the interviews was sought, but again, participants were assured that such quotes would be anonymised in any manuscript or report written up post-interview. A total of 22 participants partook in the study; the number in which all researchers felt data saturation was reached. Participants were located in various locations across Ireland (Co. Meath, Limerick, Cork, Kerry, and Tipperary).

### Data Analysis

The audio recordings were transcribed verbatim by a transcribing software (Otter.ai). Transcripts were

**Appendix: Interview Guide**

1. When you go to purchase cattle, what do you think are important considerations in terms of their general health?
2. When you go to purchase cattle, what considerations do you give to TB?
3. What are your views on the disease risk posed by cattle movement to animal health in general?
4. In relation to TB, what are your views on the disease risk posed by the movement of cattle?
5. What opinion do you have/how do you feel about asking for the TB history of the herd when you go to purchase?
6. Think back to the last time you sold stock, what information did you offer to potential buyers?
7. Before purchasing cattle, what kind of information do you ask the vendor about when it comes to the TB history of the herd?
8. What considerations do you give to the TB history of the geographical area from which you are purchasing cattle?
- a. Why do you not consider this?
9. In relation to the class of animal (breeding animals versus animals to be finished), do your standards vary when it comes to purchasing?
10. What information would you like the vendor to provide when purchasing cattle?
11. In your opinion, are there any differences in the risk profile of different classes of animals? If so, what are they?
12. Is there anything further you would like to add to this discussion today?

checked against the recordings for accuracy and to remove identifying features. The interviews were subjected to the six-step approach to reflexive thematic analysis, which identifies patterns of meaning across qualitative data [40,41]. An inductive approach was taken whereby themes were generated from the data and not restricted by theoretical knowledge [40]. First, the transcripts were read multiple times until content familiarity was achieved. Initial ideas were marked for coding in the later steps. Second, patterns in the dataset were clustered systematically to generate preliminary codes, with multiple responses coded from each participant. Third, codes were grouped to create themes. Fourth, themes were iteratively refined through discussions in the research team, ensuring themes reflected the dataset and research questions. Fifth, themes were defined and named. Last, compelling quotes were selected to illustrate answers to the research questions [40,41].

The analysis was conducted by the first author and interviewer (UK). To assess the robustness of the coding framework, the fourth author (SF), double-coded 50% of the data which is above the recommended guidelines in qualitative research [42]. Any discrepancies between codes were collaboratively discussed until a consensus was reached. The final themes were discussed with the wider research team to ensure they captured the research questions and a final number of 6 themes (Table 1) was agreed upon.

## FINDINGS

### **Theme 1: Animal Health Matters When Trading**

Most participants reported being conscious about the overall health of an animal when trading. Factors such as, good health status, high animal welfare standards, farm structure and cleanliness, satisfactory visual assessment (good weight for age, appearance, coat and feet), vaccination status (what a farmer is vaccinating for, his/her

vaccination programme, and when he/she last vaccinated, especially when buying younger animals), breeding status and Economic Breeding Index (EBI), current animal disease profile and history, the quality (genetics) and behaviour of the animal (bright, active, alert, energetic), cell count, milk report and buying from both a clear herd and surrounding region were mentioned as being important when trading animals. Some participants also stated that they avoided trading in marts or buying online to reduce the risk of disease contamination. Instead, such farmers spoke about dealing directly with farmers they knew to trade animals with, as they would be familiar with the operation being run on that farm, and thus would be more confident that the animal being purchased would have a low health risk. One participant also aired suspicions about animals being sold cheaply for a reason, and that he would be mindful of that.

*P6: "When I go to purchase cattle, it is very seldom, but when I do purchase cattle, I think that... are they relatively healthy looking? Like their coat and their weight for age and things like that. It depends on what you're looking for, like it depends on the quality you are looking for, but overall good health, do they look well, they have a nice coat and a good weight for age"*

*P14: "That they are looked after, plenty of feed, high animal welfare standards, you know, veterinary interventions when they needed it"*

*P21: "I suppose the disease status of the entire herd has to be a big factor. I was always looking for vaccines, routines for vaccines, and I guess the mindset of the farmer more than anything too, because I think you could vaccinate all you like but If the mindset of the farmers isn't to keep their herd healthy in the first place, then it can be a waste of time."*

Farmers also listed various diseases and infections that they are conscious of when trading, including BVD, IBR, Mortellaro, TB, Leptospirosis, Salmonella and Pneumonia.

When asked about TB, many stated that it is a top priority disease they would look out for when buying in new stock. Some proceeded to comment that they only buy in new stock in a 'controlled manner', meaning that they buy from a clear herd/region, farm-to-farm, from a credible source with good records or from the same farmer to reduce the risk of TB. Others mentioned questioning farmers about the TB history of their herd and that of their neighbours, when they were last tested/'locked up' and refuse to buy from a herd that had TB in the last six months - five years. However, they also alluded to the fact that they could only 'take a man for his word' and would never really know whether he/she was telling the full truth about the TB history of their herd. Some also mentioned that they would like to see the TB history of the herd up on the board before purchasing an animal at the mart, whilst others stated that they do not buy in stock at all for fear they will get TB or have stopped buying because they have gotten TB in the past, despite taking all the right measures when purchasing new animals. Lastly, a minority of farmers mentioned that they do not consider TB when trading as it has been a long time since they have been 'locked up' and are not knowledgeable about the disease.

*P15: "I would be afraid if I was purchasing now definitely. That, I nearly rather buy from an individual that I knew, or a herd that I knew, rather than just going to the mart and just rocking on and just buying something that I kind of find out afterwards they are from a black spot"*

*P17: "I wouldn't have really worry about it up until now. But look, it's a massive consideration in terms of is the herd that they're coming from? How long has it been free of TB free? What's the health status around that area. And there's certainly a lot of caution in terms of what you're buying in. And I'd be very, very selective going forward in terms of what I buy, they'd have to come from a really clean herd, they'd have to be milk recorded. And you have to be buying something really good because farmers just won't sell the good ones. you'll never get, farmers will never sale his best heifers. So, it's about buying the right replacements from a trusted source that you know, as credible and that they have good records maintained"*

*P21: "We would be very slow to purchase something in an area that is that has incidence of TB but also what the what the current status of the herd is you know, has it had TB problems with the last couple of years and just come out of TB or how are they managing the farm to remain clear, because I think how we manage our farms has a big part to play in a farm stays TB clear as well so. TB, TB has to be the big one"*

## **Theme 2: Perceived Disease Risk during Cattle Movement**

Many participants believed that cattle movement is highly linked to disease spread, especially when animals are being moved through (i) the mart system; (ii) between dealers to farmers; (iii) from across the Continent or (iv) between multiple plots of land. Increases in dairy herd sizes and herd blending were also alluded to as being problematic for disease spread. Farm to farm cattle movement or using websites to purchase cattle from other like-minded farmers that choose not to buy through the mart system, were considered less of a, to no risk, of disease spread. Some felt that a closed herd is a much safer way of operating a farm so that disease spread from cattle movement is minimised, whilst others stated that there is no option but to move cattle and to accept the risk that there is a chance of every disease being spread. Animal stress and subsequent reduced immunity were also considered two contributing factors to disease spread when cattle are moved from one environment to another. Lastly, one participant mentioned that there is a need for farmers to be more mindful of the risk associated with cattle movement and disease spread, as well as the agricultural industry as a whole.

*P1: "I consider it huge. I consider the mart a septic of headache and trouble. and I suppose listen one would have to include TB in that list also. but just as I say the Mortellaro, the IBR the BVD all those bloody viruses are spread so easy, you can bring anything out of a mart"*

*P12: "When you think about when you take a step back and think about it, I'm a passionate farmer, but when you take a step back and think about it and consider all the cattle lumped in together then going through a mart, in and out of trailers and all the dirt that goes with it. You know, it's just it's just a prime environment to spread diseases. And I am sort of saying to myself, you know what, I'm not going to get involved in that. And I've joined a group Farm Fair you call them where you can advertise likeminded buyers like me that don't want to go to the mart. And you share information of what kind of cattle you have, what you are looking for, or selling, because I look after my cattle"*

*P22: "I think it's something we need to be more and more mindful of. I guess to be fair, I think that goes for the farming sector as a whole. We haven't had enough focus on it as farmers and I think it's a kind of a tricky one because we mustn't impede the movement of animals but at the same time, we need to be cautious of moving animals from areas that have more disease and more TB or likewise"*

In relation to cattle movement and TB spread, most felt

that there is a 'high correlation' between both, especially with older animals and 'sleeper animals' who, according to farmers, have TB but somehow pass the TB test every time. Some felt that the risk of TB spread is also particularly high when cattle are moved from a 'hotspot area' to an area with little to no TB and expressed concern that farmers often do not know whether/do not know how to find out if, an animal is coming from a hotspot area or not. Others however, mentioned keeping a close eye on 'hot spot' areas to minimise the risk of bringing TB to their farm. Many also expressed concern about the validity of the 30-day TB pre-test, given that such animals may still be coming from a farm with a history of TB, which may then present itself beyond the 30-day mark. Contrastingly, other respondents felt that all you can do is trust in and rely on the 30-day pre-testing system when moving cattle, and to keep testing them once they arrive to one's farm. A sense of frustration was aired by some of the participants that DAFM are not acting quick enough when an animal tests positive for TB. Such participants felt that DAFM should come immediately to remove the animal from that farm, instead of asking farmers to isolate the animal until such a time it is removed. Wildlife was also raised as an issue by many when it came to TB spread. Some felt it is not right to blame TB spread on cattle movement alone and aired concern that there is no badger surveillance system, like that of cattle, which is contributing to bovine TB spread.

*P8: "I am not sure that (cattle movement) is the only factor. It also comes down to wildlife you know. Anyone who could answer that question would be a bloody genius, you know what I am saying like. Yes, there's some level of risk with TB but I'm not sure how dramatic or high that risk would be. Like as the saying goes, I wouldn't buy an animal out of Wicklow if you gave it to me for nothing. You understand what I am saying? Wicklow has a bad, it is a high-risk area so I wouldn't buy an animal out of Wicklow"*

*P10: Look I suppose, the more movements there are the greater the risk. Am obviously I would be very conscious of where they're coming from geographically and what the TB incidences would be from those areas? I wouldn't have any direct knowledge of the immediate purchaser but ah I would be trying to keep an eye out on high-risk areas and try not to buy from a highly infected area"*

*P16: "I think it's the main cause of the spread of TB, as far as I'm concerned, you know the movement of cattle"*

### **Theme 3: TB Herd History Information Revealed and Concealed**

Most farmers stated that they happily and honestly give other farmers all the information they need or ask for

when trading. Types of information offered included (i) a full genetic history of the animal; (ii) how calves were raised/when weaned; (iii) skin tests (how many an animal has had since being born); (iv) vaccination status and dosing routines; (v) herd health programme; (vi) a valid TB test to place on the boards at the marts; (vii) EBI and milk recording records and (viii) clear herd health status. To a lesser extent, some of the participants stated that they do not offer any information to other farmers about their TB history unless it is asked of them, for fear that it would have an impact on their sales. Some also stated that they have never been asked about the TB history of their herd when trading with other farmers. Lastly, those trading in marts declared that they only offer the information that is put up 'on the boards'.

*P3: "If they didn't ask me about TB history, I wouldn't be telling them because I would like to sell my cattle do you know? It's either made mandatory or it's not. To me, as a seller I wouldn't be telling them that I have a history of TB in this herd. Unless they asked me, as I might not get a sale. Some farmers might not care, but other farmers would"*

*P6: "I was never asked anything about about TB. That's one question I was never asked. I have sucklers and dairy cows. Like with sucklers, I sell some of them private but there was never an issue were they being tested, or never has the question been asked from other farmers"*

*P19: "I would like to ask, if the farmer if the individual farmer said he went down with TB, I'd be very reluctant to buy stock, but there's neighbouring farmers too. Because some areas get hit with TB, that's more difficult to ask so I would have to say, I would like to ask that question also yes, but it is more difficult to ask has your neighbour gone down with TB that would be more difficult to ask"*

When buying animals, most farmers stated that they sought information from the vendor such as (i) the date of the last TB restriction of their herd; (ii) when were they last/were they ever 'locked up', if so, how many animals went down with TB; (iii) TB history in the area; (iv) an explanation for why a farmer thinks he/she had a breakdown; (v) contiguous tests and (vi) whether the farmer lived near a forest. Some participants did however state that you could 'only take a man for his word' when dealing with a farmer privately and trust what is on the boards at marts when buying in that manner. Some did state that they look out for the quantity of information being provided across farmers about their herd and that through a process of elimination one can rule out farmers who provide very little information. To a lesser extent, participants stated that they never ask questions of other

farmers about their TB history once their herd is clear. Also alluded to were feelings of suspicion one would have towards farmers who are not open about providing TB information about their herd. Lastly, some felt it was their right to ask the vendor for the TB history of a herd to protect the health status of their own herd and considering the finance being spent on buying their stock.

*P4: "I suppose you would ask you know, is there a lot of TB in the area? and have they had a breakdown in the last two years? That would be the questions I would ask. And if they had, then I'd ask them probably you know what they think, where did they think it came from. Are you near a forest or is there deer around?"*

*P9: "If I was going private sale, it would be very high, very high up. It would be the first question I would ask him then I'd be asking him about what vaccines the animals got. I mean the whole TB situation in Ireland it's sad to think that it's still as prevalent as it was 40- 50 years ago"*

*P20: "I think you're quite entitled to it. I suppose if you're going to buy in animals, you're the person paying the money, you're entitled to know if you want to know. It's your right to know really. So, I wouldn't have any issue about that. Your first responsibility is to your own herd and the herd health of your own animals so you have to protect that, I had people in the past who were purchasing animals from me, I used to sell a lot of Friesian stock, and I would tell them what the history of the herd was"*

Most participants declared that they felt comfortable about asking potential vendors for the TB history of their herd when trading, viewing it as an 'absolutely paramount' or 'essential' piece of information, with two participants stating that they would be too 'embarrassed', or it would be 'too difficult' to ask. One participant mentioned including the TB history of herds on the ICBF database with a report available on it for farmers, so that the 'awkwardness' of asking the question of a farmer is removed. Overall, however, the farmers in this study felt this type of questioning was mostly relevant when privately dealing with a farmer, and not at the marts. Others stated that they have never asked farmers for the TB history of a herd in the past but would ask nowadays as it is too risky not to. Many farmers questioned whether DAFM were planning to use colour codes to represent the TB history of respective herds at marts; an action that was negatively viewed by most. While they thought it was relevant, they felt it would damage the reputation/sale of a given farmer with a poor TB history. They also felt that it would cause young farmers in particular a lot of stress and would lead to increased suicide rates.

P4: "To penalise somebody, a farmer with like, putting him on a black mark, this fella has TB, you know, for the last two years, don't buy off him. You ruin him. He will commit suicide. it's a very dangerous thing to do. Extremely dangerous thing to do. A lot of farmers are not making a huge amount of money, that it could be very easy to tip them. It could. Suicide is a big problem with young farmers. Young guys aren't able to handle the stress. They've taken on an awful lot of stress. They have big herds now and they have big borrowings. And if something like that was stuck up in the mart through no fault of their own, that they had a breakdown with TB. I could see massive problems there. And I am serious. You could see suicides; I wouldn't be surprised"

*P7 "I think it would be part of the conversation that you've asked someone. Like you would want to know the health status of the herd and TB is a big factor"*

*P14: "I'd ask them when they were locked up, like and if they didn't tell me or wouldn't tell me, I wouldn't buy the stock. yeah, it's too big of a risk"*

#### **Theme 4: Geographical Trade Considerations**

TB risk and the geographical location from which farmers purchase stock from was considered by some, but not all farmers in this study. Some stated that they give very little thought to the geographical region as they typically buy from friends in their own locality and trust that there is no TB circulating on nearby farms. Others expressed that they give no consideration to the overall geographic region, rather their consideration would be more farm specific. Most farmers interviewed however, expressed that they gave 'a lot of weight' to the geographical region from which they buy in stock from and would not buy stock from regions that they knew were 'riddled' with TB, where there is a lot of road construction happening due to badger sets being disturbed, or where a farmer does not have a clear TB herd test within the last year. They also mentioned strongly considering whether an area is, and the neighbouring farms are, clear of TB before purchasing an animal. However, some of these farmers expressed frustration by the lack of official information available to them about high-risk areas and felt that they had to rely on anecdotal evidence or on information from their local vets to make an informed purchasing decision. Lastly, some spoke about being aware of their direct neighbour having TB but having no knowledge on whether a farmer 'a few doors down' had TB; an issue they felt was difficult to contend with and one that they lacked information on.

*P14: "I don't have that much geographical information if I'm buying stock. I can only go off what farm I'm buying*

*them off. Maybe you can get that information, but I'm not aware of it like, in terms of where TB. So, I don't give it a huge amount of consideration. Once the herd itself I'm buying off is clear, that's the biggest consideration. So, I don't give any consideration because I don't have any information on that"*

*P15: "I wouldn't even ask, because I know there are black spots in the country here, it seems to change around but yeah, there are definitely black spots in the country that I would try to stick to your area if I was buying cattle"*

*P18: "I will give more mass on that. But again, how would you find out? There's no way of finding out only through the grapevine if an area has TB or not. And I only found out that there was TB in neighbouring farms after we got locked up. I didn't hear before that. And I'm not talking about the next-door neighbour. I'm talking further down. So, it did come up. So how do you find out about who's locked up and who's not locked, is that information out there? I don't unless you're unless I know you get a letter, a notification that it says that your next-door neighbours locked up. But if you're not, right beside them, it's just another farm down, then there's no way of finding out"*

#### **Theme 5: Animal Class Profile is Relevant**

Perceptions of animal class risk profile and its relevance to trading differed among the farmers interviewed. Some felt that dairy cows are more at risk to disease compared to beef animals due to the pressure they are under to produce milk and due to their proximity to one another in a milking parlour. Furthermore, some felt that a farmer needs to be more aware of standards and disease profile when it comes to breeding animals as the animal will be with them on the farm a lot longer than finishers would be. Some also pointed out that breeding animals are moved around more often, through marts, and thus have a higher disease risk profile compared to dairy cows who have very few movements across a small number of yards. Such farmers stated that they ask more questions as a result, to find out as much as they can about the breed, in so far back as the genetics of the grandmother. Lastly, others expressed that with a beef finishing line, the cattle will still fatten, finish and sell, even in the event of a TB outbreak, so there is less pressure on that type of farmer.

Age was also perceived to be a risk factor, with younger animals believed to be more at risk for TB and other diseases by some farmers, whilst others believed that older animals have a weakened immunity and thus are more susceptible to disease. Buying from a herd with younger animals was perceived to be safer by some farmers, when it came to disease risk profile, as they had never experienced sickness in younger animals that they had

bought in, in the past. Farmers also held the belief that one must be more cautious about TB and other diseases with breeding animals, as opposed to finishing animals, as they need to be clear of such diseases to be 'moved on'. They felt that a build-up of young calves, not clear of disease, in their farmyard would be very stressful as they would not have the facilities to keep them.

*P13: "I suppose maybe are milking cows and things are they more vulnerable? when they are probably coming under a bit more stress and things, and are together more often, inside in milking parlours, they come together more often than beef cattle that are being killed and fed finished cattle, so they're never under stress like"*

*P7: "Yeah calves generally are very young animals and would have a minimum risk of TB, whereas older animals have a larger risk, but only the ones that are exposed. Only with regard to exposure within the herd, like I might consider purchasing calves from a farm that has a somewhat of a history of TB within the herd, if the calves are young but I wouldn't consider purchasing replacement heifers from that herd because they've had more exposure to the environment within that herd"*

*P20: Well, I suppose a breeding animal you are always going to be much more careful in the sense that they are going to hang around the herd for a long time, at least that's what you're hoping. The finishers might only be there for 6 or 9 months, whatever the case might be I don't buy any beef stock but the logical would tell you that the breeding animal at least you have to be a lot more careful there because you're keeping them for a lot longer, they are costing you more and having more of an impact on your herd"*

#### **Theme 6: Buyer-Seller Information Preferences**

Most farmers interviewed expressed that they would like as much (truthful) information as possible from the vendor, such as the IBR, TB status/history of the herd, knowledge about the neighbours' herd and geographical area, the date of the last TB test, Johnes disease and BVD status, vaccination status, the history of the breed, the diet of the herd, ICBF data, the EBI, somatic cell count, and lameness. If the vendor was not willing to give a farmer such information, many interviewees expressed that they would not buy off that vendor. However, it was mentioned that farmers differ in terms of what they might place high up on their priority list, so it is very farmer-specific when it comes to buying and selling. One piece of information that some farmers felt should not be made mandatory when it came to the vendor, was the inclusion of the TB herd health status up on the boards at marts. Others felt that this information should be showcased at marts to protect

the buyer from purchasing poor stock. Lastly, it was raised that farmers should be able to ask the vendor for a disease report of their herd; something they felt could be easily generated by a co-op, that the vendor could not 'lie about'.

*P11: "So let's say from the milk, sides of things, just to give you an example. I know, that's what you're asking. Like, if we can get a co-op performance report that he can't lie about, like those figures are generated by the co-op itself, and there's very few of them that he could shuffle anyway, so if I get that, I know, from my point of view, exactly what his herd is doing. But at the moment, as far as I know, I can't say to him, "Can you give me, can you give me a disease report".*

*P18: "An official record. of the vaccinations, like a vet report to say he has purchased these vaccinations. And obviously, ideally, the amount of reactors that he's had over a 10-year period or whatever"*

*P22: "Health status of that farm. We would, we would be looking at that. And I do think that we should maybe have easier access to the TB status of that farm. Like I said, either through ag food or ICBF, I think that would be a huge step forward for this country, maybe to make it common practice. So that's because there's a lot of people that we'd know, from selling heifer calves there, we would sell a lot of heifer calves every year. And people don't ask us the question "Whats the TB status of your herd? Like "Are we clear when we can sell it?", but we might have been only clear for six months like so. I think if it was if it was made more mainstream data, then it would people would be more conscious to ask the question"*

## DISCUSSION

The importance of investigating farmers' perceptions, attitudes and practices concerning animal health and disease to find effective ways of containing infections is more relevant than ever, with the rise of bTB in Ireland. To date, few qualitative studies have sought to understand why farmers reason and act the way they do when it comes to risk-based trading. This study therefore explored dairy farmers views of i) animal disease transmission when trading, specifically bTB; (ii) the type of information they seek/provide when trading and (iii) whether the bTB herd history and geographical location are considered when buying in new stock. These stock would be purchased for breeding purposes with a view to be retained for several years. Overall, findings revealed that Irish dairy farmers were conscious of animal health status when trading and declared being particularly mindful of an animal's overall appearance, vaccination and breeding status, as well as their genetic profile. Similarly, Coleman and colleagues [43] found that some farmers choose animal health over economic gains, preferring to pay a higher price for the

animal to minimise disease risk. The farmers in this study were also mindful of who the vendor was and the bTB status of that respective vendors' herd. This finding is quite novel considering many of the social science studies conducted to date have generally focused on farmers' attitudes towards biosecurity as a means of disease control [44-46], however, our study shows that farmers are also responding to bTB control through their considerations of who they are trading with and the vendors' bTB history – showing that positive risk-based trading practices exist amongst dairy farmers in Ireland, despite no official policy in place as of yet, and stated opposition from farm representative organisations.

Throughout the literature the importance of the wider social context has emerged as being central to our understanding of farmers' attitudes towards bTB and its control [45-48]. This is evident in our study in that farmers were selective about who they traded with and where they traded, stating a preference for trading practices between farms than at local marts, and with those they could trust and were familiar with. This finding is welcomed considering an Irish study examining whether within-herd measures combined with risk-based trading could effectively control Johne's disease spread within and between dairy cattle herds found that risk-based trading effectively reduced the increase in herd prevalence over a 10-year-period [49], like that of their French counterparts [50]. However, it is important to note that some farmers alluded to the fact that they would never truly know whether a vendor is being honest about the bTB history of their herd. As such, social trust, which represents whether citizens have confidence in their social community and other individuals within it [51], is questioned by dairy farmers when trading, however it seemed that whether they choose to accept the information provided at face value and trade with other farmers was ultimately up to them, as there was no means of knowing otherwise. They did not seem aware of the herd categorisation score assigned to every herd every year. This shows that the decision-making power of dairy farmers is perhaps limited because the incidence and prevalence of bTB is inextricably linked to social factors outside of their control, such as farmer-to-farmer trust.

Beyond social factors, individual farmer traits also played a role in whether dairy farmers choose to trade cattle in this study. Unlike past research which has reported that a majority of farmers are not convinced that moving cattle will spread bTB, a view held more strongly in high incidence areas [7-52], the dairy farmers in this study were aware that trading animals represents a key factor for infectious disease transmission; a key practice that has indeed been shown to increase risk in various

studies to date [70-54], with marts representing one of the most common causes of disease spread [55]. Fear of introducing bTB into one's herd was listed in this study as one of the main reasons for choosing not to trade with other farmers or in mart settings. The heightened and persistent threat of diseases, such as bTB, has been shown to intensify stress among farmers and their families, not only due to its financial ramifications, but also due to the psychological impact of losing livestock, a sense of losing control and the social stigma [56]. As such, our finding is perhaps not surprising considering a bTB outbreak on farm necessitates additional workload, with the need for additional feed and accommodation, and repeated testing and affects when farmers are permitted to trade again. A minority of farmers, however, did hold a contrary view, in that they dismissed the idea of bTB when trading due to a lack of knowledge or a lack of current (in the past 5 years or more) bTB incidence within their herd. Perhaps this finding shows that certain dairy farmers in Ireland are experiencing concern fatigue when it comes to bTB; a phenomenon that has been noted by other researchers in this field [56,57]. Due to the length of time farmers in Ireland are dealing with bTB, it is quite possible that it is no longer considered a new problem for them.

The dairy farmers in this study were confident that cattle movement, in various forms (mart, farmer-to dealer interactions, cross-continental) is linked to infectious disease spread, particularly bTB. Unlike other studies which have reported that farmers believe that diseases occur at random and are not linked to farmers' own actions or practices [58,59], the participants in this study felt that increased dairy herd sizes, herd blending practices and moving animals from hotspot areas of high bTB incidence to an area of low bTB incidence were problematic for bovine disease spread; all of which have been previously identified as risk factors for bTB [7-60]. This finding demonstrates that the farmers in this study are quite aware of the risk factors associated with bTB spread. Beyond farmer behaviour, many also felt that moving animals from one environment to another causes them stress making them more susceptible to disease and subsequent disease spread. Wildlife was also perceived to play a role in bTB spread, with many airing frustrations at the lack of a badger surveillance system in Ireland. The same feelings towards wildlife have also been illuminated in the United Kingdom and Spain, where it has been demonstrated that badgers and other forms of wildlife (e.g., boars) play a crucial role in the maintenance of the bTB endemicity [61] [7-62]. Although, the contribution of wildlife to the bTB maintenance is well established, the relative importance of cattle to cattle transmission has assumed a greater

importance as herd size has increased (Casey et al., 2025 under review). The role of trade is inextricably linked to the role of cattle to cattle transmission. Therefore, there is a pressing need to learn more about how farmers behave when trading with other farmers or in other settings such as marts, in Ireland.

Lastly, government protocols around the 30-day pre bTB test and the perceived slow rate at which animals are removed from farms following a positive bTB test were believed to be a cause of disease spread. This finding illustrates a lack of connect with DAFM protocols following the identification of a reactor as farmers are required to isolate all reactors as soon as they have been found and clean and disinfect the farm; both of which would prevent any disease spread. As such, this perceived challenge raised in the interviews is within the control of the farmer, and perhaps shows that there is a need for DAFM to further educate farmers on the sequence of events following a positive reactor.

Perceived protective positive behaviours, such as operating a closed herd, buying from likeminded people and monitoring hotspot areas of high disease incidence, were considered favourable ways of minimising disease spread. Like the work of Brennan and colleagues (2016), this finding shows that some farmers feel they can affect whether they get diseases on their farm, through their own personal behaviours and belief systems. However, some felt that dairy farmers need to be accepting of the inevitable occurrence of disease that will spread on farm when trading animals. This result shows that some dairy farmers may rely on their own perceptions of risk in situations where they do not believe that disease can be controlled. Animal health advisors, such as private veterinary practitioners, clearly have a role to play in advising such farmers accordingly when trading animals. There is a need for animal health advisors to focus on communication around explaining the effect of uncertainties and the best course of action accounting for these ambiguities.

Findings from this study also suggest that most farmers understand the importance of sharing and seeking TB herd history. As this disclosure is currently voluntary, the importance of trust and honesty were highlighted in their responses. This is reflective of the 'good farmer concept' [63,64], where symbolic elements, such as 'hard work' and 'honesty' are core values within the farming community [65,66]. Previous research also suggest that farmers tend to trust information received from peers within their farming community [67,68]. However, there was equally an awareness from respondents, that those who offered limited TB information were potentially hiding

unfavourable TB herd histories. Considering the impact of buying in a high-risk animal to a herd [69,70] and the wider neighbourhood [71,72] it is a concern that farmers must rely upon the vendors trustworthiness to disclose the herds TB history. In contrast, the ICBF performance indicators are a good example of where information enables farmers to make carefully considered informed decisions on, for example, the selection of breeding bulls [73].

Although most of the respondents felt comfortable asking questions regarding the animal's testing and bTB herd history, some reported feeling 'awkward'. This is likely due to the long-standing negative associations surrounding TB. There is evidence of deeply rooted social stigma associated with human tuberculosis in Ireland [74]. Negative feelings such as 'blame' and 'shame' were also previously reported from the farming community in relation to bovine TB breakdowns [56-75]. These generalised negative emotions associated with TB may explain a reluctance by some farmers to discuss or ask questions about bovine TB when purchasing animals.

Recent research [14] revealed that information on disease and financial compensation have little influence on purchase decisions, while farmer perceptions of good farming had a greater impact on purchasing decisions. The responses from our study indicate that most of the farmers were asking questions to the vendor regarding bTB, illustrating their understanding regarding the risk of purchase and possibly demonstrating their effort to fulfil 'good farming' practices. There is evidence that the concept of the 'good farmer' can evolve and change over time [64] [76,77]. The widespread integration of bTB information within a purchase conversation has the potential to evolve the 'good farmer', increasing acceptance to share bTB information, to protect herds from bTB. The benefits of disease reporting and disease data sharing are widely accepted in relation to other human and animal diseases [78, 79]. Enhanced sharing of bTB information within the farming community could also have positive effects in terms of TB biosecurity at a local and national level.

Furthermore, this research study found that farmers wanted access to a more formalised approach when seeking bTB herd information. This illustrates that while farmers typically value and trust information from vendors, they would also value additional opportunities to verify bTB information independently. Our findings correspond with previous research [80] which investigated information seeking behaviour of farmers and identified that farmers utilised more sources of information when purchases were considered, 'expensive, novel or risky purchases', this included machinery and livestock purchases.

Considering the potential impact of livestock purchases to a herd's disease status, a multi-information seeking approach could enhance livestock decision making and improve biosecurity at herd level.

Results from the current study also highlighted variations among farmers when considering the geographical area where they purchase livestock. This aligns with previous research findings [66] which identified diverse livestock purchasing approaches by farmers. There is an increasing awareness that livestock purchase decisions are complex, and frequently dependent upon longstanding trusted relationships and factors that satisfy the established business needs of a particular farm system [81]. This indicates that geographical considerations alone currently play a limited role in the overall purchase decision. However, there is some evidence of geographical considerations when trading livestock within larger countries, this was typically associated with distance from markets [82,83]. There is limited evidence available suggesting that farmers consider disease risk in relation to geographical regions when purchasing livestock.

The lack of geographical consideration in relation to purchasing livestock may indicate a lack of awareness within the farming community as to the regional variations associated with the incidence of bovine TB disease [84]. This unfortunately can result in newly purchased animals 'seeding' infection into a locality [85], infecting other local herds [86] and spilling over into the wildlife population [87]. The important development of Whole Genome Sequencing (WGS) [88] has enabled the identification of bTB strains and can assist when determining the geographical source of bTB strains. Integrating WGS knowledge into farmers current understanding of bTB transmission pathways may be useful and improve livestock purchase decisions. An increased awareness of the national and local bTB herd incidence levels may provide an opportunity for communities to acknowledge and safeguard areas where bTB levels are low. In keeping with the good farmer ideology, cautious purchase from lower incident areas could be encouraged within a community to protect its disease status and safeguard local farms. Lastly, there was an overall lack of awareness regarding the availability of geographical information in relation to bovine TB breakdowns, which is released quarterly by DAFM [84], and the Emerging Hotspot map produced by The Centre for Veterinary Epidemiology and Risk Analysis (CVERA) [7-95]. This perceived lack of geographical TB information appears to discourage some farmers from considering the area where they purchase cattle from. Instead, there was a reliance on purchasing from 'trusted sources' such as friends or from the local area.

The responses clearly show that farmers have an awareness of TB risk factors [89] such as 'recent TB test results' or 'badger disturbance' within an area. However, the significance and duration of TB risk within a geographic area was not fully described. This may indicate a lack of understanding in relation to the duration of TB risk factors associated with a TB breakdown [90]. Previous studies have also noted that there is often a misalignment between scientific information available and farmers understanding about bovine TB [75]. Farmers may be more likely to integrate geographical considerations into their purchase decisions if they better understand the significance of TB risk from higher risk areas and are more easily able to access this information.

With respect to animal class risk profile and its relevance to trading, perceptions varied among the dairy farmers interviewed. Dairy cows compared to beef finishers were perceived by some to represent a higher disease risk due to milk production pressures and their proximity to one another in a milking parlour. This opinion corresponds with the opinions of 70 world-leading bovine welfare experts based in 23 countries who rated the overall likelihood of a negative welfare state (i.e., welfare risk) to be higher in animals from dairy herds than from beef herds [91]. Like the farmers in our study, the toll of milk production on the welfare state of animals in the dairy industry was believed to be linked to negative welfare states. Contrary to this view, some of the respondents in the current study felt that farmer awareness of the disease profile linked to breeding animals needs to be heightened as such animals are moved around more often, through marts, and thus have a higher disease risk and will be on the farm a lot longer than finishers would be. The role of marts in the spread of bovine disease has been documented in the literature [55], thus highlighting that the farmers in this study were aware of how animal diseases can spread through trade and which environments are at most at play. However, some expressed that with a beef finishing line, the cattle will still fatten, finish and sell, even in the event of a TB outbreak, so there is less pressure on that type of farmer. It is clear from this finding that TB risk, with respect to trade, is not perceived as uniform across beef and dairy animals. Lastly, age was perceived to be a risk factor for disease when trading, with many believing that older animals are more susceptible to disease due to weakened immunities; a finding that corroborates the extant literature [92]. Buying from a herd with younger animals was perceived to be safer by some farmers as they had never experienced sickness in younger animals that they had bought in, in the past.

When it came to buyer-seller information, some of

the participants in this study also expressed a desire not to display the TB herd health status of the animals being sold at the mart as this could tarnish their reputation in a very public manner in the presence of their peers, whilst others felt it was necessary to showcase such information to safeguard their herds against disease. Despite its primary role as a venue for selling livestock, the mart has been identified as an important space for the farming community to come together to socialise, network and participate in information exchange [93]. At the mart, the selling farmer's reputation or appearance is often used as a proxy to judge their farming, and 'good farmers' are often associated with being trustworthy, honest and fair [94]. This may explain the reason for why certain farmers in this study did not want the health status of their animals showcased, for fear of reputational damage amongst their farming peers. Lastly, it was suggested that a standardised disease report might be a suitable way of communicating herd health information during the sale of cattle. Many felt that this would mitigate the worry of dishonesty surrounding the true status of the cattle as well as remove the worry of the public display of the disease status for the selling farmer.

## CONCLUSIONS

Overall, results from this study reveal dairy farmers perceptions of risk-based trading in Ireland, and its relevance to animal disease. While our research highlights that most of the study sample were conscious of good risk-based trading practice, a few gaps remain. To further investigate our findings and develop progressive next steps, enlarging the dataset with more primary qualitative work is necessary as the results found here may not translate to a wider spectrum of dairy farmers and may not fully represent how prevalent these beliefs are. New research should therefore address two broader research questions with a wider array of dairy farmers, as well as farmers from other farming sectors who routinely engage in trading practice, such as beef. Such questions should include: (i) what factors influence current farmer decision-making on risk-based trading practises? and (ii) what strategies would farmers like to see implemented to drive change towards a solution? This involves understanding what actions farmers said they already consider/take? as well as their opinions about what other actors, such as policymakers, should be doing to help and support them in tackling animal disease when trading. To conclude however, it is important to note that the current study was the first of its kind to explore farmers' views of risk-based trading and gleaned valuable insights on the status of those views in Ireland. In doing so, we have contributed to the literature on the important role of risk-based trading

in rural animal disease contexts, through the lens of social science, which clearly provided ways of discovering and illustrating this topic in a more meaningful way.

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