



# Johne's disease in the eyes of Irish cattle farmers: A qualitative narrative research approach to understanding implications for disease management



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## ABSTRACT

Bovine Johne's Disease (JD) is a disease characterised by chronic granulomatous enteritis which manifests clinically as a protein-losing enteropathy causing diarrhoea, hypoproteinaemia, emaciation and, eventually death. Some research exists to suggest that the aetiologic pathogen *Mycobacterium avium* subspecies *paratuberculosis* may pose a zoonotic risk. Nationally coordinated control programmes have been introduced in many of the major milk producing countries across the world. However, JD is challenging to control in infected herds owing to limitations of diagnostic tests and the long incubation period of the disease. Internationally, research increasingly recognises that improved understanding of farmers' subjective views and behaviours may inform and enhance disease management strategies and support the identification and implementation of best practice at farm level. The aim of this study was to use qualitative research methods to explore the values and knowledges of farmers relative to the control of JD at farm level. The Biographical Narrative Interpretive Method (BNIM) was used to generate data from both infected and presumed uninfected farms in Ireland. Qualitative analysis revealed that cultural and social capital informed farmers' decisions on whether to introduce control and preventive measures. Cultural capital refers to the pride and esteem farmers associate with particular objects and actions whereas social capital is the value that farmers associate with social relationships with others. On-farm controls were often evaluated by farmers as impractical and were frequently at odds with farmers' knowledge of calf management. Knowledge from farmers of infected herds did not disseminate among peer farmers. Owners of herds believed to be uninfected expressed a view that controls and preventive measures were not worthy of adoption until there was clear evidence of JD in the herd. These findings highlight important barriers and potential aids to prevention and control in both infected and uninfected herds.

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## 1. Introduction

Bovine paratuberculosis or Johne's Disease (JD) is a disease characterised by chronic granulomatous enteritis which manifests clinically as a protein-losing enteropathy causing diarrhoea, hypoproteinaemia, emaciation and, eventually death (Sweeney, 2011). Adverse effects on animal productivity include lower milk yield (McAloon et al., 2016c), higher cull rates (Hendrick et al., 2005; Raizman et al., 2007), reduced value for culled animals (Richardson

and More, 2009), possible adverse effects on fertility (Johnson-Ifearefulundu et al., 2000) and losses due to continued spread of infection. These are key economic drivers in promoting control of the disease at farm level. In addition, current scientific knowledge suggests that the aetiologic pathogen *Mycobacterium avium* subspecies *paratuberculosis* (MAP) may pose a zoonotic risk (Chiodini et al., 2012), although the likelihood and nature of the impact on human health remains uncertain (Waddell et al., 2016).

Nationally coordinated control programmes have been introduced in many of the major milk producing countries across the world (Geraghty et al., 2014). However, JD is challenging to control in infected herds owing to limitations of diagnostic tests and the long incubation period of the disease. In Ireland, leadership

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and coordination of non-regulatory animal health issues is provided by Animal Health Ireland (AHI) (More et al., 2011). Following the formation of AHI, an initial Policy Delphi and farmer priority identification study was carried out which identified JD as one of a number of high priority animal health issues (More et al., 2010). Consequently, a voluntary Johne's Disease national control programme was developed and introduced in 2013. Currently, herd level true prevalence among dairy farms enrolled in the national JD control programme is estimated at 28% (McAloon et al., 2016b).

It has been recognised that the translation of scientific 'best practice' into action at farm level is an area of research in herd health and production medicine that has been neglected until relatively recently (Le Blanc et al., 2006). There is growing acceptance that communicating potential economic benefits is not sufficient in encouraging farmer engagement with disease control and prevention programmes (Lam et al., 2011). This is because farmers are not solely influenced by economic consequences of management changes (Van Asseldonk et al., 2010), but also by social and cultural consequences (Vanclay, 2004). Within the sphere of udder health and mastitis, it is recognised that a deeper understanding of farmer motivations and attitudes is necessary to effect change on farm (Kristensen and Jakobsen, 2011). Furthermore, studies of bovine tuberculosis control programmes have suggested that understanding farmer behaviour may assist in the development of better disease control policy (Enticott, 2008). The necessity of exploring farmer behaviour is likely to be of particular importance in the control of non-statutory diseases such as JD.

Quantitative research techniques, such as the use of surveys, are useful in generating statistically representative data. However, qualitative methods are more appropriate for exploring values, perspectives, experiences and management practices or choices (Vaarst et al., 2002). Within qualitative research, various techniques can be used to generate data. Narrative interviewing aims to "reconstruct social events from the perspective of informants as directly as possible" (Jovchelovitch and Bauer, 2000). With minimal prompting from the interviewer, narrative interviewing encourages "storytelling" from the interviewees' own perspectives, describing events in their own words and "emphasizing actions or participants which they regard as being significant" (Bates, 2004). As a result, authentic data in relation to interviewees' real-life experiences and views are more accessible to interviewers.

The aim of this study was to explore the values and knowledge constructs of Irish farmers relevant to JD, through qualitative analysis of narrative interviews conducted in 2013.

## 2. Materials and methods

### 2.1. Interviewee selection

In contrast to quantitative methods, which frequently rely on randomised sampling of a representative proportion of the population, qualitative methods usually generate data from purposive samples selected to represent a diversity of criteria. Previous studies examining farmers' approaches to disease management have focused on factors such as gender, age, marital status, farm size, type of enterprise and, whether or not the herd has previously tested positive for a disease (Wraight et al., 2000; Sayers et al., 2012; Enticott et al., 2015). The study did not seek to analyse a particular cohort of the farming population, therefore, following the prior literature, 12 case study farmers were purposively selected to represent a diversity of criteria including herd infection status, type of enterprise, marital status, herd-size and age (Table 1). The number of case studies chosen was in excess of previous studies using in-depth narrative interviewing methodologies (McDonald et al., 2014; McDonald and Macken-Walsh, 2016). Significant saturation

**Table 1**  
Characteristics of farmers interviewed using BNIM.

	Number of Farmers
Age	
≤40 yrs	3
41–50 yrs	5
51–60 yrs	3
61–70 yrs	1
Marital Status	
Married	8
Single ('Bachelor' Farmers)	3
Widowed	1
Farm Type	
Dairy	8
Beef	4
Infection Status	
Infected	4
Presumed uninfected	8

in the data was evident, which is expected with 12 purposive qualitative interviews (Guest et al., 2006). All farmer case-studies were clients of Teagasc advisory services and all interviewees were male.

### 2.2. Interview method

Data were collected using the Biographical Narrative Interpretive Method (Wengraf, 2001). This is a specific type of interviewing methodology where the interviewer asks a single question used to induce narrative (SQUIN) from the interviewee. However, as the main focus is on the participant's story, the interviewer refrains from interrupting and provides minimal prompting. The objective is to obtain an approximately 1.5–2-h interview which details the 'life experiences' of the interviewee. In this case the question asked was "I'm a researcher who is interested in Johne's disease and in animal diseases. Can you tell me your opinions about Johne's disease and any stories about animal diseases on your farm?" Interviews were conducted by one of the co-authors (LM), a sociologist with specialist training in BNIM techniques. Interviews were recorded, transcribed and anonymised for analysis.

### 2.3. Theoretical framework

Qualitative analysis is preceded by the development of a theoretical framework (Green, 2014). The analysis for the present study draws from a theoretical framework that was developed by the group of co-authors and is presented elsewhere (Macken-Walsh et al., under review). Briefly, the framework aimed to explore farmers' knowledge constructs and values relevant to JD in order to understand how these might influence their beliefs and behaviour. Knowledge constructs were further divided into knowledge claims, cultural scripts and practical consciousness. Knowledge claims are statements of what is 'known' to be true or false; a cultural script is defined as 'culturally shared expression, story or expected event. . . that provides rationale for a particular issue or course of action' (Vanclay and Enticott, 2011, p256). Practical consciousness is the knowledge that informs our everyday routines and actions which often resists verbalisation (Giddens 1984). Values are what motivate farmers and are further divided into cultural capital, social capital and esteem farmers associate with particular objects and actions; social capital is the value that farmers associate with social relationships with others; and economic capital is the value associated with monetary wealth.

**Table 2**  
Distribution of responses to themes from 12 interviewees.

Theme	Number of responses for theme
1.1 Knowledge constructs	11
1.2 Sources and Transmission of JD	10
2.1 The Disease	9
2.2 Stigma	4
2.3 Controls	7
3.1 Industry	6
3.2 Risk to farm	9

## 2.4. Analysis

Data analysis was conducted using thematic analysis (Braun and Clarke, 2008). Initially, the first author read the data to become familiar with the material. These data were examined with a focus on the objective of the study, (i.e. knowledge and values relevant to JD). Codes were initially established and subsequently developed into themes. Findings and categories were discussed with an experienced sociologist (AMW) to improve reliability. Consistent with the aims of qualitative research, the analysis did not involve ranking the themes in order of importance or significance. Rather, the analysis focused on how the themes manifested in the data, their inter-relationships and how they were important to different issues relevant to disease management.

## 3. Results

There was evidence in the data of all the concepts contained in the theoretical framework that guided the analysis. Table 2 shows the distribution of themes across the case study farmers. An analysis of how the themes manifested in the data, their inter-relationships and their importance to disease management is presented:

### 3.1. Knowledge and experiences

#### 3.1.1. Construction of knowledge

Farmer knowledge constructs of JD were assimilated from both intrinsic (based on their own experience and/or reasoning) and extrinsic sources. They regularly drew upon the expertise of extrinsic knowledge sources including veterinarians, farm advisors and discussion groups which informed how they understood JD and disease control measures. Farmers also placed strong emphasis on their own experiences and reasoning with regard to JD. Informal talk between farmers was shown to have an important role in disseminating knowledge of JD. An illustrative example is how case-study farmer 8 with a presumed uninfected herd, associated his own lack of awareness and knowledge of JD with the fact that he did not know of any farmers who were dealing with the disease on their farm:

*“if there was an outbreak of Johne’s disease, a bad outbreak, they’d (one of the farmers in the discussion group) know about it then. And people would get talking and one farmer would tell another [you know]” (Case study farmer 8)*

However, whilst farmers spoke often about the experiences of other farmers dealing with bovine diseases other than JD (e.g. calf pneumonia), the interviews indicate that secrecy and stigma affect knowledge exchange about JD in particular. This is evident in the following interview extract where a farmer says that JD is highly prevalent across farms and that farmers are concealing the presence of JD from other farmers. This view was also expressed by all other farmers with infected herds who took part in the study;

*“Everyone has Johne’s and they’re all keeping it quiet” (Case study farmer 2)*

#### 3.2.1. Sources and transmission of JD

Farmers demonstrated an intuitive approach to the identification of risk. This was conveyed in claims farmers made relating to breeds of animals they perceived to represent a greater risk of being infected with JD:

*“I wouldn’t buy Limousins [‘cos](because) they’re supposed to be the real carrier of it” (Case study farmer 2)*

Case study farmers demonstrated an awareness of biosecurity relative to all infectious diseases including JD:

*“I suppose the biggest one would be keeping a closed herd. That would be the most important. For all the diseases” (Case study farmer 8)*

Often, this awareness was extrapolated from previous negative experiences subsequent to the purchase of animals on the farm:

*“I think I lost 24, 27 calves one winter [erm] with virus pneumonia [er] it was directly as a result of calves we bought in [like] . . . it was a harsh lesson but it was a valuable lesson” (Case study farmer 9)*

Farmers of ‘uninfected’ herds claimed “not to know much” about JD but often summarised the same key points that are highlighted by the veterinary scientific community regarding the epidemiology of the disease. However, case-study farmers operating both infected and ‘uninfected’ herds tended to emphasise the role of milk and colostrum in the transmission of JD;

*“It causes the cow to waste away and die. It passed through the milk, the test for it is unreliable” (Case study farmer 6)*

There was little mention of the faecal-oral transmission route of JD that is a key focus of the veterinary scientific community, except in the narratives of farmer case-studies that had herds with a confirmed infection and therefore JD specific contact with veterinary scientific knowledge;

*“the vet was out with me . . . and he said ‘you know it can travel through faeces” (Case study farmer 9)*

In addition to veterinary scientific knowledge, case study farmers operating infected herds placed emphasis on their own knowledge derived from experiences and reasoning. However, this knowledge did not appear to transfer (through peer relationships, for example) between infected farms or between infected and uninfected farms. Despite the apparent lack of knowledge transmission between farms, farmers were aware that general principles of biosecurity were likely to reduce the chances of introducing JD (and other diseases) to their herd.

### 3.3. JD and farmers’ values

#### 3.3.1. The disease

Farmers valued their animals and their farms for economic, social and cultural reasons. This was evident in interviews with all farmers regardless if they had an infected or presumed uninfected herd. Farmers frequently expressed cultural capital (pride) in having good quality animals on the farm but also in having what they subjectively perceived as a ‘good’ farm. Indeed, interview data for this study implies that having social status as a ‘good farmer’ is a powerful driver of herd health management practices among Irish farmers, confirming existing studies in the literature.

*“Anyone that comes visiting from anywhere, they’re brought for a drive through the farm” (Case study farmer 1)*

Farmers dealing with infected herds frequently described feelings of emotional distress associated with the presence of infected animals on the farm. These feelings were particularly prevalent in dealing with clinical cases and related to the helplessness associated with trying to manage an incurable disease;

*“It’s like being at the side of the road at a car accident and somebody, somebody dying . . . and you’re still waiting for the fire brigade to come and cut them out. . . you feel helpless to do anything . . . it’s very soul destroying” (Case study farmer 5)*

The presence of overt clinical cases of JD on the farm was associated with a negative impact on social capital. Farmers expressed anxiety related to the fact that clinically affected animals often looked like they were being neglected and not properly cared for, and were concerned about ‘what others might think’ of them and their capabilities as a farmer as a result;

*“there’s nothing worse to have someone standing next to you and there’s this cow that looks miserable . . . they must be saying I didn’t feed that cow in a month” (Case study farmer 5)*

The significance of economic capital in relation to JD was primarily communicated as the monetary investment required to control JD on infected farms and was less evident as the real and potential production costs associated with the disease:

*“This is all down to money as well [like], 6 or 700 euros of a cost (for testing) per year and when you [aint] (have not) got money, you can’t do these things.” (Case study farmer 10)*

### 3.3.2. Stigma

The concept of a stigma attached to the presence of JD on a farm was consistent throughout the interviews of farmers of infected farms. There was also evidence that this stigma was reinforced by farm advisors and veterinarians;

*“they came the . . . advisors and says ‘we’ll pass you over this year (as a hosting farm for a discussion group farm walk), you know with the disease and until we get this Johne’s thing sorted or we can deal with it’. You’re kind of shunned [like], you’re a diseased farm” (Case study farmer 3)*

Among infected farms, farmers felt that the problem was much more significant than other farmers and industry stakeholders believed, and that the industry and/or government was not addressing the issue because of the potential negative impacts on the industry;

*“Really people don’t want to talk about it. The vets don’t want to talk about it, the government don’t want to talk about it because they know ‘tis huge. You know half the country might have to depopulate.” (Case study farmer 2)*

### 3.3.3. The controls

In herds not believed to be infected, taking action to control JD was viewed as having both positive and negative outcomes for farmers. Farmers who expressed positive attitudes about the control programme did so because it had a positive impact on the industry and because it was seen as “the right thing to do”;

*“I just felt it was the right thing to do. Simple as that. For myself and for my own farm and to be responsible to everybody really [d’ya know] that adopting a policy of [d’ya know], it’s right for the industry you know” (Case study farmer 9)*

However, those that looked at controls in a more negative light highlighted financial losses and capital expenditure associated with the implementation of preventive measures. Capital expenditure presented in the form of time and effort to implement the necessary

changes. Consistent with this, there was a view that many of the changes were impractical and designed by people who had no idea of how a real farm operates;

*“I think these people you know they say you should only give the . . . calf the cow’s milk (from its own dam) don’t be calving 10 or 12 cows at night” (Case study farmer 1)*

In addition, farmers relayed very strong views that implementing changes relevant to the perinatal period were likely to result in negative consequences for calf health. In general, this related to potential difficulties in colostrum administration when practicing dam-only colostrum and snatch calving, and poor performance and failure to thrive of pre-weaned calves as a result of feeding milk replacer over whole milk;

*“which is the better situation losing calves from weakness because they’re not feeding them properly with powdered milk or Johne’s when they’re 5 or 6 years of age? . . . ‘tis (it is) quite frustrating at times” (Case study farmer 10)*

There existed a spectrum of advice in terms of the ‘aggression’ or ‘zealousness’ by which farmers had been advised to control the disease;

*“I got advice from different vets . . . all the way from ‘listen just test every 12 months through the blood, cull through the blood and leave it at that, through to [eh] total (herd) cull” (Case study farmer 3)*

Several farmers managing infected herds had been advised to depopulate the entire herd. Farmers appeared to be very resistant to this measure and knowledge in the form of cultural scripts were narrated which rationalised their resistance to it;

*“when the rabbits have it, what’s the point in culling?” (Case study farmer 5)*

On farm controls were considered numerous and impractical. Farmers explained that they could not implement all of the management changes and remain profitable. There were two possible outcomes; some farmers did not want to implement any changes; or, the recommendations were ‘filtered’ and the most practical were implemented:

*“there’s a lot of stuff in it that is kind of impractical from a management point of view. Like from a management point of view if you were to do everything that’s recommended on the list, basically you’d never get anything done because you’d spend your time changing clothes, and washing boots and everything from one shed to the next” (Case study farmer 11)*

*“you’re going to have to filter out how much of that you can actually [erm] apply to your own farm like” (Case study farmer 11)*

## 3.4. Perception of the risk posed by JD to the farm and to the industry

### 3.4.1. Risk to the industry – zoonotic potential

In relation to the risk of JD to the farming industry, farmers viewed the disease along two major threads. The first related to the zoonotic potential of the disease and was associated with fears over the potential impact that news of this link might have on consumer demand for farm produce and for the farming industry whilst the second related to the risk posed by JD to their own farm;

*“Well the thing that jumped out at me was the link, the possible link between Johne’s and Crohn’s. And that to me is a, I nearly don’t want to talk about it cos (because) it’s so scary the implications” (Case study farmer 9)*

There was a general fear that the zoonotic potential would soon be picked up by the media and presented in a sensationalist manner. Fears over a food scandal evoked imagery of major disease outbreaks such as FMD and BSE:

*“my image is like Foot and Mouth when it came in. Listen the whole thing shuts down, it’s a big disaster. It looks like the end of the world” (Case study farmer 9)*

#### 3.4.2. Risk to the farm

It was evident from their narratives that farmers were exposed to a lot of information on a large and growing list of infectious diseases. The nature of the information relayed in the farmers’ narratives was centred on the potential negative impacts of the disease if it were in the herd:

*“I came home very nervous that all these things were out there and they could all affect you” (Case study farmer 1)*

However, the potential threat of JD to the herd was regarded by some farmers as just another disease from a growing list of potential disease threats to their herd. In this context the farmers expressed a degree of scepticism regarding the importance of many of these diseases:

*“Teagasc (The Irish Agricultural Advisory Service) do be bringing it (JD) up and bringing it up. I’ve come to the conclusion at this stage, there’s going to be another one (disease) next year. There’s going to be another the following year and where does it all stop?” (Case study farmer 12)*

Other farmers further regarded the threat of infectious disease in general as one of many threats and potential risks to the farm or to the farmer:

*“Oh yeah well there’s always a risk. But there’s risks in every walk of life. Like I could be knocked down by a car walking across (to the) milking parlour. There’s always a disease threat to your animals and that’s just the way life is going to be.” (Case study farmer 1)*

The conclusion drawn from this viewpoint of disease is that farmers should wait for evidence of JD in the herd before investing time, money and effort into investigating and controlling the disease:

*“I don’t see anything wrong with my herd that would involve Johnes. The vet comes out to me if there’s something wrong with the cow and if its Johnes, let him tell me it’s Johnes. And then we’ll start doing something about it.” (Case study farmer 12)*

## 4. Discussion

To the authors’ knowledge, this is the first study to date that has used narrative BNIM methodology to explore the knowledge and values of farmers relevant to Johnes’ Disease. These findings build on a recent body of literature utilising qualitative approaches to animal diseases on farm (Shortall et al., 2016; Ritter et al., 2016). The BNIM approach used in the present study was successful in gathering rich datasets that detailed farmer’s knowledges and values.

Significantly, the findings in the present study broadly correspond to the international literature in the fields of biosecurity and infectious diseases. For example, previous studies highlight that farmer perceptions about lack of time to implement measures and poor economic return are important barriers to the implementation of controls for biosecure diseases (Sayers et al., 2013; Shortall et al., 2016). However, the present study also highlights other, non-economic forms of capital that have an important role in informing farmer decisions regarding disease management.

The concept of ‘the good farmer’ has been discussed in the rural sociological literature for many years (Marek, 1966). Within the conceptual framework of the present study, the concept of the ‘good farmer’ manifested as both cultural and social capital. Burton (2004) found that the social capital associated with the perception of a farmer among their peers was a strong motivating factor. In the present study, the presence of clinically affected animals on the farm was highlighted as a concern for farmers, for fear that other farmers would think they were neglecting their animals. It is interesting to note that the clinical picture of the affected JD animal (i.e. protein-losing enteropathy causing progressive weight loss and emaciation) mirrors that of the underfed and ‘neglected’ animal. Interpretation of these clinical signs by fellow farmers as neglect and poor farming practice poses a threat to the social capital of farmers managing JD infected herds. Interestingly, this association between animal disease and social capital also appeared to play a role in the ‘culture of secrecy’ that surrounded JD. Farmers with presumed uninfected herds often attributed their lack of knowledge to the fact that they did not know any infected herds. However, it is currently estimated that just less than 1 in 3 dairy herds are infected (McAloon et al., 2016b), so it is likely that farmers were in contact with farmers managing infected herds but were unaware of this fact because the herd JD status was not openly discussed. A similar phenomenon, (i.e. the limited exchange between peers of information on infected herds) has recently been described in the context of BVD control programmes in UK (Heffernan et al., 2016).

Vanclay (2004) proposed that ‘doing the right thing’ is a strong motivational factor for farmers, a concept that is inherently linked to the cultural capital associated with being a good farmer. Interestingly, cultural capital had both positive and negative implications for how farmers perceived on-farm controls for JD that are advocated as veterinary best practice. For example, some farmers who were interviewed felt that implementing changes relevant to JD was the ‘right thing to do’ for the dairy industry. In contrast however, other farmers voiced the opinion that many of the changes advocated for the control of JD were contrary to good farm management because they were incompatible with their own knowledge and values. Overall, these findings highlight the potential for discordance between what is currently perceived by farmers to be ‘good farm management’ on farms where there is no evidence of JD, and ‘doing the right thing’ for the industry.

This study demonstrated that scientific knowledge, or knowledge provided by extrinsic sources such as vets and advisors, constituted a variable component of the knowledge constructs of farmers. Vanclay (2004) proposed that farmers do not always assume that scientific knowledge is credible, trustworthy or infallible. In the present study, a lack of consistency of advice from extrinsic sources (e.g. vets and advisors) was evident throughout the dataset, a finding that is mirrored by similar studies (Higgins et al., 2014; Shortall et al., 2016). In addition, our study suggests that this ‘mismatch’ in information contributes to the often cynical or dismissive view farmers have of ‘scientific’ knowledge.

Farmers challenged advice when there was discordance between their own knowledge and veterinary scientific knowledge. Often, challenges were voiced using cultural scripts that captured the intrinsic knowledge that was contradictory to scientific information. Vanclay and Enticott (2011) describe 4 types of script commonly used by farmers. In the present study, scripts were most evident as a line of argument which questioned the efficacy, potential for ‘unforeseen’ negative outcomes, and the practicality of interventions that are currently considered scientific best practice. Most notably, the recommendations surrounding neonatal calf management were at odds with farmers’ knowledge about calf rearing. Several knowledge claims were stated by farmers to highlight the potential for negative consequences on calf health with the

introduction of interventions currently considered scientific best practice for control of JD. Furthermore, a number of cultural scripts were used to evaluate the controls as impractical. McAloon et al. (2016) showed that JD controls are likely to result in improved calf health, however, given the opposition to many of these controls evident in the current study, the authors suggest that veterinary advisors actively engage in developing collaborative and innovative ways to address farmers' legitimate concerns in an effort to improve farmers' uptake of JD control measures.

The present study agrees with the findings of other authors who indicate that presentation of the threat of animal diseases to herds in terms of production losses and clinical disease may not be effective in motivating farmers to adopt preventive management changes proposed by veterinarians (Lam et al., 2011). Furthermore, several farmers narrated the impossibility of implementing the wide range of control measures to counter the list of infectious diseases that exist in Ireland. Therefore, farmer's decisions on which diseases to act on varied according to social and cultural factors, including their own intrinsic knowledge of each disease and the extent that they trust extrinsic knowledge sources (e.g. scientists, advisors, vets). The authors suggest that one potential solution could be to integrate disease preventive strategies into group programmes in so far as possible, rather than providing separate, 'competing' control programmes for individual diseases.

Prior to the introduction of the JD control programme in Ireland, AHI introduced a BVD eradication programme which had been successful in reducing the number of persistently infected animals born. However, this programme took a different approach to motivating change on farm, firstly by transitioning from an initial voluntary control programme to a mandatory control programme (Graham et al., 2014) and secondly, by using herd restriction and compensation to effect change with respect to key constraining issues, in particular the retention of persistently infected animals (Clegg et al., 2016). In contrast, the JD programme is a voluntary programme, therefore regulatory solutions and related approaches to affecting change on farm cannot be applied.

However, within the sphere of mastitis and udder health there has been significant progression in the understanding of farmer motivations, and in developing tools and strategies to increase the likelihood of behavioural change (McCoy and Devitt, 2010). These progressions show that control programmes and communication approaches that are cognisant of the social and cultural nature of farming could potentially be more effective. For example, it may be important to recognise activities that farmers' subjectively perceive as "good" and "poor" farming practice and incorporate these activities into communication strategies (Burton et al., 2008). The use of customised farmer-centred communication strategies is now well accepted as a method of introducing controls to improve mastitis control (Lam et al., 2011). In addition, Jansen and Vellema (2011) suggest that a combination of central and indirect communication strategies using purpose designed tools or guides and advertisements or "cues" respectively, may be effective in responding to farmers' subjectivities and realities.

## 5. Conclusion

This study adds to the growing body of literature on the social and cultural nature of farming and highlights a range of factors that both help and hinder the adoption of measures to prevent and control JD. Significantly, this paper shows that the concepts of social, cultural and economic capital are deeply embedded in our case-study farmers' framing of JD and influence their decisions about implementing control and preventive measures. The perceived incongruence between neonatal calf management practices advocated for the control of JD, and existing calf management

practices on farm negatively influenced the farmers' perceptions of JD control measures at farm level. In addition, a variety of cultural scripts were narrated by the farmers in our sample showing that control measures could be evaluated by farmers as impractical. Further quantitative assessment could be undertaken to characterize the distribution of the themes identified in this study within the Irish farming population. However, there are limitations to how quantitative methods such as surveys can investigate qualitative themes that require an in-depth and open ended interviewing approach.

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