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‘They've got to be testing and doing something about it’: Farmer and veterinarian views on drivers for Johne’s disease control in dairy herds in England

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'They've got to be testing, and doing something about it': Farmer and veterinarian views on drivers for Johne's disease control in dairy herds in England

ABSTRACT

There needs to be an understanding of the reasons why key stakeholders engage in disease control efforts if disease is to be successfully and sustainably controlled. It is increasingly recognised within veterinary epidemiology and policy making in animal health that these 'people factors' are important influences on the success or otherwise of animal disease control programmes. Research methodologies adopted from the social sciences offer ways to understand this important dimension, through investigating the attitudes and opinions of the key actors involved. The study reported in this paper, based on qualitative interview research, investigates the views of dairy farmers and cattle veterinarians on the drivers and incentives for controlling Johne's disease in English dairy herds. Twenty semi-structured interviews involving 17 dairy farmers and seven veterinarians were conducted in two dairy-intensive regions of England. The findings demonstrate the varied influences of veterinary advice and encouragement; appreciation of the economic cost of the disease at herd level; a voluntary national control plan; and fear of a future consumer food scare as the main reasons to engage in Johne's disease control on dairy farms. The study demonstrates how a combination of a voluntary industry-led control scheme, compulsory participation through retailer and processor contractual requirements, and threats of reputational harm and market loss have strongly influenced farmer and veterinary behaviour in relation to Johne's control without statutory involvement. The findings illustrate the importance of considering the political economy and societal impact of animal disease.

Keywords: Johne's disease; Dairy cattle; Disease control governance; Political economy; Social science; Stakeholder attitudes

1. Introduction

Johne's disease (paratuberculosis) in cattle is a major global animal health challenge, and a complex and costly problem for dairy production across the world (Kennedy, 2011; Geraghty et al., 2014; Whittington et al., 2019). In addition to having a significant impact on dairy cow health and herd productivity as an endemic disease in many countries with intensive dairy industries, there are longstanding (and increasing) concerns about a possible association between the causative organism – *Mycobacterium avium* ssp. *paratuberculosis* (MAP) – and Crohn's disease in humans (Grant et al., 1996; Collins, 2011; Atreya et al., 2014; Kuenstner et al., 2017; Qasem and Naser, 2018). This risk of human infection has mainly been linked to the consumption of contaminated food products derived from cattle, direct contact with infected animals, and possible exposure to sources of environmental contamination including water supplies (Waddell et al., 2015). Considering the animal health and welfare implications of this economically important and endemic infection, and the possible zoonotic implications, there is an urgent need to achieve more effective Johne's control in cattle to reduce the burden of infection. Achieving this ambition will require further understanding of what influences the human actors engaged in managing Johne's disease at farm level and knowing the most important drivers for control.

There has been an increasing appreciation of the benefits of understanding the perspectives of key stakeholders, particularly farmers, in animal disease control efforts across a wide range of animal health and welfare challenges (Garforth, 2015; Ritter et al., 2017). For example, researchers have investigated farmer attitudes and behaviours in relation to the

management of livestock health issues such as mastitis (Jansen and Lam, 2012), bovine tuberculosis (Robinson, 2017a), gastrointestinal parasites (Bellet, 2018), bovine viral diarrhoea (Heffernan et al., 2016), footrot (O'Kane et al., 2017), antimicrobial use (Rell et al., 2020) and colostrum management (Palczynski et al., 2020). The use of social science research methodologies has therefore increasingly been utilised and accepted within veterinary epidemiology. Earlier calls have been heeded from within the discipline to contextualise disease control by appreciating the importance of farmer decision-making and how this influences the demand for, and functionality of, animal health programmes in both the state and private sectors (Meek, 1993; Perry et al., 2001). Animal health economists such as Rushton et al. (2018) advocate the further integration of social science approaches into the economics of animal health policy making, and these approaches help to explain 'why people do what they do' (Rushton, 2017). Furthermore, Rushton et al. (2007) recommend moving toward 'animal health decision-making that includes political, social, economic and technical components in order to ensure that animal health interventions benefit society'.

Moving beyond the confines of veterinary epidemiology and animal health economics, social scientists from a range of disciplinary backgrounds including human geography and rural sociology have further contributed to our understanding of how to place farmers within the political and socioeconomic climate in which they manage their businesses. Rose et al. (2018), having reviewed the literature on farmers' decision-making and behaviours, are critical of research approaches which focus on analysing individual farmer behaviour. Instead, they advocate analysing the collectives within which farmers make decisions within their circles of influence, including farming peers, professional advisors, food manufacturers

and retailers, and the wider economic and political environment in which they make decisions (Rose et al., 2018). It is instructive that this wider framing of farmer decision-making and behaviour in relation to social factors and political economy has commonly been considered by social scientists covering a range of agricultural topics beyond animal health and welfare (e.g. Gasson, 1973; Le Heron, 1989; Burton, 2004; Haggerty et al. 2009). Robinson (2017a, 2017b) provides examples of how a socioeconomic and political economy approach can be applied to livestock disease control using bovine tuberculosis as a case study in the political ecology of health. Others have investigated biosecurity and animal health, revealing multiple layers of complexity in how farmers and their professional advisors manage infectious livestock diseases (e.g. Hamilton et al., 2019; Shortall and Brown, 2020). Qualitative studies combining the views of farmers and veterinarians, potentially highlighting areas of disconnect in outlook and approach, are also becoming more common (Shortall et al., 2018; Charlton and Robinson, 2019; Golding et al., 2019).

A review of the knowledge gaps hampering the prevention and control of Johne's disease similarly highlights the need for social science approaches to better understand the motivations of both farmers and veterinarians affecting participation in Johne's control (Barkema et al., 2017). There have been previous questionnaire-based approaches which examined farmers' reasons to join voluntary Johne's control programmes in the United States (Benjamin et al., 2010), Denmark (Nielsen, 2011) and the Netherlands (Hop et al., 2011). However, there has been a lack of qualitative social science research in this area to date, which can produce richer and deeper understandings of motivations through the two-way interaction of interviewing (May, 2018). Two individual interview-based studies have been conducted in Canada and Ireland investigating farmer attitudes and opinions (Ritter et

al., 2016; McAloon et al., 2017), but to the author's knowledge there has been only one similar interview study also seeking the views of veterinarians on this topic (Roche et al., 2019), and none in the United Kingdom (UK). Johne's disease is recognised to be endemic in the UK (Geraghty et al., 2014) with one study calculating that dairy herd prevalence in Great Britain (GB) (based on tests of bulk milk samples) was 68.3% (Velasova et al., 2017). The aim of this study was therefore to investigate the views and experiences of both dairy farmers and veterinarians on Johne's disease control in England using a qualitative interview research methodology. The objective was to gain a contextualised understanding of how Johne's is viewed at farm level, and how farmers and veterinarians are responding to control it on dairy farms. The data presented in this paper focus specifically on the drivers for participation in active Johne's control efforts such as veterinary advisory visits, milk or animal testing and on-farm husbandry measures, which dairy herd owners conduct and pay for without state compensation.

2. Materials and methods

2.1 *Study area and sample characteristics*

The study was conducted in two dairy production-intensive regions in the south-west (Group A) and Midlands (Group B) of England. A purposive sampling strategy (Marshall, 1996) was used to select a range of dairy farmers with different herd sizes and involving a mix of those known to be already engaged in active Johne's surveillance and control measures, and others who had minimal or no engagement at that point. The farmers were selected from networks of known personal contacts, suggestions from other participants ('snowball sampling' – Noy, 2008), and through 'gatekeepers' (Campbell et al., 2006) such as veterinarians who approached a few of their clients on behalf of the researchers. The

139 veterinarians were likewise recruited through contact networks or snowball sampling. All
140 the farmers interviewed were responsible for the main herd management decisions on their
141 farm. Veterinarians working in both areas were also interviewed according to their
142 involvement in dairy work and willingness to participate in the study. The veterinarians all
143 spent a substantial proportion (or all) of their time employed on dairy farms and
144 represented six different private veterinary practices. Participation in the study was entirely
145 voluntary and confidential, and no rewards or incentives were offered to the participants.

146 2.2 *Data collection and analysis*

147 The interviews were conducted in two phases – between December 2016 and March 2017
148 (Group A), and between November 2017 and November 2018 (Group B). The study was
149 conducted in two parts because the initial phase was conducted in connection with a
150 university degree research project. The findings from this project were deemed so
151 interesting that funding was secured to conduct a subsequent round of interviews. This was
152 added to expand the field of research to another region of England and to triangulate the
153 findings through interviewing another sample of farmers and veterinarians using very
154 similar questions and semi-structured interview structure guide.

155 In total, 17 dairy farmers and seven cattle veterinarians were engaged across 20 semi-
156 structured interviews conducted by a university animal science student (Group A – 9
157 interviews, involving 8 farmers and 2 veterinarians) and the author, an academic
158 veterinarian and social scientist who supervised the initial project (Group B – 11 interviews,
159 involving 9 farmers and 5 veterinarians). Most of the interviews were one-to-one, but there
160 were also several one-to-two person interviews with farmers. The farmer interviews were
161 conducted on farm, and the veterinarians were interviewed in their work base location.

Interviews were conducted until the second interviewer was satisfied that the point of data saturation had been reached (Guest et al., 2006) and no major new themes were being discovered.

The interviews were manually transcribed in full by the interviewers using *NVivo 11* (QSR International (UK) Ltd, London, UK) (Group A) and *f4* software (audiotranskription, Marburg, Germany) (Group B). As far as possible, the interviews were transcribed before the next interview took place to allow reflection on the findings as the research proceeded. This iterative process of interviewing, transcription and preliminary analysis before further interviewing is consistent with a grounded theory approach (Meek, 1993; Glaser and Straus, 2008). All the transcripts were analysed thematically and coded in *NVivo 11* by the author. This involved repeatedly reading and evaluating the transcripts and highlighting key themes and quotes, illustrating the commonalities and contrasts between the opinions and experiences described (Vaismoradi et al., 2016). Key quotations were chosen and collated under the corresponding themes. The findings from Groups A and B were deemed to be correlated, with much overlap between the datasets. Multiple themes were identified in relation to perceptions of Johne's disease and its management and control (clinical impact, transmission, diagnosis etc.), but this paper focuses specifically on the theme of drivers for the control of the disease.

2.3 *Ethics approval*

The study received ethical approval from the research ethics committee of Harper Adams University for each phase of the study. Interview participants were provided with information on the overall aims of the project before commencement and were assured of anonymity. The interviews were audio-recorded with verbal and written consent provided

by the interviewee before each interview began. The study was conducted in a manner consistent with the consolidated criteria for reporting qualitative (COREQ) research (Tong et al., 2007).

3. **Results**

The 20 interviews (farmer interviews n = 13, veterinarian n = 7) lasted between 30 and 90 minutes each, and in total produced 122,854 words of transcript for subsequent analysis. The farmer interviewees managed dairy herds containing between 165 and 1000 cows (mean herd size = 397 cows, n=13). The following subsections present commentary on extracts of the interview transcripts divided into four main themes: the impact of veterinary advice; economic cost of the disease; the national voluntary Johne's control programme; and the fear of a future consumer food scare.

3.1 The impact of veterinary advice

The veterinarians spoke of the direct influence they had on their farm clients as they tried to persuade them to actively test for Johne's disease and implement control measures. For some, this influence was more impactful and successful than for others. Some of the veterinarians were exasperated by an apparent lack of interest or action on the part of some of their clients, despite clinical cases of Johne's disease regularly occurring on their farm:

> 'We did have one guy [with 250 cows] and he had literally no idea what Johne's was! … And it took 12 months of repeatedly having discussions with him for him to get it, and to appreciate that he needed to do something. He didn't milk record, so

206 we got him to test all the milking cows at one point, but that's not enough - he
207 wouldn't repeat it.' (Int B01, veterinarian)

208 'I can think of one herd … where we regularly turn up clinical cases, but they still
209 don't seem to have the desire to find it in their herd at all; they're just seeing it as an
210 individual cow disease.' (Int B09, veterinarian)

211 'I can think of a great example: this man has a [supermarket] contract, so he has to
212 do Johne's testing - it's obligatory for him. He loses clinical Johne's cows hand over
213 fist, and every single time I go there to look at a sick cow that's dropped its milk [I
214 say] … "Is it on the Johne's list?" [He says]:"I haven't looked." So he does the
215 recording because his milk buyer tells him he has to, but he's making no effort, even
216 though he's losing … 5% of the herd a year to clinical Johne's.' (Int B04, veterinarian)

217 Despite such examples of an apparent lack of desire to act to control Johne's disease, the
218 veterinarians also spoke of personal encouragements, where farmers were actively
219 engaging in testing and control measures:

220 'From a Johne's point of view I've had quite a lot of input on certain farms,
221 instigating plans, or shall we say "tweaking", control plans to get the best of it.' (Int
222 B10, veterinarian)

223 'If you get people started … I have never seen anybody stop Johne's control
224 measures. If anything, they just ratchet them up and up as they go on further as they
225 see more and more benefit from it.' (Int A06, veterinarian)

226 'I did a Johne's meeting in late 2013 … and about six people at the end of that said:
227 "We should probably do something about this". And year on year … I do a Johne's

meeting … and more and more people come every year, and it's different people, and each time I get a couple more people interested.' (Int B11, veterinarian)

A few of the veterinarians spoke of their own personal and professional ambition to engage their clients on Johne's control, with some making it a priority disease to advise their farmers on:

'The vast majority of our herds are actively testing for Johne's … A big focus for us at present is more on the moving the guys who [are] at that reclusive-traditionalist boundary, and you then get into a debate about whether you are better focusing your attention on improving the control of the ones who have already engaged, or continuing to hammer away at the ones who are difficult to engage with, and we're probably in the former of those buckets.' (Int B04, veterinarian)

'Yeah, it's just something I feel passionate about, and it's something I can see being a real issue. I also like my job, and I want my clients to be there in ten years' time, and this could be a make or break for a lot of people.' (Int B11, veterinarian)

'You do have personal crusades as a vet, don't you? And I have personal crusades to do with lameness, and transition health, and cow handling, and cow happiness and comfort; very much so. So does Johne's rate in there for me personally? No, it doesn't, but it does come in just below there. I do feel embarrassed when I haven't got on top of it in certain herds, or I haven't managed to get their engagement.' (Int B09, veterinarian)

While the veterinarians mentioned their influence on their farm clients, this was spoken of more infrequently by the farmers, but a few did speak positively about their veterinarian's

influence. For example, these farmers, who were early adopters of quarterly individual milk ELISA testing on their whole herd, spoke of the impact of their veterinarians on their joint efforts to control the disease:

> 1: 'We're on a testing scheme, and we're moving towards an eradication scheme, working with our vets.'
>
> 2: 'Our vets are very keen on it.' (Int B03, dairy farmers)

Despite such enthusiasm, other farmers believed that what their veterinarians were asking them to do on Johne's was unrealistic and impractical, leading to inaction and a negative attitude towards Johne's control:

> 'They'd like to see me monitoring it. They'd like to see me reacting and isolating cows that are Johne's positive and being more pro-active. I guess the problem is from a veterinary side it's all very well and good saying [that, but] …' (Int B07, dairy farmer)
>
> 'There's a whole world of what [veterinarians] would want us to do ... like the idea you should only a give a calf its mother's milk - you know, it's just not possible! It's just not possible in a system like ours.' (Int B02, dairy farmer)

Whether initially prompted by their veterinarian or based on knowledge acquired from other sources such as the farming press, some farmers were clearly very motivated themselves to try to reduce the Johne's prevalence in their herd, without having to be unduly 'forced' into action. This 'self-motivation' was mentioned by a few of the veterinarians, particularly clearly demonstrated in this interview excerpt:

> Interviewer: 'What are the main incentives for farmers to increase Johne's control?'

Veterinarian: 'Self-motivation. There are financial incentives, but you've got to look at the long-term, haven't you? … I think maybe as an industry we need to be a bit more progressive in taking control ourselves – gone are the days of subsidised incentives.' (Int A07, veterinarian)

In the opinion of two veterinarians, a useful tactic to prompt engagement from late adopters was to apply pressure through asking their clients why they were not engaged when many of their farming peers were:

Interviewer: 'Do you think more could be done to encourage farmers to include more control strategies?'

Veterinarian: 'Yeah, I think it's just chipping away at it constantly. And as time goes on more and more people get interested in it and get involved in it, and it's getting to the critical mass of client base once you get more than 30-40% of your farms doing something then it's easy to go out to the rest of them and say "Why aren't you doing this? Everyone else is doing it – you're behind the curve; you're losing out!" But to get to that point is just a lot of hard work and talking to individual farms and chipping away at it.' (Int A06, veterinarian)

'I think you have to wait for your moment, and I think there is usually a moment, when you're diagnosing the 17th Johne's cow of the year with them: "Do you know that you're the only farm in a 15-mile radius not testing for Johne's?" I don't think we're far from the tipping point for the message changing into "Everybody else is doing this, why aren't you?'' That's the point they'll start asking questions, because that's when they'll go to the pub on a Friday night and they'll say: "Are you doing

anything about Johne's?' And their mate will turn round and say: "Yeah, we've been testing the herd for 4 years! Have you not?" [*Laughs*] (Int B04, veterinarian)

3.2 *Economic impact of the disease at herd level*

It is well established that Johne's disease can have a notable economic impact on the production efficiency and profitability of dairy herds (Stott et al., 2005; Richardson and More, 2009; Pritchard et al., 2017). Given the on-farm interactions between veterinarians and their clients described in the previous section, it might have been expected that this would feature as one of the significant drivers for taking action. This was confirmed by the responses of these farmers when asked about their main incentives for managing the disease:

'Loss of yield, poorer fertility, reduced margins per cow.' (Int A08, dairy farmer)

'AHDB (British farmer levy board) tell us it costs £1800 to rear a heifer to calving now. What's the point in rearing a Johne's heifer and spending £1800 on her when you might as well shoot it, or sell it and let someone else have the hassle? It doesn't make sense - it's hard enough farming as it is without knowingly rearing unhealthy animals.' (Int A09, dairy farmer)

'Having spent the sort of money we've just spent on a new shed and four [milking] robots, we thought it was quite important when we moved forward that we didn't have a herd of Johne's cows. We thought we would be a bit more proactive about it and I think monitoring Johnes in the long term is the best thing … I think it's something you need to do, and I think people ought to be doing.' (Int A05, dairy farmer)

316 Although some of the farmers certainly recognised the economic cost of the disease for
317 their herd, this dimension was not particularly widely discussed as an incentive to more
318 effectively control it. One farmer complained about the financial cost of removing Johne's-
319 positive animals from the milking herd after positive tests, and this appeared to act as a
320 *disincentive* to engage more fully because of the cost of culling infected animals:

321 'So we did our last test, and we've had 15 more! So the 20 has moved up to 35! …
322 And that's [a loss of] £20-25,000 on my bottom-line just straight-off!' (Int B02, dairy
323 farmer)

324 In contrast, the veterinarians were more likely to mention the production costs of disease as
325 a driver, and they described how this was one of their arguments to persuade farmers. A
326 typical example was provided by this veterinarian, who described how he specifically used
327 both the scientific literature and farm-level research on individual herds to demonstrate the
328 production impact of Johne's:

329 'I talk to them about various studies that have been done that show what animals
330 which are Johne's-positive look like in their production compared with their peers,
331 and things like mastitis and cell counts as well. We've had students here on electives
332 that we've asked to look at a handful of herds - looking at their Johne's [herd]
333 prevalence, and then looking at Johne's-positive animals in terms of their production
334 and cell counts; that completely backs up all the wider studies that have been done.
335 It's quite nice to go to a client and say: "This student has looked at your data and
336 these are the facts". That soon sort of turns them around.' (Int B09, veterinarian)

However, another veterinarian explained how farmers' motivation for controlling Johne's in their practice appeared now to have become much more driven by *having* to, rather than *choosing* to, engage in testing and control efforts:

> 'In the first five years that I was down here [farmers] were doing it for the right reasons, because they realised that it was problem in their herd, [and] that it was going to improve their [herd] health … and they see the cost effectiveness of it and the reduced stress and everything else on themselves. But now it's flipped, and the ones that are starting to engage now are doing it because they have been told they have to. Unfortunately, it's not the right way around, but even if you get people started my experience would show they will see the benefit of it.' (Int A06, veterinarian)

As the next section of the paper further explains, a voluntary national programme run by industry stakeholders such as milk processors and retailers appeared to be having a notable impact on farmer behaviour in relation to the disease.

3.3 The national voluntary Johne's control programme

A National Johne's Management Plan (NJMP) has been developed by the *Action Group on Johne's* – a forum of industry stakeholders interested in reducing Johne's disease incidence on dairy farms in GB (Action Johne's, 2019). This forum is jointly funded by a national farmer levy board (Agriculture and Horticulture Development Board - AHDB) and milk purchasers. The forum was set up in 2010 and launched the NJMP in 2015 (Orpin et al., 2020a). It includes representation from companies and organisations such as milk purchasers and processors, farmers' unions, veterinary associations, academic institutions and cattle

359 companies. It is estimated that 80% of the total milk volume produced in GB is covered by
360 members of this scheme (Action Johne's, 2019).

361 Phase 1 of the NJMP, which ran from 1st April 2015 until 31st December 2017, was primarily
362 focused on education and engagement with producers and training of veterinarians
363 according to a standardised training course on Johne's. Phase 2 of the scheme was launched
364 in 2018 and involves participating farmers obtaining a signed declaration by an accredited
365 Johne's veterinary adviser that they will implement one of the control strategies specified
366 by the scheme (Action Johne's, 2019; Orpin et al., 2020b). The scheme is not a statutory
367 scheme governed by legislation, but enrolment has become a compulsory part of milk
368 contracts between many milk purchasers in GB and their milk suppliers. The roll-out of the
369 scheme was reported to be having a very notable impact on engagement between
370 veterinarians and their clients on Johne's, and between farmers and their milk purchasing
371 companies:

372 'As of five months ago, just over half our herds were milk testing, and now it would
373 be more than that. The [NJMP] has made my life easier in terms of getting people
374 engaged, because there's that wall that you just push people towards, and they see
375 what's coming, and they jump before they're pushed.' (Int B11, veterinarian)

376 'The [NJMP] has helped in that they have to do it [milk testing], and we won't sign
377 something unless they are doing it.' (Int B09, veterinarian)

378 'There is the national Johne's control plan which is being rolled out and increasingly
379 taken up by, and supported by, [milk] buyers. So more and more of our clients are
380 going under that umbrella … The national control plan I think is a really practical tool

and it allows you to do different things on different farms and still be under that umbrella, and still be compliant.' (Int A06, veterinarian)

Awareness of the NJMP as the primary driver for more active national Johne's control efforts seemed to be low amongst some of the farmers interviewed, but all of them were aware that the disease had become more high profile. Their more immediate focus was specifically on what their milk buyer was requiring of them in terms of Johne's control in their herd:

Interviewer: 'Did you first start testing because of the contract you were on?'

Farmer: 'Yes, pressure from milk buyers in the last year has been towards doing this. They haven't dictated that we *have* to do it … I think there will be more pressure from the buyers to do it. So that's why we do it.' (Int A05, dairy farmer)

Interviewer: 'Are you getting any pressure from your [milk] processor?'

Farmer: 'Yes, we are now - just started.'

Interviewer: 'So that will force you into doing something?'

Farmer: 'Yes. There you go [*shows letter from milk processor*]. So yes, it's a road - we're on a road, and hopefully it's factually led. You think it's an issue, and government institutions think it's an issue, then I'll do whatever is required. But until that happens, that's where I'm at.' (Int B07, dairy farmer)

'A concern might be that when the milk price drops again like it did two or three years ago, if there's any reason for your milk not to be as good as the person up the

401 road they might take theirs and not yours. I guess I wouldn't want to give my milk
402 purchaser any reason not to buy my milk.' (Int B08, dairy farmer)

403 Despite this pressure from milk buyers through the NJMP, other farmers spoke of how their
404 milk buyer (a supermarket retailer) had been encouraging routine testing of their milk for
405 several years before the NJMP was launched. This meant that they had been actively
406 engaged in Johne's control for longer than most through identifying infected animals on
407 milk serology:

408 'We're on a [supermarket retailer] contract and we've been doing Johne's ever since
409 [the supermarket] wanted us to really.' (Int A01, dairy farmer)

410 'There have been others out there that are on [supermarket retailer] contracts, and
411 other contracts as well, who have been testing for a [lot] longer than we have – four,
412 five, six years.' (Int A04, dairy farmer)

413 Farmer 1: '[The supermarket retailer] actually made us test seven years ago. They
414 paid us … to test.'

415 Farmer 2: 'But they don't do that anymore.'

416 Farmer 1: 'No, but for six years they did … So full marks to [them] for getting right on
417 board.' (Int B05, dairy farmers)

418 When the veterinarians were asked about how influential the pressure from milk buyers and
419 retailers was having on farmers' engagement with Johne's control, there was unanimous
420 agreement that this was a very significant factor, as typified by these quotes:

Interviewer: 'How much of a role do the milk buyers play in the farmers' willingness to manage the disease?'

Veterinarian: 'Huge. Yeah, 'cos I think that's where a lot of the drive comes from now. I think they're (farmers) being beaten with a financial stick from the milk buyers that if they are implementing a plan there is a potential for them to get a few more pence per litre. So yeah, I won't deny I think that's a massive part of it.' (Int A07, veterinarian)

'Most of our farmers that are coming on board now are doing it because they are told they have to by the supplier, if I'm honest.' (Int A06, veterinarian)

'As with most other diseases, the carrot and stick approach of the milk buyers, the milk processors, the industry: "We'd really like you to start taking this disease seriously." (Int B04, veterinarian)

Despite this increasing engagement, there was concern that some farmers still viewed engagement with the NJMP as a bureaucratic 'tick-the-box' exercise, rather than being convinced that reducing the disease prevalence was in the interests of their herd profitability and sustainability:

'The NJMP has helped push things forward, but I do still find I'm sitting down for a drink of tea after a routine visit … and they say "You just need to sign this", and they pull out the declaration. And to some of them, it still is just a box-ticking exercise, and we've been incredibly resolute in saying "It isn't just a case of signing that - we're going to do you a Johne's risk plan, and we're going to do you a Johne's health

plan, and we're going to make sure this is done properly, because this is a great opportunity to do it."'(Int B09, veterinarian)

'He's losing 20 clinical Johne's cows a year - 5% of the herd a year to clinical Johne's. Who knows what the rest of the iceberg looks like? The report comes every three years and he doesn't even look at it! He doesn't change any of his management practices - he's literally just ticking a box.' (Int B04)

These veterinarians' views appeared to be justified by what these farmers said in response to being asked about why they were starting to test routinely for Johne's; they demonstrated some degree of reluctance, and a failure to see a wider objective apart from meeting a contractual requirement:

Farmer 1: 'Our milk company asks us to sign a declaration that we're doing something about it.'

Farmer 2: 'But that's all - we're not being driven to do something - we're being asked to test.'

Farmer 1: 'And we're not being incentivised to do anything about it either.'

Farmer 2: 'We're not being paid to go Johne's disease clear; the milk companies aren't saying "We need you clear within 10 years." To tick the boxes we just need to say that we test, and we do test, so we tick the box.' (Int B02, dairy farmers)

'I wouldn't probably have done anything about it, because you read about it in the farming press, and the vets' newsletters - this is being honest - and you think, "Well, it's not really affecting me." But then two years ago [the milk buyer] sent us a Johne's form saying that we had to be seen to be doing something about it, so

464 because of that I did a bit more reading, and spoke to our vet, and just said "What
465 should we be doing?", because he agrees that we haven't really got a problem. So
466 since then I decided to be proactive just in case there was something hidden.' (Int
467 B06, dairy farmer)

468 *3.4 Fear of a consumer food scare*

469 In addition to encouragement from veterinarians, the economic arguments, and the
470 pressure being exerted by milk processors and retailers through the national management
471 plan, there was also an important line of argument on why Johne's disease needed to be
472 more effectively controlled – fear of a potential zoonotic infection risk, and future consumer
473 food scare. This driver for control was mentioned by both farmers and veterinarians but was
474 particularly emphasised by the latter. Some of the farmers spoke of their own fears of
475 Johne's potentially being a zoonotic disease linked to Crohn's disease in humans:

476 Farmer: 'That does concern me. Yeah.'

477 Interviewer: 'Why?'

478 Farmer: 'Because it's a public health issue, and if that's proved to be correct, then
479 we're all going to have to react, aren't we? Yeah, that is an issue. And I know a
480 person with Crohn's who seems to think it's my cows that created it!' (Int B07, dairy
481 farmer)

482 'It was quite striking when I went to Ireland about ten years ago, when I'd only
483 started dairy farming, that I went to a farm with a friend, and we were sat at the
484 kitchen table and I asked him why he didn't drink his own milk, and he said: "Oh, I've

485 got Johne's in the herd, and I wouldn't ever drink it - I don't want to get Crohn's".
486 (Int B08, dairy farmer)

487 These views were echoed by most of the veterinarians, who were also similarly concerned
488 about a zoonotic threat from Johne's:

489 'My assumption - the stance that I have taken - is that I'm fairly happy there is a link
490 there to some degree. And I think if I adopt that stance and try to encourage my
491 clients to work towards control and eradication policies, then I think that's the best
492 approach - the sort of gold standard approach. Whereas I think if I reassured myself
493 there's not a particularly significant link, then I think that would potentially induce
494 you to take your eye off the ball a bit, and your foot off the gas.' (Int B09,
495 veterinarian)

496 'It's a grey area scientifically, but I think for me as a consumer or a mother feeding
497 children, it's enough of an unclear issue to say "No, I wouldn't want to take that risk."
498 At one of my Johne's [courses] I found it horrendously scary that they find it in infant
499 formula. And the lecturer there was from the States and particularly in the States,
500 the consumption of ground meat, minced meat - all these Johne's cull cows go for
501 mincemeat don't they, and they do find it. We think of it as just in the milk or blood
502 or whatever, but in ground minced meat they were finding MAP in samples. And I
503 find that really scary!' (Int A07, veterinarian)

504 'It's been talked about for probably 20 years or more and nobody has really come up
505 with any conclusive proof. So I think it's one of those things that increasingly now
506 farmers see as bit of a scaremongering tactic. It's the thing that's brought out of the
507 drawer whenever you want to try and scare people into doing anything … It's

> difficult – there's no clear data that farmers have massively higher Crohn's levels, and it is a difficult one to pin down but obviously, the same bug is found in both syndromes, so there is something there. (Int A06, veterinarian)

Certainly not all the veterinarians were focused on a possible zoonotic risk. These veterinarians were not fully convinced that MAP was zoonotic and were not using that specific argument to convince farmers to engage in Johne's control:

> 'I don't know enough about that. I know that some farmers are aware there might be a link, and that's one of the reasons why the milk buyers are very keen on people controlling it.' (Int B01, veterinarian)

> 'I've never had that [opinion], no. I think the reason is because our farmers tend to come at it from an animal health point of view, and we tend to come at it from an animal health point of view … Because there hasn't been any strong animal health-human health links drawn up for the disease. I think that's why I don't talk about it as if it's a zoonotic disease.' (Int B10, veterinarian)

Ultimately, if a zoonotic risk from MAP and Johne's disease was irrefutably proven, there were fears about a future food scare affecting the retail sales of milk and meat products from the dairy industry due to consumer concerns around product safety. This view was echoed by both farmers and veterinarians, and comparisons were made with previous significant consumer food scares linked to animal diseases in the UK historically – specifically BSE (bovine spongiform encephalopathy) (Smith et al., 1999) and *Salmonella* in eggs (Smith, 1991) - as exemplified in these quotes:

529 'Everybody has got to have a Johne's plan - they've got to be testing and doing
530 something about it, otherwise they'll be out of business … You've got responsibilities if
531 you're going to keep cattle. And particularly as a milk producer, if Johne's blows up like
532 BSE, it could ruin us. You know what happened with … the eggs - all the British eggs were
533 infected with *Salmonella*. So, there is a political message - the milk buyers and the
534 government just need to get everybody up to speed.' (Int B05, dairy farmer)

535 'The *Salmonella* in eggs scandal is where I could see this going if it's not managed well. I
536 think as a country we are managing the situation better than anyone else has done
537 before. So if we can get our farmers engaged, and get control measures in place, and we
538 can say ... "If you have a herd that is a low risk Johne's herd, you can sell your milk and
539 sell your products in a world market."' (Int B11, veterinarian)

540 Linkages were therefore made between animal and human health, future economic
541 viability, market access and the politics of social responsibility.

542 **4. Discussion**

543 It is recognised that the stakeholders involved in controlling disease and responding to
544 voluntary and statutory policy initiatives in livestock health have an important influence on
545 the success or otherwise of on-the-ground efforts (Garforth, 2015; Robinson, 2015; Ritter et
546 al., 2017; Fortané, 2020). While research studies have demonstrated that veterinarians are
547 regarded by many farmers as trusted disease control advisers (e.g. Richens et al., 2015;
548 Marier et al., 2016), veterinary advice is not always implemented by farmers, perhaps
549 determined by perceived feasibility or other on-farm priorities (Ritter et al., 2017; Svensson
550 et al., 2019). As noted by Barkema et al. (2017), most Johne's disease control programmes

551 globally are voluntary, and their success depends ultimately on either the self-motivation of
552 farmers to be involved, or the active encouragement of veterinarians, to promote
553 enrolment and persistence for the long-term. Attempting to control this challenging
554 endemic disease requires sustained effort and it is particularly important to understand
555 what the main drivers for Johne's control might be, and the externalities that may be
556 involved, as with any animal disease prevention and control programme (Gilbert and
557 Rushton, 2018; Hennessy and Wolf, 2018).

558 It is interesting to speculate on why, despite the presence and acknowledgement of the
559 economic impact of Johne's disease on English dairy farms for decades (Winter, 1960;
560 Gilmour, 1976), concerted effort to control the disease more effectively has apparently
561 been lacking until now. There appears to have been a longstanding toleration of the impact
562 of the disease which, as the data in this study demonstrates, persists on some farms. This
563 suggests a greater need for farmers to be convinced of the economic and cattle health
564 benefits for reducing the burden of MAP infection in their dairy herds (Garcia and Shalloo,
565 2015); the message has either not been effectively communicated by enough veterinarians,
566 or received and ignored by too many farmers.

567 Veterinarians in this study were very keen to educate and engage their farm clients in
568 Johne's control efforts, with some seeing it almost as a personal crusade. They were finding
569 much more willingness to test for the disease than in the past, but they also reported
570 struggling to persuade a small minority of farmers who had clinical Johne's disease in their
571 herd to actively seek to control the disease. Even some of those farmers who were regularly
572 testing for the infection were not fully convinced of the benefits of this ongoing expenditure.
573 Similar challenges in convincing farmers on the importance of Johne's control were reported

574 by Ritter et al. (2016) and Roche et al. (2019) in Canada, and McAloon et al. (2017) in Ireland.
575 As McAloon et al. suggest, convincing farmers to voluntarily control the disease based on
576 animal and herd health arguments alone may not be enough to achieve engagement,
577 particularly when farmers perceive the proposed solutions as impractical, or the effects of
578 the disease are hidden. Likewise, Ritter et al. (2019) emphasise the importance of barriers to
579 the implementation of Johne's control measures such as the perceived practicality and
580 whether the disease was considered a priority on the individual's farm.

581 In the absence of statutory control, a national Johne's programme (NJMP) led by an industry
582 stakeholder forum was found in this study to be having a significant impact on farmer
583 participation, as reported by both the farmers and veterinarians interviewed. Although
584 having a national control programme is certainly not unique, and other countries across the
585 world have attempted similar co-ordinated efforts (Geraghty et al., 2014), what is notable
586 here is the impact that contractual requirements from milk buyers (processors and
587 supermarket retailers) were said to be having on farmer uptake. This was reported to be
588 facilitating the pathway towards deeper veterinary engagement in the disease enabled
589 through the framework of the NJMP. Using Ritter et al.'s (2019) thematic mapping of the
590 motivations for Johne's control, this is another example of an extrinsic motivator, linked to
591 the premiums and penalties suggestion of the Canadian dairy producers that they
592 interviewed in focus groups.

593 Previous qualitative studies have also found levels of concern among farmers (particularly
594 McAloon et al., 2017 and Roche et al., 2019) about the potential for a zoonotic risk and link
595 to Crohn's disease in humans and future negative economic impact on their industry. A
596 questionnaire study of Australian veterinarians found that one third of those surveyed

597 believed that MAP was likely to be causally associated with Crohns disease in humans, and
598 70% of them supported adopting a precautionary principle in relation to Johne's disease
599 (Acharya et al., 2020). This possible zoonotic risk appeared to be a powerful driver for
600 several of the farmers and most of the veterinarians interviewed in this study. Both groups
601 compared how a consumer food scare could develop in the future centred on dairy products,
602 similar to what has happened in the past with BSE in cattle and *Salmonella* in chicken eggs.
603 As Atkins (2008) shows, negative consumer reactions to zoonotic food hazards have a long
604 and notable history in the UK, and similar impacts have been shown across Europe and
605 indeed globally (Bánáti, 2011). Mullan (2019) cautions that formal international recognition
606 of MAP as a human pathogen is more likely than not, and this line of argument is
607 increasingly evident in the scientific literature, and sometimes without equivocation (e.g.
608 Singh et al., 2016; Monif, 2018; Dow and Sechi, 2019; Zarei-Kordshouli et al., 2019). If
609 concerns about MAP from cattle affecting human health increase, consumer attitudes to the
610 consumption of dairy products are likely to be correlated with the effectiveness of the
611 mitigation measures taken against Johne's disease, and risk communication by regulators,
612 industry and the media (Groenendaal and Zagmutt, 2008).

613 What is also evident is a sense of social responsibility from farmers, and particularly
614 veterinarians, to ensure that food produced by the dairy industry is safe, and public health is
615 not harmed. These factors were found to be similar motivators in Ellis-Iversen et al.'s (2010)
616 wider study of the motivations for zoonotic disease control on English and Welsh farms.
617 Such responsibilities on food business operators are established in European law (EC, 2002)
618 and evident in the views expressed in the Canadian research on Johne's control by Ritter et
619 al. (2019). While some of this sense of societal responsibility is undoubtedly self-generated,

620 the response to Johne's control efforts through the NJMP is arguably a further example of
621 the shift of the governance of agricultural and food standards to food processors and
622 retailers in the private commercial sector rather than the state (Banks and Marsden, 1997;
623 Grant, 2012). Even without statutory legislation to legally require on-farm Johne's control
624 measures in the UK, the power of industry bodies adopting a precautionary approach to
625 hedge against potential future reputational and market risk has significantly motivated
626 farmer action, as evidenced by what both farmers and veterinarians said. This has also been
627 highlighted by press coverage in recent years in Ireland and the UK (McCullough, 2016;
628 Bowyer, 2017). Indeed, Marsden et al. (1997) argue that the state depends on the retail
629 sector to supply and regulate safe food. As Havinga (2006) points out, the food industry,
630 retail industry and government all have a common interest in ensuring safe food, and a
631 'shared fate' of reputational and market loss if consumers lose confidence in food products.
632 Food retailers therefore have an important role as 'gatekeepers' between primary
633 producers and the consumer as part of their corporate social responsibility (CSR), which
634 influences not only what is supplied by farmers, but how it is produced (Schulze et al., 2019).
635 This retailer CSR has already been demonstrated elsewhere in Europe, particularly in
636 relation to animal welfare standards (Maciel and Bock, 2013; Richards et al., 2013;
637 Christensen et al., 2019; Vogeler, 2019). However, this has not been extensively elaborated
638 in the literature in relation to infectious animal disease control, and specifically Johne's
639 disease. Nonetheless, there are models of how non-regulatory industry partnership bodies
640 such as *Animal Health Ireland* can have significant impact in raising health standards in the
641 livestock sector for issues such as Johne's disease, mastitis and bovine viral diarrhoea (BVD)
642 (More et al., 2011). It is also significant that a full supply chain collaborative approach to
643 reducing infection pressure and food contamination has been advocated for *Campylobacter*

spp. control in chickens in the UK, where retailers and processors worked in partnership with primary producers to seek to reduce the incidence of meat contamination and food poisoning (ACMSF, 2019).

The results of this study must be taken with some degree of caution. Given the different aims and approaches of qualitative research (May, 2018), the sampling strategy was deliberately purposive and non-random. The sample of 17 farmers and seven veterinarians represents a very small percentage of the total national population of dairy farmers and farm veterinarians. But assured by the recurring themes which were raised across the interviews in both study areas, the findings are nonetheless likely to be indicative of what other farmers and veterinarians in England may believe about the drivers for Johne's control. The overlapping themes from previous qualitative research in Ireland and Canada also provide support for the validity of these results. This research illustrates the benefits of a qualitative interview approach to contextualize disease control efforts at farm level, with important insights which can inform future local, national and international efforts to tackle this increasingly important endemic cattle disease.

5. Conclusions

Johne's disease control in dairy herds in England is not just about the trust that farmers have in the veterinary disease control advice of their veterinarians and whether it spurs action, or the relative economic merits of improving dairy herd health at the individual farm level. Rather, Johne's control drivers would appear to be strongly influenced by wider industry concerns focused on the health implications of a possible causal association between MAP infection and Crohn's disease in humans mediated through dairy cattle or dairy products. The findings illustrate the benefits of considering the wider political

667 economy and potential societal impact of animal disease, and how these dimensions can
668 also influence motivations for disease control, as argued in the introduction to this paper.
669 The study raises interesting questions about the relationships between the roles and
670 responsibilities for the control of endemic disease in food animals, food safety, and public
671 and private goods in a global marketplace, and whether non-regulatory approaches by
672 commercial private sector organisations are as effective, or even more effective, in raising
673 animal health standards compared to statutory regulation. The relative socioeconomic and
674 political merits of statutory, public-private partnerships, or privately funded animal health
675 initiatives for endemic livestock diseases is an area which deserves further interdisciplinary
676 research attention within the fields of veterinary epidemiology and animal health economics.

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680

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685

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