"It's just the luck of the draw": Luck, Good Farming and the Management of Animal Disease in Aotearoa New Zealand

Gareth Enticott[1 *]

M. Carolyn Gates[2]

Arata Hidano[2,3]

[1] Cardiff School of Geography and Planning, Cardiff University, United Kingdom

[2] EpiCentre, School of Veterinary Science, Massey University, Palmerston North, New Zealand

[3] Communicable Diseases Policy Research Group, Department of Global Health and Development, Faculty of Public Health and Policy, London School of Hygiene and Tropical Medicine, United Kingdom

*** Correspondence:**
Dr Gareth Enticott
enticottg@cardiff.ac.uk

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Abstract

Good and bad luck are frequently invoked to explain the misfortunes of ill health, failure and natural disasters. There are few studies, however, that examine how perceptions of luck affect farmers' decision making in response to environmental threats. In this paper, we draw attention to farmers' use of perceptions of luck to explain outbreaks of infectious animal disease where risk factors are within and outside farmers' control. The paper makes two substantive geographical contributions. Firstly, it explores the geography of luck, showing how it is articulated at local and national scales, and how the use of luck varies between areas of different disease risk. Secondly, by analysing attempts to manage the geography of cattle movements, the paper explores whether metrics of animal disease risk can offer hope and overcome perceptions of bad luck. Here, the paper explores the links between luck and notions of good farming and whether the creation of good farming subjectivities can contribute to a disease prevention mindset amongst farmers. Drawing on 41 qualitative interviews, the paper shows how good farming is constructed by farmers in Aotearoa New Zealand and how good and bad luck shape farmers' perceptions of and responses to incidents of animal disease. In both high and low-risk disease areas, farmers' perceptions of luck allow them to displace blame and rely on experts to manage animal disease. Good farming appears unconnected to disease risk metrics, meaning that methods of behaviour change that rely on good farming subjectivities may have limited impact.

Keywords: luck; chance; subjectivity; animal disease; good farming; risk, biosecurity.

1. Introduction

Faced with the unexplainable and unpalatable, luck, chance and fate provide reassuring clarity. Luck ends the destabilizing doubt of uncertainty, providing logic where no other rational explanation can suffice. Luck – whether it is good or bad – is frequently invoked to account for the effects of natural disasters, illness and personal success or failure. Whether it is flooding (Armaş and Avram, 2009; Mishra et al., 2012), earthquakes (Becker et al., 2013), tsunami (Teigen and Glad, 2011), volcanoes (Teigen and Jensen, 2010), wildfire (Eriksen and Wilkinson, 2017), heart attack (Davison et al., 1991), cancer (Sidenius et al., 2019; Vetsch et al., 2019), business (Andrews et al., 2006) or academic success (Loveday, 2018), luck explains why some people succeed or fail, others suffer or escape unharmed, whilst others hope for the best but prepare for the worst.

The purpose of this paper is to extend these studies of luck in two different ways by exploring how perceptions of luck help farmers make sense of the spread of endemic animal disease. Firstly, the paper provides a geographical analysis of luck. Rather than focus on personal evaluations of the impact of catastrophic or traumatic events, endemic animal disease provides a dynamic, long-term and mobile threat, requiring attention to the spatially variegated nature and mobility of risk. Thus, in areas of both high-risk and low-risk, the presences and absences of disease will be felt, although these experiences and associated uses of luck to make sense of them will be different. By taking different experiences of the same phenomena into account, the paper therefore seeks to develop a spatially nuanced geography of luck.

Secondly, the paper explores how luck is connected to the geographical movement of livestock and its disease implications. The geographical mobility of livestock at local and national scales is integral to modern systems of pasture-based agriculture. Livestock movements are required to provide sufficient feed whilst the specialisation and spatial disaggregation of livestock production require livestock to move at different stages of production. However, livestock movements are associated with the risk of the

translocation and spread of animal disease (Carrique-Mas et al., 2008). Given the economic costs of exotic and endemic animal disease, policy makers have sought to find ways of encouraging voluntary behavioural change amongst farmers to minimise the risks of livestock movements and reduce the spread of animal disease (Adkin et al., 2016). Building on previous studies that connect fatalism with prevention practices and risk-based trading (Enticott, 2016), this paper analyses the extent to which such voluntary initiatives can successfully reframe perceptions of bad lack and help farmers prepare for and/or prevent outbreaks of disease.

To analyse these geographical dimensions of luck, the paper turns to attempts to eradicate bovine Tuberculosis in Aotearoa New Zealand. Firstly, we outline theories of luck and their relationship to socio-cultural theories of farming behaviour and 'good farming' (Burton, 2004b). Secondly, we provide details of the management of cattle movements in Aotearoa New Zealand. Thirdly, we describe the geographical dimensions of perceptions of luck deployed by farmers when explaining and making sense of cattle movements and disease spread. Finally, we conclude be considering the wider role of luck in theories of behaviour change and animal disease management.

2. Luck: Explaining and Avoiding Harm

According to Davison et al. (1991), luck plays a significant role in cultural life, providing a seemingly logical explanation to seemingly unexplainable events. Yet, defining what counts as luck or being lucky is keenly contested (Pritchard and Smith, 2004). Broadly, luck is defined by Levy (2009) as a combination of three factors: 'chanciness', absence of control, and significance (i.e. how good or bad the outcome was). Alongside, these factors, Rescher (1995) adds that the probability of the event determines the extent to which it can be considered lucky. For others, luck is not defined by outcomes themselves, but their avoidance. Teigen et al. (1999) argue that the decisive factor in identifying luck is the 'counterfactual': what would have happened without the intervention of luck. The worse the counterfactual is (such as avoiding severe injury or death), or the proximity to misfortune ('close counterfactuals'), the

more luck is said to be involved (Teigen, 1997). Counterfactuals may be upwards or downwards, emphasising either what could have happened in relation to normal events, or the worst possible outcome. In either case, luck resides in the avoidance of an outcome, rather than the outcome itself.

Counterfactuals play a different role in relation to perceptions of bad luck. Teigen et al. (1999) note that incidents of bad luck are 'not only bad in comparison, they also seem bad in a more absolute sense'. As a result, outcomes may be considered unlucky because of the traumatic experiences described, or because they are described in comparison with upward counterfactuals. Others argue, however, that experiences of bad luck themselves generate counterfactual thinking, the content of which is determined by what is considered normal (Kahneman and Miller, 1986; Roese and Olson, 1995).

Control is a key element of good and bad luck counterfactuals. On the one hand, luck can help explain events, providing a sense of control. On the other hand, a lack of control can be central to accounts in which luck provides the explanatory ingredient. Rotter's (1966) concept of 'locus of control' suggests that people with low sense of control (i.e. external locus of control) attribute events to luck, chance and fate. For Heider (1958) luck is more likely to be invoked when the external environment is perceived to be the primary cause and beyond the control of individuals. Such accounts are common in studies of health and illness. In human health, Davison et al. (1991) describes how the public use a system of 'candidacy' to explain deaths from coronary heart disease. Luck is a central component to this explanatory framework, providing a way to make sense of exceptional deaths that do not conform to standardised risk profiles. Similarly, studies of animal disease reveal high levels of fatalism amongst farmers, with 80% believing infection is a matter of luck (Broughan et al., 2016; Enticott et al., 2014). These beliefs in luck and chance help farmers make sense of why some herds are diseased and others not, but their resulting fatalism and perceived lack of control is associated with a failure to implement preventive biosecurity measures (Enticott, 2008).

Indeed, recent studies suggest that feelings of lack of control may be connected to taking more risks rather than less (Enticott et al., In press).

Whilst luck can act as an explanatory framework (Davison et al., 1991), it may also help to guide future behaviour. In some cases, perceptions of luck are associated with positive behaviours. For example, Day and Maltby (2005) show that beliefs in good luck are associated with positive planning towards specific goals and motivations to achieve these goals. Downward counterfactuals – bad luck stories concluding that 'it could have been worse' – may also have a mood enhancing effect (Teigen and Glad, 2011). Thus, Eriksen and Wilkinson (2017) connect good luck, hope and trust to show how beliefs in good luck can lead to preventive actions in relation to managing bushfire. For policy makers concerned with engineering behavioural change to limit the impacts of natural hazards and health risks, the relationship between hope, adaptive agency and good luck may help to overcome perceptions of bad luck. Thus, Eriksen and Wilkinson (2017) suggest using discourses of hope and good luck within risk communication to influence preparedness behaviour. Such attempts to communicate risk also represent strategies to redefine subjectivity through discourses of individual responsibility. These approaches to 'responsibilisation' are common to neoliberal forms of government (Rose, 1999) but may also take material and technological forms (Higgins et al., 2012). For example, Barker (2010) describes how attempts to inspire 'biosecurity citizenship' rest on technologies of persuasion and enforcement which seek to create 'contractual obligations' for citizens to participate in the surveillance and reporting of unwanted biological presences.

Common to many of these discursive and material technologies of self-governance is the use of metrics, rankings and ratings through which citizens can calculate and compare themselves to others and adjust their behaviour to fit societal norms of appropriate conduct (Miller and Rose, 1990). Whilst metrological regimes are frequently invoked to govern economic behaviour, such as through forms of certification and market instruments (Lockie and Higgins, 2007), their success rests on the extent to which they align with cultural understandings of appropriate conduct. In agriculture, conforming to

193 ideas of appropriate conduct or what Burton (2004a, b) calls 'good farming' is
194 a key factor in the uptake of new or alternative farming practices that provide
195 public goods. For Burton, good farming refers to the cultural capital of farming:
196 the public demonstration of practical knowledge such as good stockmanship,
197 symbols of appropriate farm maintenance such as clean farmyards and tidy
198 hedgerows, and attributes such as hard work. Where new farming
199 subjectivities fail to recognise the cultural capital of good farming, instead
200 reducing farmer behaviour to economic rationality, they frequently fail (Burton
201 et al., 2008). Where calculative technologies of self-governance can
202 accommodate and reflect cultural capital, they are therefore more likely to
203 encourage and guide behavioural change amongst farmers (Burton and
204 Paragahawewa, 2011).
205
206 Following Eriksen and Wilkinson (2017), it is possible to imagine that material
207 and calculative technologies may inspire upward counterfactual thinking which
208 create hope, replacing fatalism and beliefs in bad luck, where they also align
209 with cultural ideas of good conduct. In what follows, we therefore explore the
210 extent to which accounts of good and bad luck feature in descriptions of
211 animal disease management in Aotearoa New Zealand, and the power of
212 metrologies of disease risk to turn bad luck into hope and inspire the adoption
213 of preventive biosecurity practices.
214
215 ## 3. Methodology
216
217 The management of bovine Tuberculosis (bTB) in Aotearoa New Zealand
218 offers a unique opportunity to explore how farmers implicate luck in efforts to
219 limit the geographical spread of disease. bTB is a zoonotic infection found in
220 cattle, wildlife (e.g. possums) and humans. The disease is endemic in many
221 countries and is 'notifiable' requiring any suspicion of its presence to be
222 reported to government authorities. For the purposes of controlling the
223 international spread of bTB, the World Organization for Animal Health
224 establishes the conditions under which a country can declare itself bTB-free,
225 and specifies disease surveillance practices that should be followed. In
226 Aotearoa New Zealand, bTB is managed by Operational Solutions for Primary

Industries (OSPRI), formerly known as the Animal Health Board (AHB). Following the 1993 Biosecurity Act, the AHB became a Pest Management Agency, responsible for writing and delivering the National Pest Management Strategy for bTB (Hutchings et al., 2013). The AHB was estabilised as a partnership between the farming industry and the national government, in which farmers had the majority stake due to their larger financial contribution. In this sense, the AHB is an archetypal organisation created by "roll-back" neoliberalism (Peck and Tickell, 2002) common to agricultural reforms in Aotearoa New Zealand since the mid 1980s (Haggerty et al., 2009).

The AHB's efforts resulted in a steep decline in the national prevalence of bTB in cattle herds, which now stands at 0.07% (Livingstone et al., 2015; OSPRI, 2019). This reduction has been made following vector control operations (i.e. ground or aerial poisoning) of wild possums which can transmit bTB to cattle (Davidson, 1991). However, the reliance on pasture-based feeding systems in Aotearoa New Zealand means that livestock movements are an integral part of farming systems and a key risk factor in the spread of bTB. In 2018, there were 483,253 cattle movements involving 7,927,355 cattle, 57% of which were dairy cattle (Ministry of Transport, 2018). However, cattle movements are linked to the spread of bTB: of all bTB incidents, 41% are linked to cattle movements and 44% due to wildlife with the remainder due to residual infection in a herd (OSPRI, 2015). In an attempt to reduce the risks of cattle movements, the AHB introduced area-based management controls to limit the movement of cattle from high-risk areas (Hidano et al., 2016; Livingstone et al., 2006). Moreover, unlike other countries (such as the United Kingdom or Australia), Aotearoa New Zealand has a voluntary system of risk-based trading – a metrological technology that classifies a farm's level of bTB exposure or risk. Known as 'C-status', every herd is classified according to the number of years they have been clear of bTB (e.g. C1, C2 through to C10) or infected (e.g. I1, I2 etc.). Farmers purchasing cattle from herds with inferior bTB status are penalized: if a C10 farm buys cattle from a C5 herd, it would adopt the lower status classification. This system appears to have deterred some, but not all movements of cattle from high risk regions to low risk regions, suggesting that other factors may

influence farmers' willingness to accept the potential for introducing bTB into their herds (Hidano et al., 2016).

In this system of risk-based trading, status is literally conferred on disease-free herds, defining them as 'good farmers'. The ranking system therefore identifies desirable farming qualities by equating disease freedom with good stockmanship. Moreover, the financial reward of selling high-status cattle may allow farmers to demonstrate other aspects of farming cultural capital such as hard work and financial success. By connecting disease freedom with good farming, C-status therefore provides an aspirational and hopeful pathway, potentially offering direction to farmers with bTB rather than allowing them to wallow in feelings of bad luck.

To assess the role of C-status in guiding cattle purchases and defining 'good farming', farmers were interviewed in two areas of New Zealand, one with high and the other with low bTB prevalence. The low risk area was the Manawatu, in which bTB prevalence was less than 0.03% as of 2015; the high-risk area was the West Coast region which has 48% of all bTB incidents (OSPRI, 2015). Of all cattle movements in 2018, 1.3% originated from the West Coast, whilst 11% were to the Manawatu (Ministry of Transport, 2018). In the low risk area, 21 farmers were interviewed: 16 were rated C10, 10 had previously experienced a bTB incident, and herd sizes ranged from 220-2500. In the high-risk area, 20 interviews with farmers were conducted with farmers, all of whom had experienced a bTB incident. The C-status of bTB-free farms ranged from C1 to C5. Herd sizes ranged from 150 to 370. In each area, farmers were recruited using snowball sampling based on recommendations from farmers and AHB vets working in each area. Interviews covered the history of bTB in each farmer's herd, their understanding of disease transmission, the role and meaning of C-status, and the governance of bTB.

All interviews were recorded and transcribed, then coded using NVivo v.12. Interviews were conducted on the basis of strict confidentiality and quotes used in the analysis have been anonymised. Quotes from participants in the low-risk area are identifiable by 'LR', and those from the high-risk area by

'HR'. Initial analysis involved searching the transcripts for key words (including stemmed words), including *luck, chance, coincidence, fortune, hope, trust, fate, fault, blame and control*. In addition, coding sought to identify good and bad/hard luck stories in which upward or downward counterfactual stories were told but which did not necessarily employ the key words, but idiomatic statements of luck, such as 'it could have been worse' or 'for the grace of god'. In addition, counterfactuals deploying New Zealand slang, such as 'good as gold' and 'she'll be right' were included in the analysis. Following initial identification of statements of good and bad luck, incidents were coded thematically and categorized in relation to bTB, C-status and good farming. Each author initially identified themes separately before agreeing on a common coding framework and interpretation.

4. Defining Good Farming in Aotearoa New Zealand

In interviews, farmers distinguished between '*good operators*' and those who they described as '*rogue*', '*rough*', or '*dodgy*' farmers, '*cowboys*' and '*dumbarses*'. A 'good operator' demonstrated their good farmer credentials in five inter-related ways. Firstly, 'good operators' made a positive contribution to the farming community at national and local scales. A primary concern for farmers was 'doing what's right for everyone'. This could involve being a good neighbour by maintaining fences and field boundaries, and informing neighbours of disease outbreaks (cf. Shortall et al., 2018). In terms of managing bTB, 'good operators' did not oppose methods to control disease in the wildlife population. By contrast, farmers' actions that caused 'distress' were criticized: these included those that established new practices that produced local environmental hazards or farmers that did not look after their land:

> "[He was a] funny old bugger, yeah he was, he wouldn't let anyone in there, and he'd got all these massive old trees that needed cutting out and he wouldn't let anyone going in cut wood or anything, he just hated the idea of someone making money off the land. (LR16).

Whilst conforming to these local expectations was essential to being a good operator, so was conforming to national regulations. There was little sympathy

for those farmers that flouted regulations designed to ensure the profitability and safety of farming throughout Aotearoa New Zealand. For example:

> "Some people just fall through the gaps don't they and they're the ones that, y'know, we do everything properly, we bring every two year old animal home and they all get tested and when we move them off farm it's all written down and can be traced so, but I guess there's people who don't do that" (LR13).

For this farmer, going beyond the rules was an important part of being a good farmer. Other farmers described how stopping certain practices that were perfectly legal (such as selling cattle) but which posed a disease threat gave them 'peace of mind' both in terms of limiting the spread of disease, but also maintaining their place in the farming community. Unlike other studies (Escobar and Demeritt, 2016), keeping good formal records was also associated with being a good farmer. However, there were exceptions to these behavioural norms. Whilst farmers in the high-risk area recounted tales of suspicious cattle movements under the cover of darkness, and linked them with the spread of disease, the effect of bTB on farm profitability and farmer welfare meant they could sympathise with some who had broken the law:

> "One of our sharemilkers down the road is being prosecuted because he decided to sell his herd and get out of dairy farming but as a sharemilker that is where your whole equity is so he was basically charged with reading his own animals, and 5 of them were put down the back (killed) so the herd had a clear test because at the end of the day if you have a reactor, that's his asset devalued, [by] about half. And if he is prosecuted he could end up in jail, so these are the sorts of things that people do. And in a way you feel sorry for him because that's where his equity is" (HR 05)

Sympathy was not extended to large corporate farmers: their size meant that their mistakes were their problem. Rather, a 'fair go' was reserved for traditional family farmers that were symbolic of Aotearoa New Zealand rural culture (cf. Dominy, 2001; Hatch, 1992). However, whilst farmers complained about the actions of 'cowboys' who contributed to the spread of animal disease, many were reluctant to criticize those farmers whose farming practices similarly contributed to disease spread but which were perfectly legal. Traders who bought and sold on cattle, and graziers who looked after young stock from multiple herds were singled out as risky farming practices. Despite these risks, these farmers – so long as they stayed within the law – were described as part of the farming system and not viewed as poor farmers:

> "Traders here are just part of a cog, y'know, like this this joker here he lambs a lot…but y'know when it comes dry, especially up the East Coast they've got to move those lambs on, y'know, coz they're not up to killing weight so they've got to move them and that's where the traders come in, y'know for lambs and same for cattle really…and they could end up anywhere from Invercargill to Kaitaia man…no one sees them as a risk as long as the paperwork's there… Coz without that, without your trail of the history of that animal you would be fighting a losing battle" (LR 19)

Secondly, 'good operators' were defined as financially successful who paid off their debt and had a good living. The removal of farm subsidies during the 1980s meant that 'the bottom line's got to add up' (LR14): knowing one's cost of production per hectare and a desire to make money were key to being recognized as a serious farmer. Farmers in the low risk area were keen to adopt progressive farming practices, run more than one farm or participate in off-farm business activities. Those that did not were described as 'cruisey': farmers happy with their lot, but not working hard to maximise their economic potential. Farmers in the low-risk area demonstrated productivity in visual ways too. The practices of 'humping and hollowing' or 'flipping' to improve soil quality and drainage have a clear visual effect on the appearance of the landscape, distinguishing hard working farmers trying to be productive and make money.

Thirdly, 'good operators' needed to demonstrate care for their animals. Having good-looking productive animals on display in well-kept fields was a sign of good farming, but it was important that cattle were not 'pushed too hard' such that their welfare was compromised (cf. Haggerty et al., 2009). Maintaining a balance between making money and caring for animals was therefore a subtle distinction between 'good operators' and those out to make a 'quick buck'. For example:

> 'Farming's different to just about any other industry in that you're there to look after animals, you make money from looking after animals basically, so a good farmer to me is someone who does that well. And it's always the balance between welfare and profit basically, and there's, there's a happy medium but there's often conflict between the two and so a good farmer's someone who gets that balance right. We do have farmers in New Zealand who don't. There are certainly farmers who are more developers who use the cows to pay the

> interest and often that's at the expense of the cows. So I consider them to be very wealthy but bad farmers' (LR12)

Fourthly, 'good operators' publicly displayed cultural capital by maintaining clean farmyards and healthy stock. The practice of 'hedgerow farming' (Egoz et al., 2001) in which farm quality was assessed from the car was described in relation to the appearance of livestock and pasture quality/management. Maintaining the appearance of fields and boundaries was also important in terms of pest control. Farms that had been left to go 'backwards' could attract feral animals increasing disease risks. In that sense, maintaining a clean and tidy farm showed a commitment to a collective effort to minimise animal disease risks. For example:

> 'You can normally tell the ones that are a bit better than the others through pasture management, like you can drive down the road and you'll notice a couple heading back that way on the way to town and you'll know that they're pretty relaxed … whereas y'know, you look at this fella or our farm, you can just tell by the pasture what sort of farmers they are and generally that gives you a fair indication' (LR19)

Finally, 'good operators' were distinguished by their practical skills and knowledge of farming. Good livestock not only looked good, but behaved well, not being 'easily spooked' or wound up, or displaying signs of being abused through poor handling. At the same time, the practical skills of a good stockman could also be recognized in conversation and the ability to 'talk farming':

> 'If it looks terrible, they're under performing, light cows, you can see cows from the road most days, you can see the state of their herd…You can drive up a drive way often or talk to a farmer for 10 minutes and you'll soon work it out how good they are. Yeah, knowledge and just they, you know what they are sort of saying, looking around at the environment, you only need to look at say the, if you could ask them their production per cow, the cow condition and look at the state of their farm, you generally tell what sort of farmer they are' (LR09)

Farmers who had 'no idea', lacking knowledge of even the most common aspects of farming, such as form filling, disease testing and looking after animals were associated with small-scale lifestyle farmers. For 'real' farmers, these activities were second nature and performed subconsciously. Lifestylers by contrast were 'in need of educating' (cf. Naylor et al., 2018).

5. Luck and Bovine Tuberculosis

Farmers' explanations of an incident of bTB frequently drew on perceptions of bad luck, emphasizing a lack of control over the spread of disease. This was expressed in a number of ways. Firstly, luck was connected to testing cattle for bTB. On the one hand, farmers said they were unlucky because infected cattle would usually be their best cows with good temperaments and milk production rather than '*the cruddy old cow that you were going to send to the works anyway*' (HR11). The timing of tests was also connected to luck: those that found bTB when stock levels were low were lucky. On the other hand, the diagnostic test used to detect bTB was blamed as ineffective, failing to identify cows that were infected, but which could subsequently test positive on another farm after being sold. These bad luck stories were connected to downward counterfactuals, such as wishing farmers had asked more questions about the stock they were buying. Good and bad luck were also seen in non-human terms. Farmers described how cows could be infected with bTB but that it would be 'walled off' and lie dormant within their body and immune to being discovered by the test. At times of stress, bTB could 'break out' and infect other cattle. Whilst this was perceived to be bad luck, farmers were also clear that it was not something that they could do anything about.

Luck was also connected to a geography of risk: farmers in the low-risk area perceived a bTB incident to be unlucky not just because of the test, but also if the area where cattle had been grazing prior to the test was not seen as high risk. In describing the failures of the test, farmers contrasted themselves with poor farmers, explaining that they had '*done the best we could, we followed the rules, we didn't bend the rules of anything, it just happened, its just bad luck*' (LR21). Similarly, farmers in the high-risk area connected luck with geography. Not only did they argue that they were unable to prevent the movement possums and cows coming into contact, the lack of pattern of bTB incidence meant that it could only be explained through bad luck:

> 'I really don't know I just think it's the luck of the draw. We are all within a very short distance of bush that might harbour vectors – I really don't know – I'm just at a total loss on that one. The thing is some people say it's strange that it's only the farms out by the coast but

> it's not just the farms out by the coast. Even the farms up the valleys they have all had a TB history as well' (HR01)

Other geographical dimensions to luck included whether farmers' neighbours have secure field boundaries or stock other than cattle to prevent cattle-to-cattle transmission. In the low-risk area, farmers connected bad luck with grazing cattle in areas where a sudden change results in localized disease spread. However, these farmers also cited their own 'good luck' as a reason why they did not worry about bTB: the historical and continuing low rates of bTB in the area were not something that they had any control over. Blame was rarely attached to a bTB incident, as it was as one farmer described, '*such a hard thing to really get, its more such of a thing that you get it by chance or accident than intentionally type of thing*' (LR15). As a result, farmers' experiences of bTB were different to those compared to those in high-risk areas: they had higher levels of trust in animal disease control 'experts' and officials to swiftly resolve any problems and reduce them to a 'once in a blue moon type of event' (LR07). This put them in a much better position than farmers in high-risk areas. Comparing their situation to those in the high-risk area, low risk farmers sense of luck therefore reflected the principle of 'minimal mutations of reality' in which differences are imagined in 'the closest of all possible worlds' (Pritchard and Smith, 2004). In this sense, the high-risk area represents the closest world in which 'things could be worse' and where there is little hope of becoming clear. In the high-risk area, these geographical dimensions of disease risk meant that bTB was often consigned to being 'one of those things' in which you had to expect one or two reactors every so often. This did not mean that upward counterfactuals were absent from these expressions of luck: farmers in the high-risk area suggested that you could fence off the bush or check the source of purchased cattle to reduce the risk. However, the coda to these statements was that they were unlikely to work anyway. Farmers cited finding possums in the most unlikely of places or the consequences of the actions of unscrupulous farmers as examples of their inability to control bTB. Even those that had taken action nevertheless confessed to having their '*fingers crossed that it doesn't happen again – but you just don't know*' (LR18).

6. Lucky or Good Farmers?

If the perception of bad luck was disempowering, C-status could potentially challenge beliefs in luck by providing hope that positive action could be taken. In fact, farmer's perceptions of C-status revealed how they interpreted it's meaning flexibly according to whether they were selling or buying. In this sense, C-status was not an obdurate technology (Latour, 1987), but its meaning was contextualised in use according to whether it was judging good farmers, or guiding the purchase of cattle.

When it came to buying cattle, farmers revealed that cattle purchasing decisions were not driven by one over-riding factor such as C-status, but involved balancing a range of different considerations. Price was important, particularly when cattle shortages had driven up their price. Finding cattle at the right price, though, was itself often a matter of good luck: farmers recalled 'bargains' they had come across by chance as a result of marital breakdowns, holidays, or farmers changing their business system. Price could usurp other factors such as disease if 'they were bloody cheap' (LR11) and whilst disease status could be a factor in purchasing, others cited age, production, breed and appearance as the main factors influencing purchasing decisions.

Weighing up all these factors was a matter of balancing and calculating risks. Some farmers argued that all purchasing was dangerous and best avoided: to undo their investment in the herd by unknowingly buying in diseased cattle was not only bad farming, but 'silly' and a gamble not worth risking. For others, purchasing was inevitable and weighing up the risks was part and parcel of farming. Disease, price, location and quality were all factors in a mix. Nevertheless, despite these calculated risks, farmers reported a sense of 'getting away with it' (HR17) or 'hop[ing] they are clean' (LR13).

Purchasing new cattle also involved a process matching farm cultures. Moving cattle between different climates, terrains and/or production systems was recognized to be a problem (cf. Hidano et al., 2019) potentially threatening the

productive ability of the animal and/or stressing the animal to the extent that they succumbed to bTB or other diseases. For example:

> 'Those cows must have got a bloody shock, like, they were in a little 180 cow herd up there, y'know, and then they went down to sort of 1500 cows in a rotary and that, yeah they must have got quite a surprise really… but you often wonder what they cows [are] thinking, y'know, "oh shit, this is not what I'm used to!" [Laughter]' (LR19)

Matching farm cultures was complicated by price, but also by the seasonality of the farming calendar. Most dairy farms in Aotearoa New Zealand operate a spring calving system, but small regional variations in calving dates can make some cattle unsuitable for purchasing as it lengthens the calving window and means the herd is no longer 'in sync'. Some areas were considered to be too great a disease risk to buy cattle from, such as the West Coast; although farmers in the low-risk area commented that in reality the additional cost of transport and the stress placed on animals during transportation was at the forefront of their consideration, rather than bTB. The need for cattle to have resistance to other local disease threats was also considered important.

Knowledge of people (i.e. farmers and stock agents) was also an important consideration. As one farmer said, 'you'd probably not just go down to any Joe Bloggs and buy a bull to run with your cows' (LR13). Rather, farmers that were known to be good farmers and from areas perceived to be safe or risk-free were more likely to be trusted:

> 'If someone rang me up from Masterton saying they're sending me a bull up, straight away, I'd say are you in a movement control area? We instantly know which areas of New Zealand are likely to be near them. Eketahuna, or what have you, whereas, if [a friend known to be a good farmer locally] rang me up from up the road and said I've got a couple of bulls, you can have a couple if you want, its good as gold, coz you know the area' (LR10).

If knowing 'good farmers' was an important element of cattle purchasing, logically C-status should be able to assist farmers t identify the most reliable cattle to buy, rather than rely on luck and hope. In fact, farmers in both high and low risk areas reported that having a high C-status was personally important. High C-status farmers described it as a good feeling – a '*warm fuzzy*' (LR21) - something to be pleased about, proud of and jealously guard (HR08). For farmers selling cattle, being C10 ensured the best possible price

for their cattle; those that were C2-4 suggested that selling cattle was harder as buyers sought to negotiate the price downwards because of their status.

Whilst *being* C10 was welcomed by all farmers, paradoxically, when it came to buying cattle, farmers balanced opposing views of the value of C-status. Thus, farmers reported a preference for buying C10 cattle, suggesting that it gave confidence such that they '*wouldn't even ask the question about TB, Id just buy it. I wouldn't care when it was last tested or anything because it's a C10 you've got that confidence*' (LR09). Buying cows with a high C-status could provide 'peace of mind' and with that the hope that farmers would not become infected with bTB again. However, whilst C10 cattle were seen as good cattle, the hope they offered of staying clear from bTB was a false hope. Indeed, reflecting on the hope of being C10 was itself seen as bad luck:

> 'Definitely it would be good, definitely, there's no two ways about it, but I'm just not holding my hopes on [being C10]. I know its negative but I just don't want to be yeah and then boom. Just go with what's happening there's no point getting up and down about it, it'll give you a guts-full of cancer otherwise stressing out about it' (HR09)

Reflecting the complexity of purchasing decisions, many farmers suggested that C10 was neither an indicator of good farming, or a means to eliminate luck from bTB. A common refrain amongst farmers was '*clear is clear*': that is, by passing a bTB test, the risk of infection is the same from any herd whatever its C-status. As one farmer joked, '*you can't be half pregnant can you?! [laughs]*' (LR13). Moreover, farmers that had just been declared bTB-free after years of infection claimed they were more likely to be free from bTB than a C10 herd tested only every three years.

Variations in C-status could also be logically attributable: farmers who had just established a new herd could be C2, yet their herds were comprised of animals that were C10 and not a disease risk. Alternatively, C-status failed to provide commensurate measures of risk because of numerical or metrological systems fail to incorporate specific dimensions of quality (Cooper, 2015). For example, describing his own herd, one farmer argued that disease risk was not reducible to the length of time a herd had been bTB free, but the time that

herd had existed, its permanence within the farming landscape and the genetic breeding lines within it which defined good farming:

> 'Like our herd, when we bought it, it was a family herd, and it had been on the same farm together for basically - the herd grew from 100 heifers and 60 budget cows and the farm owner grew them and we've actually got one left of that original herd, that was a heifer, she'll be 17 this year if she's in calf. So, that, I would consider that being a safer herd than someone that's got a make up of 4, 3, 5 herds put together as one herd' (LR15).

In this way, good farming was not seen to be commensurate with a high C-status. Farmers in the high-risk area thought that a C10 farmer from outside the area who bought cattle from there would 'have to be silly' and 'asking for trouble' (HR09). However, this did not mean that they believed a low C-status reflected poor farming. Rather, for these farmers it reflected the false hope of C-status: randomness, chance, and bad luck which meant that '*Whether you are a 10 or a 5 or what, it makes absolutely no difference: you are only one test away from disaster, and it doesn't matter how long you've been clear*' (HR13). Farmers that were C5 were no better off than those that were C10 – they had simply had five years more good luck rather than better management practices (HR08). For example:

> 'If you are on movement control it doesn't make any difference whether they are C10 or not. We've bought in, they've been Tb tested and they've been in the milking herd for a couple of years and the next thing they react and they've got Tb' (HR04)

Farmers in the low risk area also rejected associations between good farming and C-status. Rather than being earned, C10 in a low risk area was something that was to be expected: it was more unusual if farmers were not C10. This 'inheritance' of C-status was therefore simply a reflection of the area rather than ability, and the luck of farming there rather than on the West Coast:

> 'I don't think it's farmer's ability, it's not your ability as a farmer to control whether you get TB or not, I don't think. You could have all the traps in the world and you can do all the things in the world, if you're in an endemic area and you're the best farmer in the district you can still get TB. Similarly, you can be the worst farmer in the district in a non-TB area and still not get TB, y'know what I mean. Or the worst farmer in a TB endemic area and still not get TB' (LR01)

> 'They could be a shit farmer and still have a C10, yeah, it doesn't tell them whether they're, whether they're sort of treating their animals to the best of their [ability], or what, but yeah,

> no, it doesn't, I'd have to say it doesn't reflect on their farming ability it just reflects on the fact that they haven't had TB there for 10 years' (LR19)

This sense of bad luck and the failure of C-status to reflect good farming was reinforced by the usual aspects of good farming, such as record keeping and following regulations being apparently of little use in the fight against bTB. Similarly, the vagaries of the bTB test were also cited to show how dependent farmers were on luck to stay clear. In this sense, even farmers that committed some of the most basic mistakes, such as buying low status cattle were able to escape blame, so long as they were following the rules, be prepared to learn from their errors, and explain to others the risks involved:

> 'An example was our national dairy council last year, a farmer bought an infected bull in for his breeding regime and it was riddled with TB and he didn't know, he just bought it off the block, I don't think the block even knew, I don't think they really…he was a fairly onto it farmer, I don't think he had been treating it too lightly [he] just was unaware, [but] he was willing to educate us to say look you've got to be careful because I didn't think this would happen…He was willing to tell everyone about it, very soul destroying for that farmer, and we were all very concerned and it was an education thing really' (LR09)

As this quote shows, for farmers in the low risk area, regulations like C-status allowed them to push bTB to the back of their minds and focus on other farming challenges. Many admitted to becoming complacent, ignorant of their neighbours' C-status and purchasing C10 cattle for the sake of it rather than thinking more deeply about the risks of bTB. In doing so, they transferred the responsibility of managing bTB to the AHB, placing their faith in experts and authority to resolve any problems. Thus, beliefs in luck were doubled-edged. On the one hand, going down with bTB following a C10 purchase was bad luck and just one of those things – an accident, a failure of the test, or the fault of 'dodgy' farmers. On the other hand, however, experts and the authorities offered farmers hope that things would be sorted out as soon as possible:

> 'My job is to produce a good product and send good milk out the gate. The next guy down the road, the next guy at the factory, he's the expert that's gotta deal with it from there and I can't worry too much, y'know what I mean. And I guess the TB thing's a bit the same that, I'll do my best to do my bit here and I hope everybody else is but every so often there's going to be a fall down somewhere and you've got to leave it to the experts to sort it and trust that they do so, [and] we'll face it when it happens' (LR14)

7. Lucky Geographies

From these findings, we identify four substantive points that contribute to conceptual understandings of farmer behaviour, luck and the management of animal disease. Firstly, in relation to theories of good farming, the paper shows that luck is a central component of good farming. Whilst previous studies have attempted to connect good farming to animal disease control (Little et al., 2017; Naylor et al., 2018; Shortall et al., 2018), our findings are the first to show the importance of luck to good farming. In both study areas, good farmers were seen to be lucky and unlucky whether they avoided animal disease or not. Whilst skill and practical knowledge, and the display of symbolic cultural capital helped identify good farmers, the characteristics identified were mediated by the influence of luck. At the same time, perceptions of luck helped farmers make sense of unexplainable events. By attributing incidents of animal disease to luck, these events were less worrisome, allowing farmers to concentrate on aspects of farming that were consistent with good farming subjectivities. Whilst these findings are specific to animal disease, it is possible that other aspects of farming are also assessed through the lens of luck. This might include, for example, farmers responses to flooding and climate change (cf. Hamilton-Webb et al., 2019), other animal health challenges such as reducing the use of antibiotics (cf. Bellet, 2018; Helliwell et al., 2019), or participating in outcome-based agri-environmental schemes (cf. Higgins et al., 2012)

Secondly, farmers' accounts of disease describe a geography of luck in which good and bad luck feature at different spatial scales. Luck was associated with the local geography of farming communities such as the presence/absence of landscape forms and disease vectors, and the social geography of farming communities. Farmers imagined disease risks spatially, identifying spatial patterns of disease and infection, and safe or vulnerable zones. Reflecting other research (Davison et al., 1991), these spatial patterns were nevertheless subject to good and bad luck. Safe spaces could be unlucky spaces, whilst in risky areas, bad luck could be mitigated by hoping for the

715 best. Luck was also spatialised at regional and national scales, often
716 associated with the degree of animal disease risk. In fact, these spatialisations
717 of luck were connected to different forms of counterfactual thinking. Upwards
718 counterfactuals ("if only I had fenced off my boundaries") were connected to
719 bad luck and used by farmers in the high-risk area. Whilst there is some
720 evidence that upward counterfactuals can lead to adaptive behaviour
721 (Epstude and Roese, 2008), farmers in our study were more likely to view bad
722 luck as 'one of those of things' that could not be changed whatever actions
723 were taken. Thus, whilst some farmers mulled the impact of buying C10 cattle,
724 these ruminations were counterproductive contributing to a sense of false
725 hope (cf. El Leithy et al., 2006). Indeed, for some farmers, hope itself could be
726 seen as bad luck, precipitating a bTB incident.
727
728 By contrast, downwards counterfactuals ("it could have been worse") tended
729 to be found in the low risk area. These perceptions were largely based on a
730 positive attitude towards and a reliance on the agencies responsible for
731 managing bTB who – in the low risk area – had successfully demonstrated their
732 ability to manage the threat from wildlife vectors. Reliance was not adaptive:
733 farmers blamed incidents of bTB on 'rogue' farmers, testing failures, and
734 excusable accidents. Purchasing C10 cattle was preferred, but farmers did not
735 rule out buying other cattle for valid farming reasons. In this way, bTB was just
736 'one of those things' that farmers could not do anything about, but which
737 outside experts would resolve.
738
739 Whilst C-status was connected to a sense of false hope against future bTB
740 infection, it is curious that farmers continued to place faith in 'government' (i.e.
741 the AHB) and veterinary experts to resolve bTB. In one way it encapsulates
742 the positive feelings of hope: that something or someone can prevent bTB. In
743 the low-risk area, this hope was connected to the historic actions of the AHB,
744 almost eliminating bTB through vector control operations after the government
745 had stood back from funding controlling disease (Enticott, 2017). However,
746 these feelings of hope reveal the tensions within individualistic discourses of
747 responsibility associated with these forms of neoliberal governance. On the
748 one hand, farmers do take some actions on their own farms to limit bTB. On

749 the other, they find security in the continuity of government and experts whose
750 role is to 'clean up' disease outbreaks (cf. Harries, 2008). This hope was not
751 present in the high-risk area although without the antagonistic low levels of
752 trust in government found in other countries (Enticott et al., 2014).
753
754 These findings therefore suggest an ironic separation between farmers and
755 their own system of animal disease governance: farmers pay for the
756 governance of bTB through production levies, whilst farmers also sit on
757 regional and national eradication boards, having a direct say on how disease
758 should be managed. Yet despite this neoliberal approach, these farmers
759 continued to rely upon an external 'authority' and its experts. The downward
760 counterfactuals used by these farmers therefore articulate an ironic separation
761 between farmers and the governance of animal disease, in which individual
762 responsibility is outweighed by a reliance on external 'others'. Indeed, at the
763 time of our interviews, the development of a new national cattle tracing system
764 (known as NAIT) provided further hope to farmers that 'government' could and
765 should control animal disease, rectifying problems seemingly beyond their
766 control caused by 'rogue' farmers, such that there is little that they needed to
767 do to manage disease beyond comply with regulations. Since then, an
768 outbreak of *Mycoplasma bovis* revealed that NAIT was not fit for purpose. In
769 this context, farmers believed they were lucky that the disease was not more
770 serious (such as Foot and Mouth Disease), but also blamed 'dodgy farmers'
771 for their failure to comply with NAIT, whilst continuing to rely on the
772 government to develop stronger regulations and prosecute 'rogue' farmers
773 (Williams, 2018). Reliance on the government to 'fix' disease risks appears to
774 be a consistent response to all diseases that present existential threats to the
775 cattle industry. Whilst this may belie themes of individual responsibility
776 associated with neoliberal animal disease governance, it may also suggest
777 continued attempts to influence government and capture regulatory
778 frameworks to further the interests of economic sectors. In doing so,
779 references to 'dodgy farmers' are used as a 'bad apple' neutralization device
780 (Mooney, 2007) to deflect blame and shift debate away from systemic
781 biosecurity issues within cattle farming such as the reliance on cattle
782 movements that are integral to the continued spread of disease. This

783 continued reliance on what farmers see as 'government' therefore has
784 important implications for countries seeking to copy the AHB's neoliberal
785 model of animal disease control and suggests the need to pay attention to
786 luck and good farming in other disease contexts.
787
788 Whilst surprising, the reliance on government shown in this research may also
789 reflect broader attitudes towards farming and national identity. Despite threats
790 to its social license (Ainge Roy, 2019; Piddock, 2018), agriculture continues to
791 play an important role in the economy of Aotearoa New Zealand, whilst the
792 dairy industry is a leading global player. The ability of farmers to 'punch above
793 their weight' on the global stage is a source of pride for farmers, providing
794 them with status in agriculture and Aotearoa New Zealand as a whole. The
795 vulnerability of dairy exports to global market fluctuations, competition and
796 food safety crises (Lewis et al., 2017), places all farmers in a similar position,
797 ensuring the need to work together. Whilst this shared identity explains a
798 reluctance to castigate farmers operating legally but using practices that
799 present a disease risk, it also requires governmental authority to discipline
800 farmers that flout the basic principles of good farming such as record keeping.
801 Thus, the irony of the neoliberal governance of animal disease in Aotearoa
802 New Zealand, whilst encouraging farmer ownership of disease, has been a
803 reliance on a central authority to discipline those that step out of line and
804 maintain a collective farming identity to preserve their global market share
805 rather than governing through a reliance on social norms of behaviour.
806
807 Finally, by focusing on perceptions of luck amongst farmers, these findings
808 also have relevance for policy makers seeking to limit the spread of animal
809 disease. Attempts to control the movement of cattle and encourage
810 responsible cattle trading have been a mainstay of past and present attempts
811 to manage animal disease (Godfray et al., 2018; More et al., 2015). On its
812 own, however, a voluntary system such as C-status appears to offer little
813 comfort in comparison to perceptions of good and bad luck. Farmers may
814 state that C10 cattle are preferred, but the complexity of purchasing decisions
815 and attempts to make sense of luck and risk mean that voluntary systems of
816 risk-based trading will always be balanced against a range of other factors

817 and understandings of good farming. In this way, metrological assessments of
818 animal disease risk are malleable and multiple, providing neither certainty nor
819 clarity that farmers require. Attempts to understand how agricultural
820 metrologies 'work' (Rosin et al., 2017) should therefore pay great attention to
821 the role of luck. Indeed, there is also the danger that such metrics can provide
822 'false hope', in that their simplistic descriptions of risk efface the kinds of
823 reflection and deep thinking that managing animal disease risk requires. If the
824 aim of policy makers is to overcome the consequences of lucky thinking,
825 statutory systems of risk-based trading are possibly more likely to provide a
826 more consistent and effective method of regulating cattle movements.
827
828 ## 8. Conclusion
829
830 A common critique of understandings of farmer behaviour amongst veterinary
831 scientists is the emphasis placed on rational behaviour (Hidano et al., 2018).
832 By focusing on luck, this paper has explored the role that the magical,
833 unscientific and irrational plays in explaining farmers' management of animal
834 disease. By examining farmers' responses to outbreaks of bTB across
835 Aotearoa New Zealand, this paper contributes to a greater understanding of
836 how perceptions of luck justify and legitimize courses of action that are
837 seemingly at odds with scientific veterinary advice. At the same time, the
838 paper outlines a geography of luck in which perceptions of luck describe how
839 a spatial imagination helps farmers make sense of animal disease risk, and
840 how luck is articulated in different ways in different places. These findings
841 have important implications for policy makers, suggesting that the power of
842 luck in farmers' thought means that statutory regulations may be more
843 effective in limiting the risk of disease spread arising from cattle movements.
844 In doing so, we argue that farmers' perceptions and beliefs in luck need to be
845 taken more seriously in relation to other environmental threats.
846
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