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Missed Opportunities? Covid-19, Biosecurity and One Health in the United Kingdom

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Introduction: An unprecedented crisis?

Unprecedented. Whatever we read about Covid-19, the word unprecedented is not far away: whether in describing policy choices, the daily death tolls, the scale of upheaval, or the challenges that await a readjusting world. This paper takes an alternative view: if not unpredictable, the crisis unfolding in the United Kingdom (UK) is not unprecedented. Rather, it is foretold in accounts of successive animal health crises. In the UK at least, social studies of biosecurity and animal disease management provide an 'anticipatory logic' - a mirror to the unfolding human catastrophe of Covid-19, providing few surprises. And yet, these accounts appear to be routinely ignored in the narrative of Covid-19 or as social scientists have sought to claim a place at the disease control table alongside traditional forms of expertise like epidemiology. Do social studies of animal disease really have no value when it comes to guiding and assessing responses to Covid-19? Following Rosenberg's (1989, p.3) description of epidemics as a 'dramaturgic event', we answer this question by firstly describing the narrative arc of the UK's approach to managing Covid-19. We then overlay findings from social studies of animal disease to reveal the warnings they provided for a pandemic like Covid-19. We then reflect on the reasons why these studies have been paid minimal attention and the extent to which the failure to learn from these lessons of animal health management signals a failure of the One Health agenda.

Covid-19 in the UK

Rosenberg (1989, p.2) describes epidemics as a dramaturgic form, following a plot line 'of increasing revelatory tension, move to a crisis of individual and collective character, then drift towards closure'. In doing so, this narrative arc 'illuminat[es] fundamental patterns of social value and institutional practice' (ibid.). The responses to Covid-19 in the UK share Rosenberg's archetypal epidemic plotline: four key stages that are organised around the concept of the 'lockdown', the primary strategy adopted by the government to manage the spread of the virus (see figure 1). The acts to this lockdown drama are described below:

1. Evading lockdown

For Rosenberg (p.4), the 'progressive revelation' of an epidemic ensures that denial characterises the first stage of an epidemic: 'bodies must accumulate...before officials acknowledge what can no longer be ignored'. The UK government's response followed a similar pattern: through late-february and early-march, it came under increasing pressure to act as cases in nearby countries expanded exponentially. The response, released on March 3rd (Department for Health and Social Care, 2020), was to evade draconian measures and instead 'contain, delay, research and mitigate'. Evasion was based on an understanding of individual rather than collective behaviour during emergencies (Drury et al, 2020). Firstly, the idea of 'behavioural fatigue' was used to argue that a lockdown would not be effective because it would be unacceptable to the public, who would become tired of restrictions and behave in potentially hazardous ways (Jetten et al, 2020). Secondly, the idea of 'herd immunity' was used in cautioning against a full lockdown. The Prime Minister announced that a balanced approach to protecting the National Health Service (NHS) would mean some people would have to take coronavirus 'on the chin'. More scientifically, the government's Chief Scientist suggested that herd immunity would broaden and flatten the epidemic peak. Individual responsibility and a sense of duty to 'do the right thing' was tasked with defeating Covid-19. Thus,

rather than government imposed containment measures, such as banning mass gatherings and closing schools, it was members of the public who took these decisions.

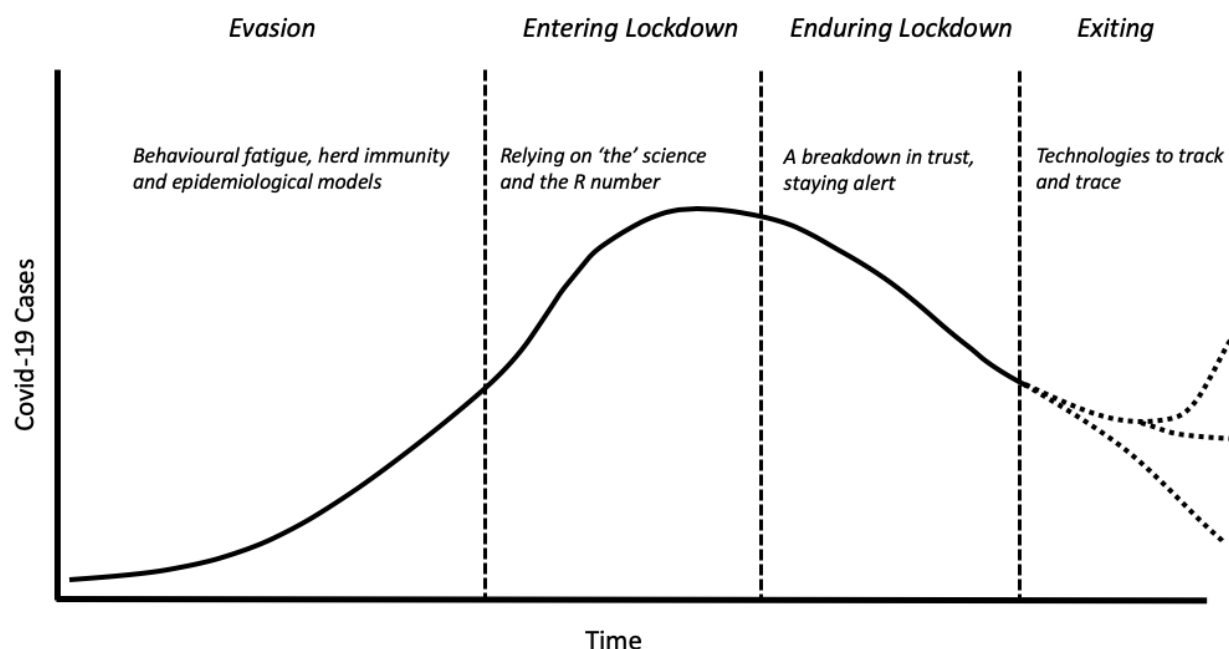


Figure 1: Key stages of the Covid-19 epidemic curve in the UK. Dotted lines reflect the uncertain paths the Covid-19 epidemic may take in future.

2. Entering lockdown

If turning to 'rational understanding of phenomenon in terms that promise control', represents the next stage in Rosenberg's plotline (p.5), this was made palpable in the UK's adoption of lockdown measures by the release of epidemiological modelling in mid-March (Imperial College COVID-19 Response Team, 2020). These models estimated that the containment approach would lead to 250,000 deaths (Scally et al., 2020). A week later, the lockdown was announced, with policymakers emphasising that lockdown decisions were reliant on 'the' science and the rate of infection (known as the R number). The message to the public was clear: 'stay home, protect the NHS, save lives'. The approach reflected a dramatic shift away from relying on individual freedom, and highlighted the government's centralised scientific infrastructure involved in controlling disease. Whilst the Scientific Advisory Group for Emergencies (SAGE) and its sub-groups like the Scientific Pandemic Influenza Group on Modelling (SPI-M) had been advising the government since the start, these scientists appeared at daily press briefings, and their advice deferred to in the exclusionary narrative of 'the' science. Devolved approaches fared less well, reflected in the abandoning of localised test and trace methodologies that had worked well in other countries (Scally et al., 2020).

3. Enduring lockdown

Accompanying this rational understanding, the third act of an epidemic involves routines and rituals and the imposition of 'familiar frames of explanation and logically consequent policies' (Rosenberg, p.7). Throughout the UK's lockdown, a daily government briefing became a scientific stage for 'the' science and the 'R number' to reassure the public of the government's strategy (cf. Hilgartner, 2000). Targets were set to recruit 18,000 contact tracers, to test 100,000 people a day and to supply millions of pieces of personal

protective equipment (PPE). Back-stage the reality was messier with double-counting of tests creating what leading statistician Professor Sir David Spiegelhalter called 'pure number theatre'. If this dented public confidence in the government's handling of the pandemic, it was a mere foretaste. Firstly, a change in messaging from 'stay home' to 'stay alert' created confusion amongst the public. Secondly, the UK's former chief scientific advisor, David King, established an "Independent SAGE", with a more diverse scientific membership, to address criticisms of the lack of scientific transparency and trustworthiness. Then, news broke that Dominic Cummings - the Prime Minister's chief advisor - and his family had broken rules. Public trust in government plummeted, the devolved governments in Scotland and Wales emphasised their differences, and Cummings was used by the public to justify breaking lockdown rules.

4. Exiting lockdown

Whilst epidemics may end with a whimper, their ending also prompts moral judgment: to ask if the 'dead have died in vain?' (Rosenberg, p.9). The ending of the lockdown, began on May 13th, reaching its zenith on 'super Saturday' when English pubs reopened on July 4th. Yet this stage is also marked by ambiguity, for example through increasing organisational complexity. This includes the establishment of a Joint Biosecurity Centre, to advise on the UK's coronavirus 'alert levels' as part of a new Covid-19 alert system. Chaired by a member of the security services, Covid-19 is reframed as a matter of security and its relationship to existing public health infrastructure is unclear. Organisational complexity is demonstrated too by the reliance on a range of private organisations (such as Serco) to deliver contact tracing or create contact tracing apps. As scientists took a backseat following their daily appearances, politicians took control of the recovery, seeking to 'build back better' and restore the economy. The spectre of a second-wave, super-spreading events in abattoirs and local lockdowns, suggests the final curtain is yet to fall.

The Anticipatory Logic of Animal Health

If epidemics like Covid-19 follow familiar plotlines, can it be described as unexpected and unprecedented? If the Covid-19 epidemic narrative reflects institutional forms and cultural assumptions, it also reflects how understandings of disease control are too narrowly framed and ignore important lessons from the management of animal disease in the UK over the last 20 years. The outbreak of Foot and Mouth Disease (FMD) in the UK in 2001, for example, focused government attention on preparedness planning, not least because the inability of the government to handle such an outbreak had already been predicted (Drummond, 1999). As Anderson (2010) argues, 'precaution, preemption and preparedness' have become obsessions, giving rise to 'anticipatory logics', and practices of calculating the future to instill resilience across government organisations and responsible conduct amongst the public. Bearing witness to the management of animal disease - its social practices and consequences - can be seen as an anticipatory logic itself. Indeed, as the discourse of 'One Health' suggests (AVMA, 2008), there should be much to learn and apply from animal to human disease management. For the narrative arc of Covid-19, what would this anticipatory logic have told us, and potentially pre-empted?

Firstly, arguments over the role of epidemiological modelling should be expected because of the way space, subjectivity and politics are encoded within it. The experience of FMD in 2001 highlighted different political choices on which to base decisions. For some, a pre-emptive cull of animals was not only illegal, but socially and economically regressive due to the abstract nature of modelling (Campbell and Lee, 2003). Other studies of FMD modelling have pointed to the geographical disconnect between computer modelers in distant cities, compared with the situated and nuanced understandings of other experts (such as field veterinarians) whose connection with place provides a different understanding of disease transmission (Bickerstaff and Simmons, 2004). These differences are also tied to spatial styles for governing: command and control is associated with governing from a distance using models that treat space as universal and knowledge as mobile (Leach and Scoones, 2013). By contrast, devolved approaches are associated with proximate experts and expertise that is situated and variable. Clearly, these distinctions are disciplinary as

well as spatial. Thus, different epidemiological subjectivities are endorsed and/or marginalised by choices made by governments when managing disease (Enticott and Ward, 2020). The management of Covid-19 displays the same pattern: command and control through modelling and the marginalisation of local and regional health knowledges. In animal health, the effect of this disciplinary and social marginalisation can have long-lasting effects. These studies also point to a better future that recognises how epidemiological knowledge is not bounded but created in a borderland in which approaches overlap (Hinchliffe et al, 2013) and by integrating participatory forms of modelling (Scoones et al, 2017), more inclusive forms of disease control can be developed.

Secondly, the collapse of trust in the UK government's approach to governing Covid-19 was foretold through the management of animal disease. Starting with Bovine Spongiform Encephalopathy (BSE), government failures in communicating scientific uncertainty (Jasanoff, 1996) have contributed to a lack of public confidence in the handling of disease. BSE was not an isolated incident: the public were similarly alarmed by the handling of FMD (Poortinga et al, 2004), whilst farmers were similarly distrustful of attempts to manage bTB. Distrust may stem from the contrast between different forms of understanding disease and the distinctions between scientific and experiential knowledges (Maye et al, 2014). As Cassidy (2015) describes, recourse to 'big science' as a means of resolving disputes that rest on values rarely succeeds and often has the opposite effect. Part of the problem here is communicating the distinction between population and individual medicine and the creation of what Rose (1984) calls 'the prevention paradox'. As studies of animal disease show, where population disease interventions fail to correspond to individual experiences, exceptions to the rules and conflict with cultural norms drives mistrust of government and fatalism. For Covid-19, the reliance on the R number has the same problems. Not only does it misrepresent that epidemics are multiple and vary between sites (for example: community, hospital and care homes), but the universal presentation fails to reflect how the public have a geographically nuanced understanding of disease risks and transmission (Enticott, 2008).

Thirdly, the challenges of creating testing regimes and technologies to track and trace infections are well understood within studies of animal disease and agriculture. The extent to which testing can deliver on promises set for it will reflect its social organisation. For example, in the management of bTB, who conducts tests has come to reflect broad political-economic choices that have infiltrated the management of animal disease. Presumed efficiencies of the private sector have led to the contracting out of disease surveillance but this has not been without consequences. The close 'relational distance' between farmers and their own veterinarians paid by government to regulate their clients has raised questions over the 'accuracy' of interpretation of test results, as a result of testers acting as field-level epidemiologists and taking local factors into account (Enticott, 2017). Similarly, for Covid-19, if test results are to trigger the use and commitment to new track and trace technologies, then these will rely on more than just test results. As Higgins et al (2018) show, acting on biosecurity information involves a different set of behavioural logics than those that are imagined by regulators. The cultural expectation of what counts as 'good farming' and the 'good farmer' can undermine official guidance on avoiding animal disease or disclosing suspicious symptoms (Shortall et al, 2018; Naylor et al, 2018). Shaping conduct by governing through individualistic biosecurity subjectivities (Barker, 2010) written into official documents and technologies has limits: use of biosecurity practices and reporting of suspicious deaths and sightings is not simply a matter of 'staying alert', but is emergent from a complex relationship of social, economic and environmental relationships (Brugere et al, 2017; Palmer et al, 2009; Bronnet et al 2014; Barnes et al, 2015).

Finally, studies of the management of animal disease highlights the mobility of disease experts and expertise. Whilst the psycho-social impacts of eradicating animal disease upon animal disease experts (Bailey et al, 2006; Hood and Seedsman, 2004) may foretell how medical doctors and health care staff will respond to their own trauma of treating Covid-19, one likely response will be to exit the profession or migrate to other countries as a form of recovery (Enticott, 2018). In fact, whilst the UK's initial approach to managing Covid-19 through herd immunity may reflect a form of 'British Exceptionalism', animal disease management

has recently been anything but international. Policy documents clearly reflect the international spread of logics and technologies of disease management, such as the neoliberal forms of responsabilisation and cost-sharing and its technologies of risk-based trading developed in Australia and New Zealand. Nevertheless, whilst the global flow of ideas, experts and expertise appears to continue to shape how disease control is imagined, it is equally true that the globalisation of disease regulations has not been met without resistance, as politicians seek to protect their own interests (Higgins and Dibden, 2011; Maye et al, 2012). In this sense, in the face of global consensus over the appropriate tools and methods to deploy, the UK's approach finds some precedent in the management of animal disease.

Conclusion: Whose Failure?

In traversing Covid-19's narrative arc, we wish to make three related points. The first is that it seems that social studies of animal disease provide a mirror of clarity to the narrative arc of Covid-19. If paying attention to the management of animal disease provides an 'anticipatory logic', it seems to be one worth paying attention to in order to provide the kind of 'situational awareness' required to help prevent mistakes from being made in future pandemics. Social studies of animal disease add to the 'ecology of knowledges' that are required to resolve problems where 'the facts are uncertain, the social stakes are high, decisions are urgent and values are in dispute' - what Funtowicz and Ravetz (1993, p.744) define as 'post-normal science'. The warnings and advice that social studies of animal disease can signal may therefore help to broaden institutions' 'sense-making' capabilities, providing different perspectives and alternatives, and as Weick (1995) puts it, to drop familiar tools and develop new ones.

Secondly, there is also a broader lesson for the kinds of social science that can be used here too. One difference between the handling of FMD in 2001 and Covid-19 has been the rise of behavioural science. The pandemic has provided an opportunity for behavioural scientists to reframe disease management as a behavioural problem and claim a place alongside epidemiologists. Their claims of expertise have, however, routinely ignored the social science of animal disease. Thus, van Bavel et al's (2020) review of the role of social science in managing Covid-19 ignores social research on the human dimensions of managing animal disease. Equally, there is a danger that the social sciences have been narrowly framed: aligned with disciplining the individual perspective of 'nudge' behavioural economics rather than acknowledging community action (Drury et al, 2020). Alternatively, these attempts to provide social scientific certainty, ignore the messy realities of disease and the need to understand the kinds of social work required to make disease control possible (Hinchliffe, 2015).

This narrow definition leads to our final question: why have lessons from animal disease studies been ignored? This seems all the more apposite given the extent to which the discourse of 'One Health' has become ubiquitous in anticipation of the next pandemic (Craddock and Hinchliffe, 2015). In response to Covid-19, was it most appropriate for veterinary experts to help on the front line of the human medical crisis, donate their PPE from the sidelines, or in the face of a labour crisis, to focus on those dimensions of health (such as veterinary public health) that their specialism allowed? With Chief Veterinary Officers suggesting the latter, the experience of Covid-19 seems to speak to the broader limitations of the One Health movement, or at least, reinforce a demarcation and segregation between its various components. Indeed, social scientific studies of One Health already reveal the extent to which understandings of even an epidemic are socially constructed, distributed and laden with power relations (Craddock, 2015; Tirado et al 2015). Or, as Hinchliffe (2015, p.28) suggests, visions of One Health can reduce complexity by focussing narrowly on contamination and transmission, thereby effacing the 'local, contingent and practical engagements that make health possible'. Rather than this version of One Health, argues Hinchliffe, what is preferable is a version that understands the social work that is required to make health work within increasingly complex disease ecologies. Whilst social studies of animal disease offer an immediate mirror

into new and emerging infections like Covid-19, it is towards this longer lasting social understanding of health that might be its greatest contribution.

References

- AVMA (2008). One Health: a New Professional Imperative. Schaumburg, Illinois, American Veterinary Medical Association.
- Anderson, B. (2010). "Preemption, precaution, preparedness: Anticipatory action and future geographies." Progress in Human Geography **34**(6): 777-798.
- Bailey, C., I. Convery, M. Mort and J. Baxter (2006). "Role Stress in Front Line Workers during the 2001 Foot & Mouth Disease Epidemic: The Value of Therapeutic Spaces." Australasian Journal of Disaster and Trauma Studies **2**(1): 1-31.
- Barker, K. (2010). "Biosecure citizenship: politicising symbiotic associations and the construction of biological threat." Transactions of the Institute of British Geographers **35**(3): 350-363.
- Barnes, A. P., A. P. Moxey, B. Vosough Ahmadi and F. A. Borthwick (2015). "The effect of animal health compensation on 'positive' behaviours towards exotic disease reporting and implementing biosecurity: A review, a synthesis and a research agenda." Preventive Veterinary Medicine **122**(1): 42-52.
- Bavel, J. J. V., K. Baicker, P. S. Boggio, V. Capraro, A. Cichocka, M. Cikara, M. J. Crockett, A. J. Crum, K. M. Douglas, J. N. Druckman, J. Drury, O. Dube, N. Ellemers, E. J. Finkel, J. H. Fowler, M. Gelfand, S. Han, S. A. Haslam, J. Jetten, S. Kitayama, D. Mobbs, L. E. Napper, D. J. Packer, G. Pennycook, E. Peters, R. E. Petty, D. G. Rand, S. D. Reicher, S. Schnall, A. Shariff, L. J. Skitka, S. S. Smith, C. R. Sunstein, N. Tabri, J. A. Tucker, S. v. d. Linden, P. v. Lange, K. A. Weeden, M. J. A. Wohl, J. Zaki, S. R. Zion and R. Willer (2020). "Using social and behavioural science to support COVID-19 pandemic response." Nature Human Behaviour, **4**(5): 460-471.
- Bickerstaff, K. and P. Simmons (2004). "The right tool for the job? Modeling, spatial relationships, and styles of scientific practice in the UK foot and mouth crisis." Environment and Planning D: Society and Space **22**(3): 393-412.
- Bronner, A., V. Hénaux, N. Fortané, P. Hendriks and D. Calavas (2014). "Why do farmers and veterinarians not report all bovine abortions, as requested by the clinical brucellosis surveillance system in France?" BMC Veterinary Research **10**(1): 93.
- Brugere, C., D. M. Onuigbo and K. L. Morgan (2017). "People matter in animal disease surveillance: Challenges and opportunities for the aquaculture sector." Aquaculture **467**: 158-169.
- Campbell, I. D. and R. G. Lee (2003). "Carnage by computer: the blackboard economics of the 2001 Foot and Mouth outbreak." Social and Legal Studies **12**(4): 425-459.
- Cassidy, A. (2015). "'Big science' in the field: experimenting with badgers and bovine TB, 1995-2015." History and philosophy of the life sciences **37**(3): 305-325.
- Craddock, S. (2015). "Precarious connections: Making therapeutic production happen for malaria and tuberculosis." Social Science & Medicine **129**: 36-43.
- Craddock, S. and S. Hinchliffe (2015). "One world, one health? Social science engagements with the one health agenda." Social Science & Medicine **129**: 1-4.
- Department of Health and Social Care (2020) Coronavirus Action Plan: a guide to what you can expect across the UK. <https://www.gov.uk/government/publications/coronavirus-action-plan/coronavirus-action-plan-a-guide-to-what-you-can-expect-across-the-uk> (accessed 18th June, 2020)
- Drummond, R. D. (1999). Notifiable Disease Preparedness within the State Veterinary Service. London, MAFF.
- Drury, J., S. Reicher and C. Stott (2020). "COVID-19 in context: Why do people die in emergencies? It's probably not because of collective psychology." British Journal of Social Psychology **in press**.
- Enticott, G. (2008). "The ecological paradox: Social and natural consequences of the geographies of animal health promotion." Transactions of the Institute of British Geographers **33**(4): 433-446.
- Enticott, G. (2017). "Navigating veterinary borderlands: 'heiferlumps', epidemiological boundaries and the control of animal disease in New Zealand." Transactions of the Institute of British Geographers **42**(2): 153-165.
- Enticott, G. (2018). "International migration by rural professionals: Professional subjectivity, disease ecology and veterinary migration from the United Kingdom to New Zealand." Journal of Rural Studies **59**: 118-126.
- Enticott, G. and K. Ward (2020). "Mapping careful epidemiology: Spatialities, materialities, and subjectivities in the management of animal disease." The Geographical Journal **in press**.
- Funtowicz, S. and J. Ravetz (1993). "Science for the post-normal age." Futures **31**(7): 735-755.
- Higgins, V. and J. Dibden (2011). "Biosecurity, trade liberalisation, and the (anti)politics of risk analysis: the Australia - New Zealand apples dispute." Environment and Planning A **43**(2): 393-409.

Higgins, V., M. Bryant, M. Hernández-Jover, L. Rast and C. McShane (2018). "Devolved Responsibility and On-Farm Biosecurity: Practices of Biosecure Farming Care in Livestock Production." *Sociologia Ruralis* **58**(1): 20-39.

Hilgartner, S. (2000). *Science on stage. Expert advice as public drama*. Stanford, Stanford University Press.

Hinchliffe, S. (2015). "More than one world, more than one health: Re-configuring interspecies health." *Social Science & Medicine* **129**: 28-35.

Higgins, V. and M. Bryant (2020). "Framing Agri-Digital Governance: Industry Stakeholders, Technological Frames and Smart Farming Implementation." *Sociologia Ruralis* **60**(2): 438-457.

Hinchliffe, S., J. Allen, S. Lavau, N. Bingham and S. Carter (2013). "Biosecurity and the topologies of infected life: from borderlines to borderlands." *Transactions of the Institute of British Geographers* **38**(4): 531-543.

Hood, B. and T. Seedsman (2004). "Psychosocial Investigation of Individual and Community Responses to the Experience of Ovine Johne's Disease in Rural Victoria." *Australian Journal of Rural Health* **12**(2): 54-60.

Jasanoff, S. (1997). "Civilization and madness: the great BSE scare of 1996." *Public Understanding of Science* **6**(3): 221-232.

Imperial College COVID-19 Response Team (2020) Report 9: impact of non-pharmaceutical interventions (NPIs) to reduce covid-19 mortality and healthcare demand. <https://www.imperial.ac.uk/media/imperial-college/medicine/sph/ide/gida-fellowships/Imperial-College-COVID19-NPI-modelling-16-03-2020.pdf> accessed 8th July, 2020

Jetten, J., S. Reicher, S. A. Haslam and T. Cruwys (2020). *Together Apart. The Psychology of Covid-19*. London, Sage Publications.

Leach, M. and I. Scoones (2013). "The social and political lives of zoonotic disease models: Narratives, science and policy." *Social Science & Medicine* **88**(0): 10-17.

Maye, D., J. Dibden, V. Higgins and C. Potter (2012). "Governing biosecurity in a neoliberal world: comparative perspectives from Australia and the United Kingdom." *Environment and Planning A* **44**(1): 150-168.

Maye, D., G. Enticott, R. Naylor, B. Ilbery and J. Kirwan (2014). "Animal disease and narratives of nature: Farmers' reactions to the neoliberal governance of bovine Tuberculosis." *Journal of Rural Studies* **36**(0): 401-410.

Naylor, R., A. Hamilton-Webb, R. Little and D. Maye (2018). "The 'Good Farmer': Farmer Identities and the Control of Exotic Livestock Disease in England." *Sociologia Ruralis* **58**(1): 3-19.

Palmer, S., F. Fozdar and M. Sully (2009). "The effect of trust on West Australian farmers' responses to infectious livestock diseases." *Sociologia Ruralis* **49**(4): 360-374.

Poortinga, W., K. Bickerstaff, I. Langford, J. Niewöhner and N. Pidgeon (2004). "The British 2001 Foot and Mouth crisis: A comparative study of public risk perceptions, trust and beliefs about government policy in two communities." *Journal of Risk Research* **7**(1): 73-90.

Rose, G. (1985). "Sick individuals and sick populations." *International Journal of Epidemiology* **14**(1): 32-38.

Rosenberg, C. E. (1989). "What Is an Epidemic? AIDS in Historical Perspective." *Daedalus* **118**(2): 1-17.

Scally, G., Jacobson, B. and Abbasi, K. (2020) The UK's public health response to covid-19: Too little, too late, too flawed. *BMJ* **2020**; *369*:m1932 doi: 10.1136/bmj.m1932

Scoones, I., K. Jones, G. Lo Iacono, D. W. Redding, A. Wilkinson and J. L. N. Wood (2017). "Integrative modelling for One Health: pattern, process and participation." *Philosophical Transactions of the Royal Society B: Biological Sciences* **372**(1725): 20160164.

Shortall, O., L.-A. Sutherland, A. Ruston and J. Kaler (2018). "True Cowmen and Commercial Farmers: Exploring Vets' and Dairy Farmers' Contrasting Views of 'Good Farming' in Relation to Biosecurity." *Sociologia Ruralis* **58**(3): 583-603.

Tirado, F., A. Gómez and V. Rocamora (2015). "The global condition of epidemics: Panoramas in A (H1N1) influenza and their consequences for One World One Health programme." *Social Science & Medicine* **129**: 113-122.

Weick, K. E. (1995). *Sensemaking in organizations*. Thousand Oaks, Calif., Sage.