The politics and crisis management of health security governance: Epistemic networks and the interface between public and animal health dimensions

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Abstract

In many senses we are witnessing the ‘good life’ British Government’s organisational preparedness for dealing with threats and crises. This has emerged as a result of governmental learning from a number of complex and difficult crisis situations in recent times. Yet despite the considerable progress that has been made in the systems of governmental crisis management (largely since the millennium) key challenges now lie not only in ‘joining-up’ the machinery of government but in dovetailing the epistemic and knowledge-based dimensions of crisis management. Recent international crises, such as Ebola, avian influenza, Zika virus, and swine flu have demonstrated the need to focus on the sources of crises and for the detection of risks at the animal-human interface. The policy areas of animal and human security policy, and their knowledge networks, are by no means joined-up e.g. stakeholder interests are divergent and the areas suffer from asynchronous political visions. The paper explores this issue and argues that contemporary governmental crisis management challenges for health security governance now lie in the management of epistemic collaborations/synergies across multiple levels of governance.

Introduction

In many senses we are witnessing the ‘good life’ in terms of British crisis management governance. There are now institutionally embedded crisis management operational response systems within the central executive territory of UK government. This system has been strengthened as a result of learning from number of complex, varied and difficult crisis situations. Examples have been the 2001-02 foot and mouth crisis (and the 2007 outbreak), the 2002 fuel protests, the 2005 avian flu outbreaks, the 2007 London terrorist attacks, swine flu in 2009, the 2011 London riots, the heinous murder of Fusilier Lee Rigby in 2013, the 2014-15 Ebola crisis, the 2015 Paris shootings, flooding crises (2007, 2014 and 2015), and the Calais migrant crisis in 2015. In the event of a crisis COBRA (Cabinet Office Briefing A) of the Civil Contingencies Secretariat (CCS) of the Cabinet Office (which is often chaired by the Prime Minister and departmental ministers) is normally convened and serves to exude the image of government readiness to tackle crises and/or chronic policy problems (Connolly,
At a legislative level, the UK Civil Contingencies Act 2004 advances a resilient-orientated and learning culture in government aimed at embedding a joint-up and coordinated approach to dealing with threats and managing crises (Brassett and Vaughan-Williams, 2013; Brassett et al., 2013; Coaffee, 2013). Despite the considerable progress that has been made in the development of central-level crisis management coordinating systems of British governance since the millennium (McConnell, 2003; Connolly, 2015a) there are acute challenges that emerge from ‘modern crises’ which often are transboundary in nature and inherently ‘wicked’ (Boin et al., 2013; Connolly, 2015b). The complex nature of modern crises require policy models which dovetail the epistemic and knowledge-based dimensions of crisis management given their cross-sectorial implications. A significant case of such challenges can be applied to health security governance for the management of disease threats at the animal and human interface.

This paper, informed by interviews with policy actors, argues that a significant wicked problem for contingences and crisis management are disease threats at the animal-human interface. The paper questions the level of maturity of epistemic network collaborations/synergies across multiple levels of governance. The health security policy sector is not short of policy challenges. Policy-makers recognise that there are policy dilemmas which are inherently political. These include the politics of risk communication; power relationships and dynamics between the pharmaceutical industry and government; the challenges of managing international policy relationships (between states and between states and international agencies/organisations); and the politics of territorial governance (Connolly, 2015b). The nature of cross-border threats warrants intra- and inter-organisational communication and coordination. Modern governance systems (through increased interdependence of peoples, technologies and economic systems) aid and abet the prevalence of transboundary vulnerabilities. This resonates with the view of contemporary crisis management studies which is increasingly concerned with managing crises which have cross-jurisdictional and multi-level implications (Bovens et al, 1996; Boin, 2004; Boin and McConnell, 2007; Boin et al 2013). Recent international crises, such as Ebola, avian influenza, swine flu, and the Zika virus have demonstrated that diseases do not respect borders. This means that the focus of public policy should be on the source of threats at the animal-human interface rather than on the current focus – that of reactive forms of crisis management decision-making. This proposal calls for increased public health capacities for addressing animal infections (with the latter being the source). The issue is that the domains of animal and human security policy, and their knowledge networks, are by no means joined-up. For example, stakeholder interests are divergent and these respective domains suffer from a lack of cohesive political visioning. An epistemic network of actors bridging animal and public health security, reflecting what epistemologists describe as a ‘one health’ model (Zinsstag et al 2011), would be the most significant policy paradigm to mitigate against the manifestation of disease outbreaks and would serve to increase public health capacities to tackle animal health-induced crises affecting the human population. The one health perspective is based on the idea of ‘one medicine’ - the paradigm that both human and veterinary science disciplines can contribute to the development of each other. An epistemic community of this kind would support the shifting global discourses on health security
governance. Finally, this paper proposes an evaluative framework for assessing how to establish the extent to success in the emergence of, and impact of, epistemic networks on policy change in the context of health security governance.

From joined-up government to joined-up thinking

Bringing together disciplines and knowledge to affect policy change has been subject to less attention in the academic literature compared to organisationally-focused studies of joined-up government. Perspectives on ‘joined-up thinking’ (Frost, 2005) has been a feature of the social policy and education literature (e.g. Allen, 2003; Hutchings and Williams, 2014; Penny, 2015) but less of a focus in British public administration research. The literature suggests that the challenges of ‘joining-up’ are not insignificant. This is due to political value conflicts (Davies, 2009), bureau-politics (Rosenthal, et al 1991); lack of clarity of ownership and confused lines of accountability (Wilkens, 2002), and preparedness innovate, challenge convention and work in new ways - both in an intra- and inter organisational sense (Clarke and Stewart, 1997a: 3). As Ling (2002: 626) notes, aspects of joined-up government entail shifts in governing arrangements which include new accountabilities and incentives (e.g. shared outcome targets); new ways of working across organisational boundaries (including shared leadership and budgeting processes); new ways of delivering services (e.g. joint delivery across sectors and greater scope for consultation with the end user); and new types of organisation (e.g. information sharing, shared cultures and capacity building). All of these are important for joined-up approaches but fundamental to efforts towards greater organisational synchronicities and integration though partnerships and collaborations is the role of knowledge and the pooling of epistemes and new ways of thinking in order to address what Clarke and Stewart (1997b: 22) refer to as ‘wicked issues’. Wicked issues or ‘wicked problems’ are, from a public policy perspective, unstructured, relentless and cross-cutting (Weber and Khademian, 2008: 336). Such characteristics are associated with matters of health security in the sense that the ‘complexities of disease threats and their transcendence of systems means that there is a requirement trade-offs, flexibility, resource-sharing and collaboration’ (Connolly, 2015b: 370). Frost (2015) highlights what actors can do to enable joined-up thinking:

- Share information between agencies
- Complement rather than duplicate
- Coordinate and achieve continuity through a single information channel
- Avoid responsibilisation avoidance
- Coordinate spending and resourcing to deal with the problem
- Co-locate agencies or strategise to bring knowledge together across geographical boundaries
- Use knowledge as part of a participative planning process which is outcome rather than objective-orientated.

(adapted from Frost, 2005: 17-18)
For crisis management it is certainly the case that successive UK governments since the New Labour administration from 2002 have embedded the institutional path laid down by the Blair Government towards more joined-up and resilience-focused approaches - so much so that some policy actors suggest that we are living in an era of ‘post-politics’ when it comes to crisis management. A senior official in charge of contingencies for health security in Public Health England noted that: ‘what I say to my team is that as long as this works there is not a terrible amount of politics in it because everyone wants it to work’ (PHE official, 2014, emphasis added). In other words, if the processes of crisis management operate well then there is less likelihood for ‘politics’ to feature as part of the process. There have undoubtedly been changes in the institutional development of the machinery of British crisis management and this has been demonstrated in the UK response to avian influenza, swine flu in 2009 and, more recently, when it comes to contingencies management for Ebola – although, at a global level, the WHO was too slow to act in the case of Ebola (Kamradt-Scott, 2015). A key question, however, is about where the politics of crisis management now lies in modern governance. For health security the politics lies in network dynamics to enable epistemic linkages across policy spaces to address transboundary problems such as disease threats.

The epistemic community literature (see for example, Haas, 1992; Adler and Haas, 1992; Radaelli, 1997; Richardson, 1996; Verdun, 1999; Zito, 2001; Waarden and Drahos, 2002; Howorth, 2004; Galbreath and McEvoy, 2013) has been the most useful literature in considering how networks of expert actors come together to attempt to influence policy agendas. An epistemic community is ‘understood as a network of professionals with competence in a policy area on the basis of a shared objective to ameliorate a political problem via the implementation of agreed measure’ (Galbreath and McEvoy, 2013: 170). According to Haas (1992: 3) epistemic communities possess key elements:

They have {1} a shared set of normative and political beliefs, which provide a value-based rationale for the social action of community members; {2} shared causal beliefs, which are derived from their practices leading or contributing to a central set of problems in their domain and which then serve as the basis for elucidating the multiple linkages between possible policy actions and desired outcomes; {3} shared notions of validity – that is, intersubjective, internally defined criteria for weighting and validating knowledge in the domain of their expertise; and {4} a common policy enterprise – that is, a set of common practices associated with a set of problems to which their professional competence is directed, presumably out of the conviction that human welfare will be enhanced as a consequence.

The underpinning theme of Haas’ epistemic community framework is that the claim to expertise provides such networks with a potentially significant role in providing lessons for policy-makers on how to address complex policy issues. The concept, however, has not been without its criticisms (for example, Risse-Kappen, 1994; Richardson, 1996; Wright, 1997; Sabatier, 1998; Verdun, 1999; Zito, 2001a, Zito 2001b; Susskind and Ali, 2014). Criticisms largely refer to the fact that, in the end, governmental agendas and other power agendas will dominate. However, Dunlop (2009: 289) notes that ‘[W]e still know very little about the
variety of ways in which decision-makers actually learn from epistemic communities’. Part of the problem of the epistemic community framework has been the lack of evaluation of their impact on policy learning and change and its lack of application to the area of health security governance. In order to evaluate the presence and impact of an epistemic community the assessment should be structured around Adler and Haas’ (1992) levels of epistemic community influence in terms of:

- *policy innovation* (e.g. level of influence in framing the policy issues and standard-setting)

- *policy diffusion* (transnational communication with international organizations and knowledge dissemination)

- *policy selection* (whether the epistemic community is chosen by the decision-maker to support the latter’s policy).

- *policy persistence* (the levels of success in terms of the sustainability of outcomes and the level of policy consensus)

- *policy evolution as learning* (the extent to which epistemic communities decisively to a process of policy learning and adaptation).

Contemporaneous international crises, such as SARS, Ebola, avian flu and swine flu, have demonstrated how the movement of people, international migratory bird patterns (for avian flu) have led to significant levels of risk in terms of the spread of diseases across the globe. In 2015 pandemics (particularly from influenza) topped the UK government’s 2015 risk register with terrorist attacks coming in fourth place behind flooding and widespread electricity failure (Cabinet Office, 2015). Managing threats and putting in place appropriate processes and procedures for health security opens up windows of opportunity for the involvement of multiple actors working at multiple levels of governance. The post-2009 swine flu strategy compiled by the UK Department of Health, for example, suggested that all political administrations in the UK worked effectively during the crisis (Department of Health, 2011). However, a Scottish Government official noted that ‘it is not always the case that the devolved administrations are there and creating plans with the UK government’ (Scottish Government official, 2014). The main priority when it comes to inter-territorial relations is that communication and information channels are effective in order to share knowledge across geographical space and that policy relationships are nurtured and allowed to mature. The (then) deputy Chief Medical Officer for Scotland, Dr Aileen Keel, outlined this point:

There are communication issues and you need to get the right channels of communication established and it certainly helps if you know the people that you are dealing with before the crisis arises. Part of our job is to have the right contacts at the Department of Health and the right contacts in Europe. We all feed in through Health Protection Scotland to the expert advice that is coming
from the WHO and similar organisations but clearly there are challenges when you are talking about multiple agencies. At my level that is the UK CMOs level and that has never been a problem. We meet regularly and know each other very well and at the policy side we have Scottish representation on UK committees. It is about making sure that you have those channels of communication well established before you are facing a crisis.

(Keel interview, 2014)

When considering the multi-level governance dimensions of British crisis management it is not just national and subnational relations that are important but also the national and supranational dimensions. For the supranational dimension the key institutional actors are the WHO, the European Commission and the European Centre for Disease Control (ECDC). It is clear that threats which have implications for animal health and public health security EU member states present opportunities for the increased Europeanisation of national crisis management. The strengthening of EU legislation in the aftermath of national crises in the area of health security governance was a policy change after the 2001-02 foot and mouth crises in the UK (which has a bearing on contingences for other diseases such as avian flu) and after the swine flu pandemic in 2009 (Connolly, 2008; 2014a; 2014b). For public health matters, the European Security Committee of the European Commission been incrementally strengthened since the SARS outbreak 2002-03 and it saw its role becoming more formal in the aftermath of pandemic influenza in 2009. In an interview the Chair of this committee, Mr John Ryan suggested that a strengthened European Security Committee (ESC) ensures that national level data is shared and national authorities are held to account for their planning activities:

Having a more formal role for the ESC was popular after the pandemic because the member states realised that continuing in a more informal, limited way in terms of just coordinating in terms of communicating diseases as we did before was inadequate because many of the aspects relating to communicable diseases and large scale events are cross-sectorial.

(interview with the author, 2014)

There is evidence of more coordinated thinking in terms of the diffusion of knowledge at the EU level. The EU public policy framework also includes EU Early Warning and Response Systems for disease outbreaks and a joint procurement arrangement for coordinated resourcing for vaccine production. This arrangement is not just for crisis management for pandemics - ‘it covers any of the diseases on our agreement…So HIV is covered, tuberculosis, communicable diseases, cervical cancer for example’ (Ryan interview, 2014). Ryan also notes how joint procurement ‘is really ground-breaking stuff in public health as it is the first time it has been done in the EU whereby first of all there is a security aspect and then there is the public health aspect’ (Ryan interview, 2014). In terms of British crisis management, Ryan suggests that, on the matter of health security, the UK have been positive

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1 The ECDC, based in Stockholm collect and shares data on health security and provide guidance and standards to Member States.
and less concerned for sovereignty in many senses (but this is not to be generalised to other areas of public health):

In terms of Health Security the UK have been supportive due to the strong capacity that they have nationally...they have a lot of experience in dealing with chemical and biological agents. They have lots of experience in dealing with different outbreaks and they recognise the importance of international cooperation. They are also involved in the WHO and multi-lateral groups the global health security initiative. They have not got as many issues or jealous about sovereignty in this area as they would in other areas of public health. If you were to start to talking to them about the rights of patients or the quality of health systems they would have a different attitude. They are quite hands on they have helped us to our preparedness planning and our exercises. We have a contract with Public Health England to help us do that. They are anxious to ensure that data sharing is done in the right way.

At the same time, Prof David Heymann (Chair of Public Health England) argues that matters of technical public policy relating to health security e.g. information and data sharing arrangements with supranational bodies are not devoid of questions about national sovereignty when he suggested that ‘Many countries so feel that [a strengthened EU in the area of public health] is a challenge to their sovereignty, yes...Having said that I think it is remarkable how closely they are following ECDC or European guidelines in various areas’ (Heymann interview, 2014). Davies et al’s (2015: 9-11) analysis of ‘disease diplomacy’ in relation to the revision of International Health Regulations for WHO member states (which expands what is expected from states in the fact of public health emergencies in terms of detecting and containing outbreaks) raises questions about state capacities, political will and sovereignty in global health security. Interestingly, given the British political climate in early 2016 in the run up to the ‘in or out’ referendum on British membership of the EU, a senior official responsible for contingency planning in Public Health England highlighted the fact that although questions of sovereignty gain considerable political attention by Eurosceptics, it is important to acknowledge the value of the EU as a crisis manager (see Boin et al, 2013) but that ‘it is difficult to communicate to the public, in a time of Euroscepticism, that the EU has an important function in managing diseases across levels of government’ (PHE interviewee, 2014).

What is clear is that the politics of European integration may not work in the best interests of facilitating systems thinking and counterproductive to efforts to effectively address wicked problems. A systems thinking view of health security governance is anchored towards addressing complex global problems through multiple interacting agents (Peters, 2014: 51). Peters (2014: 51), however, argues that complexity is an inherent feature of global public health due to complex problems which does not lend themselves to blueprint policy solutions. Prof David Heymann, argues that, for health security, a strategy for addressing complexity is to strengthen public capacity in order to address problems at their source rather than being focused on detecting and responding to threats and crises:
At the *animal and human interface* there are a series of things that are happening. Most countries now have strengthened their capacities – most industrialised countries including the UK - to detect and respond to infections where and when they occur. More needs to be done *to focus on the source of the disease rather than focusing on detecting and responding.*

(Heymann interview, 2014, emphasis added)

In a similar vein to research addressing the complexities of health inequalities, a recommendation is to proactively address the structural drivers affecting the *causes of the causes* (Marmot, 2005; Mackenzie et al 2016) - e.g. through regulatory change and policy levers to tackle poverty. The same logic is can be applied when it comes to health security. A shift in health security governance towards joined-up thinking to that of a ‘one health’ model is required due to threats of the transmissibility of diseases between animals and humans. Mackenzie et al (2013: x) elaborate on this point:

> [T]he health of humans, animals, and ecosystems are interconnected, and that to better understand and respond rapidly to zoonotic diseases at the human-animal-environment interfaces requires coordinated, collaborative, multidisciplinary, and cross-sectoral approaches. This holistic approach has been referred to as ‘one health’, indicative of the commonality of human and animal medicine, and their connection to the environment.

SARS, pandemic influenza, avian influenza and Ebola, have all had public health implications but their origin has been in animal infections. For example, the most likely explanation for the 2003 SARS outbreak was that the infection came from a cat which was the carrier of the coronavirus in a live animal market in a province in South China (Heymann and Dixon, 2013: 209). The 2009 pandemic influenza outbreak, also referred to as ‘swine flu’, also had animal health origins in that the virus was a new strain of H1N1 as a result of a triple re-assortment of bird, swine and human flu viruses further combined with a Eurasian pig flu virus (Trifonov et al, 2009). Avian influenza (particularly the highly pathogenic H5N1 strain), which spread worldwide in 2005, proved to have public health implications (Thorson and Ekdahl, 2005). The 2014 Ebola in West Africa was most likely caused by the consumption of infected bushmeat or that the virus can be contracted directly from bats (Connolly, 2015a: 162). The 2016 outbreak of the Zika virus in Brazil was found to be transferred to humans via *Aedes* mosquitoes (Centres for Disease Control and Prevention, 2016).

There is no shortage of evidence to suggest that the sources of disease which threaten a largescale outbreaks and risk public health on a global scale emerge from infections in animals. Moreover, the spread of disease is aided and abetted by vulnerabilities by the nature of a globalised system. This begs the question about why there has not been more advances in dealing with diseases at the animal-human interface and to address the epistemic incongruities between the public health and animal health domains. The answer is largely down to the fact that detection has not been the main focus of disease containment and eradication strategies coupled with the lack of long-term political commitment for dealing
with the ‘causes of the causes’ of disease outbreaks (with economic interests being the ultimate priority over public health). Heymann summarises this issue:

The areas of animal and human security policy, and their knowledge networks, are by no means joined-up. Stakeholder interests are divergent and the areas suffer from asynchronous political visions ... The difficulty is that animal health is to keep animals healthy but the ultimate goal is a profit whereas human health is to keep people alive and healthy. So already there are tensions between the two groups and if you want to sell anything to the animal health community it has to be different to how you sell something to the human health community. For the animal health community the bottom line is cost effectiveness. With public health, it is also cost effectiveness but it is a very different approach than in the animal sector because the animal health sector is trying to spend the least amount of money to get the most profit whereas in the human health sector you are trying to spend money in a cost effective way.

(Heymann interview, 2014)

From Heymann’s analysis there are opportunities for transnational public policy network which can enable joined-up epistemes and to work in the shared interest of health security governance at the animal and human interface.

Evaluating the development of ‘one health’ paradigm through the epistemic community lens

Zinsstag et al (2011: 148) observe that there is a ‘huge gap between knowledge and its application both in human animal health delivery’ and that ‘large portions of human and animal health thinking and actions still remain in separate disciplinary silos’. This problem has emerged to be key driver for a series of recent research funding by multiple agencies and research councils in the UK in recognition of the fact that:

Zoonoses are diseases capable of passing from animals to humans and are estimated to have cost more than $20 billion in direct costs globally between 2000-2010, with a further $200 billion in indirect costs. As well as threatening human and animal health, zoonoses affect livestock production, causing economic and social harm to communities in developed and developing countries.

(Economic and Social Research Council, 2014)

This requires a ‘one health’ model of health security in order to give much more prominence to conceptual and integrative theoretical and empirical development (Zinsstag et al, 2011: 148). Bardosh (2016: 206) suggests that a ‘social-political movement’, which is more than dovetailing standards but is actually about the creation of an epistemological force, should be the way forward:
Without a more concerted appreciation of one health as a social political movement, the aspirations of researchers, practitioners and policy-makers in advancing a more holistic understanding and engagement with zoonotic diseases will fail to live up to expectations. One health promises to break down divides and shift conceptual boundaries about disease, health and the environment.

This view of health security means that both animal health and public health disciplines should be seriously refracted to ensure that a systems thinking approach becomes a fundamental dimension to health security governance at the animal-human interface. This is on the basis that such a change will facilitate ideational coordination, sharing goals, values or intended outcomes and that the focus is on the causes of problems as opposed to a focus on reactive approaches to addressing disease outbreaks. The fact that research funders are beginning to take this issue more seriously and have recognised the hitherto acute underfunding of the analysis of risks at the animal and public health interface is a positive step forward. Since 2014 multiple funders (including the Economic and Social Research Council (ESRC), the UK Department for International Development and the Medical Research Council) have funded a range of research initiatives amounting to £20.5 million in order to address animal diseases which can ultimately lead to crises for public health. The funded projects are detailed in Appendix 1. In terms of national UK networks of experts, the Human Animal Infections and Risk Surveillance (HAIRS) group, chaired by Public Health England, is a multi-agency and cross-disciplinary group which has sought to identify infections with potential for interspecies transfer (UK Government, 2016). The partners within HAIRS include the all of the devolved administrations and major public health agencies from across the UK, the UK Department of the Environment, Food and Rural Affairs, and the Food Standards Agency. The contribution that this network will make to the establishment of a one health epistemic community in the longer term, coupled with assessing the outcomes of UK Research Council funded projects, represents a research agenda to investigate whether this network has influence at domestic and international levels of governance (Adler and Haas, 1992). It is the case that health security is high on the agenda of the EU institutions and this has been evidenced by strengthened committees within the European Commission - a direct lesson learned from the 2009 swine flu pandemic (Connolly, 2014b). National public and animal health actors interact with international counterparts in a number of forums such as Health Security Community (of the European Commission), the ECDC and the WHO.

In terms of evaluating the one health model, the epistemic community framework is an effective conceptual lens for identifying the level of ‘joined-upness’ of knowledge and the breaking down of disciplinary silos. The criterion of policy innovation, policy diffusion, policy selection, policy persistence, policy learning are key dimensions to enable the assessment of the establishment of a ‘one health’ epistemic community and indicators of such criterion can support the analysis of the effectiveness of a one health epistemic community in contributing to policy change and learning. In many senses learning and change could be regarded complementary (see, for example, Heclo, 1974; Argyris and Schon, 1978; Huber, 1991; Bennett and Howlett, 1992; Hall, 1993; Farkas, 1998; Aldrich
and Ruef, 2006; Demers, 2007; Connolly, 2015a) and comes with different labels (Sabatier, 1987; Rose, 1991; Levinthal and March 1993). Examples of such labels include policy-orientated learning (Bennet and Howlett, 1992; Sabatier and Jenkins-Smith, 1993), social learning (Dunn, 1971), government learning (Etheredge, 1981), organisational learning (Argyris and Schôn, 1978; Corbacioglu and Kapucu, 2006; Demers, 2007). Learning also underpins ideas associated with lesson-drawing, policy transfer, policy diffusion and policy convergence (Rose, 1991; Bennett, 1991; Dolowitz and Marsh, 2000; Stone, 2012; Nicholson-Crotty and Carley, 2015). Networks of actors are key channels through which learning and change take place within policy subsystems. However, for a one health epistemic community to be established, evidence of innovation, diffusion, selection, persistence and policy learning would support plausible claims about the emergence and impact of joined-up epistemes. Yet, it has been said, and it is fair, that there are elements of vagueness of what joined-up thinking might constitute (Dunleavy, 2010: 8). In recognition of this, Table 1 overleaf provides an evaluation framework for the assessment of the developments towards a ‘one health’ epistemic community in the context of health security governance – including indicators of joined-up thinking.
Table 1: Epistemic communities and indicators of success in the context of health security

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<th>Outcomes</th>
<th>Description</th>
<th>Indicators of joined-up thinking</th>
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| Policy innovation      | Level of influence in framing the policy issues and standard-setting         | - The level of knowledge utilisation of networks of experts which challenge orthodoxy towards dealing with the source of disease threats at the animal-human interface.  
- Whether epistemic actors have been instrumental in guiding policy-makers to adopt new approaches to standard-setting, monitoring and evaluation in health security governance. |
| Policy diffusion        | Transnational communication with international organizations and knowledge dissemination | - Epistemic networks operating at domestic and international levels communicate evidence of how to move towards a one health model.  
- Epistemic actors become inter-agency or network information-seekers in a formal and informal basis  
- Networks of experts have key roles in monitoring the implementation of health security processes and standards |
| Policy selection        | Whether the epistemic community is chosen by the decision-maker to support the latter’s policy | - The level of synchronicity between the beliefs of the network of experts and policy-makers  
- The level of political astuteness and readiness of adapt positions in light of policy-maker preference regarding health security governance and capacity building |
| Policy persistence      | The levels of success in terms of the sustainability of outcomes and the level of consensus | - The policy solutions of networks of experts remain on the policy agenda and, linked to this, whether networks of experts have long-standing insider status and institutional representation in health security committees.  
- Networks of actors champion and advocate a widening of health security standards across time and space.  
- Networks of actors have autonomy to re-open issues and to propose new ideas and have a licence to continually innovate |
| Policy learning         | Extent to which epistemic communities contribute authoritatively to a process of policy learning and adaptation over time. | - Networks of experts are key architects of social learning by policy-makers to adapt their cognitive understandings in light of knowledge from epistemic actors  
- Networks of experts are involved in knowledge production regarding the best policy solutions to develop capacity to address health security threats  
- Networks of actors promote an international policy culture and shape global discourses on health security governance towards a one health model |

Note: The content of Table 1 has been informed by Heclo (1974); Frost (2005); Dunlop (2009); Galbreath and McEvoy (2013); McConnell (2011); Stone (2015)
Table 1 presents a framework for establishing a ‘one health’ epistemic community. This includes indicators across the features of the epistemic community framework which focus on the organisation of knowledge within an epistemic network in order for policy change and learning to be detected and, ultimately, joined-up thinking. This framework supports the assessment of the shaping of policy discourses on health security at multiple levels of governance in addition to the roles of epistemic networks in standard-setting which are sustained over time and space.

**Conclusion**

The overall narrative of this paper has been that modern crisis management for health security governance, and the vulnerabilities associated with it, are in no small part due to the source threats which lie at the animal and human interface. Although this is the case, the governmental moves towards a focus on addressing the causes of infections at the animal-human interface necessitate considerable development. In order to address the acute vulnerabilities of the spread of disease and pandemics - e.g. influenza, SARS and Ebola - the establishment of a ‘one health’ policy model of health security governance, coupled with the development of public health capacities and the breaking down disciplinary silos, is a vital step forward. This paper identifies a framework for undertaking evaluation research in relation to the establishment and impact of a one health epistemic community in terms of a) whether an epistemic community has been realised and b) what implications such an epistemic community has had on sustaining a policy model for health security governance which is interdisciplinary and focuses on the causes of the causes of threats at the animal-human interface.

There are positive stories to tell about UK crisis management in recent times in that there has been evidence of more resilience-focused governance and institutional development to facilitate communication and coordination in crisis management (Connolly, 2015a). The goal, however, should be one the sources wicked problems (which include environmental and social conditions e.g. poverty and poor infrastructure). Evaluating the ‘drawing together’ of epistemic networks and their role(s) in affecting policy change should be the focus of future research. Getting to this point is not an apolitical process due to the public and animal health disciplines often being part of different policy subsystems, and the fact that their respective policy sectors are engulfed by different stakeholder interests and questions about state sovereignty when it comes to information and data sharing across territories (see Davies et al, 2015). Furthermore, public health visions are long-term policy commitments which are often out of sync with short-term political terms and spending cycles. Nonetheless, as noted above, there have been positive developments in terms of the focus of Research Council funding which cross-cut public and animal health disciplines. There are high levels of veterinary and public health expertise in the UK (the UK hosts reference laboratories which are world renowned) and there have been efforts to improve joined-up thinking and communication flows between the public and veterinary health disciplines through HAIRS and across government levels. The EU institutions are also strengthening their capacity for monitoring and
evaluation of disease threats. The next step of this research is to examine the longer term outcomes of such developments to assess, using the epistemic community framework, whether a one health model of health security governance has been realised.
Appendix 1: Funded projects to address animal diseases due to their implications for public health.

- Factors affecting transmission of zoonotic pathogens from livestock to people - Cleaveland, University of Glasgow
- Zoonoses in Livestock in Kenya (ZooLINK) - Professor Eric Fèvre, University of Liverpool
- Establishing a strategy to control brucellosis in dairy herds of West and Central Africa - Professor Javier Guitian, Royal Veterinary College
- Developing the evidence base to control brucellosis in sub-Saharan Africa - Professor Daniel Haydon, University of Glasgow
- Combating bird flu by developing new diagnostic tools and vaccines - Dr Munir Iqbal, The Pirbright Institute
- An integrated approach for surveillance and control of zoonoses in emerging livestock systems - Professor Duncan Maskell, University of Cambridge
- Controlling and monitoring emerging zoonoses in the poultry farming and trading system in Bangladesh - Professor Dirk Pfeiffer, Royal Veterinary College
- Tackling Human African Trypanosomiasis on the edge of wilderness areas - Professor Stephen Torr, Liverpool School of Tropical Medicine
- Epidemiology and evolution of zoonotic schistosomiasis in a changing world - Professor Joanne Webster, Royal Veterinary College London
- Controlling Bovine Tuberculosis in Ethiopia - Professor James Wood, University of Cambridge
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