Disaster Prevention and Management

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Received 15 October 2015
Revised 16 May 2016
Accepted 16 May 2016

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Abstract

Purpose – Holistic approaches to public health such as "One Health" emphasize the interconnectedness between people, animals, ecosystems, and epidemic risk, and many advocate for this philosophy to be adopted within disaster risk management (DRM). Historically, animal and human diseases have been managed separately from each other, and apart from other hazards considered for DRM. Shifts in DRM, however, may complement a One Health approach. The taxonomy of hazards considered under DRM has expanded to include medical and social crises such as epizootics and terrorism. However, there is a gap in understanding how epidemic risk is integrated into DRM at the community-level. The paper aims to discuss these issues.

Design/methodology/approach – TACTIC adopts a participatory case study approach examining preparedness for multiple hazard types (floods, epidemics, earthquakes, and terrorism) at the community-level. This paper reports on findings from the epidemic case study which took as its focus the 2001 foot-and-mouth disease epidemic in the UK because of the diverse human, social, and environmental impacts of this "animal" disease.

Findings – Epizootic preparedness tends to focus on biosecurity and phytosanitary measures, and is geared towards agriculture and farming. Greater engagement with public health and behavioural sciences to manage public health impacts of animal disease epidemics, and activities for citizen engagement to improve preparedness are discussed. The impermeability of boundaries (hazard, institutional, disciplinary, etc.) is a key constraint to integrating One Health into DRM.

Originality/value – This work helps to situate the One Health discussion within the community-level DRM context.

Keywords Preparedness, Community-based disaster risk management, Epidemics, One Health

Paper type Case study

1. Introduction

The One Health concept draws attention to the interconnectedness between people, animals, ecosystems, and public health, emphasizing the importance of a holistic approach that considers these relationships to improve wellbeing and reduce epidemic risk (Coker *et al.*, 2011; Dhama *et al.*, 2013; Zinsstag *et al.*, 2011). New infectious diseases emerge from a "complex set of multifactoral circumstances including population growth, globalization of trade, changes in nutritional, agricultural, and trade practices, shifts in land-use including accelerated urbanization, deforestation, and encroachment on wildlife" (Coker *et al.*, 2011, p. 326). Climate change and land-use change alter the range of vector-borne diseases and microbial conditions, and antimicrobial resistance among zoonotic bacteria alongside the use of antibiotics in the treatment of animals, posing further uncertainty and challenges for epidemic

Funding for the TACTIC project is provided by the European Union Seventh Framework Programme under grant contract number 608058. Information given in this paper reflects authors' views only. The community is not liable for any use that may be made of the information contained therein.

Disaster Prevention and Management
Vol. 25 No. 4, 2016
pp. 506-519

0965-3562
DOI 10.1108/DPM-10-2015-0241

preparedness (Dhama *et al.*, 2013). Consequently, these circumstances overlap as driving factors for, or may have other negative consequences contributing to, disaster risk from "natural"[1] hazards and other hazard types, motivating the recommendation that a One Health philosophy be adopted within disaster risk management (DRM) (Dhama *et al.*, 2013).

Epizootics such as foot-and-mouth disease (FMD) affect animal populations and cannot be transmitted to humans. In contrast, zoonotic diseases can be transmitted from animals to humans. When a disease outbreak becomes widespread, within one or a few countries, for example, it is considered an epidemic. Pandemics occur when a disease outbreak spreads to numerous countries, or globally. Roughly two-thirds of all human pathogens are zoonotic, and approximately three-fourths of new and re-emerging infectious diseases are zoonotic, for example, avian influenza, severe acute respiratory syndrome, West Nile virus, and a H1N1 pandemic influenza (Coker *et al.*, 2011). Many of these diseases are classified as transboundary animal diseases (TADs) because they pose significant health, economic, and food security risks to a number of countries, can easily reach epidemic proportions, and require the cooperation of a number of countries for disease control and prevention (FAO-OIE, 2004).

Historically, epizootics and zoonotics have been managed separately from each other, and apart from other types of hazards considered for DRM. The frequency and severity of disasters over the past decade, however, has motivated many countries to rethink and reorganize DRM in ways that may be complementary to a One Health approach. Civil contingencies planning in many European countries, for example, now lists medical and social crises including epizootics and terrorism alongside "natural" and technological hazards within the taxonomy of hazards managed under DRM (Alexander, 2003). Incorporating medical and social crises into the hazard taxonomy for DRM may be a positive step towards One Health, however, many obstacles remain. Historically, different hazard types have been approached and managed via different social, conceptual, and institutional frames. The evidence base therefore is limited with regards to the benefits of an integrated versus sectoral approach to DRM. Furthermore, an integrated approach requires a high degree of "border-work", that is, linking scholarship and practice across different boundaries (disciplinary, institutional, hazard, operational, etc.) (Horlick-Jones and Sime, 2004). Decentralization of hazard governance under civil contingencies planning has shifted greater responsibility for DRM onto the community-level, thus there may a similar lack of evidence and guidance for a community-led DRM approach.

The overall aim of the TACTIC project is to increase preparedness to large-scale and cross-border disasters amongst communities and societies in Europe. To achieve this, TACTIC will consider studies on risk perception and preparedness (including good practices and preparedness programmes) in order to develop a participatory community preparedness self-assessment enabling communities to assess impacts in a multi-hazard context, and their motivations and capacities to prepare for large-scale and/or cross-border disasters. This forms the basis for developing context-sensitive education and training strategies and practices that are embedded in an overarching long-term learning framework for increasing the overall prepares of communities and societies across Europe. Rather than taking a top-down approach to preparedness, TACTIC will pursue a collaborative project strategy by including different user and stakeholder groups in the development, testing, and validation of tools and materials throughout the process of the project by conducting four case studies focusing on terrorism, floods, epidemics/pandemics, and earthquakes[2]. Project outcomes and resources are synthesized in a freely available online platform.

This paper reports on key findings from the epidemics case study, which took as its focus the 2001 FMD epidemic in the UK. The 2001 FMD epidemic was the single largest animal epidemic the world has ever experienced, and one of the most serious epidemics the UK has experienced in modern times (Rossides, 2002, p. 831). Additionally, it was the first major crisis to occur under the "devolved" governance (McConnell and Stark, 2002). Severity of flooding in 2000 and the 2001 FMD epidemic were important motivators for major policy reforms in the UK, including the Civil Contingencies Act of 2004, and the National Health Service Emergency Planning Guidance in 2005 (Achour *et al.*, 2015). Response to a consequent FMD outbreak in 2007 was much more successful, resulting in the slaughter of far fewer animals (2,160 vs 6.5 million), at lesser expense to the government (£47 million vs £3 billion in direct costs) (Anderson, 2008). The TACTIC case study uses the 2001 FMD epidemic as the reference event from which to learn how communities[3] can better prepare for and learn from similarly complex threats.

Results of the case study recommend that, whilst many positive gains have been made in terms of government led operational response and policy changes, community engagement and community-level preparedness requires greater attention. Improvements to risk communication, and greater recognition of the diverse human, social, and environmental impacts of "animal" diseases are needed to improve preparedness. Epizootic management tends to be siloed outside of the day-to-day DRM context for community members who are not engaged with agriculture or farming, which may limit risk awareness. Preparedness remains largely focused on operational response, which is led by central government, and veterinary sciences. Preparedness activities tend to be geared towards specific groups such as farmers and agricultural workers, and pertain to biosecurity and phytosanitary measures aimed at reducing the occurrence and transmission of diseases. Whilst these strategies are necessary and beneficial, they do not engage with the potential human, social, and environmental impacts of "animal" diseases, nor to they foster community-wide engagement in preparedness. Greater engagement across boundaries (disciplinary, hazard, institutional, livelihoods, etc.) is needed to raise awareness of preparedness and motivate community-wide engagement in epidemic preparedness, whether epidemics arise from human or animal diseases. Engaging with public health to manage the public health impacts of "animal" disease epidemics, and learning from community-led initiatives that were vital in coping during the 2001 FMD epidemic, would help to improve preparedness levels. Community-led informal networks and support initiatives that sprang up during the 2001 FMD event played an instrumental role in recording public health impacts and supporting those affected through a very traumatic event. Citizen panels similarly played a role in identifying and monitoring the diverse impacts of the 2001 FMD epidemic. Many lessons were identified that could improve risk communication, and assist communities in coping with impacts such as social isolation and fragmentation of social networks. Community-level preparedness strategies are not well recognized as an element of contingency planning. TACTIC's tools were perceived as being useful for strengthening risk communication and creating a preparedness baseline. Nevertheless, the impermeability of boundaries (hazard, institutional, disciplinary, policy) remains a key challenge for to an integrated approach to DRM, and to adopting holistic philosophies such as One Health.

1.1 Background

1.1.1 FMD. FMD is an infectious viral disease that replicates rapidly, is highly contagious, and can affect a wide range of domestic and free-living ungulates (hoofed mammals)

(Thomson and Bastos, 1994). FMD is a TAD that is endemic (regularly found) in two-thirds of the world and is currently the single largest constraint to international trade in animal products (Rweyemamu *et al.*, 2008, p. 73).

The UK maintains "disease free" status with regards to FMD. Disease free status indicates that a disease is not endemic in a country, however, this does not mean that the disease cannot be introduced through contaminated animals or animal products, for example. To maintain disease free status, a country must actively control disease outbreaks and conform to international trade and phytosanitary guidelines. Many disease free countries follow a "stamping-out" (culling) policy for disease control. "Stamping-out" policy generally includes slaughtering infected animals, animals that may have come in contact with infected animals, as well as animals in neighbouring premises that may be susceptible to infection. Movement bans prohibiting movement of animals within or between farms, and which restrict access of the general public into infected or suspected areas of infection, are also commonly enforced (Rweyemamu *et al.*, 2008). Depending on the characteristics of the epidemic, for example, severe weather conditions or extended animal movement bans, animals often are slaughtered for welfare reasons. Governments typically provide financial compensation to farmers whose livestock are slaughtered, however, compensation varies depending on the government and disease type. Indirect costs from disease control measures such as biosecurity activities and other losses incurred from business disruption are frequently borne by the famers (Hoag *et al.*, 2006). Vaccination for FMD is used as a disease control measure in some countries, but remains controversial in others (Rossides, 2002).

The 2001 FMD epidemic in the UK was the most serious epidemics the UK has experienced in modern times (Rossides, 2002, p. 831). The last major FMD epidemic in the UK occurred in 1967-1968, resulting in the slaughter of over 400,000 animals whereas the 2001 epidemic resulted in the slaughter of 4 million animals for disease control purposes and an additional 2.5 million that were killed on welfare grounds (Rossides, 2002). Total direct and indirect costs for the UK for the 2001 event were estimated at £8 billion (Anderson, 2008). The severity of the 2001 FMD epidemic is attributed largely to delayed reporting and response time. There was one source case, however, identification came three weeks after infection. The disease had already been spread around the country as a result of animal movement, mainly sheep, through markets and dealers (Anderson, 2008).

Within a month of the outbreak, FMD has spread to France, Ireland, and the Netherlands; however, the primary focus of the TACTIC case study is in Cumbria, England. Cumbria is a county in north western England bordering Scotland. Cumbria is a rural area and livestock farming, tourism and outdoor recreation are mainstays of the economy. Cumbria was at the epicentre of the epidemic; it suffered 893 disease outbreaks, was the second longest affected region, and FMD reduced the economy of Cumbria by an estimated £266 million (4 per cent of the GDP of the county) with roughly £130 million (roughly 41per cent) loss of the normal livestock output of the county and roughly £200 million suffered from tourism losses (Cumbria Foot and Mouth Disease Inquiry Report, 2002).

Major changes occurred to animal disease policy following the 2001 epidemic. The Department of Environment, Food, and Rural Affairs (DEFRA) was developed and replaced the Ministry of Agriculture, Fisheries, and Food as the lead government institution in charge of managing exotic notifiable animal diseases including FMD.

DEFRA manages the operational response strategy and local response is led by the Local Disease Control Centre (LDCC), managed by regional operations directors, and operational management is supported through divisional operational managers. Contingency planning was redesigned across Government, DEFRA, Animal Health, and the devolved administrations of Scotland and Wales, and continues to be revisited following consequent epidemic events (Anderson, 2008). Despite many positive improvements in policy and preparedness since 2001, community engagement and building trusted relationships with local stakeholders still requires improvement (Anderson, 2008). Furthermore, it is recognized that there is not "one size fits all" communications strategy, and risk communication is an area requiring further attention.

TACTIC's case study aims to gain an understanding of perceived changes in management at the community-level, and management culture that might have occurred in reaction to the 2001 event. This will have a particular focus on the involvement of members of the wider community who were affected then (e.g. the public, the agriculture industry, the tourism sector, etc.) and who are likely to be affected in any subsequent or similar events.

2. Methods

Government and public inquiries, reports, and academic articles on lessons learnt or related impacts of FMD were reviewed to provide context for the epidemic workshops. Two workshops on epidemic preparedness were hosted in Cumbria, UK in March and November of 2015. Informal interviews and meetings were conducted with local researchers, DRM practitioners, and organizations engaged in farming and agriculture. Further details on workshop objectives, participants and outcomes can be found in the technical workshop reports (Shreve *et al.*, 2015; Shreve and Fordham, 2016).

3. Results

3.1 Literature review

The majority of lessons learnt studies focused on government handling of the event, but from a variety of stakeholder perspectives (Table I). Communication emerged as the primary challenge across studies reviewed. Response time, mixed messaging, misinformation, and conflict emerged as common themes for communication challenges. The need for greater engagement with public health emerges as a secondary theme in lessons learnt, but one that is emphasized in workshops and interviews.

3.2 Workshop findings

The first workshop confirmed communications were a challenge during the 2001 FMD epidemic, providing greater detail and specificity then is available in lessons learnt. Furthermore, communication challenges identified in lessons learnt tend to be from the government perspective, referring to internal communication challenges within agencies, or challenges with IT systems. Specific communication methods were highlighted in the workshops, for example, radio played an important role in communications in the 2001 epidemic, as fewer people had internet or mobile phone access, and sensationalism of the disaster by the media (portraying graphic images of animal carcass disposal), discouraged many residents from using the internet. It was noted, however, that increased internet and mobile phone usage could be better utilized in present day, especially to address challenges with delays in information sharing between actors, and addressing network fragmentation that occurs during disease

Authors (year)	Description	Lessons identified and recommendations
Ritchie *et al.* (2004)	Analyses the response of the tourism industry to the 2001 FMD epidemic at the local and national level, drawing on interviews with stakeholders	Not knowing whom to contact for relevant information, misinformation regarding disease conditions and impacts, and graphic images of carcass disposal portrayed in the media posed challenges for the tourism industry. FMD was confused with zoonotic diseases such as hand, foot, and mouth and bovine spongiform encephalopathy (BSE), and timely information on which regions were closed to tourists due to disease control measures was not available
Spear (2001)	Provides lessons learnt from the public health perspective	Environmental Health Officers (EHOs) (local public health officials) were largely left out of decision-making process. EHOs can assist by providing public health risk assessments for different disease control interventions, warning of potential contamination of water supplies, etc.
Donaldson *et al.* (2006)	Examines the key changes that have been put in place in disease control, farming, and rural policy since the 2001 FMD epidemic	Recommends that important drivers of epidemic vulnerability in the UK such as livestock densities (intensification), consideration of the costs and benefits of "disease-free" status, and financial responsibility for disease control have not been adequately addressed in policy, resulting in lasting negative impacts for rural areas (Donaldson *et al.*, 2006). Rural economies continue to lag behind urban economies in England. In Cumbria and Devon, the worst affected areas in the 2001 epidemic, economic growth has lagged behind with 13% lower incomes in rural areas, compared to urban, and nearly a million households in rural areas with an income of less than 60% of the English median (Donaldson *et al.*, 2006, p. 3)
Pickles (2006)	Reflects on lessons learnt from past epidemics, including 2001 FMD epidemic, to inform pandemic influenza planning	Identifies challenges with accountability, mixed messaging, misinformation, and the need to plan for the worst case scenario as major lessons identified from epidemics in the UK. Questions the sustainability of having one epidemic response be led by a single institution, and calls for greater discussion across disciplinary boundaries

(*continued*)

Table I.
Examples of lessons learnt studies from different social perspectives

Authors (year)	Description	Lessons identified and recommendations
McConnell and Stark (2002)	Examines political factors shaping government response to FMD	Recommends that epidemics can be easily politicized due to conflict in perspectives over policy regarding vaccination, culling (animal slaughter policy), and fairness of distribution of disease compensation measures. Attention to these factors is needed to deal with social amplification of risk, which can have serious socio-economic impacts
Anderson (2008)	Formal government inquiry revising the 2001 FMD epidemic, and reflecting on progress and future needs following the 2007 FMD epidemic	Significant reform to animal disease policy has taken place since the 2001 FMD epidemic. New communication strategies and IT systems are in place, and contingency plans are in place, for example. However, community engagement and building trusted relationships with local stakeholders still requires improvement. It is recognized that there is not "one size fits all" communications strategy. Greater vigilance, testing of the full emergency response chain, review of selection/staffing of regional operations directors/managers, assessment of scalability of contingency plans, continued development of vaccination plans, and regular review of legislative frameworks such as the Civil Contingencies Act should be maintained

Table I.

control measures such as animal movement bans. Families, businesses, and agencies experienced disruptions to their normal networks during the 2001 epidemic. Children were kept from school and farmers and other workers were isolated from their businesses. This resulted in social isolation, and strain and fragmentation within agencies responding to the crisis. Long delays in receiving risk communication (hours to days) or other guidance from relevant government sources were reported.

Another communication challenge that emerged from the literature, and also in workshop discussions, pertains to knowledge of farming practice and institutional turnover. The scale of the 2001 epidemic rapidly overwhelmed contingency plans requiring a rapid influx of external resources (Anderson, 2008). On shorter timescales, the organizational landscape shifted quite rapidly from primarily vets and farmers being involved to the military and then a mass influx of frontline workers. Communications with different organizations were challenging for residents because many workers were temporary and most had inadequate knowledge of farming, which further slowed communications. One participant recalled, for example, a

government worker asking "what sex is your bull?" On the international level, educational initiatives through European Union's commission on FMD have arisen to rapidly train veterinary staff on how to deal with FMD. However, a lesson still to be learnt is to provide educational initiatives to train all staff involved with response on wider farming (e.g. "natural practice") and public health issues of animal diseases. During the second workshop, two local Cumbrian residents received an award for developing a training initiative to educate local police to be able to distinguish different breeds of sheep, as livestock theft has been a problem in the region. Co-production of knowledge between government and local community members to develop this type of training and make it readily accessible could help to improve preparedness and may further contribute to capacity building and establishing trust with government officials.

Discussion of epidemic preparedness strategies employed during 2001, and perceptions of change since that time, recommend that biosecurity measures are a significant focus. Uncertainty regarding the effectiveness of different preparedness activities was identified as a concern. The effectiveness and potential environmental impacts of washing down vehicles and road surfaces, for instance, was raised as a concern. Some biosecurity measures required contracting of services through different vendors, many who were not familiar to the local community, nor were there any trusted baselines of fees for services provided. Whilst the availability and quality of biosecurity guidance has improved, much is available now through the DEFRA website, for instance, increasing transparency in biosecurity procedures, including contracting and cost requirements, could be beneficial.

Community-led coping strategies also emerged during the crisis, however, these activities are not widely recognized as preparedness activities recognized in contingency planning. Informal networks such as voluntary help-lines and support services, and ad hoc community messaging services, played and important role in coping during the event. Examples such as the Pentalk network, an educational and support initiative that was founded in the Penrith area of Cumbria, provided fee computers and IT training to those affected during the height of the epidemic in March 2001. It rapidly spread to the whole of the county gaining more than 2,400 Cumbrian farmers in its membership. Run by a voluntary charitable company, financial support was drawn from government, educational, business, and charitable sources. Pentalk helped farmers to communicate more effectively online and develop their IT skills to improve their farm businesses. Whilst Pentalk has ended, it can be used as a case study regarding good practice for identifying and addressing communication needs during an epidemic.

Conflict was another theme that emerged in workshop discussions, especially regarding heterogeneous impacts of the 2001 FMD event and compensation. It was recommended that compensation for losses accrued as a result of disease control measures should be more thoroughly examined to ensure fairness and avoid wastage. Where some farmers may have profited economically, as compensation payments exceeded the livestock market value, others received less compensation than it would cost them to re-stock. Compensation values do not reflect other significant costs during the 2001 FMD crisis including infrastructure, human resources (vets, slaughter teams, disposal teams), other materials (e.g. pyre materials, etc.) and anecdotal evidence recommends there was much wastage (Convery *et al.*, 2008). Compensation for services rendered during the disaster was also unequal; some slaughtermen reported earning £13.50 an hour, money they could not hope to match in normal working circumstances,

while an apprentice farrier whose employer had little work because of restrictions earned £5 an hour for very unpleasant disposal work dragging out carcasses.

Tourism was also severely impacted by the FMD epidemic. Countryside tourism in Cumbria and throughout Northern England is intrinsically linked to farming – tourism marketing efforts are strongly centred on the picturesque farming landscape, tourism activities frequently centre around animal shows or fairs, and many farmers have diversified their farming businesses with tourism, for example, building hotel and restaurant accommodations on farms. Total revenue to tourism was reduced by £200 m with an additional £60 m estimated in indirect effects in Cumbria (Cumbria Foot and Mouth Disease Inquiry Report, 2002). Revenue losses for non-farming businesses in rural areas amounted to billions of pounds – Central Government allocated £39 million pounds to a Business Recovery Fund but paid £1.34 billion in compensation to farmers for loss of livestock during the crisis (Donaldson *et al.*, 2006).

Public health impacts of the 2001 FMD epidemic were not well recognized by government sources. Government channels did not report a significant increase in the demand of mental health and wellbeing services in affected areas, however, the demand was present (Cumbria Foot and Mouth Disease Inquiry Report, 2002; Mort *et al.*, 2004; Bailey *et al.*, 2006). The government acknowledged that this was partially due to lack of proper reporting mechanisms. Informal support services such as help-lines and voluntary counselling services that arose locally did record a significant demand in mental health and wellbeing needs. The Cumbria Stress Information Network ran a 24-hour phone help-line which received thousands of calls during the outbreak with frequency increasing from a normal level of a few calls a month to up to 50 a day (Graham, 2001, pp. 110-111). It was recommended that public health needs arising from epizootic events may not be reflected by formal health care services alone, therefore it is necessary for informal services, such as crisis counselling or help-line services, to be consulted to record impacts and assess local needs.

Workshop participants also recommended that there seemed to be failures in engaging public health expertise, for example, resources such as Public Health England (PHE), to manage public health implications of the event. PHE played an active role in Ebola response in West Africa, and H1N1 "swine flu" pandemic influenza in 2009 provides another example when public health was brought to the fore. Very different strategies and mechanisms were used for disease management for public health, however, there is a general failing to engage in knowledge exchange between public health and veterinary sciences.

A study researching the public health impacts of the 2001 FMD epidemic found numerous public health implications (Mort *et al.*, 2004). Researchers engaged citizen's panels as a consultative mechanism to understand public health impacts of the 2001 event. Participants kept weekly diaries throughout the study (December 2001-June 2003), engaged in group discussions, and in-depth interviews at the start of the study (Bailey *et al.*, 2006, p. 159). Public frustration and outrage over disease control measures led to conflict, with much of the blame being channelled towards government workers. Many government workers reported feeling traumatized by the experience of frontline work, as well as animosity directed at them over disease control measures. Public meetings served as an avenue for residents to voice frustrations and raise concern over disease management, however, such meetings also increased risk of disease transmission. Many residents, and consequently, frontline workers,

experienced a range of mental health impacts including anxiety, depression, and long-lasting feelings of bereavement. Respondents sought out care and support for these impacts locally, through informal support, practical advice, financial assistance from each other, and from voluntary organizations, and anonymous, emotional support from rural telephone help-lines (Bailey *et al.*, 2006, p. 161).

While the physical epidemiology of FMD is well mapped by the government, the "citizen" epidemiology is poorly reflected in contingency planning, and mental health impacts continue to be overlooked. "Lifescapes" are presented as a method for capturing what respondents reported in terms of their everyday lives, to convey the localized, social-spatial public health impacts of the disaster (Bailey *et al.*, 2006). The use of lifescapes and citizens panels were recommended as actions to support preparedness and promote citizen engagement by participants in the first workshop. Workshop participants recommended that it is also necessary to recognize that it may be a very painful experience for residents to revisit traumatizing events, and to focus on the future mindful of lessons learnt.

4. Discussion

4.1 Practical measures for the UK

Results of the case study recommend that, while much progress has been made in the management of animal disease epidemics regarding operational response led by the government, animal disease management remains largely soiled outside of community-level DRM. Preparedness measures and contingency plans focus largely on biosecurity or phytosanitary measures, and veterinary sciences. These are necessary and important, however, they ignore the potential human and environmental impacts of animal diseases, and opportunities for citizen engagement in preparedness.

Greater diversity is needed in risk analyses, for instance, considering costs and benefits of epidemics to different groups of people, businesses, institutions, and with regards to environmental sustainability. Costs tend to be calculated in economic terms, and from the perspective of government or agricultural industry, however, studies also show the significant public health impacts. Practical measures to begin this dialogue could be engaging the Foreign and Commonwealth Office, in their capacity at facilitating international trade agreements, and the Department for Business, Enterprise, and Regulatory reforms, in their capacity at facilitating economic policy and trade could help to advise on business continuity for agriculture, tourism, and other local businesses influenced by trade policy, as this is more of a concern for epidemics compared to other hazard types. Engaging with the PHE to facilitate "bottom-up" public health strategies such as those presented in Bailey *et al.*, 2006 can improve epidemic preparedness for both human and animal disease epidemics. Furthermore, public health expertise for managing public health impacts of "animal" diseases can be strengthened.

Greater exchange across boundaries (disciplinary, hazard, institutional, geographic, livelihood, etc.) would facilitate more integrated DRM strategies, and better promote community engagement in existing strategies. While more holistic mitigation measures such as agri-environment, organic, and regionalized/localized branding schemes, aimed at shortening the food supply chain and improving environmental sustainability, are available in the UK (see Curry, 2002), these strategies are not well emphasized in the day-to-day DRM context. Raising awareness of the cost, prevalence, and relationship of TADs, and producers' and consumers' abilities to engage in risk reduction through mitigation options, should be a focus for DRM.

The success, for instance, of localized or branding schemes depends on both consumer and producer buy-in (Donaldson *et al.*, 2006).

Whilst beyond the scope of the current paper, which focuses on Cumbria, additional complexities arise from differences in institutional structure among different countries in the UK. In Scotland the "extent of administrative and legislative transfer allowed the Scottish Executive to manage the outbreak in a way that the 'Lessons to be Learned' inquiry recognized as better than elsewhere" (Scott *et al.*, 2004, p. 2). In contrast, the weaker framework for devolution was a problem for Wales, leading the responsible Minister to complain publicly that "although local responsibility rested with him, overall powers of decision-making remained in Westminster, leading to the worst of all possible outcomes" (Scott *et al.*, 2004). Social differences including values and beliefs among different countries in the UK were also evident in recovery plans. The Welsh Rural Recovery Plan rejected the course set out by the UK government, viewing the proposed emphasis on "efficient" agriculture as environmentally damaging and instead choosing to place emphasis on the importance of the social and cultural fabric of Welsh rural society as a whole (Welsh Assembly Government, 2001), as can be evidenced in part by investing more monies in non-farm business recovery, marketing, and development for tourism businesses, and other measures to tackle rural stress compared to other countries in the UK such as England (Scott *et al.*, 2004). Evaluation of the priorities and performance of devolved administrations, assessment of community capabilities, or consideration of other hazards the community faced is limited for epidemics and other hazards in the UK context with some exceptions. In other words, many concerns regarding localism, such as the effectiveness of community organizing, social equity, or longer term resilience, are not well addressed for different hazard types, or for a "multi-hazard" DRM approach.

4.2 Potential contribution of TACTIC

This paper has reviewed TACTIC's epidemics case study, which engaged a diverse group of local stakeholders to reflect back on lessons learnt since the 2001 FMD epidemic to improve preparedness to future epidemics in the context of community-level DRM. Workshop participants confirmed that many positive gains have been made to animal disease policy in the UK, however, there are opportunities to motivate wider citizen engagement and promote epidemic preparedness in the context of DRM. Specific preparedness needs and activities are identified that could improve preparedness for both human and animal diseases by facilitating a more coordinated response between local communities and government, and better manage the public health impacts of "animal" diseases.

Preparedness and risk communication findings from the case study were used to inform the development of TACTIC's self-assessments for the general public and for organizations. TACTIC's tools can be used by members of the general public to assess their preparedness levels and to share risk perception and risk communication needs and preferences anonymously with local organizations. The organizational self-assessment has an additional focus of helping to develop, or improve, an organization's risk communication strategy, for example, helping to identify strengths and weaknesses regarding specific communication aims (i.e. warning, raising risk awareness, enhancing capacities to act, and solving conflicts and building trust), and choosing appropriate communication methods (i.e. graphic aids,

face-to-face communication, SMS, etc.) suited for communication aims and end-user needs. All users receive a feedback report on self-assessment questions detailing the scientific rationale, and tailored recommendations for preparedness from the "good practices" library. The "good practices" library is intended to serve as an idea bank, providing examples of preparedness activities geared at the community-level.

Notes

1. The term "natural" hazards is generally used to indicate naturally occurring threats such as floods, earthquakes, landslides, drought, etc. however, the consequences of these hazards are typically measured on human populations.
2. Details regarding the TACTIC project can be found on the project website at www.tacticproject.eu
3. Communities here refers to geographic regions with a shared responsibility for DRM.

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