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The political economy of One Health research and policy

Victor Galaz, Melissa Leach, Ian Scoones and Christian Stein

One Health

Dynamic Drivers of Disease in Africa

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Political Economy of Knowledge and Policy

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The political economy of One Health research and policy

'One Health' has emerged over the last decade as a key concept guiding international research and policy in the field of emerging infectious diseases such as zoonoses. This paper explores the emergence of One Health and examines the political, economic and knowledge processes shaping who is doing what, where and why. It begins with a brief overview of the emergence of the concept, and an analysis of the different definitions in play and their discursive construction and consequences. We combine quantitative network analysis and interviews with key players in international global public health and veterinary debates and show significant disconnects between the inclusive rhetoric of global policy and scientific practices, highlighting tensions in patterns of global collaboration and their politics.

The paper also explores diverse perspectives on the utility of the One Health approach, asking why, given the emerging consensus around it, the approach is gaining relatively little policy and institutional traction. Reasons include power-laden professional hierarchies, institutional lock-in around single-sector approaches, the influence of funding flows and convenient articulations with securitisation agendas in global health.

About the Authors

Victor Galaz is Associate Professor in political science at the Stockholm Resilience Centre at Stockholm University. He co-leads the political economy of knowledge and policy theme of the Dynamic Drivers of Disease in Africa Consortium.

Melissa Leach is Director of the Institute of Development Studies at the University of Sussex and is Principal Investigator of the Dynamic Drivers of Disease in Africa Consortium.

Ian Scoones is a Professorial Fellow at the Institute of Development Studies at the University of Sussex and is Director of the ESRC STEPS Centre. He co-leads the political economy of knowledge and policy theme of the Dynamic Drivers of Disease in Africa Consortium.

Christian Stein is an independent consultant and a research associate with the Stockholm Environment Institute. His interdisciplinary research focuses on the role of social networks in the contexts of natural resources governance.

About the Dynamic Drivers of Disease in Africa Consortium

The Dynamic Drivers of Disease in Africa Consortium is a multidisciplinary research programme designed to deliver much-needed, cutting-edge science on the relationships between ecosystems, zoonoses, health and wellbeing with the objective of moving people out of poverty and promoting social justice. It is focusing on four emerging or re-emerging zoonotic diseases in four diverse African ecosystems – henipavirus infection in Ghana, Rift Valley fever in Kenya, Lassa fever in Sierra Leone, and trypanosomiasis in Zambia and Zimbabwe.

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For further information please contact: STEPS Centre, University of Sussex, Brighton BN1 9RE

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Acronyms

AI	Avian influenza
BMGF	Bill and Melinda Gates Foundation
CDC	Centers for Disease Control and Prevention
DFID	Department for International Development
FAO	Food and Agriculture Organization
IFRI	Français des relations internationals
LSHTM	London School of Hygiene and Tropical Medicine
OIE	World Animal Health Organisation
RVC	Royal Veterinary College
SACIDS	Southern African Centre for Infectious Disease Surveillance
UNSIC	UN System Influenza Coordination Office
UN	United Nations
US	United States
USAID	US Agency for International Development
WHO	World Health Organization
ZELS	Zoonoses and Emerging Livestock Systems

Abstract

‘One Health’ has emerged over the last decade as a key concept guiding international research and policy in the field of emerging infectious diseases such as zoonoses. This paper explores the emergence of One Health and examines the political, economic and knowledge processes shaping who is doing what, where and why. It raises fundamental questions about 'whose world, whose health?', and about the interactions between science and policy. The paper begins with a brief overview of the emergence of the concept, and an analysis of the different definitions in play and their discursive construction and consequences. Through a quantitative network analysis of published sources on One Health, the paper goes on to track the geographic locations of key organisations involved, and the evolution and form of collaborative networks over time. Our analysis shows significant disconnects between the inclusive rhetoric of global policy and scientific practices, highlighting tensions in patterns of global collaboration and their politics. Through interviews with key players in international global public health and veterinary debates, the paper goes on to explore diverse perspectives on the utility of the One Health approach, asking why, given the emerging consensus around it, the approach is gaining relatively little policy and institutional traction. Reasons include power-laden professional hierarchies, institutional lock-in around single-sector approaches, questions of personnel capacity, education and training, the influence of funding flows, and convenient articulations with securitisation agendas in global health. All these combine both to limit One Health implementation in practice, and to reinforce a northern-dominated, top-down, control and surveillance orientated approach that privileges a particular rendition of One Health, while masking diverse national and local perspectives, and priorities around human-animal-environment-health interactions.

Keywords: emerging infectious disease; global health governance; narratives; science-policy interface

1. Introduction

One Health has emerged over the last decade as a key concept guiding international research and policy in the field of emerging infectious diseases such as zoonoses. In its simplest form, One Health refers to integrated approaches as a means to improve human, animal and environmental health. Integrated in this context means multidisciplinary, cross-sectoral and cross-level approaches designed to reduce and address health risks (Zinsstag *et al*. 2006; Zinsstag *et al*. 2011). This paper examines the concept's emergence, and its relationship with related approaches such as 'Ecohealth', in terms of the political economy of knowledge and practice. By this we mean the ways in which different interest groups ally or compete with different versions of the concept, and how these interactions are influenced by institutional arrangements and resource flows. Even though the concepts One Health and Ecohealth share several important common principles (Zinsstag 2012 a and b), we focus on the former due to its strong policy purchase, and the interest it has generated, at least rhetorically.

The notion of One Health has, despite its spread and increased popularity, led to repeated criticism from a diverse set of actors, due to its possible multiple interpretations, and lack of implementation. Currently however, there is a lack of systematic analysis of One Health as a phenomenon with strong political-economic dimensions. There is clearly a gap in our understanding of how the concept has diffused amongst scientific and policy communities over time; the key drivers to this rapid expansion; what resource flows and power relations have influenced this process; which actors dominate the concept's international knowledge production and dissemination; and the tangible institutional and policy implications of increased One Health rhetoric.

This paper advances such an analysis. First, we argue that One Health indeed has multiple interpretations, and is a contested term associated with different policy narratives-storylines that define the problem and solution in different ways (Roe 1991). Second, we show that, despite widespread rhetorical support for the approach, its uptake in practice has been patchy. Third, we elaborate the versions that have emerged to dominate in both rhetoric and implementation, and those that have been excluded. As we argue, this is largely focused on a northern-dominated institutional response mode that overlooks other 'worlds' and other 'healths'. It therefore often ignores, we argue, perspectives grounded in the knowledge and practices of poorer people in diverse southern contexts, and the political economies that shape the conditions for disease emergence and spread.

The paper draws on documentary and interview analysis, combined with bibliometric data assessment. We first analysed 28 policy documents published between 2004 and 2013, all frequently cited in discussions of a One Health policy, to identify definitions and associated narratives (see Appendix 1). Documents were selected purposively based on levels of citation, internal cross-referencing and mention by interviewees. We also analysed 83 interviews carried out between 2008 and 2013 with a range of international stakeholders, all with active professional interests in One Health, as researchers and practitioners involved in policy (see Appendix 2). The interviews draw from work on the political economy of avian influenza (Scoones 2010) and trypanosomiasis (Scoones 2014), as well as interviews carried out specifically for this project. By focusing on active participants in the debate, our aim was to gain insights into the politics of policy processes from insiders' perspectives. This qualitative work is complemented by a bibliometric network analysis of One Health publications from 2007 to early 2014 extracted from the Web of Science database,[1] and so focused only on peer-reviewed journal articles

[1] The information related to the articles was accessed and retrieved from the Thomson Reuter Web of Science website (www.isiknowledge.com) on 25 March 2014.

(see Appendix 3). This represented a slightly different network of actors, focussing more on formally published scientific research than policy. However the links between the analysis of policy actors and those active in journal publishing is interesting in order to explore science-policy connections. Through this multi-pronged methodology, following Keeley and Scoones (2003), we were therefore able to investigate narratives, interests, actors and networks operating in the world of policy and practice, as well as academic research, and so examine the interrelationships between them.

We begin this paper with a brief account of the origins and multiple definitions of One Health, and an analysis of the emergence of different narratives derived from our review of key policy documents. We then move on to the bibliometric network mapping, together with an analysis of the institutional contexts for One Health thinking. In the next section, we examine the political, economic and institutional reasons why some versions of One Health have been adopted, while alternatives, often promoted by the rhetoric, have not. In conclusion we reflect on the consequences of this selectivity for the on-going development of One Health approaches.

2. One Health Narratives

The idea of an integrated approach to human, animal and environmental health is of course not new (Woods and Bresalier 2014; Murray *et al*. 2014). On the contrary, a number of parallel concepts emerged from the sector of veterinary medicine as recognition of the interdependence between animal health and human health, such as the term 'One Medicine' from the 1970s coined by American veterinarian, Calvin W. Schwabe (Zinsstag *et al.* 2011; Gibbs 2014). Although unlabelled, these approaches were also evident in the practice of field-based health practitioners before professionalised, institutional and sectoral silos took hold.[2] The shift in use from One Medicine to One Health is sometimes explained as an evolution of the former concept, and traced to the beginning of the twenty first century (Kaplan and Scott n. y.). The term Ecohealth emerged in the 1980s as environmental issues and sustainability became more prominent in public debate (Waltner-Toews 2001; Charron 2012) and is highly complementary, but with different emphases. We have chosen One Health as our focus for analysis because of its contemporary policy prominence and its influence on policy framing, research prioritisation and funding flows.

'One World, One Health' emerged as the World Conservation Society's copyrighted slogan in 2004, following the Manhattan Principles (Cook *et al.* 2004), bringing together interests in conservation and health. But it was only with the outbreak of avian influenza in the first half of the 2000s, and the development of an international response (led by international organisations, notably the World Health Organization (WHO), the Food and Agriculture Organization (FAO) and the World Animal Health Organisation (OIE), with oversight from the UN System Influenza Coordination Office (UNSIC)) that the term, One Health gained international strength (Scoones 2010). There was a stark realisation that to handle a zoonotic outbreak of such potential significance, both institutional cooperation and a more integrated approach was needed. A number of major meetings involving the core international organisations and national governments were held, including in China, Egypt, India and Vietnam, with the joint aims of entrenching a One Health vision across major global and national agencies and raising funds, especially for the avian influenza response[3]. Further attempts were made to bring groups together under the auspices of the Stone Mountain Dialogue under the guidance of the Institute of Medicine and National Academies (Rubin *et al*. 2013). Numerous other major meetings followed with a One Health tag. Public Health Canada, for example, hosted a major meeting in Winnipeg in the wake of the avian influenza outbreak, while the first One Health Congress was held in Australia in 2010.[4] Subsequently many others have occurred, including in Africa[5]. Networks, consortia, initiatives and commissions have been formed with a One Health brief,[6] and there has been a veritable explosion of activity associated with the term. All these efforts have extended and consolidated the One Health approach in a variety of quarters. In terms of policy debates, as well as research funding streams, One Health has become a major focus.

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[2] For example this is evident in colonial practice and the arguments of John Ford (1971) around the response to trypanosomiasis in Africa.

[3] http://www.cdc.gov/onehealth/resources/recent-meetings.html#one

[4] http://globalhealthvet.com/2011/02/20/one-health-congress-report-14-16-feb-2011-melbourne-australia/

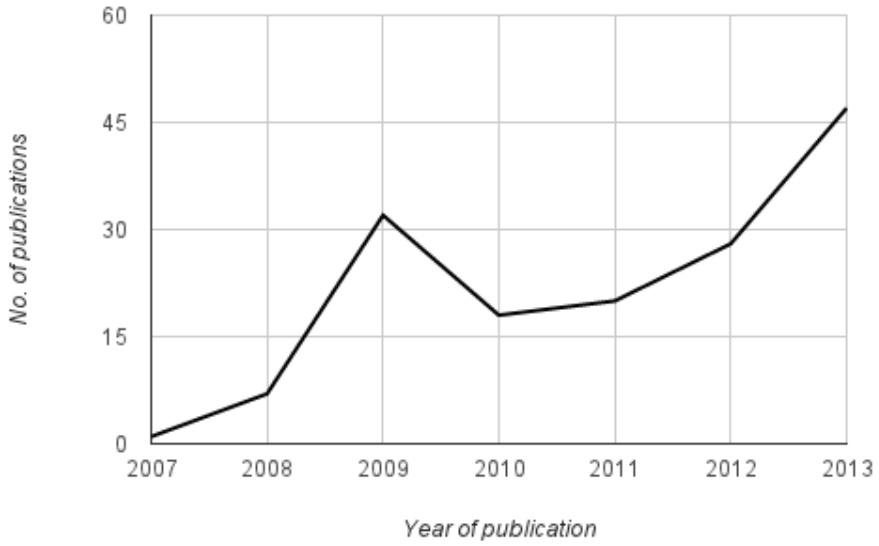
[5] http://www.sacids.org/kms/frontend/?m=101

[6] See: http://www.onehealthglobal.net/ ; http://www.onehealthinitiative.com; https://www.onehealthcommission.org/, among others.

In recent years One Health approaches have been applied to a huge array of issues, from control of dengue (Kittayapong *et al*. 2012), tuberculosis (Kaneene *et al*. 2014), leishmaniasis (Palatnik de Sousa and Day 2011; Vilas *et al*. 2014), malaria (Franco *et al*. 2014), brucellosis (Godfroid *et al*. 2013), tick-borne diseases (Dantas-Torres *et al*. 2012), rabies (Häsler *et al*. 2014) and trypanosomiasis (Ndeledje *et al*. 2013), among many otäer examples. In terms of the fields of health and medicine, the concept is being applied to parasitology (Thompson 2013), clinical microbiology (Miller 2010; Miller and Griffin 2012), companion animal vectors (Day 2011) and vaccine development (Monath 2013; Middleton *et al*. 2014), as well as broad zoonosis prevention and control (Okello *et al*. 2011; Liverani *et al*. 2013) and ecosystem health (Rabinowitz and Conti 2013; Zinsstag 2012a and b). And it has taken root in diverse locations from Australia (Adamson *et al*. 2011) to North America (Leung *et al.* 2012) to Europe (Frazzoli *et al.* 2014) to Africa (Mbugi *et al*. 2012; Kayunze et al 2012; Okello *et al*. 2014; Karimuribo *et al*. 2011) and Asia (Nguyen-Viet et al 2014; Pfieffer *et al*. 2013).

As Figure 2.1 shows, this has had an impact on the scientific literature, with a rise of mentions of One Health in titles and abstracts of published articles over time, and a particular increase in 2009 when articles on swine flu, as well as broader reflections post-avian influenza, were being published.

Figure 2.1: Annual output of One Health articles in peer-reviewed literature (from Web of Science), 2007-13



Despite the appeal of One Health as a holistic, integrative, cross-sector, interdisciplinary, and coordinating approach, it has in fact multiple definitions and interpretations associated with it. There is far from a uniform view of what One Health is or should be. Through an analysis of 28 policy documents concerned with One Health policy issues from 2004 to 2013 (Appendix 1), and informed by previous work on policy narratives in this field (Scoones 2010; Dry and Leach 2010), we identified three recurrent narratives that define a One Health position, and many variations in between.[7] The documents were chosen from a purposive search via Google/Google scholar, as well as our own knowledge of these debates, of those that had been widely used (as reflected in Google citations) and also to gain a range of cases across different organisations. While the sample is far from comprehensive, it covers the range of mainstream policy positions, as reflected in the grey policy literature.

[7] Perhaps unsurprisingly this reflects patterns found in other assessments of overlapping sources (for instance Häsler *et al.* 2013).

In our qualitative analysis of the documents we looked for narrative structures–storylines with beginnings, middles and ends. As we elaborate below, different interpretations of One Health are associated with different assumptions of the nature of problems and solutions, but also, significantly for this paper, institutional, professional and personal interests among the actors concerned, which in turn relate to competition for prestige and funding.

The first narrative offers a broad argument for a holistic, integrated approach, necessary to deal with complex interactions between ecology, animals, people and disease. Such issues, the narrative argues, cannot be dealt with by one discipline or one sectoral agency alone. This has been the rallying call in general for cooperation, institutional reform, funding approaches and the redefinition of training approaches. Examples of this framing include FAO-OIE-WHO (2010), WHO (2008), World Bank (2010), and FAO World Animal Report (2013). This argument is reflected in the academic literature too, with a number of review articles in key journals making the case for an integrative One Health approach (for example, Zinsstag *et al*. 2009; Zinsstag *et al*. 2011; Zinsstag *et al.* 2012a and b; Okello *et al*. 2011; Coker *et al*. 2011; Kahn *et al*. 2009; Conraths *et al*. 2011; Rabinowitz and Conti 2013; Hueston *et al*. 2013, among many others), as well as the need to address organisational and governance challenges (Leboeuf 2011; Lee and Brummer 2013; Anholt *et al*. 2012; Conrad *et al*. 2013).

A second narrative focuses on the risks of emergence and spread, and the challenge of surveillance. In this version One Health is defined as a way to prevent risk and respond to crises in a more efficient and rational way. For example WHO (2007) 'Applying the One Health Concept' explores the role of One Health as a means to control disease spread through improved diagnosis and surveillance, and prevention and control activities (see also CDC 2011). This then requires cooperation in surveillance, including early identification of emerging disease, through virus hunting and identifying hotspots, and contingency planning and coordinated emergency responses. This is firmly located within a broader 'outbreak narrative' (Wald 2008) that highlights the risks of new diseases emerging in far-flung localities, and spreading rapidly through global travel and trade to affect populations and economies in the wealthy global North (Dry and Leach2010). It also aligns with broader narratives around global health security and biosecurity (Elbe 2010), and has induced the rapid increase of transboundary epidemic response and alert networks (Galaz 2014).

The third narrative focuses on the potential economic benefits of implementing One Health approaches. For example, based on economic estimates from six major outbreaks of highly fatal zoonoses between 1997 and 2009, the World Bank has argued that the global benefits of adopting a One Health approach amount to US$6.7 billion per year (World Bank 2012). Other published literature picks up on this narrative. Grace (2014) for example offers, 'the business case for One Health', while Rushton *et al.* (2012) and Häsler *et al.* (2013a and b) present the array of economic rationales for an integrative approach. Zinsstag *et al*. (2006) show the economic benefits of combining human and animal health interventions, including those for rabies in Chad and brucellosis control in Mongolia. Meanwhile Narrod *et al*. (2012) estimate the costs of zoonotic diseases on society, and so justify expenditures on a One Health approach.

Reflecting on the analysis of this recent policy literature, as well as the commentaries by actors in the policy field (see Appendix 2), we note the marginalisation of an alternative fourth narrative rooted more in local ecological and disease contexts, and voiced by people living with, and responding to disease (Dry and Leach 2010; Scoones 2010; Bardosh *et al*. 2014a and b). This perspective argues that integrated surveillance and response must be built on local contexts and understandings, and can benefit from inclusive and participatory methodologies. Some of these also point to the political-economic contexts in which zoonoses develop and are driven, including structures of production, urbanisation, and global capitalist relationships and their impacts on disease emergence and spread locally (Hinchliffe 2007; Forster 2012). This approach is highlighted in emerging work by social scientists

working with field practitioners, and an increasingly better recognised tradition of participatory ecohealth and epidemiology approaches (Waltner-Toews 2001; Grace *et al*. 2012a and b; Spiegel *et al*. 2005).

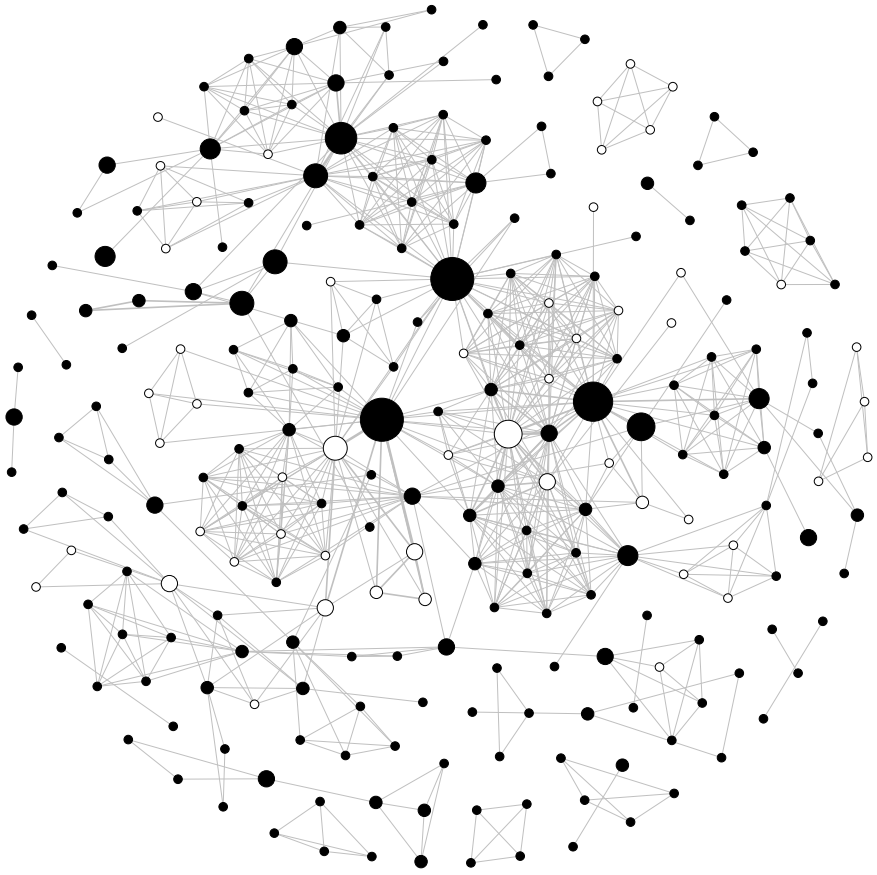
3. One Health Networks and Institutions

Policy narratives such as these do not exist in isolation. They are part of larger processes of knowledge production located in scientific networks. Scientific knowledge production plays a key role from this perspective as it guides the ways central actors, such as policy makers, perceive societal problems and design solutions, offering credibility and justification to policy concepts such as One Health.

In this section, we move from policy narratives, as expressed in grey literature policy documents, to explore the formal, published literature (i.e. peer-reviewed articles), to identify key actors, disciplines and regions currently dominating scientific knowledge production around One Health. We also examine how the policy networks linked to the narratives discussed above connect with scientific research networks.

Figure 3.1 shows the co-authorship network of organisations that published together in the field of One Health, based on 157 articles appearing in the Web of Science database between 2007 and early 2014, and selected post-screening (Appendix 3). A relationship between two organisations is defined by the joint publication of one or more peer-reviewed articles on One Health.

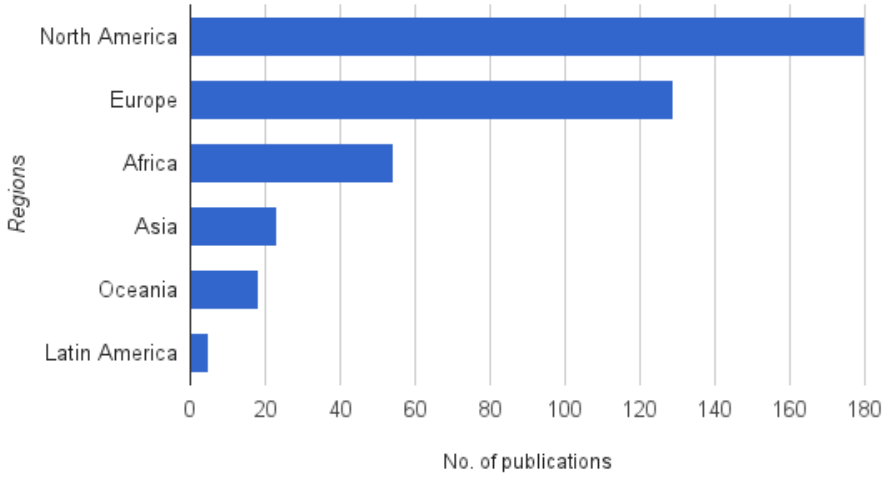
Figure 3.1: Co-authorship network of institutions that have published on One Health



Institutions are colour-coded by geographic representation from global North (black nodes) and global South (white nodes). The node size is based on the number of publications the institution has co-authored.

As the network map shows, there is a dominance in published outputs by actors from the global North who are at the centre of a number of clusters (highlighted by the dense connections within the map). This is despite repeated calls for more integrated and representation from the global South, and the rhetoric about global public goods and 'one world, one health'. This is reinforced by the data in Figure 3.2, which shows that over 80 per cent of authorship is by scientists affiliated with an institution from the global North.[8]

Figure 3.2: Publication record, based on regional affiliation of authors



The major clusters within the overall One Health network map shown in Figure 3.1 are shown in more detail in Figure 3.3. This network map highlights organizations that have many co-authorship relationships alongside their geographic regions. While some clusters contain organisations from the global South, others are exclusively northern.

Table 3.1 highlights the disciplinary *foci* of publications related to One Health.[9] It shows the strong representation of veterinary sciences. Medical sciences were also important, making 11 per cent of publications, while there were few articles covering ecological and social sciences. However, it proved difficult to associate a certain discipline with some articles, hence the large category of ambiguous disciplinary associations. Some papers were also linked to a range of 'other' sciences, while a few were categorised by the Web of Science as 'multidisciplinary science' (see Appendix 3).

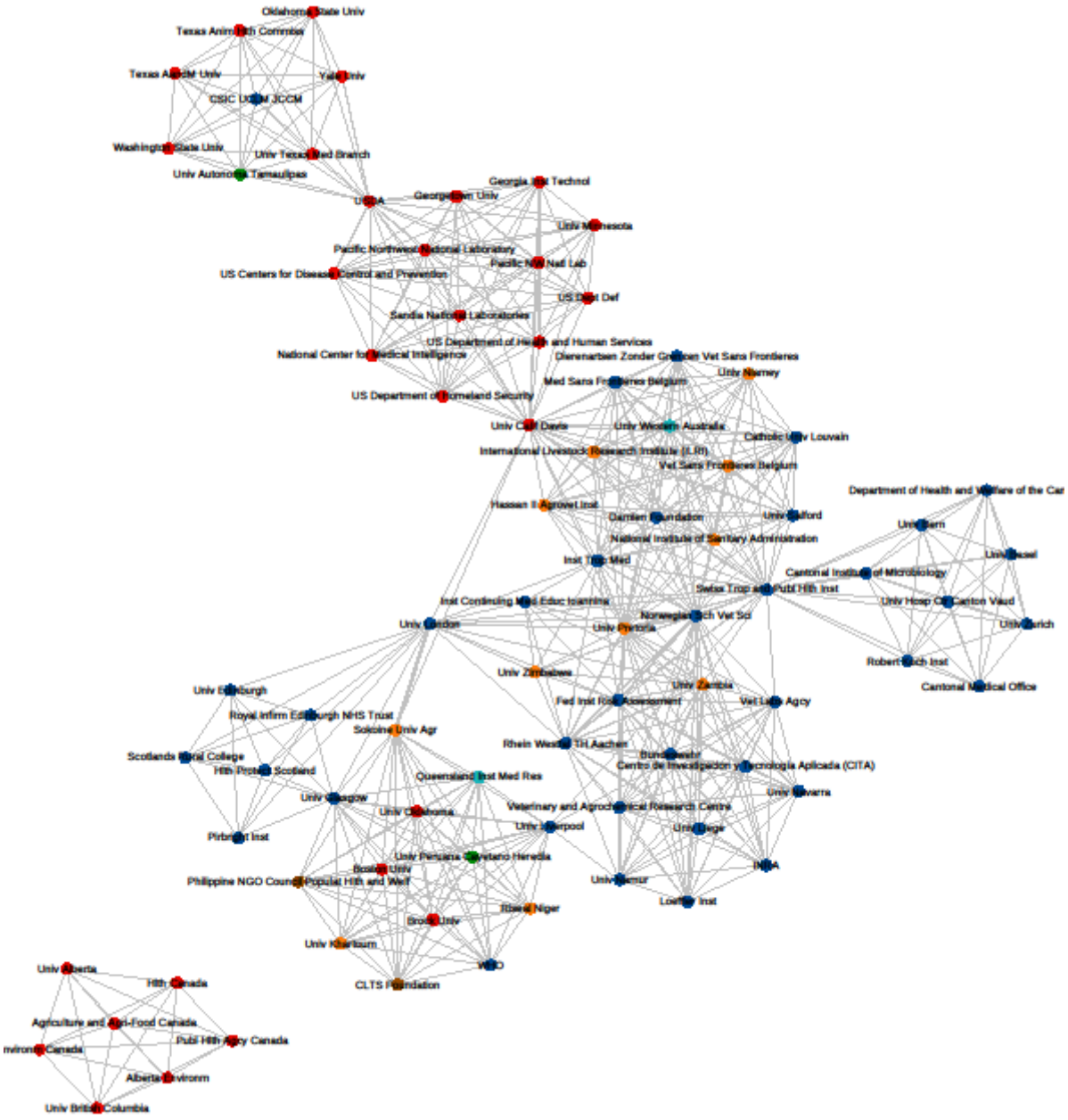
The network mapping brings to light some of the key actors that connect otherwise disconnected clusters within the overall network. These include some of the most prominent One Health research collaborations centred on Switzerland (Swiss Tropical Institute), London (London School of Hygiene and Tropical Medicine, Royal Veterinary College) and the United States (US) (UC Davis, and to a lesser extent US Department of Agriculture (USDA)). These institutions, and their associated individuals,

[8] For this paper we have not examined relationships between authors/institutions in co-authorship arrangements. There are multiple collaborations, including those between northern and southern authors emerging, and this has increased over time. Future analyses will look at these issues.

[9] The article's disciplinary affiliation is determined by the journal in which it is published, using Web of Science's own classification system. See Appendix 3 for details.

bridge the clusters and provide an important role in the overall network.[1] Most publications have appeared in journals associated with veterinary sciences, suggesting that veterinarians are currently driving and dominating the scientific discussion on One Health.

Figure 3.3: Network diagram of co-publishing patterns between organisations that have six or more co-authorship relationships (k-core 6)



[1] Note however that these links very well may be the result of the activities of very active individuals rather than institutions *per se*. The networks maps focus on their institutional affiliation however to simplify the analysis.

Nodes are colour-coded based on geographic regions (Red – North America: Blue – Europe: Orange – Africa: Brown – Asia: Turquoise – Oceania: Green – Latin America and the Caribbean)

Table 3.1: Disciplines associated with articles published on One Health over the period 2007-2014 based on Web of Science categories.

	Disciplines associated with publications	**Percentage**
1	Veterinary	61
2	Ambiguous	13
3	Medical	11
4	Ecology/Environment	5
5	Other	4
6	Multidisciplinary Sciences	3
7	Social sciences	3

The abstracts of the 157 articles on One Health were also searched to identify their disease focus. A number of categories were used, with influenza and Hendra/Nipah virus fevers being the most frequently mentioned in titles and abstracts. Neglected diseases – a large group of different diseases identified by WHO – have also become associated with the promotion of One Health approaches (WHO 2008; Okello *et al*. 2011).

This brief bibliometric analysis – with all its accepted limitations (see discussion in Appendix 3) – shows how in the academic, peer-reviewed literature the term One Health has grown in use over the last few years. It is tightly linked with certain networks that are mostly centred in Europe and the US. While southern collaboration is sought, such authors are generally not at the centre of such networks, and nor is it the production of scientific knowledge. The two exceptions to this are the University of Pretoria and Sokoine University of Agriculture (or individuals within these institutions), both of which have significant publication outputs on this theme. The disciplinary and focus of publications suggests a dominance of veterinarians in these networks. There is very little evidence of a growth in social science expertise in these networks, despite the rhetoric of interdisciplinarity. The disease focus shows the link to policy concerns, with frequent mentions of influenza (avian and, subsequently, swine).

A comparison of the network patterns and relationships seen in the academic literature and policy debates shows a number of individuals and organisations bridging between different networks. These players are often associated with key positions in the network, and act as brokers between scientific and policy worlds (Pielke 2007). Otherwise the academic and policy networks are surprisingly separate. We found, for example, only a handful of individuals from our 83 policy interviews appearing in the Web of Science-derived networks. We had expected a much greater integration, as we had purposively chosen our policy interviewees as key players in the field, all of whom had research backgrounds. However many interviewees were quite senior, and probably in this period had little time for journal writing, focusing instead on their policy commitments, and contributions to the vast grey literature that has blossomed under the One Health banner (indeed they all appear frequently in the 28 policy reports we selected). This makes the few science-policy brokers, and their associated institutions (in the US and Europe) essential for the linking between the still divided worlds of academic publishing

and policy engagement, a separation that appears quite distinct even in this most policy-relevant area of research.

In the next section, we probe in more depth the reasons why One Health networks – both in academia and the policy world – have been formed in the ways we have identified. Here we turn from text-based narrative analysis and quantitative bibliometric mapping to explanations rooted in political-economic and institutional processes that underlie these contemporary patterns of publishing and collaboration, which result in the prominence or silencing of different narratives.

4. The Political Economy of One Health

In this section, we focus on the political economy of One Health, moving from the 'what' to the 'why' and 'how'. We rely on the explanations offered from our interview informants to explain the patterns seen in the narrative and bibliometric analysis.

From our interviews, we identify three recurrent themes that help explain why particular versions of One Health have become dominant, and why rhetorical acceptance of the idea, particularly as associated with certain narratives, is often not matched in practice. These have to do with organisational mandates and funding flows; difficulties in bridging disciplinary silos; and conflicting interpretations of 'integration'. These themes came up again and again across our interviews, nuanced in different ways, but seem to be at the core of explaining the limits to One Health thinking in practice.

4.1. Organisational mandates and funding flows

While there were precedents, avian flu provided a significant spur for the bringing together of organisations that had in the past barely collaborated. As a senior United Nations (UN) official put it, 'Without avian influenza we would have no One Health. It brought lots of money, and people were brought together' (Interview 25). Avian influenza (AI) fit the contours of a global outbreak narrative very closely. That is, an initial scare of a zoonotic disease that threatened to spread to the rest of the world and affect northern populations quickly mobilised funds and organisations.

According to our interviewees key individuals were important in this process, not least David Nabarro who became the UN Secretary General's 'flu tsar'. As an aid agency official commented, 'David Nabarro was a great factor in raising the funds. He is very effective at loosening the purse strings [...] David's tub thumping speeches helped raise the profile' (Interview 1). New institutional networks were established, notably between WHO, FAO and OIE, with the UN System Influenza Coordination Office (UNSIC) playing a coordination role. UNSIC was created in in 2005 as a means to improve coordination between UN organisations, sectors such as those of animal and human health, and governments. Under the banner One World, One Health a whole series of events were held, bringing diverse groups together, and raising considerable funds (see above). An aid agency official observed that, 'AI has seen some of the most effective coordination between international agencies I have ever encountered. […] All the FAO has to do right now [in 2008] is shout 'avian flu', and people will shower them with money!' (Interview 1).

Some observed that a new form of organisational networking emerged, facilitated by UNSIC, 'A movement has been created […] UNSIC is small, flexible, light. It is a model of a new UN […] a solution for big, complex issues' (Interview 1) A senior UN official reflected, 'W' need to better understand how we can use this model in the future for coordination […] it is a coordination function and also an energising function […] the benefits are extremely significant, but it requires a mandate […] It wasn't enough to say here is something for the global public good, we first had to build relationships' (Interview 2). As a result of the avian influenza experience, significant shifts have occurred. As an OIE official put it, 'These days at the global level there is no longer partition. You can move freely. Before everyone was in their own compartments. There is now free movement of personnel and information. This is an important achievement' (Interview 3).

However this optimistic view was tempered by other perspectives. Some commentators suggest that, while interactions improved, these rested very much on the dramatic outbreak form of influenza, and its associated politics, 'The turf needs to be political for the seed to grow. It needs a strong political platform', as one interviewee put it (Interview 1). There is a recognition too that while avian influenza

(and subsequently swine flu) established the political and funding momentum for One Health, there cannot be a single response, 'Of course responses have to be different with an endemic rather than epidemic disease' (Interview 4). But extending the argument to endemic and neglected diseases that do not threaten northern populations and so galvanise the international community and its funding is perhaps more difficult. Indeed, as a former US State Department official observed, the One Health agenda does not, 'seem to be getting the same high-visibility traction and funding from governments and others as many of us would think was warranted because once that immediate scare from H5N1 seemed to have receded […] we've lost some of that high-level political impetus for it'(Interview 5).

Political impetus, and so funding has, both in the global North and South, been associated with and supported by risk-based narratives around One Health, particularly the global 'outbreak' version discussed earlier. This has provided the justifications for organisational change, particularly in terms of such coordination-reducing costs. Thus while the overarching 'integration' narrative is widely deployed at a rhetorical level, it has had less traction when supporting organisational change, as competition for funds, profile and leadership remain. Moving organisational configurations from ones established in the post-war period around sectoral responsibilities has proved very difficult, despite moves towards light-touch coordination and facilitation. In this context, the general arguments for coordination often overlie real competition for funds between sectors and organisations, particularly as the flood of initial avian influenza money has subsided, 'AI was a brand if you like that could make a number of things happen. It allowed us to focus on something that was a tangible threat and source significant amounts of money from contingency funds. Talking about generic threats at the human-animal interface - zoonoses - is less arresting and makes it harder to draw funds down' (Interview 27).

There has thus been a scramble for attention and funds. Most investments have emphasised human health impacts, rather than long-term, unknown, potential emergence of disease. The reason seems to be that funding flows have prioritised interventions with easy definable metrics thereby marginalising more complex drivers of disease such as ecosystem change and socio-political dynamics. Funding flows have instead followed the standard approach of technological solutions and emergency response. However, there has also been a growing emphasis on research and action geared to understanding the drivers of disease emergence, placing greater emphasis on ecosystems and other endemic and neglected diseases.[11] These are relatively marginal in terms of funding and organisational support, and are at an early stage, but they offer the potential for more integration and moving beyond an epidemic, outbreak narrative.

Much of the organisational innovation has occurred between veterinary and human health agencies. However, as a former WHO official commented, 'This paradigm shift requires that animal health and human health and many other sectors such as trade and commerce work together in One Health' (Interview 6). Integration may happen when other organisations have an incentive to collaborate, as happened with avian influenza. 'All agencies now want to be involved – tourism, migration, civil aviation etc. Everyone wants to be involved in global health issues' (Interview 7).

There is however a tension between an informal, networked 'movement' and more formalised organisational change. As one informant commented, 'There is a need to be flexible, so that people can pull institutions with them. Not very much has been formalised. It is an interesting moment […] we are inventing the future' (Interview 8, see also Galaz 2014: 69-72). Galvanising people must go beyond the rhetoric. In our interviews One Health has been variously referred as a badge, a slogan, a brand

[11] Examples are: US Agency for International Development (USAID) Predict and Prevent; Bill and Melinda Gates Foundation (BMGF) One Health challenge call; UK Government Zoonoses and Emerging Livestock Systems (ZELS) Programme.

and an, ‘idea too popular for its own good’ (various interviews). Yet as one researcher observed, ‘People sound pseudo-religious about it, but it doesn’t penetrate very deeply’ (Interview 9).

4.2. Professional and Disciplinary Expertise

The core of the One Health approach is integrating different forms of expertise and professions, especially across human, animal and ecosystem health. However the idea of harmonious, equal integration has proved more difficult to realise in practice, exposing professional hierarchies, disciplinary biases and difficulties of communication and translation, and the legacies of each profession’s embedded histories (Lélé and Norgaard 2005).

Some of our interviewees saw the key push for One Health as coming from the veterinary profession, for whom it represents new internationally high-profile contexts to reinvent and deploy their expertise, especially in the context of declining public funds. One Health is seen as ‘a push by the vets in the organisation’ (Interview 10). ‘At the moment, the people fighting for this are a small number of open-minded vets and a small and disparate community of ecologists’ (Interview 11). The veterinary profession’s dominance is certainly clear in our earlier analysis of policy documents and published outputs.

However practising a One Health approach has presented major challenges to veterinarians. As a researcher put it bluntly, ‘Today we need system vets who can see the bigger picture, and relate to these wider policy concerns. But most think that vet medicine is just sticking your hand up a cow’s arse’ (Interview 26). Challenges continue in translating expertise into policy, ‘One of the problems is that within veterinary advice systems, the core advisors are nearly all lab vets, not epidemiologists for example. These are the chief technical advisers in governments and agencies […] This a limited view when the disease is in a population – and the population exists in a social context […] we haven’t got enough disease control experts who understand these wider issues. Those who exist don’t stick around for long, and don’t necessarily get into the international system’ (Interview 12).

Even more significant challenges have involved integrating veterinary and medical expertise. Some argue that there has been little interest in One Health from the medical profession. As a senior researcher observed. ‘Engagement of the medical sector is rare […] I’ve never seen a One Health session in a medical conference [except in Africa]’ (Interview 9). Vet advocates have faced difficulties in some organisational settings, ‘It’s mostly medics, and they don’t see One Health as a priority,’ commented someone from the Centers for Disease Control and Prevention (CDC) (Interview 10). These challenges reflect a more recent separation, ‘When I originally worked in Uganda as a researcher, vets and medics would meet. Discuss over coffee each morning. It was One Health in a way. But sometimes it’s a challenge. Medics don’t need to be told anything by anyone’ (Interview 13). As this quote suggests, a professional hierarchy has emerged. This was frequently commented on. ‘There is mistrust between the two castes – the doctors and the vets. It has prevented lots of collaboration. There is a slight complex of inferiority among the vets. And there is a big complex of superiority among the medics’ (Interview 7), ‘medical doctors are still far higher status than vets’ (Interview 28), ‘If the medics are in charge they will resist. They want their disease focus […] The medics are in charge these days. Livelihoods and integrated thinking is out’ (Interview 14).

Hierarchies notwithstanding, bringing the expertise and ‘mindsets’ of medics and vets together has proved difficult. As a veterinarian working in a human health organisation commented, ‘The thinking between vets and medics is really, really separate. It’s challenging. […] The minds are still that way, even if they are working on something like avian influenza’ (Interview 15). Ways of thinking are deeply entrenched. Thus, as one informant put it of avian influenza, ‘we’ve got David Nabarro drawing a picture of a spectre that is going to engulf the world, and you’ve got vets saying, you can say anything you like but it is about chickens’ (Interview 16). Translation and communication problems persist, ‘they

don't necessarily all speak the same language and therefore that's one of the challenges with the One Health agenda, because it means different things to different people' (Interview 17). Different framings of problems and solutions exist even within the medical profession. As a medical doctor commented, 'as clinicians we take the individual perspective but actually taking this broader perspective of One Health [is challenging]' (Interview 18). Epidemiologists and those with a broader population level perspective are seen as having less of an influence.

Meanwhile, a focus on drugs and vaccines as the technological solution is seen as dominant, in turn reinforcing outbreak narratives. As one informant observed, 'the medical and defence establishments think in very similar ways. Drs and nurses are the new army and vaccines the new weapons. This is a very different view of health security [compared to the more integrative One Health perspective]' (Interview 7). Thus while One Health acts as a boundary term drawing people together, it is a fuzzy boundary across which differences of understanding, meaning and narrative persist.

A number of interviewees commented on what it would take to strengthen collaboration across professions and forms of expertise so that a truly integrative One Health could be realised in practice. They emphasise the need for bottom-up field-level collaboration. For instance, 'it will certainly take a long time to change the thinking if it comes from above. But if people get involved with each other at a technical level – if they interact – it will come up from below and things will happen' (Interview 15). Several highlighted the importance of joint training, 'for example if vet and medical schools have zoonoses classes together, joint seminars' (Interview 15). There have been some attempts in this direction, including at Maryland, UC Davis, Cambridge, and the London School of Hygiene and Tropical Medicine (LSHTM)/Royal Veterinary College (RVC) at the University of London (Conrad *et al*. 2009; Courtenay *et al*. 2014; Gargano *et al*. 2013; Winer *et al*. 2015). However the longer-term impacts, and the extension of these to southern settings, have yet to be felt, other than in a few networks (Rweyemamu *et al*. 2013; Silkavute *et al*. 2013; OH-NEXTGEN 2015). Beyond training, there needs to be professional incentives for collaboration. Several commented on the lack of support for cross-disciplinary work in conventional academic research and publishing. 'At university level you need an incentive to work together as you're measured by publications – if working on a One Health project you have to ensure that there's enough incentives for each partner', noted one international researcher (Interview 19).

But One Health is more than integrating vets, medics and ecologists. Some emphasised the importance of drawing social scientists in. This has been highlighted in some research programmes[12], although overall the visibility of social science, outside some economics inputs, in this field is miniscule. One role for social science envisaged in some commentaries is in connecting better with local perspectives and community-level forms of expertise. One informant argued, 'It's also trying to get the community involved in kind of participatory epidemiology and getting people to be thinking cross-disciplinarily as well as thinking in terms of how to involve the community' (Interview 20). This extends the already formidable challenges of linking different expertise, requiring also the integration of local people's knowledge and everyday, experiential expertise. As the same informant put it, 'It is also going to take cultural brokering between different groups of people who haven't worked together before' (Interview

[12] Recent calls in the UK have explicitly involved social science funding, such as the Zoonoses and Emerging Livestock Systems programme (http://www.bbsrc.ac.uk/funding/opportunities/2012/zoonoses-emerging-livestock-systems.aspx). Equally, funding for the Dynamic Drivers of Diseases in Africa Consortium, from which this paper emerges comes from multiple sources, and encourages cross-disciplinary working with social and ecosystem sciences central to it (http://www.espa.ac.uk/). The UK Department for International Development (DFID) plays an important role in this context as an important funder.

20). As we come to argue in the conclusion, this sort of extension of the One Health approach is currently not happening, but it urgently needs to be.

5. Making the case for One Health: whose knowledge, whose interests?

How then is the case for One Health made, and how does this reflect the different knowledges and interests we see represented, as well as the exclusions we have noted? Earlier we identified three narratives. Across the policy documents and interviews, we have observed the widespread deployment of the 'integration' narrative, although with multiple meanings and interpretations, and with sometimes limited effects in practice. We have also noted the importance of the risk and surveillance outbreak narrative, particularly as it came to prominence through avian influenza as a key means to mobilise political interest and funds.

Sustaining interest in a One Health approach, given other institutional priorities and the absence of fundamental organisational reform, has proved an uphill struggle. Demonstrating impact and favourable cost-benefit ratios has become a central theme, supporting the economic costs narrative Häsler *et al.*(2013a and b). Thus Grace *et al*. (2012a: S71) argued that, 'what cannot be measured, cannot be managed'. Even if this is not strictly true, it is certainly the case that economic measures have a large influence on decision-making. 'What will decision makers listen to? It's money. So let's not worry too much about all the intangible benefits […] If we can make the case for One Health through the things we can measure. Show the added value' (Interview 4). As one senior World Bank advisor put it, 'It's [One Health] economically extremely valuable and a very important thing to do in economic terms. The investments are very small related to the benefits (Interview 21).

At a more local level, particularly in the contexts of the developing world, the added value and therefore cost-savings of combining human and veterinary health field operations, such as vaccination campaigns, have been highlighted. For example, Zinsstag *et al*. (2007) highlight significant benefits for human public health from livestock interventions, with examples of rabies vaccination in Chad and brucellosis vaccination in Mongolia (see also Roth *et al*. 2003). Joint vaccination campaigns also result in cost-savings and net benefits (Zinsstag *et al*. 2006; Schelling *et al*. 2005; Schelling *et al.* 2007). In this respect, 'working together is not just a nice way of putting it, but effectively brings us to win-win situations which makes us better address the potential threats, and also of course work more efficiently' (Interview 22). Hence the economic costs and benefits narrative provides operational justification for investment.

While such arguments may be convincing in relation to existing disease challenges, including bringing those previously neglected further up the policy agenda, such cost-benefit metrics cannot be applied when uncertainty and ignorance about future disease emergence and impacts prevail. As one researcher put it, 'the trouble is when not dealing with outbreaks, but more anticipation, early warning, standard measures of cost and benefit are not useful as the events have not yet happened' (Interview 14).

Others pointed to the often-narrow focus of One Health on disease and its control, and on narrow impacts, whether on human or animal health. The coordinator of the One Health Global Network argued for a broadening of the case, 'It's currently only human and animal health, and focused on disease. That's far too narrow. Donors want to hear about development more generally – about poverty, food security, water access and so on, not just about diseases' (Interview 8). This alludes to a wider variety of system level impacts, many of which are difficult to quantify. An easy response to the challenge of bringing such a diversity of factors into an economic narrative around health has been to limit the focus to the more easily measurable indicators.

Others suggest that the One Health paradigm needs to embrace the wider system factors that contribute to disease emergence. This points to underlying structural conditions and local ecological disease contexts that have largely been ignored in the three dominant narratives, but are, as some commentators suggest, critical to prevention as well as locally-attuned responses. As a leading figure in the global public health community observed, '[…] the real solution is going back even further to the determinants, to what's causing those infections in animals and preventing them occurring […] So moving the paradigm, or shifting it from the present rapid detection of response back to prevention hopefully can decrease or even prevent some of these emergences from occurring' (Interview 6).

As we suggested earlier, such dimensions can be seen as part of an alternative, though marginalised, One Health narrative. The reasons for marginalisation relate, as we elaborate below, partly to questions of organisational mandates and funding and professional expertise. However political-economic factors work against the more structural and social changes required. They suggest an undermining of response-focused solutions based on drugs and vaccines that serve important commercial interests and have become embedded in standard government responses. As a US State Department official pointed out. 'a lot of health ministries, and health ministers, are focused on a pharmaceutical solution there, where the biggest solution might be a social one' (Interview 23).

A senior official of the European CDC wondered about whether versions of One Health that suggested shifts in industrial agriculture and food production would ever take hold, 'I believe in One Health, but I'm a little bit cynical as to whether you do get changes in animal husbandry, and particularly surveillance in animal husbandry, if it potentially affects the production of industrial food products. It's a very, very valid approach, an essential approach; I'm just questioning whether people will be prepared to see it through' (Interview 24). In essence, the challenge is around confronting powerful interests and entrenched political-economic relations.

An alternative One Health narrative that takes local contexts seriously also requires the empowerment of alternative voices. This was summed up by one informant as, 'One Health could deliver if it's afforded the opportunity of giving people and the community the sense that this agenda is going to service local needs and not just international needs having to do with security and commerce on a grand scale' (Interview 20).

Local agendas suggest that there is not One World, One Health, but in fact multiple ways of understanding and producing healthy animals, bodies and ecologies, involving an array of localised practices situated within wider sets of structural drivers (Wallace *et al*. 2014) and fundamentally requiring a social science perspective that integrates fully with community knowledge and priorities (Craddock and Hinchliffe 2014; Lapinski *et al*. 2014; Bardosh 2014; Parkes *et al*. 2005). Yet such a view contrasts sharply with the three narratives dominating global discussions of One Health, which all in different ways invoke a singular global threat as justification for the mobilisation of resources and interests.

6. Conclusion

One Health has risen up the policy agenda in a dramatic way in the past decade. It has generated much research and policy debate, and a whole series of meetings, workshops, statements, networks, consortia, initiatives, and funding flows. In many respects an integrated approach to responding to disease threats through combining animal, human and ecosystem health is simple common sense. It is also not new, as there is a long history of practical, integrated approaches with different labels, such as Ecohealth (Zinsstag 2012), and none. What is significant about the past decade has been the level of interest in the approach, and the degree of policy attention and resource mobilisation associated with it.

In this paper we have traced the emergence of One Health as a concept, and noted the multiple precedents and parallels. We have focused on One Health instead of similar terms such as Ecohealth because of the term's policy purchase, and the interest it has generated, at least rhetorically. Through an analysis of policy documents and a reflection on multiple interviews carried out since 2008, we have identified three different One Health narratives, each suggesting a set of policy responses, and associated justifications. These were 'integration', 'risk, surveillance and outbreak' and 'cost-benefit economics'. None of these focused however on what we identified as a fourth, somewhat hidden narrative, that offers a rather different framing, and questions the universalised globalism of the core policy narratives. This focused on local understandings, structural drivers, and the diverse framings of health emerging from local settings.

A basic bibliometric analysis of published research (and so therefore a sub-sample of available material) looked at the scientific research networks associated with the One Health concept. This allowed us to ask, who are the research advocates, where do they come from, and what disciplinary and or disease *foci* do they have. This analysis exposed the limits to the rhetoric of integration, cross-disciplinarity and global research. One Health research is dominated by veterinarians and animal health scientists, is predominantly located in the global North, and is focused on relatively few institutions and individuals who act as leads, and brokers between clusters of researchers. This is, of course, not universally the case, but it is a striking pattern. This is also to some extent reflected in the policy literature, based on our qualitative analysis.

One Health was projected to the centre of the policy stage in the context of several avian influenza outbreaks in the early 2000s and large-scale global disease threats with pandemic potential have continued to dominate the research and policy debate. This has driven funding flows for policy initiatives and scientific research, with zoonoses (avian and swine influenza and more recently Ebola) attracting significant policy interest and associated funding. However in this field, where there is such an obviously close link between policy concerns and research agendas, it was a surprise to find that the networks of individuals and institutions associated with peer-reviewed, academic research did not overlap with the key actors in the policy domain, who we identified through a snowball sampling approach over a number years. The exceptions were key individuals based in key institutions (in Switzerland, the UK and the US, all northern contexts) where scientists were linked to policy. These were the brokers, appearing as key nodes in the research network maps, and contributing to both academic and policy literatures. The science-policy connection in this field seems to be dominated by relatively few individuals associated with a handful of northern organisations, reflecting a surprisingly narrow integration between science and policy.

A question we have asked throughout this research is this. If One Health is obviously such a good idea (perhaps just common sense), then why is it not more widely practised and institutionalised? With all the funds, events, publications, initiatives, why has it not had more of an impact? It is of course difficult

to assess impact, as there are so many variables and attribution is impossible. Meanwhile some remarkable headway has been made, as many of our informants noted. However, as our discussion shows, despite the claims that One Health is central to a global challenge of emerging infectious disease especially from zoonotic origin (as well as, as discussed above, many other disease challenges without the headline-grabbing policy attention), there are some real constraints to making One Health happen in practice.

As many have observed, many of these limitations are created by remaining barriers between medicine and veterinary medicine, as well as lack of human and economic resources and institutional capacities and support, especially in the global South (Smith *et al*. 2014, Okello *et al*. 2014, Bardosh *et al*. 2014a and b). In this paper however, we elaborate three additional recurrent limitations. These are: organisational and funding modalities, disciplinary and professional silos, and conflicting interpretations of the meaning of integration. All are deeply structural, embedded in particular types of legitimated knowledge, certain institutions and professions, and all wrapped up in complex power relations. They are all at root political economy explanations, of knowledge, organisation and interests. This means that existing arrangements, current practices and incumbent, powerful institutions are all difficult to shift. And this despite the cacophony of (common sense) rhetoric, and the increasingly well-articulated justifications, offered in different registers, from economic value to moral imperative, and a whole array of fora.

One of the issues we highlight is that it is often not clear what a move to One Health would actually entail in practical terms. Beyond the rhetoric, the substance is often remarkably thin, and remarkably few examples exist on the ground by way of illustration. As we have noted, cynics, with some justification, see it as a last-gasp attempt by veterinarians to claim a slice of the funding pie as well as improved social standing, while others recognise the value in theoretical terms and see more coordination and integration simply as an escalation of transactions costs without any evidence of real tangible benefits. Others see One Health as a threat to professional, disciplinary and institutional specialisations that they hold dear. With decreasing public funds for a whole array of activities, others fear the prospect of sharing this more widely, especially to those not traditionally party to such funding sources, such as social scientists and ecologists. So without a clear 'business case' (Grace 2014) or 'proof of concept' (Bonfoh *et al*. 2011), too easily the default is the status quo.

These discussions are occurring within a mainstream One Health community, with all the geographical, disciplinary and institutional biases we have identified, and so reflect a particular set of turf wars, particularly between vets and medics. Another, perhaps more fundamental, challenge comes from outside these networks, questioning some of the more fundamental tenets of One Health framing, asking, 'whose world, whose health' is being talked about by the One Health research and policy communities? This comes from a social science critique that argues that an unquestioning globalism hides politics and disciplines in practice and policy, constraining alternative knowledge and framings about what matters for whom (Hinchliffe 2014, Dry and Leach 2010; Scoones 2010) There are multiple worlds and multiple healths that emerge in context.

This more political argument does not chime easily with the institutional politics of One Health that is attempting to bring together large, monolithic organisations that have traditionally competed. It problematises the notion of integration and simplistic holism, as this will always involve negotiation of what we mean by health and for whom, and whose knowledge counts – an intensely political process. And it sits uneasily with the classic internationalism of One Health that often elides with a northern domination of institutions and geopolitics, including in health (Elbe 2010; Davies *et al*. 2014). It questions how health inequalities, and forms of 'structural violence' (Farmer 2004) emerge in a highly unequal world, and how this influences how diseases emerge and who gets sick. Unfortunately, as our analysis has shown, such alternative framings sit outside mainstream One Health networks that, except

for a scattering of economists, largely exclude social scientists as well as the broader social determinants of health.

If One Health is to have genuine purchase and real impact, and so become rooted in new ways of thinking and working that genuinely challenge current practice, then, we argue, there will need to be a more radical overhaul of current research and policy networks to allow such alternative framings to have a space. The rise of One Health thinking has created in practice quite a narrow set of networks, associated with a core group of people and organisations and set of framings that regularly exclude key aspects of debate. Contrary to the claims, One Health runs the danger of getting siloed and institutionalised with new forms of funding and power, and so becoming subject to precisely the problem it has sought to challenge. We hope that a critical reflection on the political economy of One Health – its origins, narratives, research-policy networks and its future – as offered in this paper will provide some challenges to the One Health approach as it has emerged, encouraging it to broaden out framings and open up to more diverse knowledges and practices than it has to date, and thus become more easily implemented in practice in the real, diverse, uncertain world.

Bibliography

Adamson, S., Marich, A. and Roth, I. (2011) 'One Health in NSW: coordination of human and animal health sector management of zoonoses of public health significance', *NSW Public Health Bulletin* 22.5–6: 105–112

Anholt, R. M., Stephen, C, and Copes, R. (2012) 'Strategies for Collaboration in the Interdisciplinary Field of Emerging Zoonotic Diseases', *Zoonoses and Public Health* 59.4: 229–240

Bardosh, K. (2014) 'Global aspirations, local realities: the role of social science research in controlling neglected tropical diseases', *Infectious Diseases of Poverty* 3.1: 35

Bardosh. K., Inthavong. P., Veunghang. S. and Okello, A, (2014a) 'Controlling Parasites, Understanding Practices: The Biosocial Complexity of a One Health Intervention for Neglected Zoonotic Helminths in Northern Lao PDR', *Social Science and Medicine* 120: 215–223

Bardosh, K., Sambo, M., Sikana, L., Hampson, K. and Welburn, S. C. (2014b) 'Eliminating rabies in Tanzania? Local understandings and responses to mass dog vaccination in Kilombero and Ulanga districts', *PLoS Neglected Tropical Diseases* 8.6: e2935

Bonfoh, B., Schelling, E., Tanner, M. and Zinsstag, J. (2011) 'Proof of One Health Concept: Towards Capacity Building and Intersectoral Interventions', *Ecohealth* 7: S117–S117

CDC (2011) *A CDC framework for preventing infectious diseases: Sustaining the Essentials and Innovating for the Future*, Atlanta GA: Centres for Disease Control and Prevention, http://www.cdc.gov/oid/docs/ID-Framework.pdf

Charron, D. F. (2012) 'Ecosystem approaches to health for a global sustainability agenda', *Ecohealth* 9.3: 256–266

Coker, R., Rushton, J., Mounier-Jack, S., Karimuribo, E., Lutumba, P., Kambarage, D., Pfeiffer, D. C., Stärk, K. and Rweyemamu, M. (2011) 'Towards a conceptual framework to support one-health research for policy on emerging zoonoses', *The Lancet: Infectious Diseases* 11.4: 326–331

Conrad, P. A., Meek, L. A. and Dumit, J. (2013) 'Operationalizing a One Health approach to global health challenges', *Comparative Immunology, Microbiology and Infectious Diseases* 36.3: 211–216

Conrad, P. A., Mazet, J. A., Clifford, D., Scott, C. and Wilkes, M. (2009) 'Evolution of a transdisciplinary "One Medicine–One Health" approach to global health education at the University of California, Davis', *Preventive Veterinary Medicine* 92.4: 268–274

Conraths, F. J., Schwabenbauer, K., Vallat, B., Meslin, F. X., Füssel, A. E., Slingenbergh, J. and Mettenleiter, T. C. (2011) 'Animal health in the 21st century—A global challenge', *Preventive Veterinary Medicine* 102.2: 93–97

Cook, R. A., Karesh, W. B. and Osofsky, S. A. (2004) *The Manhattan Principles on "One World, One Health": building interdisciplinary bridges to health in a globalized world*, New York: Wildlife Conservation Society

Courtenay, M., Conrad, P., Wilkes, M., La Ragione, R., and Fitzpatrick, N. (2014) 'Interprofessional initiatives between the human health professions and veterinary medical students: a scoping review.', *Journal of Interprofessional Care*, 28.4: 323–30

Craddock, S. and Hinchliffe, S. (2014) 'One world, one health? Social science engagements with the one health agenda', *Social Science and Medicine,* Epub ahead of print, http://www.ncbi.nlm.nih.gov/pubmed/25434985

Dantas-Torres, F., Chomel, B. B. and Otranto, D. (2012) 'Ticks and tick-borne diseases: a One Health perspective', *Trends in Parasitology* 28.10: 437–446

Davies, S. E., Elbe, S., Howell, A., and McInnes, C. (2014) 'Global Health in International Relations: Editors' Introduction', *Review of International Studies* 40.5: 825–834

Day, M. J. (2011) 'One Health: the importance of companion animal vector-borne diseases', *Parasites and Vectors* 4: 49

Dry, S. and M. Leach (2010) *Epidemics – Science, Governance and Social Justice*, London: Earthscan

Elbe, S. (2010) *Security and global health*, Cambridge: Polity

Farmer, P. (2004) 'An anthropology of structural violence', *Current anthropology* 45.3: 305–325

Forster, P. (2012) 'To Pandemic or Not? Reconfiguring Global Responses to Influenza', STEPS Working Paper 51, Brighton: STEPS Centre

Franco, A. O., Gomes, M. G. M., Rowland, M., Coleman, P. G. and Davies, C. R. (2014) 'Controlling Malaria Using Livestock-Based Interventions: A One Health Approach', *PloS one* 9.7: e101699

Frazzoli, C., Mantovani, A., Dragone, R., and Dragone, R. (2014) 'Local Role of Food Producers' Communities for a Global One-Health Framework: The Experience of Translational Research in an Italian Dairy Chain', *Journal of Agricultural Chemistry and Environment* 3.2: 14

Galaz. V. (2014) *Global Environmental Governance, Technology and Politics: The Anthropocene Gap,* Cheltenham: Edward Elgar

Gargano, L. M., Gallagher, P. F., Barrett, M., Howell, K., Wolfe, C., Woods, C., and Hughes, J. M. (2013) 'Issues in the development of a research and education framework for one health', *Emerging Infectious Diseases* 19.3: e121103, doi: 0.3201/eid1903.121103

Gibbs, E. P. J. (2014) 'The Evolution of One Health: a decade of progress and challenges for the future', *Veterinary Record*, 174.4: 85–91

Godfroid, J., Al Dahouk, S., Pappas, G., Roth, F., Matope, G., Muma, J., Marcotty, T., Pfeiffer, D. and Skjerve, E. (2013) 'A "One Health" surveillance and control of brucellosis in developing countries: moving away from improvisation', *Comparative Immunology, Microbiology and Infectious Diseases* 36.3: 241–248

Grace, D. (2014) 'The Business Case for One Health', *Onderstepoort Journal of Veterinary Research* 81.2: 725

Grace, D., Gilbert, J., Randolph, T. and Kang'ethe, E. (2012a) 'The multiple burdens of zoonotic disease and an ecohealth approach to their assessment', *Tropical Animal Health and Production*, 44: 67–73.

Grace, D., Kang'ethe, E. and Waltner-Toews, D. (2012b) 'Participatory and integrative approaches to food safety in developing country cities', *Tropical animal health and production* 44.1 (Supp.): 1–2

Häsler, B., Hiby, E., Gilbert, W., Obeyesekere, N., Bennani, H. and Rushton, J. (2014) 'A One Health Framework for the Evaluation of Rabies Control Programmes: A Case Study from Colombo City, Sri Lanka', *PLoS Neglected Tropical Diseases* 8.10: e3270

Häsler, B. Cornelsen L., Shankar, B. and Rushton J. (2013a) 'Metrics for One Health benefits: key inputs to create an economic evidence base', Expert workshop report, London: London School of Hygene and Tropical Medicine, 12 September

Häsler, B., Gilbert, W., Jones, B. A., Pfeiffer, D. U., Rushton, J. and Otte, M. J. (2013b) 'The economic value of One Health in relation to the mitigation of zoonotic disease risks', pp. 127–151 in *One Health: The Human-Animal-Environment Interfaces in Emerging Infectious Diseases,* Berlin/Heidelber: Springer

Hinchliffe, S. (2014) 'More than one world, more than one health: Re-configuring interspecies health', *Social Science and Medicine* Soc Sci Med. doi: 10.1016/j.socscimed.2014.07.007

Hinchliffe, S. (2007) *Geographies of nature – societies, environments, ecologies*, London: Sage

Hueston, W., Appert, J., Denny, T., King, L., Umber, J. and Valeri, L. (2013) 'Assessing Global Adoption of One Health Approaches', *Ecohealth*, 10.3: 228–233

Kahn, R. E., Clouser, D. F. and Richt, J. A. (2009) 'Emerging infections: a tribute to the one medicine, one health concept', *Zoonoses and Public Health* 56.6/7: 407–428

Kaneene, J. B., Kaplan, B., Steele, J. H., and Thoen, C. O. (2014) 'One Health approach for preventing and controlling tuberculosis in animals and humans', Chapter 2 in C. O. Thoan, J. H. Steele and J. B. Kaneene (eds) *Zoonotic Tuberculosis: Mycobacterium bovis and Other Pathogenic Mycobacteria*, Third Edition, Oxford: Wiley Blackwell

Kaplan, B. and C. Scott (no year) 'Who coined the term "One Medicine"?', One Health Initiative website, http://bit.ly/16LfJKL

Karimuribo, E., Wambura, P., Mounier-Jack, S., Sonoiya, S., Short, N., Aanensen, D., Mboera, L., Rushton, J., Coker, R. and Rweyemamu, M. (2011) 'Contrasting features and opportunities for 'One Health'infectious diseases surveillance system in Tanzania', *EcoHealth* 7.1: S49

Keeley, J. and Scoones, I. (2003) *Understanding environmental policy processes: Cases from Africa*, London: Earthscan

Kittayapong, P., Thongyuan, S., Olanratmanee, P., Aumchareoun, W., Koyadun, S., Kittayapong, R. and Butraporn, P. (2012) 'Application of eco-friendly tools and eco-bio-social strategies to control dengue vectors in urban and peri-urban settings in Thailand', *Pathogens and Global Health* 106.8: 446–454

Lapinski, M. K., Funk, J. A. and Moccia, L. T. (2014) 'Recommendations for the role of social science research in One Health', *Social Science & Medicine* (ePub ahead of print) http://www.ncbi.nlm.nih.gov/pubmed/25311785

Leboeuf, A. (2011) *Making sense of One Health. Cooperating at the human-animal-ecosystem health interface,* IFRI Health and Environment Report 7: Paris: Institut Francais des Relations Internationals

Lee K. and Brumme Z. L. (2013) *'Operationalizing the One Health approach: the global governance challenges'*, Health Policy and Planning 28: 778–785

Lélé, S. and Norgaard, R. B. (2005) 'Practicing Interdisciplinarity', *BioScience* 55.11: 967–975

Leung, Z., Middleton, D. and Morrison, K. (2012) 'One Health and EcoHealth in Ontario: A qualitative study exploring how holistic and integrative approaches are shaping public health practice in Ontario', *BMC Public Health*, 12: 358

Liverani, M., Waage, J., Barnett, T., Pfeiffer, D. U., Rushton, J., Rudge, J. W., Loevinsohn, M. E., Scoones, I., Smith, R D., Cooper, B. S., White, L. J., Goh, S., Horby, P., Wren, B., Gundogdu, O., Woods, A. and Coker, R. J. (2013) 'Understanding and managing zoonotic risk in the new livestock industries', Environmental *Health Perspectives* 121.8: 873–877

Mbugi, E. V., Kayunze, K. A., Katale, B. Z., Kendall, S., Good, L., Kibik, G. S., Keyyu, J. D., Godfrey-Faussett, P., van Helden, P and Matee, M. I. (2012) '"One Health" infectious diseases surveillance in Tanzania: Are we all on board the same flight?', *Onderstepoort Journal of Veterinary Research* 79,2: E1–7

Middleton, D., Pallister, J., Klein, R., Feng, Y. R., Haining, J., Arkinstall, R., Frazer, L., Huang, J-A., Edwrds, N., Wareing, M., Elhay, M., Hashmi, Z., Bingham, J., Yamada, M., Johnson, D., White, J., Foord, A., Heine, H. G., Marsh, G. A., Broder, C. C. and Wang, L-F. (2014) 'Hendra Virus Vaccine, a One Health Approach to Protecting Horse, Human, and Environmental Health', *Emerging Infectious Diseases* 20.3: 372

Miller, J. M. (2010) 'Implications of the one health paradigm for clinical microbiology', *Clinical Microbiology Newsletter*, 32.7: 51–56

Miller, J. M. and Griffin, P. M. (2012) 'One Health through the eyes of clinical and public health microbiology: Scientists from a variety of disciplines are needed to understand infectious diseases and prevent human infections', *Microbe* 7.1: 23–27

Monath, T. P. (2013) 'Vaccines against diseases transmitted from animals to humans: a one health paradigm', *Vaccine* 31.46: 5321–5338

Murray, M., Holmes, P., Wright, N., Jarrett, O., and Kennedy, P. (2014) 'History of One Health and One Medicine', *Veterinary Record* 174.9: 227–227

Narrod, C., Zinsstag, J. and Tiongco, M. (2012) 'One health framework for estimating the economic costs of zoonotic diseases on society', *Ecohealth* 9.2: 150–162

Ndeledje, N., Bouyer, J., Stachurski, F., Grimaud, P., Belem, A. M. G., Molélé Mbaïndingatoloum, F., Bengaly, Z., Oumar Alfaroukh, I., Cecchi, G. and Lancelot, R. (2013) 'Treating Cattle to Protect People? Impact of Footbath Insecticide Treatment on Tsetse Density in Chad', *PLoS One* 8.6

Nguyen-Viet, H., Unger, F., Gilbert, J., McDermott, J., Lapar, L., Mehta-Bhatt, P., Pham Duc Phuc, Dang Xuan Sinh and Grace, D. (2014) *One Health and Ecohealth in Southeast Asia: Highlights of research by the International Livestock Research Institute and its partners*, ILRI Research Brief 26, Nairobi: International Livestock Research Institute

OH-NEXTGEN (2015) Web-based training programme OH-NEXTGEN, targeting research development and improved control of zoonoses in Africa, http://www.oh-nextgen.eu/

Okello, A. L., Bardosh, K., Smith, J. and Welburn, S. C. (2014) 'One Health: Past Successes and Future Challenges in Three African Contexts', *PLoS Neglected Tropical Diseases* 8.5: e2884

Okello, A., Welburn, S. and Smith, J. (2014) 'Crossing institutional boundaries: mapping the policy process for improved control of endemic and neglected zoonoses in sub-Saharan Africa', *Health Policy and Planning*, doi:10.1093/heapol/czu059

Okello, A. L., Gibbs, E. P., Vandersmissen, A. and Welburn, S. C. (2011) 'One Health and the neglected zoonoses: turning rhetoric into reality', *The Veterinary Record* 169.11: 281–285

Palatnik-de-Sousa, C. B., and Day, M. J. (2011) 'One Health: the global challenge of epidemic and endemic leishmaniasis', *Parasites & Vectors* 4.1: 1-10

Parkes, M. W., Bienen, L., Breilh, J., Hsu, L. N., McDonald, M., Patz, J. A., Rosenthal, J P., Sahani, M., Sleigh, A., Waltner-Toews, D. and Yassi, A. (2005) 'All hands on deck: Transdisciplinary approaches to emerging infectious disease', *Ecohealth* 2.4: 258–272

Pfeiffer, D. U., Otte, M. J., Roland-Holst, D. and Zilberman, D. (2013) 'A one health perspective on HPAI H5N1 in the Greater Mekong sub-region', *Comparative Immunology, Microbiology and Infectious Diseases* 36.3: 309–319

Pielke, R. A. (2007) *The honest broker: making sense of science in policy and politics*, Cambridge: Cambridge University Press: 188

Rabinowitz, P. and Conti, L. (2013) 'Links among human health, animal health, and ecosystem health', *Annual Review of Public Health* 34: 189–204

Roe, E.M. (1991) 'Development narratives, or making the best of blueprint development', *World Development* 4: 287–300

Roth, F., Zinsstag, J., Orkhon, D., Chimed-Ochir, G., Hutton, G., Cosivi, O., Carrin, G. and Otte, J. (2003) 'Human health benefits from livestock vaccination for brucellosis: case study', *Bulletin of the World Health Organization* 81.12: 867–76

Rubin, C., Myers, T., Stokes, W., Dunham, B., Harris, S., Lautner, B. and Annelli, J. (2013) 'Review of institute of medicine and national research council recommendations for one health initiative', *Emerging Infectious Diseases*, 19.12: 1913–1917

Rushton, J., Häsler, B., de Haan, N. and Rushton, R. (2012) 'Economic benefits or drivers of a "One Health" approach: Why should anyone invest?', *Onderstepoort Journal of Veterinary Research* 79.2: 461

Rweyemamu, M., Kambarage, D., Karimuribo, E., Wambura, P., Matee, M., Kayembe, J. M., Mweene, A., Neves, L., Masumu, J., Kasanga, C., Hang'ombe, B., Kayunze, K., Misinzo, G., Simuunza, M. and Paweska, J. T. (2013) 'Development of a One Health National Capacity in Africa : The Southern African Centre for Infectious Disease Surveillance (SACIDS) One Health Virtual Centre Model', *Current Topics in Microbiology and Immunology* 336: 73–94

Schelling, E., Bechir, M., Ahmed, M. A., Wyss, K., Randolph, T. F. and Zinsstag, J. (2007) 'Human and Animal Vaccination Delivery to Remote Nomadic', *Emerging Infectious Diseases* 13.3: 373–379

Schelling, E., Wyss, K., Béchir, M., Moto, D. D. and Zinsstag, J. (2005) 'Synergy between public health and veterinary services to deliver human and animal health interventions in rural low income settings', *British Medical Journal (Clinical research ed.)* 331.7527: 1264–7

Scoones, I. (2014) *The Politics of Trypanosomiasis Control in Africa*, STEPS Working Paper 57: Brighton: STEPS Centre

Scoones, I. (ed.) (2010). *Avian Influenza: Science, Policy and Politics*, London: Routledge

Silkavute, P., Tung, D. X. and Jongudomsuk, P. (2013) 'Sustaining a regional emerging infectious disease research network: a trust-based approach', *Emerging Health Threats Journal* 6

Smith. J., Taylor, E. M. and Kingsley, P. (2014) 'One World-One Health and Neglected Zoonotic Disease: Elimination, Emergence and Emergency in Uganda', *Social Science and Medicine,* http://www.ncbi.nlm.nih.gov/pubmed/24984807

Spiegel, J., Bennett, S., Hattersley, L., Hayden, M. H., Kittayapong, P., Nalim, S., Nan Chee Wang, D., Zielinski-Gutiérrez and Gubler, D. (2005) 'Barriers and Bridges to Prevention and Control of Dengue: The Need for a Social-Ecological Approach', *EcoHealth* 2.4: 273–290, doi:10.1007/s10393-005-8388-x

Thompson, R. C. (2013) 'Parasite zoonoses and wildlife: One health, spillover and human activity', *International Journal for Parasitology* 43.12: 1079–1088

Vilas, V. J. D. R., Maia-Elkhoury, A. N., Yadon, Z. E., Cosivi, O. and Sanchez-Vazquez, M. J. (2014) 'Visceral leishmaniasis: a One Health approach', *Veterinary Record* 175.2: 42–44

Waltner-Toews, D. (2001) 'An ecosystem approach to health and its applications to tropical and emerging diseases', *Cadernos de Saúde Pública*, *17*: 7–36

Wallace, R. G., Bergmann, L., Kock, R., Gilbert, M., Hogerwerf, L., Wallace, R., and Holmberg, M. (2014) 'The dawn of Structural One Health: a new science tracking disease emergence along circuits of capital', *Social Science & Medicine* doi:10.1016/j.socscimed.2014.09.047

WHO (2008) *Integrated Control of Neglected Zoonotic Diseases in Africa: Applying the 'One Health' Concept,* Report of a joint WHO/EU/ILRI/DBL/FAO/OIE/AU meeting, Nairobi, 13–15 November 2007, http://whqlibdoc.who.int/hq/2008/WHO_HTM_NTD_NZD_2008.1_eng.pdf

Winer, J. N., Nakagawa, K., Conrad, P. A., Brown, L., and Wilkes, M. (2015) 'Evaluation of medical and veterinary students' attitudes toward a one health interprofessional curricular exercise', *Journal of Interprofessional Care* 29.1: 49–54Woods, A. (2013) 'Origins of "one medicine"', *Veterinary Record*, 173.24: 614–614

Woods, A., and Bresalier, M. (2014) 'One health, many histories', *Veterinary Record* 174.26: 650–654

World Bank (2010) *People, Pathogens and Our Planet Volume 1: Towards a One Health Approach for Controlling Zoonotic Diseases*, Washington DC: World Bank

Zinsstag, J. (2012) 'Convergence of ecohealth and one health', *EcoHealth* 9.4: 371

Zinsstag, J., Mackenzie, J. S., Jeggo, M., Heymann, D. L., Patz, J. A. and Daszak, P. (2012a) 'Mainstreaming one health', *EcoHealth* 9.2: 107–110

Zinsstag, J., Meisser, A., Schelling, E., Bonfoh, B. and Tanner, M. (2012b) 'From "two medicines" to "One Health" and beyond', *Onderstepoort Journal of Veterinary Research*, 79.2: 492

Zinsstag, J., Schelling, E., Waltner-Toews, D. and Tanner, M. (2011) 'From "one medicine" to "one health" and systemic approaches to health and well-being', *Preventive Veterinary Medicine*, 101.3–4: 148–156

Zinsstag, J. Schelling, E., Bonfoh, B., Fooks, A. R., Kasymbekov, J., Waltner-Toews, D. and Tanner, M. (2009) 'Towards a "One Health" research and application tool box', *Veterinaria Italiana* 45.1: 121–133

Zinsstag, J., Schelling, E., Roth, F., Bonfoh, B., de Savigny, D. and Tanner, M. (2007) 'Human benefits of animal interventions for zoonosis control', *Emerging Infectious Diseases* 13.4: 527–31

Zinsstag, J., Schelling, E., Wyss, K. and Mahamat, M. B. (2006) 'Potential of cooperation between human and animal health to strengthen health systems', *The Lancet* 366.9503: 2142–2145

Appendix 1: Policy Documents

AVMA (2008) *One Health: A New Professional Imperative; One Health Initiative Task Force: Final Report*, Schaumburg Il: American Veterinary Medical Association

CDC (2011) *A CDC framework for preventing infectious diseases,* Atlanta GA: CDC http://www.cdc.gov/oid/docs/ID-Framework.pdf

CDC (2010) *Operationalizing 'One Health': A Policy Perspective – Taking Stock and Shaping an Implementation Roadmap*, Initial planning document for a collaborative meeting, Atlanta GA CDC//OIE/FAO/WHO, http://www.cdc.gov/onehealth/pdf/atlanta/meeting-overview.pdf

CDC (2004) 'The Manhattan Principles', as defined during a meeting, 'Building Interdisciplinary Bridges to Health in a Globalized World', New York NY: Rockefeller University http://www.cdc.gov/onehealth/pdf/manhattan/twelve_manhattan_principles.pdf

CDC/EEAS/USDA (2011) 'Atlanta Report 201: Expert Meeting on One Health Governance and Global Network, Atlanta GA: CDC, http://eeas.europa.eu/health/docs/2011_report-experts-atlanta_en.pdf

Chatham House (2010) 'Shifting from Emergency Response to Prevention of Pandemic Disease Threats at Source', Report of a meeting April 2010, London: Chatham House, http://bit.ly/16WRDfI

Cook, R. A., Karesh, W, B., Osofsky, S. A. (2004) *'The Manhattan Principles' on 'One World, One Health': building interdisciplinary bridges to health in a globalized world*, New York NY: Wildlife Conservation Society

Corning, S. (2014) 'World Organisation for Animal Health: strengthening Veterinary Services for effective One Health collaboration', *Revue Scientifique et Technique-Office International des Epizooties* 33.2: 639–650

FAO (2011) *One Health: Food and Agriculture Organization of the United Nations Strategic Action Plan*, Rome: Animal Production and Health Divison, FAO, http://www.fao.org/docrep/014/al868e/al868e00.pdf

FAO (2008) *Contributing to One World, One Health: a strategic framework for reducing risks of infectious diseases at the animal-human-ecosystems interface*, Geneva: FAO/OIE/WHO/World Bank/UNICEF/UN, http://www.fao.org/docrep/011/aj137e/aj137e00.htm

FAO/OIE/WHO (2011) *High-level technical meeting to address health risks at the human-animal cosystems interface*, Mexico City: FAO, www.fao.org/docrep/017/i3119e/i3119e.pdf

FAO/OIE/WHO (2010) The FAO-OIE-WHO *Collaboration: Sharing Responsibilities and Coordinating Global Activities to Address Health Risks at the Animahuman-ecosystems Interfaces: A Tripartite Concept Note*, Rome/Paris/Geneva: FAO/OIE/WHO, http://bit.ly/1AeLcT7

Government of India (2007) *Vision and Road Map,* Report of Ministerial conference on Avian and Pandemic Influenza, 6 December, http://www.cdc.gov/onehealth/pdf/delhi/vision_roadmap.pdf

Hall, D., Coghlan, B. (2011) Preparatory study for Europe Asia meeting, 'Implementation of the One Health Approach in Asia and Europe: How to set up a common basis for action and exchange of experience', Paris: EU/Conseil Sante Consortium, http://bit.ly/1uIsUaq

ILRI (2012) *Mapping of poverty and likely zoonoses hotspots*, Nairobi: ILRI

Institute of Medicine (2009) *Sustaining Global Surveillance and Response to Emerging Zoonotic Diseases*, Washington DC: National Academies Press, http://www.iom.edu/Reports/2009/ZoonoticDisease.aspx

King, L. J., Anderson, L. R., Blackmore, C. G., Blackwell, M. J., Lautner, E. A., Marcus, L. C., Meyer, T. E., Monath, T. P., Nave, J. E., Ohle, J., Pappaioanou, M., Sobota,. J., Stokes, W. S., Davis, R. M., Glasser, J. H. and Mahr, R. K. (2008) 'Executive summary of the AVMA One Health Initiative Task Force report', JAVMA 233.2: 259–261, http://avmajournals.avma.org/doi/pdfplus/10.2460/javma.233.2.259

Newman, S. and Slingenburgh, J., Kaeslin, E., Reantaso, M., Subasinghe, R. nd Lubroth, J. (2011) *Realising One Health: How the Food and Agriculture Organization of the United Nations Envisions Success,* Rome: UN Food and Agriculture Organization

Public Health Agency of Canada (2009) 'One World One Health: from ideas to action', Report of Expert Consultation 16–19 March, Winnipeg: Public Health Agency of Canada, http://bit.ly/1KMMsOK

Rubin, C. S. (2013) 'Operationalizing One Health: Stone Mountain and Beyond', *Current Topics in Microbiology and Immunology* 366: 173–183
http://www.cdc.gov/onehealth/resources/stone-mountain.html

WCS (2004) *One World – One Health*, New York NY: Wildlife Conservation Society http://bit.ly/1CkmgVh

WHO (2008) *Integrated Control of Neglected Zoonotic Diseases in Africa Applying the 'One Health' Concept,* Report of a meeting in Nairobi, 13-15 November, Nairobi, Geneva: WHO, http://whqlibdoc.who.int/hq/2008/WHO_HTM_NTD_NZD_2008.1_eng.pdf

World Bank, (2012) *People, Pathogens and our Planet, Vol 2: The Economics of On Health*, Washington DC: World Bank

World Bank, (2010) *People, Pathogens and our Planet, Vol 1: Towards a One Health Approach for Controlling Zoonotic Diseases,* Washington DC: World Bank

World Bank (2010) *Animal and pandemic influenza: a framework for sustaining momentum: synopsis of the fifth global progress report,* Washington DC: World Bank http://bit.ly/1FBTPpk

Appendix 2: Interviews

Interview data derived from 83 interviews and recorded discussions carried out at various points between 2008 and 2013. These were transcribed and analysed. Interviews came from work carried out for the avian influenza project with Paul Forster, mostly during 2008 (Scoones 2010); video interviews at the STEPS Centre/Centre for Global Health Policy workshop on Pandemic Flu Controversies were carried out by Naomi Marks (IDS, Sussex, January 2013); Skype and phone interviews carried out for the project on the political economy of trypanosomiasis by Ian Scoones (Scoones 2014); interviews and discussions at the LCIRAH workshop (LSHTM, London, September 2012), carried out by Ian Scoones; and interviews/informal discussions at the Africa Ecohealth conference (July 2013, Abidjan), carried out by Naomi Marks and Victor Galaz. 28 interviews are quoted in the paper, and assigned numbers in line with the table below. These are all anonymised, as is the full list of interviews listed below.

Interview number	Position/affiliation of interviewee: location and date of interview
1	Official, Department for International Development, (London, January 2008)
2	Official, UNICEF (Geneva, March 2008)
3	Official, OIE (London, September 2013)
4	Consultant (Skype, July, 2013)
5	Bill and Melinda Gates Foundation, formerly US State Department (Sussex, January 2013)
6	Chatham House/Public Health England (Sussex, January 2013)
7	WHO (Geneva, March 2008)
8	European Commission (London, September 2013)
9	Scientist, (Grand Bassam, October 2013)
10	CDC, Atlanta (London, September 2013)
11	ILRI Scientist, (Grand Bassam, October 2013)
12	Researcher, RVC (London, April 2008)
13	Retired researcher, Edinburgh (Skype, July 2013)
14	Scientist, Edinburgh (Skype, July 2013)
15	WHO (Geneva, March 2008)
16	Economist, World Bank (Washington DC, April 2008)
17	Public Health Canada (Sussex, January 2013)
18	Brighton and Sussex Medical School (Sussex, January 2013)
19	ILRI Scientist (Abidjan, October 2013)
20	Academic, University of Arizona (Sussex, January 2013)
21	Economist, World Bank (Sussex, January 2013)

22	Consultant, retired from FAO (Sussex, January 2013)
23	State Department official (Washington DC April 2008)
24	European CDC (Sussex, January 2013)
25	WHO official (London, September 2013)
26	RVC researcher (London, September 2013)
27	UNSIC team member (New York, April 2008)
28	CGIAR researcher (Abidjan, October 2013)

Interviews carried out in 2008, focusing on avian influenza (Ian Scoones and Paul Forster)

CVO, Netherlands, ex OIE

UNSIC/WHO social scientist (Geneva)

WHO x 5 (Geneva)

OIE officers x 2 (Paris)

FAO officers x 5 (Rome)

ECTAD officials x 2 (xx)

DFID official (London)

RVC academic (London)

Independent consultant (London)

DG SANCO officials x 2 (Brussels)

EC DVM, AI response (Brussels)

EuropeAid/AidCo cooperation x 3 (Brussels)

UN OCHA x 5 (Geneva)

UNICEF x 2 (Geneva)

UNDP x 1 (New York)

UNSIC x 2 (New York)

UNSIC (London)

US State Dept – Avian Influenza Action Group x 3 (Washington DC)

US State Department Special Representative (Washington DC)

USAID x 2 (Washington DC)

World Bank x 2 (Washington DC)

USDA (Washington DC)

STEPS Centre/Centre for Global Health Policy conference, Sussex January 2013 (transcripts from video interviews; interviews by Naomi Marks)

European Centre for Disease Prevention and Control

Centre on Global Health Security, Chatham House

Brighton & Sussex Medical School

Independent consultant

Wellcome Trust

Bill and Melinda Gates Foundation

University of Arizona

World Bank

Health Canada

National Security Affairs, US Naval Postgraduate School

CGIAR scientist

Trypanosomiasis Skype interviews by Ian Scoones (July 2013)

Independent consultant (UK)

Researcher (retired) (Edinburgh)

EU consultant (Latvia)

IAEA scientist (Vienna)

CGIAR scientist (Washington DC)

FAO scientist (Rome)

LCIRAH meeting 12 Sept 2013 (discussions with Ian Scoones)

One Health Division, CDC, US

OIE official

WHO official

FAO official

DAI consultant

EU/One Health Global Network

Academic, RVC

Academic, Edinburgh

Academic, NUPI/ILRI

OIE Collab Centre, Massey

Interviews from the EcoHealth conference, Abidjan, July 2013 (Interviews by Naomi Marks, Catherine Grant and Victor Galaz)

CGIAR Scientists x 3

Scientist, University of Glasgow

Lecturer, University of London

Scientist, Swiss Tropical Institute

Scientist, Canada/IDRC

African national scientists x 4

Asian national scientists x 3

Appendix 3: Bilbliometric Analysis Methods

Information about peer-reviewed articles from Thomson Reuter Web of Science was used to construct a bibliometric database and create co-authorship networks on One Health. Covering the period from 2007 to early 2014, 157 articles have been analysed. This Appendix presents details about the bibliometric and network analysis, with regards to data sources, cleaning, visualization and analysis.

Data Sources and Cleaning

A search for peer-reviewed articles on the Web of Science TM Core Collection using the search term One Health in the search field topic generated a total of 737 results. The complete information related to the articles was accessed and retrieved from the Thomson Reuter Web of Science website (www.isiknowledge.com) on 25. March 2014.

The titles, abstracts and keywords for all 737 articles were checked manually to verify that the reference to One Health was relevant for the study. Only publications relating to the One Health concept and/or containing the keyword One Health have been kept. After checking all articles for their relevance, 157 articles covering a period from 2007 to early 2014 remained for further analysis. Author and institution names spelled differently across publications but relating to the same actor have been renamed consistently. Subunits of the same institution (e.g. university departments) have been merged so that they are represented as a single actor.

Creating the Networks

Two distinct networks have been generated form the bibliometric data, using the network analysis software Pajek.[13] One network based on individual authors and the second network based on institutions. In each case the relationship between two actors (either authors or institutions) is defined by the joint publication of one or more peer-reviewed articles on One Health, i.e. two actors are connected if they have co-authored an article.

Countries and Regions

Information about the geographic location of institutions was taken from the authors address field in Web of Science. Each institution was associated with the country where it is based. The country information was aggregated into world regions as well as developed and developing countries (or North-South), using the classification system of the United Nations Statistical Division. Detailed information on the composition of geographical regions and the grouping into developed and developing countries is available on the website of the United Nations, (http://millenniumindicators.un.org/unsd/methods/m49/m49regin.htm).

To assess which regions mainly contributed to the scientific discourse on One Health, all the countries linked to a publication via the author's institutional address have been aggregated. If a publication had multiple institutions and hence countries associated with it all countries were included. Likewise, if an author had multiple institutional affiliations, the countries associated with the author's institutional addresses were all included in the analysis.

[13] Batagelj, V., Mrvar, A., (1997) Pajek: Program Package for Large Network Analysis. University of Ljubljana, Slovenia, http://pajek.imfm.si/doku.php

Disciplines

Web of Science categories have been used as a proxy to assess what scientific disciplines predominantly contribute to the discourse on One Health. Web of Science categories are a journal based classification system assigned by Thomson Reuters. The Web of Science categories associated with publications on One Health have been grouped into one of the following disciplinary categories: medicine, veterinary science, social sciences, ecology/environment and multidisciplinary sciences. Web of Science categories that did not fit into any of the above disciplines, have been grouped into the category 'other' science disciplines.

Usually a publication has multiple Web of Science categories associated with it. If all Web of Science categories related to the same discipline, the publication was assigned that discipline. If a publication was associated with different disciplines, no discipline was assigned and the publication was coded as 'ambiguous'. A description of the Web of Science categories as well as a description of each category can be found online, (http://images.webofknowledge.com/WOKRS515B5/help/WOS/hp_subject_category_terms_tasca.html).

Diseases

To identify diseases that are frequently mentioned in publications on One Health, the abstracts have been searched for diseases commonly associated with the discourse on One Health. From the total of 157 articles, 68 articles mentioned one or more diseases in the abstract. Diseases have been grouped into the following disease categories: avian influenza, hemorrhagic fevers, hendra, nipah or henipah virus, Tropical diseases, Neglected tropical diseases and SARS. An article mentioning diseases from different categories, would contribute to multiple categories.

Data analysis and visualization

For the analysis and visualisation of the network data the network analysis software Gephi[14] was used. Network visualisations are based on the Fruchterman Reingold[15] layout algorithm. Being interested in the co-authorship networks and patterns of institutional collaboration, actors that have not collaborated with anybody else, so called isolates, have been removed from the network visualisations.

To identify authors and institutions that collaborate extensively with others we calculated the actors' degree centrality, i.e. the number of direct links an actor has in a network. Degree centrality based on co-authorship relationships, in combination with the number of publications and citations of articles on One Health allowed the identification of key actors in the scientific discourse. To explore key actors in the co-authorship networks further, sub-graphs based on k-cores have been visualised and analysed. A k-core is, '[…] a subgraph in which each node is adjacent to at least a minimum number, k, of the other nodes in the subgraph'.[16] In other words an actor needs to have a minimum number of k relations to be part of a k-core. To set a value for k, the average degree for all actors in the network was calculated (average degree = 5.9) and the value for k was set so that k is equal or greater the average

[14] Bastian M., Heymann S., Jacomy M. (2009) 'Gephi: an open source software for exploring and manipulating networks**.** International AAAI Conference on Weblogs and Social Media', http://gephi.github.io/

[15] Fruchterman, T. M., Reingold, E. M. (1991) 'Graph drawing by force-directed placement', Software: Practice and experience 21, 1129–1164

[16] Wasserman, S., Faust, K. (1994) *Social network analysis: methods and applications, Structural analysis in the social sciences*, Cambridge: Cambridge University Press

number of co-authorship relations in the network (k-core ≥ 6). Hence the k-core contains cohesive subgroups with all actors in the k-core having co-authorship relations that are above the average.

Discussion/limitations of the dataset

We have only considered journal articles from the Web of Science TM Core Collection. Meeting abstracts, editorial material and other publication types have been excluded, since they did not contain all the information necessary for the analysis. Including other document types, non-English publications and/or other data sources would have provided a more comprehensive dataset and hence understanding of the scientific discourse around One Health.

It must be acknowledged that constructing an attribute like disciplinary orientation based on Web of Science categories is somewhat subjective, since it could be debated to which discipline a Web of Science category belongs. However, two slightly different associations between discipline and Web of Science categories had no significant impact on the number of publications associated with specific disciplines. Partly this is due to the fact that veterinary science is by far the most frequent Web of Science category associated with publications on One Health. While Web of Science categories and journals can be used as proxies for disciplines, they are not disciplines *per se*.

When interpreting results of the quantitative analysis, the relative short time period from 2007 to 2014 and the small sample size of 157 publications must be kept in mind. Since many actors published only one article on One Health and collaborations are often confined to separate clusters in the networks, relatively small changes in the data (e.g. new publications) could significantly alter the structure of the co-authorship networks. For example, if two institutions from two previously disconnected network components co-author a publication together, this could significantly change the network typology and associated measurements.