

Chapter 2

**Health solutions:
theoretical foundations of the shift
from sectoral to integrated systems**



Photo: Kevin Queenan



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Abstract

The current fragmented framework of health governance for humans, animals and environment, together with the conventional linear approach to solving current health problems, is failing to meet today's complex health challenges and is proving unsustainable. Advances in healthcare depend increasingly on intensive interventions, technological developments and expensive pharmaceuticals. The disconnect grows between human health, animal health and environmental and ecosystems health. Human development gains have come with often unrecognised negative externalities affecting ecosystems, notably loss of resilience, mostly through biodiversity loss and land degradation. Reduced capacity of the ecosystem to serve humanity threatens to reverse the health gains of the last century. A paradigm shift is urgently required to de-sectoralise human, animal, plant and ecosystem health and to take a more integrated approach to health, One Health (OH). The sustainable development goals (SDGs) offer a framework and unique opportunity for this and we argue the need of an OH approach towards achieving them. Feasibility assessments and outcome evaluations are often constrained by sectoral politics within a national framework, historic possession of expertise, as well as tried and tested metrics. OH calls for a better understanding, acceptance and use of a broader and transdisciplinary set of evaluation approaches and associated metrics, which is a key objective of NEOH. We need to shift our current sectoralised, linear focus to a more visible balanced health investment with more global benefits to all species. This is encapsulated in the movements for OH, EcoHealth, Planetary Health and Ecological Public Health, which are essentially converging towards a paradigm shift for a more integrated approach to health.

Keywords: One Health, health governance, health policy, sustainable development goals, ecosystems health, global health, planetary health

2.1 Introduction

One health is a paradigm shift from mechanistic determinism in health sciences to post-normal science. Can we therefore, through a One Health approach, deal with a seemingly insoluble set of wicked problems through systems science and inter-/transdisciplinarity? Could the future direction in health be restoration of healthy lives in healthy ecosystems? The choice is ours but governance of this process is key.

The development of human and animal health, as well as environmental and ecosystems health continues within a governance and policy framework which remains highly sectoralised and structural despite calls for an integrated and transdisciplinary approach (Karesh *et al.*, 2014; Lee and Brumme, 2013; Valeix *et al.*, 2016; Wallace *et al.*, 2014). The medicalisation of health within conventional health systems and their increasing intensification and dependence on advances ensues in often highly profitable technological innovations and expensive pharmaceuticals. This occurs whilst neglecting drivers and preventive interventions, and has contributed to unhealthy practices (e.g. antibiotic misuse) that are now proving too expensive to maintain (Wallace *et al.*, 2015).

Earlier gains in human health are now looking vulnerable, with widening global health inequalities and increasing number of emerging and re-emerging diseases (Rabinowitz *et al.*, 2013). Many 20th century advances in human health and development came with a delayed unexpected/unforeseen cost to ecosystems, the consequences of which are now increasingly a cause for deterioration in human health (Prüss-Ustün *et al.*, 2016; UNEP/UNECE, 2016). Neglect of environmental or ecosystems health and associated loss of biodiversity is now at a critical point, threatening 'Planetary Health' and the fundamental processes on which life depends (Whitmee *et al.*, 2015). Human health is also vulnerable to consequences of concurrent underinvestment in the health and productivity of livestock (NAS, 2015) and plants (Chakraborty and Newton, 2011). This is particularly true within the context of climate change (Porter *et al.*, 2014). Poorer disease control and reduced productivity of livestock and crops will affect food security and livelihoods and indirectly human health.

Maintaining individual and public health in the ever changing, complex adaptive socio-ecological system that we form part of, requires us to think foresightedly and creatively, while remaining flexible and contributive. The same goes for maintaining the health or survival of an individual animal or single species population. Houle (2015) (p. 401), questioned whether the concepts upon which we base our understanding of health (within the disciplines of epidemiology, pathology, etc.) are themselves 'unhealthy and maladaptive' and that we should acknowledge our dependency, passivity, weakness and vulnerability as features of our human existence. Rook (2013) argues that microbial symbionts and commensals should be seen as a neglected ecosystem service, essential for the development of our immune systems and our well-being.

A paradigm shift is needed towards a fully integrated approach to health; a system(s) approach with a focus on restoring resilience of biological systems at all scales, including humans, animals and plants (Kock, 2015; Rabinowitz *et al.*, 2013; Zinsstag *et al.*, 2015), an approach known as One Health (OH), derived from the One World One Health concept which emerged in the first decade of the 21st Century (Anon, 2009; WCS, 2004).

When defining OH, Zinsstag *et al.* (2015) focused on the added value that could be achieved (improved health, financial savings and environmental services) through cooperation of human and veterinary medicine rather than having these disciplines functioning separately. Whilst integration of human and animal health, without specific consideration of socio-ecological factors, takes some steps towards inter-sectoral collaboration, it fails to address the many structural and environmental issues critical to health. By contrast, Wallace *et al.* (2014) (p. 1) state 'It (OH) redresses an epistemological alienation at the heart of much modern population health, which has long segregated studies by species. To this point OH research, however, has also omitted addressing fundamental structural causes underlying collapsing health ecologies.' Furthermore, 'ecosystem approaches to health' or 'EcoHealth' considers inextricable linkages between sustainable ecosystems, society and health of animals and humans (Rapport *et al.*, 1998, 1999). One Health and EcoHealth thinking converge strongly, especially through OH's recognition of health as an outcome of social-ecological systems and its implication for sustainability (Zinsstag, 2012; Zinsstag *et al.*, 2011, 2012). The term OH is used in this discussion because of its high acceptance, whilst we clearly recognise that 'ecosystems approaches to health' (Charron, 2012) (p. 257) and 'health in social-ecological

systems' (Zinsstag *et al.*, 2011) (p. 2) are imbedded in the One Health approach to complex systems.

2.2 Names, definitions and hierarchy

Several uncomfortable truths confront human development and all its potential that was achieved in the 20th Century. The environment and biodiversity are rapidly declining, whilst ecosystem services, namely those benefits that humans derive from the dynamic system of plants, animals and microorganisms, such as clean air and water, fertile soils and timber as well as recreational and spiritual benefits (Millennium Ecosystem Assessment, 2005), are in themselves, metaphorically speaking unhealthy (Lu *et al.*, 2015). Earlier gains in human health are threatened by several emerging and multidirectional health and disease threats, including effects of climate change, novel pathogens, growing mental health issues, obesity and hunger, micronutrient deficiencies and ecotoxicologies. To compound this, global health (which focused only on humanity) seems more disconnected than ever, despite estimates that 23% of global human premature deaths representing 12.6 million deaths every year are attributed to modifiable environmental factors (Prüss-Ustün *et al.*, 2016).

How did these problems and these disparities emerge despite the growing understanding of and investment in health across all sectors? To answer this, we review the definitions of health around which the sectoralised health systems have developed.

2.2.1 Human health

When we think of health, we think firstly of the health of individual humans and communities. The WHO defined (human) health as 'a complete state of physical, mental and social well-being, and not merely the absence of disease or infirmity' (WHO, 1946). It has subsequently evolved to account for the rights (Saracci, 1997) and changing needs of the individual in relation to age, culture and personal responsibility (Bircher and Kuruvilla, 2014). The significance of health in underpinning development and the socio-ecological determinants of health are increasingly recognised (Dora *et al.*, 2015). Population health was presented by Frankish *et al.* (1996) (p. 6) as 'the capacity of people to adapt to, respond to, or control life's challenges and changes.' The term Global Health (frequently confused with OH) remains human centric, defined as 'an area for study, research and practice that places a priority on improving health and achieving equity in health for all people worldwide' (Koplan *et al.*, 2009).

2.2.2 Animal health

Animal health is much more disintegrated, in that notifiable diseases, welfare, terrestrial and aquatic wild animal health are often addressed in separate laws. For example, recent legislation (British Columbia Government, 2014) in British Columbia, Canada (British Columbia Government, 2014) defines it as 'the health of a population or subpopulation of animals and includes the preservation of a population or subpopulation of animals that is at risk of being exposed to or affected by a notifiable or reportable disease'. Animal health typically focusses on the control of domestic animal infectious diseases that impact on

humans, either directly as zoonotic diseases or indirectly through economic losses. Only recently, the World Animal Health Organisation (OIE) added wildlife diseases to its listed diseases¹ and now also includes health as an aspect of its definition of animal welfare².

2.2.3 Wildlife health

Wildlife health is a fairly recent concept without any formal sectoral responsibility. It is often covered under environmental and biodiversity legislation and under legislation for zoonoses in public health or diseases of concern for domestic animal health. A working definition of wildlife health is needed; one that recognizes that the major threats to wildlife are not diseases but rather anthropogenic impacts through so-called development. Stephen (2014) states that a modern definition of wildlife health should emphasize that: (1) health is the result of interacting biologic, social, and environmental determinants that interact to affect capacity to cope with change; (2) health cannot be measured solely by what is absent but rather by characteristics of the animals and their ecosystem that affect their vulnerability and resilience; and (3) wildlife health is not a biologic state but rather a dynamic social construct based on human expectations and knowledge. Conservationists have recognised and promoted what are known as the ‘Manhattan Principles’³, that the health and sustainable maintenance of wildlife in natural reserves are mutually interdependent with the health of communities and the livestock surrounding them (Osofsky *et al.*, 2005).

2.2.4 Plant health

Plant health, much like animal health, is primarily understood in the context of plants’ contribution to the food sector for humans and to livestock feeds, rather than in the context of their contribution to biodiversity and overall health of the ecosystem. More recently however, climate change has drawn attention to global plant population health as part of the solution to global warming (CBD, 2015). The links between plant health and their contribution to food security of animals and humans and determination of human health are recognised in the Three Health model (Boa *et al.*, 2015).

2.2.5 Ecosystems health/health in social-ecological systems

Ecosystem approaches to health concerns is embedded in the United Nations Environment Programme (UNEP). Recently UNEP has diverged from static reports on chemicals, waste, air, water, biodiversity and soils to a more holistic view of the health paradigm as evidenced in their ‘Healthy Planet Healthy People’ report (UNEP/UNECE, 2016). The theory and practice of understanding and managing human activities in the context of social-ecological systems has been well-developed by members of The Resilience Alliance⁴ and was also used extensively in the Millennium Ecosystem Assessment⁵ in its work on human wellbeing

¹ <http://www.oie.int/animal-health-in-the-world/oie-listed-diseases-2016/>.

² <http://www.oie.int/doc/ged/d5517.pdf>.

³ <http://www.oneworldonehealth.org/>.

⁴ <https://www.resalliance.org/>.

⁵ <http://www.millenniumassessment.org/en/index.html>.

outcomes. It is therefore not difficult to relate human health (and similarly animal health) to social-ecological systems (SES) as health in social-ecological systems (HSES) (Zinsstag *et al.*, 2011). These systems relate outcomes to systemic interactions within related ecosystems, which are primarily influenced by resources, governance and users in a given social, economic and political setting.

2.3 Towards integration of health systems

The recent global changes in the social-ecological systems (urbanisation, globalisation, human population growth, increasing consumption, climate change and loss of habitat and biodiversity, etc.) favour the rapid and often global transmission of emerging and re-emerging pathogens (Jones *et al.*, 2017). The complexity of some of these recent global infectious disease threats (SARS, H5N1, ZIKA and Ebola) encouraged a lowering of sectoral walls and a more integrated approach to finding health solutions at an international level in principle (e.g. tripartite agreement between WHO, OIE and Food and Agriculture Organisation of the United Nations-FAO). However, at a national level in almost all countries, ministries remain separate and sectoralised, with their own budgets and agendas without integration of health programmes (Häsler *et al.*, 2013). Efforts and progress towards OH are still restricted by the inertia of long established divisions, institutional and logistical barriers to sharing data and information across institutions (World Bank, 2010), and power and leadership struggles with failure to agree on task and resource allocation issues (Rushton *et al.*, 2012). Besides a few studies on joint health service delivery (Schelling *et al.*, 2005), brucellosis (Roth *et al.*, 2003), rabies control (Zinsstag *et al.*, 2009) and laboratory infrastructure (World Bank, 2012), there is a lack of economic evidence and metrics to measure OH gains (Häsler *et al.*, 2014).

Beyond the paradigm shift called for by OH, Wallace *et al.* (2015) reinvigorate the notion of specifically focusing on the wider context which lies behind emerging health problems, including the geopolitical, economic and societal global crises and the unsustainability of natural resource use and current global economic systems. Structural OH is said to 'empirically formalise the connections among capital-led changes in the landscape and shifts in wildlife, agricultural and human health' (Kock, 2015). It requires a shift from linear thinking and simplistic medicalisation of health, to systemic transdisciplinary approaches with contributions from a wide range of professionals such as ecologists, agriculturalists, engineers, architects and also social scientists, including political scientists, economists, anthropologists and behavioural scientists, as well as from the stakeholder community and its representatives (Zinsstag *et al.*, 2015).

The United Nations (UN) community continues to develop policy and political instruments to drive change. In 2015, the 2030 Agenda for Sustainable Development set new goals (SDGs) to guide global development over the 15 years to 2030. The SDGs have a strong focus on equity and are described as being 'integrated and indivisible, global in nature and universally applicable' (United Nations, 2015). The new 2030 Agenda calls for a new cooperative paradigm based on the concept of 'full global partnership'. The need to 'think differently' to address the deep systemic changes required by this new Agenda has also been recognized at intergovernmental level (Giovannini *et al.*, 2015). We see the SDGs as a unique opportunity for change with a OH Agenda for 2030 (Queenan *et al.*, 2017).

2.4 The SDGs: opportunities for change

The latest WHO assessment of health in the SDGs acknowledges ‘that the SDGs, by contrast to the Millennium Development Goals (MDGs), reflect a far wider range of environmental, economic and societal concerns. All the SDGs are designed to be cross-cutting and the inter-linkages and networks within the SDGs are as important as the individual goals themselves’ (WHO, 2015a). Health, instead of being based as in the MDGs on three narrow targets in isolation from the other goals, is now recognised as a precondition, an outcome and an indicator of sustainable development (UNEP/UNECE, 2016), and is now one target embedded in the others. There is at least a current acceptance that health depends on many factors outside of human control and that only by attending to the health of other biological and physical elements of the planet, will this be sustained (Demaio and Rockstrom, 2015; Whitmee *et al.*, 2015).

2.5 The Interactive Web of SDGs

Waage *et al.* (2015) noted that total sustainable development is more than the sum of its parts and ‘is an outcome of positive synergies between multiple elements and may be undermined by negative trade-offs between them’ and criticise the SDGs for being developed within different sectors without recognising the interactions, both positive and negative, between them. To demonstrate, they positioned the SDGs in a framework of three concentric levels depending on their intended outcomes and argued that ‘governance within silos is no longer tenable’. The inner level of ‘well-being’, which includes ‘people-centred’ goals such as health, education and nutrition (SDGs 1, 3, 4, 5, 10 and 16), were noted as providing opportunities for synergies. The middle level, infrastructure relate to those goals perceived as essential for a modern society to function (SDGs 2, 6, 7, 8, 9, 11 and 12) and are closely linked with those in the inner level. The outer level, ‘environment’ contains goals which relate to the management of natural resources and the provision of ecosystem services and life-supporting systems (SDGs 13, 14, 15). These were noted as having been largely ignored and seriously compromised. Achieving the goals in the infrastructure level must be done so without compromising those in the outer and inner levels.

We have adapted this framework further and added an all-inclusive level of OH which extends to include the SDG 17 for global partnerships, a cornerstone of the SDG’s and of OH (Figure 2.1). We have also highlighted three of the infrastructure goals relating to economic growth, industrialisation and production and consumption (SDGs 8, 9 and 12). These goals have an antagonistic relationship with other goals, especially under current political economies (see Structural OH above). A comprehensive effort to apply the principles of New Institutional Economics, (Ostrom, 2007) could provide a global shift to decouple the dependency of economic growth on resource use (UNEP/UNECE, 2016) and move towards linking economic performance with sustainable practices; the only resource available in the future will be a renewable resource used in a greener, circular economy.

The SDGs provide a key entry point for a One Health approach to drive a paradigm shift in policy and practice towards a fully integrated approach to health in social-ecological systems (Zinsstag *et al.*, 2011). Due to the political consensus and momentum behind the SDGs as well as the recent frequent global reports on health concerns, this is a historic opportunity.

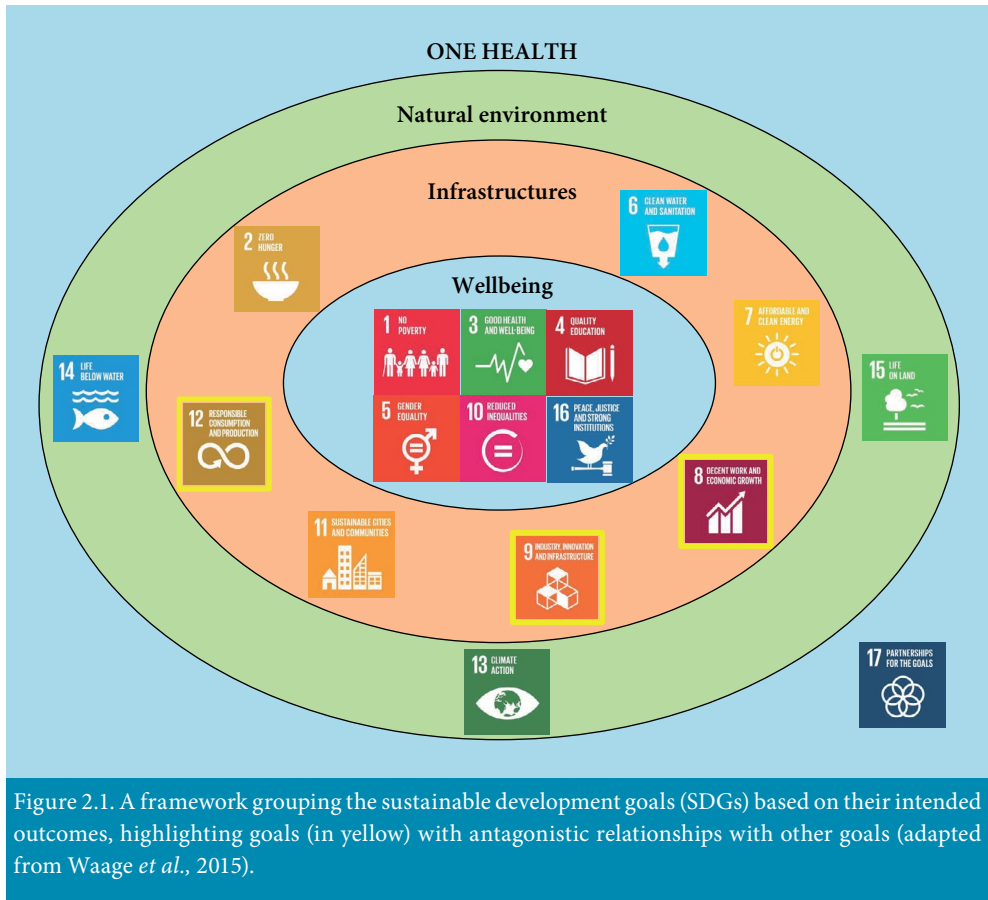


Figure 2.1. A framework grouping the sustainable development goals (SDGs) based on their intended outcomes, highlighting goals (in yellow) with antagonistic relationships with other goals (adapted from Waage *et al.*, 2015).

2.6 What have health assessments taught us?

Current health governance remains segregated in local, national and international institutions, which lack the authority and tools to prevent emerging health threats at various scales. Recent global threats like Ebola and Zika viruses provided valuable lessons, whilst the implementation of International Health Regulations have improved coordination and internationalisation of interventions (Gostin *et al.*, 2015; Heymann *et al.*, 2015; Moon *et al.*, 2015). In addition, governance is no longer dominated by health organisations but influenced by many actors, including UN agencies (WHO, UNICEF) and multinational agencies (World Bank), national governments, civil society organisations, multinational corporations and academic institutions, etc. (Frenk and Moon, 2013). Animal health and environmental health governance are in a similar state. With a better acceptance of the interconnectedness and the multiple determinants of health and the different sectors and actors involved, Frenk and Moon (2013) suggest using the more inclusive term ‘global governance for health’ to open health governance to others beyond health professionals.

As part of governance, priority setting and budget allocation is based on priority disease lists regularly provided by the WHO and OIE. These priority lists lack a OH assessment, despite the obvious linkages with the zoonotic diseases and less obvious environmental, socio-economic or structural drivers. For example, the WHO's 'top emerging diseases likely to cause major epidemics' includes diseases described as serious and requiring immediate action (WHO, 2015b). Despite all six diseases being zoonoses, with arguably strong environmental and socio-economic drivers, the list of experts responsible for prioritising these does not include veterinarians, ecologists, social scientists or other stakeholders. Although WHO and OIE are advocating a transdisciplinary approach there is little evidence yet of this in practice.

Our analysis of the drivers and risk factors for prioritised diseases listed by the WHO i.e. neglected tropical diseases, neglected zoonotic diseases, pandemic and epidemic diseases and the top ten causes of death globally, showed 98% of them could be classified as benefitting from a OH, systems thinking approach. A similar analysis of the OIE's 118 listed diseases was performed. This list has a focus on economically significant livestock diseases, however more recently, they have included wildlife diseases, including those of insects and amphibians. We analysed each disease to assess whether it had either a significant impact on producers' livelihoods (mass losses, culls or trade restrictions), on farmed and wild species populations, had a vector distribution affected by climate change, was zoonotic or caused biodiversity loss within natural ecosystems. On this basis, we advocate a One Health approach would be called for in all 118 OIE listed diseases.

Feasibility studies for policy making in society are frequently based on five elements; technical, economic, legal, operational and scheduling, with the economic element (cost benefit analysis) often having the most leverage. This is not always the case in human or animal health where political and technical considerations are primary. However, complex problems such as new emerging diseases, climate change and antimicrobial resistance create new challenges when assessing their feasibility for control. Current commonly used economic models, metrics and analyses often fail to capture the full extent of costs and benefits produced by health interventions. A sound assessment must be based on scientific evaluation and must combine economic, social, and ecological aspects (Häsler *et al.*, 2011, 2014). Predictions in complex problems are heavily dependent on modelling, whilst benefits may take many years to accrue, which increases confounding and makes a traditional cost benefit analysis difficult. Predicting human behaviour and how it may change over time, is an additional challenge. A OH approach, based on complex or wicked problem solving methods (Brown *et al.*, 2010) with transdisciplinary collaboration, warrants a better understanding, acceptance, integration and use of a broader set of evaluation metrics, as promoted by NEOH (Haxton *et al.*, 2015).

2.7 But is there proof of concept for a One Health Approach and its added value?

Policy decisions under challenging economic conditions rely not only on sound scientific evidence but on economic evidence too. Several authors have presented evidence of the feasibility and argued for the added value of a OH approach compared to isolated and linear approaches to disease prediction and control (Guimaraes and Mergler, 2012; Harris *et al.*, 2012; Monroy *et al.*, 2009; Queenan *et al.*, 2016; Rabinowitz *et al.*, 2013; Rushton *et al.*, 2012;

Schelling *et al.*, 2005; Valeix *et al.*, 2016; Zinsstag *et al.*, 2005, 2009, 2015; World Bank, 2012). The World Bank estimated the annual funding required to build capacity of human and animal health systems in developing countries (with high risk of zoonotic disease prevalence) to WHO and OIE standards was approximately US\$3.4 billion (World Bank, 2012). They estimate that such annual investment would expect global benefits of US\$30 billion each year. However, many examples lack the consideration of environment, ecosystems and structural elements of health in the interventions and benefit assessments.

Parallels between OH and sustainability (built on the pillars of society, environment and economy) have been identified and can be used to broaden the assessment of the added value of OH (Rüegg *et al.*, 2017). In particular, the economic dimensions require a wide assessment beyond the obvious cost benefit analysis to include the less tangible benefits to human and animal health and welfare (Babo Martins *et al.*, 2015; Queenan *et al.*, 2016; Rüegg *et al.*, 2017).

The objective of NEOH is to provide guidance on metrics and evaluation of OH for use into the future. Once established they will help to build confidence in the approach with scientific method in assessing the benefits to individuals up to planetary systems.

2.8 Conclusion

This chapter has described the current definitions of health, the segregation of health systems and the opportunities for change. We propose that considering animal, human and environmental or ecosystems health separately within narrow perspectives is no longer valid. This is based on the increasing evidence of deterioration in biodiversity, ecosystem services and function, and trends towards a reversal in human and animal health gains of the past century. Whilst business as usual may continue to achieve some apparent gains in human and domestic animal health (through technological advancement at high cost), failing to adopt integrated approaches to address structural issues will make the current health model increasingly unsustainable. The challenges faced by the continuously rising healthcare costs are already high on the political agenda in many developed countries. For example, the United Kingdom is financially burdened with a National Health Service (NHS), which is the 5th largest global employer accounting for ~9.75% of GDP (OECD, 2015). Although there is much to commend advanced social health systems such as the UK's NHS, being relatively more efficient than nearly half OECD countries, is it not also an indication of the parlous state of human health and the reactive rather than preventive focus of healthcare systems? Perhaps even more significant in this debate, is that the much admired NHS is in danger of collapse (Iacobucci, 2016) whilst in the USA, expenditure continues to increase in the expansion of the 'Obamacare' social health system, causing significant political and financial angst (Congressional Budget Office, 2016). Significant per capita expenditure on health in the high income economies has had historic benefits, with improving longevity a key metric. However, this trend is tailing off in some countries e.g. England (Office for National Statistics, 2016), and many other health gains threatened by resurgence of bacterial infections associated with antimicrobial resistance and emergent novel pathogens and non-communicable diseases such as obesity. Kock (2013) in a prescient piece stated that 'Awareness of the decline in ecosystem, human and animal health, reversing the hitherto positive trends in human longevity, well-being and economy might be a more effective means of achieving a new political economy.'

this being necessary to shift the current development pathways, which seem increasingly associated with these trend shifts. Ironically, low-income countries in some ways are more resilient to these changes, for example Kenya is maintaining economic growth (6% GDP) and improving health and longevity (WHO, 2017) despite investment being as low as \$169 per capita (World Bank, 2017), yet some countries spending as little as \$32 per capita remain starkly disproportionate in terms of burden of disease.

Whatever the theoretical foundations are, so as to effectively implement this change towards a fully integrated approach to health, the added value will need to be demonstrated. However, we clearly need to shift our current sectoralised, linear focus to a more visible balanced health investment with more global benefits to all species. This is encapsulated in the movements for OH, EcoHealth, Planetary Health and Ecological public health which are essentially converging towards a paradigm shift for a more integrated approach to health.

Acknowledgements

This chapter is based upon work from COST Action ‘Network for Evaluation of One Health’ (TD1404), supported by COST (European Cooperation in Science and Technology).

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