14 Reaping One Health Benefits through Cross-sectoral Services

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Introduction

Both One Health and ecohealth approaches seek a broader approach and understanding of health that goes beyond the realm of biomedical science (Zinsstag, 2012). This approach includes a more thorough attention to healthcare delivery systems than has previously been the case. The approach also implies and demands a more explicit role for plant health, and hence agriculture, in One Health, an area that has received little attention (Box 14.1). The same is true for soil and rangeland health (Boxes 14.2 and 14.3).

This chapter describes the added value of One Health through synergies created in delivering integrated healthcare services across health sectors. Current integration is weak and in the context of 'One Health' has a limited scope commonly restricted to 'integrated surveillance'. In this chapter we use integration to refer to cross-sectoral healthcare/advisory service delivery, where service needs of communities are identified jointly by at least two health sectors, and cross-sectoral planning identifies ways to reach communities more effectively with targeted and relevant services (Tanner *et al*., 1993; Tugwell *et al*., 2006). Such interventions and services applied in communities include joint monitoring of health outcomes (Schelling and Hattendorf, Chapter 8, this volume) and dissemination of information.

Conceptual models for One Health continue to evolve as theory and practice reveal new insights. We use a One Health 'service delivery model' (Fig. 14.1) to explain the rationale and benefits of a cross-sectoral approach to health service. The model illustrates some of the links, dependencies and interactions between the different health sectors and highlights the important role of plant health, the sector which has received least attention. The model highlights important influences on food security and safety (animal and plant health), for example, and the role of plant health in supporting animal and human health (inner circle). The dashed circle represents joint actions, for example cross-sectoral service delivery, learning and health assessments, while the outer circle depicts environmental influences.

The call for more integrated, cross-sectoral services was fuelled by evidence from a growing, yet still limited, number of initiatives showing that there is potential to gain wider health benefits by integrating services across sectors and disciplines, particularly in rural, low-income settings where services by default are scarce. This chapter assembles experiences from different fields of work to illustrate how these added values can be materialized and some of the challenges that get in the way of progress.

In the first part of this chapter, we describe the general characteristics of service delivery in human, animal and plant health. The focus is on rural areas in low-income countries, where integrated ways to deliver health services have the most potential to benefit people and communities. In the second part, we present examples of services that intersect different health sectors and disciplines. We draw wider lessons on the challenges and opportunities of cross-sectoral services and propose ways to

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Box 14.1. The innate ties between plant health, agriculture and One Health. Adapted from Boa *et al*., 2015.

Agriculture and plant health are intrinsically linked to the health of humans, animals and the environment in many different ways. Food security and food safety rely on healthy plants and sound production systems. Plants provide phyto-medicines, shelter, fibre and a range of vital ecosystems services. Poor plant health management leads to crop losses, accumulation of mycotoxins in food and feed, pesticide poisoning, food contamination and environmental pollution, all of which affect the health of humans, animals and ecosystems (Fletcher *et al*., 2009; Savary *et al*., 2017; Logrieco *et al*., 2018). There is evidence to suggest that some invasive plant species may play a role in malaria transmission by providing shelter for adult mosquitoes (Stone *et al*., 2018). In addition, some plants produce toxins and allergens which, if not handled correctly, make people and animals sick (Breiteneder and Radauer, 2004; Chandrasekhar *et al*., 2012).

Conversely, poor health among farmers negatively influences crop and livestock health and productivity through loss of labour and reallocation of resources for managing crop and animal health (Hawkes and Ruel, 2006). Arsyad *et al.* (2019) demonstrated that low cocoa productivity in West Sulawesi was associated with low household dietary diversity and perceptions that food availability was insufficient. Heavy agricultural workloads and low crop diversity may affect women's capacity to feed their children (Jones *et al*., 2012). Thus, poor health, malnutrition and poverty can quickly lead to a vicious 'downward spiral of livelihood degradation for vulnerable households' (Parker *et al*., 2009).

Despite the burgeoning movements and initiatives on One Health in its widest sense, plant health and agriculture are either missing, embedded in environmental health or limited to specific issues around food safety (mycotoxins, foodborne pathogens and pesticides), as in the case of the 'tripartite initiative' by the Food and Agriculture Organization of the United Nations (FAO), World Organisation for Animal Health (OIE) and World Health Organization (WHO) (FAO *et al*., 2017).

While these aspects demonstrably are of vast importance to public and environmental health and global food supply, there is more to gain by addressing the role of plant health and agriculture more broadly and, notably, embracing a stronger focus on cross-sectoral health care/advisory service delivery that meets the needs of individuals and communities.

move ahead. Integrated surveillance systems and measuring the added values from integrated methods are covered separately in Chapters 9 (Aenishaenslin *et al.*), 10 (Häsler *et al.*) and 31 (Zinsstag *et al.*), this volume.

Health Services in Rural, Low-income Settings

Human health systems service delivery and inequities in health

An equitable human health system aims to deliver quality services to all people, when and where they are needed. Ensuring that interventions reach and benefit the disadvantaged is a major challenge. Effective responses to inequalities in health often require actions outside the health sector such as poverty alleviation or rural development initiatives (Kimani *et al*., 2016). Without an explicit assessment of the impact of population health interventions on health inequalities, policies and public or private programmes run the risk of benefiting only the more privileged and better-off without improving the health of the poor – despite national averages indicating overall improvements. Improving access, coverage and quality of services, particularly primary health care, depends on availability of key resources such as trained professionals and equipment. Improvements also depend on the organization and management of services, the incentives influencing providers and users, and the availability of reliable information (WHO, 2013).

Approximately one-half of the global population lives in rural areas, but these areas are served by only 38% of the total nursing workforce and by less than 25% of the total physician workforce (WHO, 2010). The increased number of people being forced to leave rural zones and live in urban slums leads to emerging health inequities in urban centres. Health service delivery is difficult, in particular due to logistical, organizational and human resources (especially qualified personnel) and

Box 14.2. The earth beneath our feet: the case of soil health and One Health. Contributed by Maxine Whittaker.

The effects of the health of soil upon human, animal and plant health and the effects human and animal activities have upon soil health have been under-addressed in discussions of One Health.

Soil can harbour a wide range of organisms and substances that may cause disease in animals and humans, especially in the tropics. Ingestion of soil (deliberate or accidental) can lead to intake of parasitic eggs such as *Ascaris lumbricoides* and *Trichuris trichiura*. Animals in the environment, for example dogs and cats, can contaminate soil through their faeces and cause toxocariasis infection (roundworms) which can lead to organ and eye diseases, especially in young children who often accidentally eat soil (Abrahams, 2002). Microorganisms can be dispersed through soil and soil dust: *Aspergillus*, *Burkholderia pseudomallei* and *Coccidioides immitis* are all well-known causes of human illness. *Clostridium tetani* is found in surface layers of soil, and in human and animal excreta, and is especially abundant in manured and cultivated fields. Gardeners, farmers, archaeologists, pregnant women and newborn babies delivered on the ground are some of the people at risk. Human infections with hookworms are caused by skin contact with contaminated soil. These infections are extremely common and are exacerbated in areas with poor sanitation facilities and practices. Dermal absorption of abiotic components in the soil (e.g. dioxins, pesticides, polynuclear aromatic hydrocarbons) can also impair animal and human health (Lane *et al*., 2015).

Agriculture is, of course, intimately connected to soil. Soils contain essential elements required for plant health, and hence, animal and human nutrition. However, the balance between healthy and toxic levels can be fragile (e.g. selenium) (Tahir *et al*., 2018). The soil pH, drainage and other factors affect the bioavailability of these elements, and this can be affected by land use changes and climate change. Pesticides deposited on soil can pollute ground and surface waters and harm humans, animals and ecosystems. Antibiotics added to livestock feed can enter the soil and groundwater, and antibiotic-resistant microorganisms have been detected in these sources (Forsberg *et al*., 2012). The soil can also affect the quality of the water moving through the soil – leaching elements like nitrogen, iron, manganese and aluminium into groundwater supplies.

As these examples show, healthy soil – defined by the 'capacity of soil to function as a vital living system to sustain biological productivity, maintain environmental quality, and promote plant, animal, and human health' (Doran *et al*., 1996) – is a critical component of One Health.

Box 14.3. The role of healthy rangelands in One Health. Adapted from Flintan *et al*., 2020.

In the past, although giving attention to the people and the animals in pastoral societies, development interventions, including One Health approaches, usually ignored the rangelands (land and natural resources). Healthy rangelands provide for healthy livestock that provide for healthy people. Well-functioning rangelands sustain the soil, moisture and nutrient availability for plants on which animals feed. At the same time, healthy rangelands also provide a wealth of ecosystem services such as carbon and water storage, prevention of soil erosion, and provision of a generally ameliorating environment that has a direct impact on human and animal health (Riginos *et al*., 2011).

With increasing pressures on land use, there is an urgent need for investment in sustainable rangeland management and restoration. Participatory approaches to rangeland management are now being combined with a One Health approach. This includes establishing community-defined 'One Health units' at strategic points in the rangelands landscape where human, livestock and rangeland health services converge with community needs. Experience is showing that this not only benefits the individual components including rangeland management, but also has combined benefits of rebuilding an integrated system that is more productive as a whole.

financial constraints (and declining public-sector budgets). Loss of confidence by the community as a result of unmet demand should also be mentioned. Increasing numbers of displaced people, mobile, migratory populations and remote rural communities are unable to benefit equally from governmental or private health services, compared with those in urban centres.

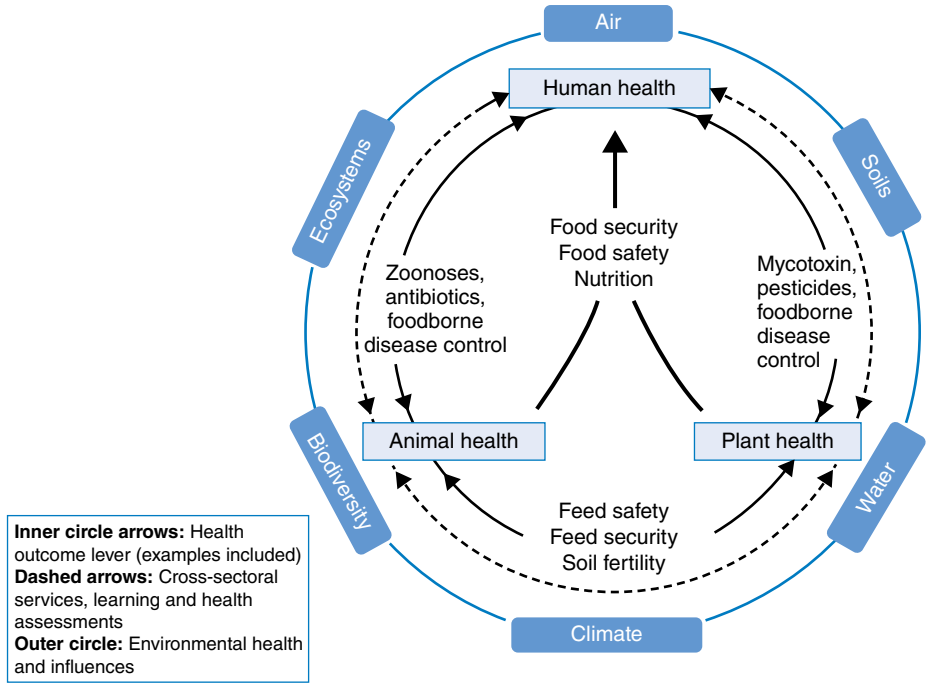

Fig. 14.1. One Health 'service delivery model'. Adapted from Danielsen, 2013.

The WHO recognizes that integrated health services are critical for reaching universal health coverage within the continuum of health promotion, disease prevention, diagnosis, treatment, disease management, rehabilitation and palliative care services. An early example was the combination of measles vaccination campaigns with the distribution of insecticide-treated bed-nets (ITN) in Ghana (Grabowsky *et al.*, 2005). Such integrated approaches should lead to more equity-effective planning (WHO and UNICEF, 2005). Studies show that rather than taking a traditional approach (i.e. initially serving those who are easiest to reach) approaches designed to first increase coverage among disadvantaged groups show most progress towards universal health coverage (Gwatkin and Ergo, 2011). The Sustainable Development Goals' (SDGs) commitment to leave no one behind strongly supports the progressive realization of universal health coverage and the right to health (WHO, 2016).

Veterinary services and rural zones

Highly contagious animal diseases and epidemics pose an economic threat to livestock producers, the entire agricultural sector and national economies. Animal disease control and elimination is therefore considered a public good. Animal health officials worldwide coordinate their disease control strategies with the OIE. Typically, national veterinary services are responsible for ensuring protection of animal health, safety of food products of animal origin and control of major animal diseases, as well as quality control of veterinary pharmaceuticals. Most veterinary services may enforce animal welfare standards, and in some countries, the veterinary service is also responsible for monitoring and controlling wildlife diseases. The latter generally fall under the jurisdiction of environment ministries, whose involvement in wildlife is largely limited to management of parks and related matters concerning biodiversity conservation (Cumming and Cumming, 2015). The 'public good' nature of some services does not necessarily imply that the government must take direct responsibility for their delivery. These services may be subcontracted to private organizations (e.g. non-governmental organizations (NGOs) or research organizations) and private veterinarians.

Animal health systems have been neglected in many parts of the world, leading to institutional

weaknesses and information gaps as well as inadequate investments in animal-health-related public goods (Abakar *et al*., 2019). This is particularly evident in remote and rural zones, where between 46% and 82% of rural households in Asia, Africa and Latin America keep livestock (Zezza *et al*., 2007).

Vaccination remains a key community-effective health intervention in human and animal health and is increasingly an important tool in wildlife health management. Smallpox and rinderpest eradication programmes benefited from committed financial and personnel investments. There are poliomyelitis-contagious bovine pleuropneumonia (CBPP) and peste des petits ruminants eradication programmes that, among others, need to deal with vaccines requiring a cold chain. This necessitates innovations and adaptation to successfully reach all communities and remaining pockets of disease transmission. The last pockets of rinderpest were among pastoralists, and only participatory approaches allowed for reaching these remote communities (Jost *et al*., 2007). Development of a thermostable efficacious vaccine was also a huge advantage.

Human and animal health vaccination programmes may experience both periodic lack of vaccination-related supplies and limited or poorly maintained infrastructure in the governmental services. Poor implementation or inferior quality of animal vaccines not only causes economic losses in the livestock sector but can also be a human health threat when vaccines against zoonoses are not efficacious. On the other hand, public health practitioners sometimes envy their veterinary colleagues who have a public-good mandate to vaccinate against epidemic and zoonotic diseases. Veterinary authorities may declare a livestock vaccine as compulsory given the economic and societal interests to better control these diseases. Vaccination programmes rooted in either the public health or the veterinary sector have hardly interacted in the past, despite the fact that they to a large extent target the same populations, those vulnerable to exclusion from any health services.

Veterinarians are not allowed to treat human patients, and paraprofessionals often are not allowed to handle certain human and animal drugs or to perform simple interventions. These restrictions also apply in remote areas, where neither physicians nor veterinarians are available. With a proper legal framework and appropriate training, however, certain public health activities could be shared – for instance, in surveillance. Public health and veterinary programmes should more widely share their knowledge and their different approaches – and explore local priorities and perceived needs. They can then develop joint implementation arrangements to improve services to remote and rural communities.

Plant health services and agricultural extension

Plant health services for farmers are usually provided as part of general agricultural extension services. Most of the 'plant health workforce' comprises agronomists and agricultural technicians who have a broad range of responsibilities. There is some separation between extension workers with responsibilities for crops and livestock, but it is common in many countries for them to give farmers advice on both. There are fewer legal restrictions on the services that agricultural/crop advisers can give compared with veterinary and human health service providers. Subject matter specialists in crop protection do exist, but they are few and usually thinly spread (Boa *et al*., 2015). Plant diagnostic laboratories provide technical backup, but they are also few and difficult for farmers to access (Smith *et al*., 2008; Mugambi *et al*., 2016). Plant health regulation is organized through National Plant Protection Organizations (NPPOs), which are generally restricted to inspecting plants and plant products entering countries. NPPOs also undertake general surveillance and organize responses to pest and disease outbreaks, but provide few if any regular services to deal with farmers' basic crop health problems. A study from Uganda revealed that there is a pervasive feeling among extension organizations and ministry officials that farmers have been abandoned in their struggle against an escalating plant pest and disease burden (Danielsen *et al*., 2014).

When emerging diseases cause major damage or pose major threats, such as banana bacterial wilt or maize lethal necrotic disease (Anderson *et al*., 2004), plant health may gain a temporary, but unsustainable, boost in priority and funding allocation. Most low-income countries are poorly prepared to deal with major pest outbreaks as shown in the slow and often ineffective responses to recent outbreaks of fall armyworm and desert locust in East Africa. Farmer services are generally scarce and under-resourced in low-income countries. A recent

assessment of extension services in ten African and Asian countries showed an overall low coverage with a ratio of extension agents to farm families varying from 1:1000 to 1:10,000 (Davis and Franzel, 2018).

Inspired by concepts and actions used in human health service delivery (Danielsen *et al*., 2013; Romney *et al*., 2013; Danielsen and Matsiko, 2016), and building on earlier work by the Global Plant Clinic (Bentley *et al*., 2009; Boa, 2009), CABI's Plantwise programme has contributed to fill the gaps in plant health service delivery since 2011. Using a plant health systems approach Plantwise supports establishment of more responsive plant health services for farmers through training of 'plant doctors' (extension workers) in field diagnostics and plant health care and establishment of networks of plant clinics. The idea of plant doctors is not new (Large, 1940). Currently, 11 universities in the USA (in Florida, Nebraska and Ohio) and Asia (Japan, South Korea and Taiwan) provide training for plant health professionals to become plant doctors, and more are joining (McGovern and To-anun, 2016) Yet, compared with the well-established professional staff categories in human and animal health, plant health lags far behind. Over 10,000 extension workers have been trained as 'plant doctors' in more than 30 countries across Africa, Asia and the Americas under the Plantwise programme (David *et al*., 2019), yet the plant doctor title has not yet been formalized in any of these countries.

The delivery of plant health care (e.g. through plant clinics) is still in its infancy and far from mainstream practice in agricultural advisory services. Organizational change is slow and constrained by institutional and capacity barriers. Yet, the recent surge in availability and access to digital tools has opened up new opportunities to connect people and services, making extension services and countries more responsive, both to farmers' daily needs for plant health advice and information and when major epidemics emerge (David *et al*., 2019; Tambo *et al*., 2019). Plant clinics also have a role to play in human, animal and environmental health, as plant doctors give advice on safe use of pesticides and postharvest management to reduce mycotoxin levels. Recent studies show promising results regarding the impact of plant clinics on pesticide use, crop yields, household income and resilience (Musebe *et al*., 2018; Silvestri *et al*., 2019; Tambo *et al*., 2020).

Cross-sectoral Services in Practice: Five Case Illustrations

Cross-sectoral services are still relatively rare, though there is a growing body of evidence that shows their value and relevance, as well as some operational challenges related to delivery of services that transect sectors and disciplines. The following cases represent experiences and lessons learned to illustrate this.

Case 1. Cross-sectoral learning – community and service provider perspectives

Communities often demand more health information. One Health services can play a role in providing appropriate health information in rural zones. People who work with animals may understand human health concepts better when linked to their experiential knowledge of animal health and diseases. Health messages that are disseminated in information, education and communication (IEC) and social marketing approaches should be adapted to the cultural background and accommodate the levels of illiteracy of rural communities. How to produce effective health communications and social marketing is generally understood (Maibach *et al*., 2007) but is often not done in remote settings because of resourcing or concerns about how to provide understandable concepts to low-literacy populations. Effective ethno-medical practices and traditional health-care networks could be an integral part of such delivery systems and be sensitive to avoid subordinating traditional medicine to the modern medical sector (McCorkle, 1996; Hitziger *et al*., 2018).

Community health and community animal health workers largely provide primary health care in remote zones (Vétérinaires sans Frontières International, 2018). The advantage of community workers is that they are more accessible to community members who may face difficulties to access services situated further away. We believe that all possible actors, including strong producer organizations and farmer cooperatives, informal and traditional health sectors and NGOs, should be included to identify opportunities for closer cooperation in adapted information delivery which may lead to synergies. An example of cross-sectoral learning is shown in Box 14.4.

Box 14.4. Cross-sectoral learning and health assessment. Adapted from Boa *et al*., 2015.

An ecohealth approach was used in Ecuador to address rampant health problems in plants (Andean weevil and late blight) and humans (high incidence of pesticide poisoning). Even though the health outcomes were less than expected, the study confirmed the validity of cross-sectoral actions. The study also provided important lessons for future similar approaches concerning other aspects of plant and human health (Yanggen *et al*., 2004; Zinsstag *et al*., 2011).

Two FAO studies in Africa looked at emerging and re-emerging diseases of agricultural importance in all three health sectors in two locations, one on the border of Tanzania and Uganda (Rugalema and Mathieson, 2009), the other between Malawi and Mozambique (Bentley *et al*., 2012). They considered the combined impact of plant, human and animal diseases from a broad livelihood perspective. A separate paper from the larger Tanzania/Uganda study looked at local perceptions of disease and why recommended control measures and strategies were often ignored (Rugalema *et al*., 2009). One of the overall conclusions was that a lack of professional collaboration between health professionals undermined attempts to limit the knock-on effect of diseases in other sectors. Most residents in the border region between Malawi and Mozambique crossed frequently and were 'rarely empty-handed, often taking plants and animals'. The studies said that it was better to share information about diseases occurring on both sides of the border, rather than attempt to limit travel and hinder trade that depended on plants and animals (Bentley *et al*., 2012). These initial insights confirm the need to continue using a cross-sectoral approach to understand and minimize the human, animal and plant health risks associated with movement of people across borders.

Case 2. Joint human and animal health delivery services

Based on findings of a simultaneous assessment of human and animal health service needs in Chad, a broad agreement was reached with national and local authorities as well as communities to test joint human and animal vaccination services (Schelling *et al*., 2008). Together with authorities, such joint vaccination campaigns were evaluated from 2000 through to 2005 and showed the feasibility of combining vaccination programmes for mobile pastoralists and their livestock. Sharing transport logistics and equipment between physicians and veterinarians reduced total costs (15% of the public health sector) (Schelling *et al*., 2007, 2015). Agronomes et Vétérinaires sans Frontières, who faced difficulties with absent private veterinarians, facilitated joint health delivery systems in Niger and Mali (AVSF, 2010).

These joint campaigns also helped improve understanding of how to set up a system that alternates between mobile and static health services, and how to make static services more responsive to receive members of communities who are only temporarily in their zones of responsibility (Lechthaler *et al*., 2018). Currently, there are evaluations on many other services beyond information and vaccination such as antenatal care, distribution of bed-nets, etc., which can be grafted in to these campaigns to benefit from shared interests, and shared human and logistical resources. The margins of adding many other services to core cross-sectoral services are narrow. Quite quickly two vehicles are needed – one for veterinary and one for public health staff – and the effects of cost sharing are virtually extinguished – leaving only provision of cross-sectoral information remaining. Wanting joint service provision to be 'all inclusive' cannot be the goal – it should instead be focused on the main community priorities, such as rabies and soil-transmitted helminths (Lankester *et al*., 2019).

Case 3. Emerging demand for crop-livestock clinics

There are an estimated 570 million small farms (< 2 ha) worldwide, more than 85% of which are in Asia and Africa (Lowder *et al*., 2016). Plants serve as feed for animals and food for humans in mixed crop-livestock smallholder production systems (Wright *et al*., 2012).

CABI's work with plant clinics over the last 15 years (see section on 'Plant health services and agricultural extension') has revealed potential 'One Health benefits' of broadening their scope to better meet farmers' demands for advice. Emerging synergies were first noted in Nicaragua, Bangladesh and

Uganda around 2005–2007 where plant clinics informally began to respond to farmer requests for advice on livestock (Danielsen, 2013). One plant clinic in Peru took it a step further and turned the clinic into a 'crop and livestock clinic' because as one of the plant doctors said: 'We always receive livestock and crop queries in the plant clinic. We receive many queries for problems which are common here for guinea pigs and cattle, for example problems with ectoparasites and flies. We try to respond as best we can' (Danielsen, 2017).

To better understand the nature of the livestock queries presented at plant clinics, a survey was carried out among 180 plant doctors from Uganda, Kenya, Zambia, Peru and Costa Rica (Danielsen *et al*., 2019). Over 80% of the plant doctors replied that they regularly receive queries from farmers on livestock topics: half on disease issues and half on animal husbandry. The answers were almost equally divided between plant doctors who gave advice and those who referred to someone else. On some occasions, animal advice was delivered by livestock specialists participating in the plant clinic sessions. Most of the plant doctors (70%) would like to formally integrate an animal advisory service into the plant clinics to better respond to farmer needs. For many extension workers, the crop–livestock connection is obvious and already part of their work. However, they also recognize the challenges involved and the need for technical backstopping. As one plant doctor said: 'I gave some basic advice on hygiene and fodder production, but in most cases I refer them to veterinary and livestock officers.'

This example shows that the single sector approach to service delivery often does not fulfil small-scale farmer needs in mixed farming areas. Rural families do not divide their livelihood issues neatly into subject matter or discipline. Plant clinics inadvertently became a mechanism for capturing farmer demand for information and advice more broadly. Joint service delivery has the potential to meet some of the unmet demand by making better use of existing resources and capacities.

Plans are underway to explore how, and with what capacity and support, such 'crop–livestock clinics' could function more formally within existing legal and institutional structures. The human health sector should also be brought into the conversations to shape the intervention towards maximizing human health outcomes through, for example, better zoonosis control and improved hygiene, thus contributing to the health and livelihoods of rural communities. However, as stated in Case 2, pragmatic solutions addressing the most urgent health needs of the communities must be tackled in a way that does not overload the cross-sectoral services (Berger-González *et al*., Chapter 6, this volume). Otherwise, the added value in terms of saving human and logistical resources could quickly be undermined.

Case 4. Integration of human and environmental health services

In Madagascar in the early 1990s, in response to lack of access to both health and environmental/agricultural extension services and lack of family planning services in conservation zones, different groups began experimenting with joint population, health and environmental initiatives. By the late 1990s, implementation strategies from both the environmental and health sectors supported joint activities such as social marketing. By focusing on small, achievable actions at the community level, the population, health and environmental (PHE) movement began to grow. Activities were implemented by local health and environment NGOs and a strategy of 'Champion Communities' was adopted in four of the six provinces in Madagascar. By 2005, a national consortium with 29 member groups was formed to link PHE efforts. Progress was measured by local monitoring that tracked the increased use of essential health services. Key health indicators and land-use practices have improved over a 3-year period among integrated compared to non-integrated communities. Use of preventive health services such as vaccination and modern family planning, home-based prevention measures (e.g. use of ITNs) as well as participation in reforestation efforts and vector control increased in PHE project zones, surpassing national norms. In addition, malnutrition prevalence dropped, and access to safe water improved (Ribaira and Rossi, 2007).

Synergies between sectors manifested themselves in improved capacity at the programme and organizational levels and in the communities' progress towards self-determined and sustainable development. The integrated approach resulted in greater effectiveness of interventions and achieved relatively better outcomes for low incremental costs compared with single-sector vertical approaches (Kleinau *et al*., 2005). The PHE programme serves as a flagship example of integrating health, population

and environment services (Kleinau *et al*., 2005; Gaffikin *et al*., 2007). This programme combining health and environment services has similar goals, evaluation approaches and conclusions to the good practices described for delivery of health services to low-income populations (Schelling *et al*., 2009).

Case 5. 'Tripartite' actions: intentions and realities

A study from Uganda demonstrated the potential for integrating health services around 'village health teams' as a single 'tripartite' point where human, animal and plant health issues can be referred (Haesen, 2013; see the 'service delivery model' in Fig. 14.1). Although all delivery systems were found to have similar challenges in paying staff and ensuring effective referrals, district officers across sectors identified clear opportunities for human, animal and plant health to work more closely together. The existing organizational structures within the three sectors arguably would allow for better coordination of community health services.

Rapid developments in digital platforms, tools and devices provide opportunities for information delivery and sharing across sectors. For example, Infonet Biovision[1] provides online and offline scientific and practical validated information related to plant (crop), animal, human and environmental health. Similarly, human, animal and plant diseases are all covered by ProMed-mail,[2] an internet-based reporting system for 'rapid global dissemination of information on outbreaks of human, animal and plant infectious diseases and acute exposures to toxins'. Run by the International Society for Infectious Diseases, alerts are issued on diseases affecting people, animals and plants.

In other cases, the embedding of plant health in 'tripartite' actions is thornier. Joint actions in diagnostics would appear to be relatively straightforward since similar methods are used to identify human, animal and plant pathogens, such as lateral flow devices (see Fletcher *et al*., 2009 for in-depth review). Human and animal pathology services already collaborate in confirming zoonotic diseases, although there is further scope for sharing facilities (Zinsstag *et al*., 2005). Yet, disciplinary boundaries and institutional barriers remain for including plants as well. A mid-term review of the UK government Foresight project on detection and identification of infectious diseases pointed out the challenges of including plants:

> The intention of the Project to incorporate plants into the cross-sectoral collaboration on infectious disease detection, identification and surveillance has occurred only in a limited fashion, most notably the Defra 'BioChip' project [development of a micro-assay to detect viruses in humans, animals and plants]. ... The intention to more closely link the medical/veterinary disease research with that of plant disease research did not materialise to any lasting extent. … This largely reflects the close relationship between the human/animal pathogens and the lack of related plant pathogens, even though the technologies have much in common.
>
> (Foresight, 2014, p. 22)

Status and Ways Forward with Cross-sectoral Services

Over the last two decades, One Health thinking and action has stimulated new ideas about a broader vision of health and encouraged transdisciplinary research that examines the complexity of interactions between people, animals, plants and their surroundings (Boa *et al*., 2015). More important than theory is that for the communities, One Health considers co-benefits and co-challenges so that solutions with multiple bottom lines can be achieved, whether they are for humans, animals, plants or ecosystems (Dominguez-Salas *et al*., 2019).

Service delivery in human, animal and plant health has common features as well as differences. What works in one sector could work in another; opportunities exist for combining services in different 'dual' or 'tripartite' ways. Considering the underlying call of the SDGs to 'leave no one behind', the three services face similar problems: how to provide (extension) services to those who are geographically or culturally furthest away from services.

The examples shown here emerged from different starting points. Some cross-sectoral interventions were motivated by the prospect of enhancing the reach of services in resource-poor rural areas through sharing of costs and staff, as in the case of joint vaccination campaigns (Case 2) and crop-livestock clinics (Case 3). These actions soon revealed that there is more to gain from the emerging synergies in terms of learning, raising awareness, and health and productivity outcomes. Other interventions sought to solve human health problems generated in agriculture (i.e. pesticide poisoning) (Box 14.4), and still others used community mobilization to address prevalent human and environmental health issues (Case 4).

There is a seemingly high potential in rural low-income areas to combine health services for joint delivery of human and animal health, plant and environmental care. Cross-sectoral health services have become noticeable examples of the added value of One Health (Schelling *et al*., 2009; The World Bank, 2010; Danielsen *et al*., 2019) (Zinsstag *et al*., Chapter 31, this volume). Nonetheless, changes in service delivery systems are the exception rather than the rule and often result from time-bound projects rather than fundamental organizational changes.

There are a number of common barriers that obstruct progress. Some of these are imposed by the bureaucratic division of responsibility and financial flows (disparities in sector funding) between institutions and ministries. Others relate to budgetary constraints, unequal institutional capabilities and differing cultures, limited inter-institutional communication, absence of a shared vision and disincentives to work more horizontally (Schelling *et al*., 2007; The World Bank, 2010; Braun *et al*., 2012). However, much progress has been achieved in the last decade. New cross-sectoral services are being tested, and new evidence on their benefits is growing fast.

A unified vision of health and health care is a powerful concept for tackling the complex challenges implicit in the SDGs. Creating cross-sectoral collaborations will require institutional innovation, careful testing of assumptions, as well as new methods and metrics for assessing jointly agreed outcomes, if such novel approaches are to bring about demonstrable and lasting change. Essentially, which is important to note, cross-sectoral services cannot serve all prevailing health issues concurrently. In fact, many are not perceived as such by the communities. The communities should themselves be empowered to state which mix of priority services they want for their community.

Based on the experiences described above, we recommend the following:

1. The inclusion of different stakeholders in the conceptual and planning phase is crucial, as it increases ownership among the concerned populations and authorities. The communities should be empowered to be decision makers to define the 'One Health services' they want.
2. Incentives for collaboration and resource sharing could be created. For example, budget lines could be shared between different agencies, directed by the Ministry of Finance. Services should demonstrate that they truly share resources and not only state that they use a One Health approach to access new funding schemes – which is against the initial thinking of 'One Health services'.
3. Equity analyses based on the geographical deployment of new programmes and strategies can help assess whether programmes are reaching those who need them most.
4. As much as possible, one must avoid establishing new parallel structures and instead make use of existing systems, infrastructure and human resources that are well linked in to the service provision systems of their countries.
5. The evaluation of community effectiveness should be designed and carried out with multiple stakeholders, including communities, national and local services, international organizations and standards.
6. Health systems and traditional institutional arrangements must be carefully examined to identify opportunities to join public health, veterinary, agricultural and environmental services. Case studies and demonstration of feasibility and outcomes are recommended before gradual expansion to other zones.

Notes

[1] Available at: https://www.infonet-biovision.org/ (accessed 27 March 2020).
[2] Available at: https://promedmail.org/ (accessed 27 March 2020).

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