CABI One Health

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A fair share? Animal health actors and resources in One Health initiatives: A multisite case study in Ethiopia and Pakistan

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Abstract

Increased outbreaks of zoonotic diseases with pandemic potential and the growing threat of antimicrobial resistance have stimulated the uptake and use of One Health approaches across the globe. Collaborative, multisectoral, and transdisciplinary approaches are vital to the effective response to health challenges; however, within One Health initiatives, animal and environmental health voices often remain secondary to human health. This article presents the findings of a transdisciplinary research project investigating the roles and contributions of animal health in One Health initiatives. We combined a multisite case study approach with a literature review, and conducted 22 semi-structured key informant interviews with animal health and One Health experts, with a focus on Ethiopia and Pakistan. Key themes explored were the nature of the animal health sector, animal health workforce, veterinary medicines and vaccines, and coordination and collaboration. Results were triangulated with existing primary and secondary data, reviewed by key stakeholders in Ethiopia and Pakistan, and tested with members of the Action for Animal Health (A4AH) coalition. We found that while One Health has become more interdisciplinary and inclusive at a global level, there remain significant challenges in operationalizing the approach at national and subnational levels. Gaps in governance, political will, and capacity undermine the inclusion of animal health in One Health structures. Power and resources are distributed unequally across One Health coalitions, echoing observations that acknowledge the crucial role of communities in supporting the provision of essential services, while their knowledge and experiences often remain excluded from project and policy development. We conclude that stronger multilevel linkages and engagement between animal health and other sectors are vital to support the implementation of inclusive, well-resourced, and effective One Health approaches.

Keywords: animal health, animal welfare, community participation, Ethiopia, One Health, Pakistan, prevention, surveillance, veterinary services, zoonoses

One Health impact statement

The threat of zoonoses with pandemic potential has raised global awareness of the interconnectedness of animal, human, and environmental health. The One Health approach is increasingly cited as an efficient and cost-effective response to address zoonoses and other disease risks. While animal health is one of its three key pillars, the allocation of resources within One Health coalitions and interventions continues to prioritize human health in programming and policy. This transdisciplinary study, conducted collaboratively among academic researchers, practitioners, and the Action for Animal Health (A4AH) coalition, used a literature review and multisite case studies to investigate the role of animal health in One Health approaches. Its findings may support governments, donors, and One Health implementing institutions and agencies to develop more inclusive programmes and policies, with a call to increase financial contributions to animal health, enhance community participation, and better tie-in projects with existing knowledge and activities at the local level.

Introduction

The emergence of novel zoonoses such as COVID-19 and Avian Influenza (AI) highlights the biological kinship between humans and animals, and the need for adopting approaches such as One Health to enhance disease prevention, surveillance, and pandemic prevention (Bernstein *et al*., 2022; Worsley-Tonks *et al*., 2022). This has resulted in a number of global initiatives, such as the development of the One Health Joint Plan for Action

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by the 'quadripartite' (Food and Agriculture Organization (FAO), United Nations Environment Programme (UNEP), World Health Organization (WHO), and the World Organisation for Animal Health (WOAH)), the establishment of a One Health High-Level Expert Panel (OHHLEP), and the intergovernmental process to draft a pandemic treaty under the constitution of the WHO.

One Health is a transdisciplinary, multilevel, and collaborative approach across animal, human, and environmental health sectors. The approach is built on three equally important pillars – human, animal, and environmental health – however, human health remains the driver for many One Health initiatives. This is linked to historically low levels of public investment in animal and environmental health, and a lack of awareness of their broader public health and economic benefits.

The deprioritization of animal health can be seen in global and national resource allocations in One Health initiatives. These retain a strong focus on zoonoses, somewhat ignoring other benefits of animal and environmental health to human health such as nutrition, food security, agricultural development, poverty reduction, mental health, and wider well-being (OIE, 2015, 2019). To date, the contribution of, and resources allocated to, animal health in One Health initiatives remains unclear. This study addresses this gap by mapping and analysing the role of animal health within One Health initiatives across two case study countries: Ethiopia and Pakistan, to improve the wider operationalization of animal health within One Health approaches.

Methods

Informed by the case study methodology (Yin, 2003), we employed qualitative research methods to collect primary data in a multisite case study approach and supported our analyses through secondary data, collected through a literature review and during interviews.

LITERATURE REVIEW

We conducted a structured literature review of policy, practice, and academic publications from open-access and subscription sources. Purposive sampling was used for literature identification and selection through an optimal database combination strategy for literature searches in systematic reviews (Bramer *et al.*, 2017). In addition, we reviewed open-access reports and literature produced by national and international organizations and agencies including WOAH Performance of Veterinary Services (PVS) country reports, Livestock Data for Decisions (LD4D), and the International Livestock Research Institute (ILRI). We reviewed SCOPUS, Science Direct, and JSTOR databases, using a combination of search terms to look through 'Title, Abstract, and Keywords': animal health, animal disease, community engagement, equitable access, vaccine/medication access, veterinary services, community, One health collaboration/investment, One health/animal health and Pakistan/Ethiopia, rabies and Ethiopia/Pakistan. The inclusion criteria used for the literature search included: (1) publication date (since 2017); (2) full text available in English; (3) focus on animal/ veterinary health; and (4) focus on low- and middle-income settings (LMIS), as defined by the World Bank, in particular the case study countries (i.e. Pakistan and Ethiopia).

PRIMARY DATA COLLECTION

Primary data was collected through 22 semi-structured key informant interviews (KII) with multilevel and multisectoral stakeholders, including donors, United Nations (UN), and non-profit organizations across Eastern Africa, Europe, South Asia, the UK, and the USA. Initial respondents were selected through professional networks and expert memberships, with subsequent participants identified through iterative discussions with KI. Respondents were also selected for the expertise in the two case study locations (Ethiopia and Pakistan) (Table 1). Interviews were conducted in English, using the online Zoom communication platform, between March and May 2022.

DATA ANALYSIS

Data from the literature review and KII were coded manually in English and analysed using a Thematic Analysis approach, to identify and construct the main concepts emerging from the research (Attride-Stirling, 2001). Concepts were synthesized in a matrix and triangulated with primary and secondary data to ensure consistency, quality, and credibility of the findings. Themes constructed included animal health contribution to One Health; community engagement; access to services; the availability, quality, and quantity of services; the availability, quality, and quantity of veterinary medicines and vaccines; the availability and quality of animal disease surveillance; and collaboration.

LOCATIONS

We selected Ethiopia and Pakistan as case studies, as both countries have been identified as areas of concern for emerging and endemic zoonotic disease (Allen *et al.*, 2017). Both countries have significant animal populations upon which many rural livelihoods depend, yet are at risk of a range of endemic and emerging infectious animal and zoonotic diseases making the effective use of One Health approaches of particular importance. Furthermore, A4AH coalition members operate programmes in both countries, which allow for effective translation and impact of the research findings.

Case study 1: Ethiopia

Ethiopia is a land-locked country in the Horn of Africa with a population of 118 million people, currently the second largest population in Africa (UN data, 2021). Agriculture accounts for 46% of the Gross Domestic Product (GDP) and 85% of total employment (World Bank data). Ethiopia is a federal state, with devolved powers and responsibilities to respective regions, administrative councils, and provinces. Regions are divided into four administrative levels: regions, zones, woredas (districts), and kebele (wards). Livestock production-level disease prevention and control is the responsibility of regional authorities, while notifiable diseases are monitored at the federal level (FAO, 2021).

Ethiopia contains a range of universities and colleges providing degree courses, with qualifications up to Diploma, Bachelor's degree, and Doctor of Veterinary Medicine (DVM) levels. The majority of Ethiopian graduates are employed in the public sector, followed by the private sector, NGOs and the UN (EVA, 2018).

The majority of farmers own small numbers of livestock, while in addition almost half of the livestock-owning households depend on their working equids for transportation and to support farming practices (Asteraye, 2022). As the population continues to grow, there is an increased demand for animal resources for food security and employment opportunities. The sector is constrained, however, by institutional factors, poor market infrastructure, shortages in feed, and animal diseases (EVA, 2018).

Case study 2: Pakistan

Pakistan, located in South Asia, bordering Afghanistan, India, China, and the Arabian Gulf, has a population of 221 million people, the fifth largest population globally (UN data, 2020). Agriculture contributes a quarter of GDP, with livestock its largest subsector, consisting of industrial poultry production, dairy, and beef farming. Like Ethiopia, Pakistan is a federal state with animal health and livestock extension services provided by the provincial livestock departments, supported by local governments at the district, Tehsil (or subdistrict), and Union Council (village) level, while the Federal Ministry of Agriculture is responsible for reporting on notifiable diseases to WOAH.

Roughly a quarter of the country's population, over 8 million rural families are engaged in livestock production, which provides over 35–40% of their income. Furthermore, millions of working equids provide support to an estimated 36 million people (Brooke, 2022). Similar to Ethiopia, the animal health sector faces complex challenges, including diseases, gaps in infrastructure, and lack of access, in particular in remote, rural areas. Endemic livestock diseases, including zoonoses, affect people's lives and livelihoods while hampering the export potential of the sector.

Table 1. Key informants interviewed per geographic location, sector, and discipline.

Code	Location	Sector	Discipline
AFG01	Afghanistan	Animal health	Capacity building
ETH01	Ethiopia	Research institute	Agriculture and livestock
ETH02	Ethiopia	Emergency response	Epidemiology
ETH03	Ethiopia	Public health	Human medicine
ETH05	Ethiopia	Academia	Veterinary medicine
ETH06	Ethiopia	Public health	Veterinary research
ETH07	Ethiopia	Animal welfare	Capacity building
ETH08	Ethiopia	Animal welfare	Veterinary medicine
FRA01	France	Animal health	Veterinary medicine
FRA02	France	International development	Capacity building
KEN01	Kenya	Animal health	Communications
KEN02	Kenya	Animal health	Capacity building
KEN03	Kenya	Animal health	Capacity building
KEN04	Kenya	Research institute	Agriculture and livestock
KEN05	Kenya	Animal health	Veterinary medicine/capacity building
KEN06	Kenya	Animal welfare	Capacity building
PAK01	Pakistan	Academia	Veterinary research/lecturer
PAK02	Pakistan	Public health	Veterinary medicine
PAK03	Pakistan	Animal welfare	Capacity building
UK01	UK	International development	Agriculture and livestock
UK02	UK	Research institute	Veterinary research
US01	USA	International development	Capacity building

LIMITATIONS

The study did not aim to provide a systematic literature review and adopted purposive sampling to identify and select literature to support the background and analysis. Furthermore, this study primarily aimed to explore animal health aspects within One Health approaches. Therefore, in response to the lack of published data available on animal health systems, we prioritized primary data collection among animal health and welfare specialists, interviewing those involved in the animal health sector. This introduced a bias towards the impact of animal health, veterinary research, investment, and related capacity-building outcomes in the results, which may be mitigated by further research for better inclusion of all relevant disciplines and stakeholders.

Importantly, while we acknowledge that environmental health is another underrepresented area within One Health, as reflected in the Discussion and Conclusion sections, a more in-depth discussion falls outside the scope of this study and may be addressed in future research.

Results

ONE HEALTH STRUCTURES

One Health initiatives are only effective when all disciplines are represented across global, national, and subnational governance levels. At the global level, we found evidence that One Health approaches and interdisciplinary collaboration continue to gain momentum. While important progress has been made in the case study countries as well, significant gaps in governance and institutional capacity remain. Key informants (KI) linked these challenges to a lack of political will required to increase cooperation and coordination across core sectors. The following section reviews and comparatively analyses the national-level systems in the case study countries to better understand key barriers and opportunities.

The Ethiopian government established the National One Health Steering Committee (NOHSC) in 2017, bringing together four key ministries: the Ministries of Health and Agriculture, the Ethiopian Wildlife Conservation Authority (under the Ministry of Culture and Tourism), and the Ministry of Environment, Forest and Climate Change, as well as relevant non-governmental stakeholders (KII ETH03) (Erkyihun et al., 2022). Currently, NOHSC is co-led by the Ethiopian Public Health Institute (EPHI) and the Ministry of Livestock and Fisheries, with rotating chairmanship (KII ETH02). The stated NOHSC objectives include integrated multisectoral surveillance systems, joint research projects, and enhancing multidisciplinary capacities for detecting and responding to disease, supported by Technical Working Groups (TWG) for specific challenges such as rabies control (GoE, 2020).

However, the operationalization of the One Health strategy is hampered by poor intersectoral information sharing and communication, the lack of a centralized surveillance, monitoring, and response system and databases (HEAL, 2021). The current

primary NOHSC focus is on zoonoses and human health, which has resulted in the environmental sector gaining particularly limited traction (HEAL, 2021) or being excluded from One Health networks altogether (Khan *et al.*, 2018). Imbalances between disciplinary representation have driven stakeholder hesitancy to engage (Fasina *et al.*, 2021), and created further barriers to multi- and transdisciplinary collaborations (KII ETH04). Key informants suggested that the interministerial agreement remained 'powerless' (KII ETH01), while One Health was not effectively institutionalized and relied instead on the goodwill of individuals in each department (KII ETH01).

On paper, Ethiopia's federal One Health structure is replicated at the regional and zonal levels; however, in practice One Health is not well integrated and underfunded at the subnational level (KII ETH02). Respondents noted that the unclear division of responsibilities between the federal and state levels is problematic for coordination and resource allocation. Furthermore, sectoral cooperation between public institutions and private sector animal health service providers was particularly weak at lower levels, lacking effective communication channels (FAO, 2021).

In Pakistan, a One Health Hub was established at the National Institute of Health (NIH) in 2017, with the aim to prevent and control zoonotic diseases of national and international concern (KII PAK01). NIH led the development of the National Strategic Framework on One Health for prioritizing endemic and emerging zoonotic diseases in collaboration with the US Center for Disease Control and Prevention (CDC) and the US Department of Agriculture (USDA). The hub established working groups on antimicrobial resistance (AMR), influenza, and laboratory capacity (CDC, 2017). The national One Health coordination mechanism nominally includes stakeholders across multiple sectors; however, KI specifically noted that the animal and environmental health sectors are not included in strategic decision-making structures.

Following the passage of the eighteenth amendment to the constitution in 2010 (Ali, 2018), decision-making power and responsibility for health and agriculture were devolved to Pakistan's provinces, where multisectoral coordination and collaboration are less well established, including for One Health governance (McKenzie *et al.*, 2016). This is further complicated by significant differences in capacity between federal and provincial levels, and within and between provinces. Key informants emphasized a lack of collaboration and data sharing between human and animal health sectors, citing the fact that veterinary professionals were often excluded from zoonotic disease responses and projects, which focus on human health, rather than including all relevant sectors for disease prevention and control.

Bilateral and multilateral development partners such as the FAO, WHO, bilateral donors, universities, and NGOs are important supporters and champions of One Health activities across both case study countries. Their influence can be seen in activities such as zoonotic disease prioritization exercises that were supported by the United States (US) Centre for Disease Control (CDC) (CDC, 2017); however, this scheme continues to prioritize human health and livestock trade over animal health (KII PAK02); (Erkyihun *et al.*, 2022). Other programmes supported the provision of training to veterinary officers by the WOAH (KII KEN01) at national levels, and global and regional programmes have supported laboratory and human resource capacity building for zoonotic disease and AMR prevention and control (KII ETH01). Supporting organizations also facilitate linkages between global projects, such as global rabies elimination programmes and their implementation at the provincial health departmental level (KII PAK01) with support from WHO.

RESOURCES AND INVESTMENT
Operationalization of One Health networks and initiatives require sufficient resources. We found that animal and environmental health remains underfunded when compared to human health services in both case studies. The lack of resources and investment was seen by respondents as driving low access to primary animal health services, particularly in rural and remote areas where few animal health professionals are active, and infrastructure for disease testing and surveillance, data collection, distribution of vaccines, and medicines is limited. We consider this to be further evidence of disconnection and 'short sightedness' as these issues have real and significant impacts on the human health sector.

The lack of services in remote and rural areas results in irregular animal disease surveillance and reporting, particularly in pastoral areas. In Ethiopia, the lack of a comprehensive surveillance system represents a significant gap in governance, commitment, and lack of capacity of local organizations (KII ETH07). Some disease data is collected at the Woreda level (KII ETH04); however, these data are rarely shared through the messaging system designed for outbreak surveillance, due to limited internet connectivity, lack of computers and required electronic equipment, and low technological capacity of the field staff. It is worth noting that even if data is returned to the federal government, this is rarely shared beyond the Ministry of Agriculture (KII ETH01). In Pakistan, notifiable animal diseases on government and/or commercial farms are reported to the WOAH through the Federal Ministry of Food Security and Research (KII PAK03), but few data flows to provincial animal health departments or others, limiting effective disease prevention and control (KII PAK01). Data on zoonoses of concern is collected ad hoc by NIH, reflecting the priority of responding to human health impacts of zoonotic disease.

Respondents did not feel that these reporting barriers were necessarily related to a lack of available veterinary workers. In both countries, KI believed there is an adequate quantity of veterinary graduates; however, many were reported to lack the required knowledge, experience, and capacity (KII ETH02). As the statutory regulatory authority, the Pakistan Veterinary Medical Council sets requirements in terms of quality standards for animal health professionals in Pakistan, including compulsory professional internships. Despite these structures, there is a lack of quality control in private colleges and universities (Muhammad *et al.*, 2016), which contributes to a wider lack of access to, use of, and trust in veterinary services, in particular among smallholders in rural areas (Gizaw *et al.*, 2021).

The challenges in the veterinary system in Pakistan have resulted in many graduates leaving the profession for other sectors; those who remain often lack exposure to modern technologies and adequate laboratories (KII PAK01). Unemployment remains high among recent animal health graduates driven by what KI identified as a lack of adequate teaching facilities and staff and a lack of practical classes during training, resulting in a lack of skills and capacity (EVA, 2018). Furthermore, few veterinarians opt to work in rural areas where service delivery is often hampered by poor facilities and infrastructure, sparse medical supplies, and other resources (FAO, 2021; HEAL, 2021). Access to animal health services, therefore, is limited, and the sector lacks human and medical resources and supplies. Increased inflation, in combination with a state-controlled financial sector, has limited foreign currency earnings capacity (Reuters, 2021), with a direct impact on veterinary supplies that require input from abroad.

No reliable data was available on Pakistani veterinary trajectories; however, it is widely believed by KI that from the thousands of veterinarians who graduate annually, the majority choose a career in private livestock production companies or international agencies, rather than the public sector. As a result, KI estimate that there is on average one veterinarian per 100,000 animals, driven by a lack of government funding; in response, many public veterinarians provide fee-for-service outside office hours to supplement their income, compared to the situation in Pakistan.

Gaps between courses taught to veterinary students and the practical skills required exist in both Pakistan and Ethiopia (KII ETH05); (Muhammad *et al.*, 2016), particularly around preventative measures. Previous assessments identified a need to focus on health systems and prevention, as well as curative veterinary medicine. There is a call for linking training with the needs and expectations of employers: current curricula for instance do not include species-specific training while focusing on treating individual animals rather than on general herd health (Muhammad *et al.*, 2016). Muhamad *et al.* recommend the integration of complementary and alternative veterinary medicine in the curriculum, as almost every case presented to a veterinarian has first been treated by the owners themselves, using indigenous therapies, reflecting the importance of parallel animal health systems (Muhammad *et al.*, 2016).

We also considered the location of service providers in evaluating access. In both countries, the majority of veterinarians were located in urban areas (KII KEN06) and focused on providing livestock extension services (KII PAK02). In rural areas, many public veterinarians have established parallel private practice outside office hours for supplementary income (KII PAK02), although subsistence livestock keepers rarely have resources to use these services (KII ETH02) driving further differentiation and access barriers in these settings.

In both countries, national animal health laboratories were primarily focused on the evaluation of livestock diseases for export, while regional laboratories had limited capacity to screen for emerging and priority animal diseases and zoonoses (KII ETH02). The lack of laboratory capacity drives animal health professionals to employ symptomatic disease diagnosis (KII UK01) and treat with broad-spectrum antibiotics that increase the risk of AMR (KII FRA02). This risk is amplified by owners who often procure medication and vaccines directly from vendors on the open market, and self-administration of medicines and vaccines to animals is common among both smallholders (KII PAK01) and commercial farms (KII ETH01).

In Pakistan, the Provincial Veterinary Research Institutes produce vaccines and diagnostic reagents and, where financial and human resources allow, conduct limited research on infectious diseases. Vaccinations are provided through the Provincial Veterinary Extension Directorates and District Livestock Officers free of charge through field veterinarians and paraveterinary staff; however, these have limited capacity and a general shortage of human and financial resources. This has resulted in an estimated vaccination cover (of vaccines against animal diseases such as Foot and Mouth Disease (FMD), Anthrax, Rabies; cattle and buffalo diseases including haemorrhagic septicemia (HS) and Black Quarter (BQ); diseases of sheep and goats including Peste des Petits Ruminants (PPR), pox, contagious caprine pleuropneumonia (CCPP); and poultry diseases such as Avian Influenza (AI) and Newcastle disease (ND)), of less than 25% (UNIDO, 2013), further complicated by gaps in the cold chain. Furthermore, many medium to large commercial farms procure vaccines and medicines directly from the private sector, in particular the poultry industry with the procurement and unrestricted use of antimicrobials increasing the risk of AMR (UNIDO, 2013). Following devolution, the independent Drug Regulatory Authority of Pakistan (DRAP) was established to regulate the manufacture, import, export, storage, distribution, and sales of human and veterinary medicines and vaccines (UNIDO, 2013); however, gaps in the monitoring system to control quality and safety of vaccines remain.

Ethiopia faces shortages of good quality legitimate medicines and vaccines across both the human and animal health sectors (HEAL, 2021). Vaccines for priority zoonoses are either produced at National Animal Health Diagnosis and Investigation Center (NAHDIC) (KII ETH03) or procured abroad by the Ministry of Health and Ministry of Agriculture, which is a challenge due to a lack of available foreign currency. Cold chain gaps further degrade

vaccine and medicine quality and quantity (KII FRA01); (Piracci, 2016; Holm and Kortekaas, 2020), while at times the supply runs out before reaching remote areas (KII ETH04), where dissemination depends largely on local partners (KII ETH02). As a result, both the availability and uptake of vaccines and medicines are a significant challenge, resulting in a reluctance of pharmaceutical companies to develop vaccines for endemic diseases (Lubroth *et al.*, 2007), exacerbated by animal owners reluctant to pay for vaccines for 'common' diseases that cause few clinical signs (Donadeu *et al.*, 2019).

Private sector companies provide an alternative means of access to medicines and vaccines, however, mainly operate in only larger cities. Rural medicine supplies are often limited to anthelmintic treatments, which may be purchased and administered by livestock keepers without sufficient knowledge of treatment doses and length. The gaps in the availability of medicines and vaccines have led to the use of older-generation and unsuitable compounds, as well as the infiltration and proliferation of counterfeit low-quality products which further erode communities' trust in modern medicine (HEAL, 2021) and have implications for AMR.

COMMUNITY LEVEL

The significant governance and resource gaps described above drive livestock owners' dependence on local partners, community contributions, and participation in animal health structures. In particular, the limited availability of veterinary health services in rural areas (KII ETH04; KI ETH06) has led to a rise in community animal health workers (CAHW) across settings (Catley *et al.*, 2004).

In Ethiopia, an estimated 14,000 CAHW, nominated, selected, and endorsed by community representatives and the chairman of the kebele, received training from regional livestock and health bureaus and non-profit organizations to provide extension and animal health services. The training included 'community partnership skills', covering community engagement to better understand local knowledge and traditions, raising awareness in the local language, and consolidating and supporting existing animal health skills such as hygiene and simple treatments. Once graduated, local leaders monitor their activities as a quality assurance and engagement measure. Through their interdisciplinary training, the CAHW are integral parts of kebele-level surveillance teams that include human-focused community health workers (CHW) and other human and animal health staff; these teams work closely with public and private service providers (HEAL, 2021).

The results of these collaborations are visible in improved response speed and other tangible effects; in Pakistan CAHW directly helped lower the prevalence of economically important diseases in buffalo and cattle (Khan *et al.*, 2009). International organizations trained CAHW to administer vaccinations, provide nutritional support, administer treatments, and conduct artificial insemination and deworming activities (Khan *et al.*, 2009). Both male and female CAHW were selected from within the local community, trained and supervised by veterinarians, and paid by community members in return for services. Elsewhere, projects have shown that a network of well-trained and equipped CAHW or veterinary paraprofessionals, working closely with trained veterinarians, can effectively support animal health in rural and remote areas, as well as One Health surveillance, prevention, and treatment, for instance, in rabies prevention and control (KII KEN01), where more high-level intersectoral collaboration is lacking (KII AFG01).

Respondents noted that an effective One Health system supported by CAHW and veterinary paraprofessionals requires proper standards, regulations, and support (KII FRA01). While international donor projects support some of these CAHW networks by enhancing the use of local resources and people's knowledge of disease (KII ETH04; KII ETH05), not all projects are considered sustainable (KII KEN05) due in part to the exclusion of communities from planning and programming consultations (KII

FRA02). Further investigation of this phenomena with informants uncovered a key dichotomy; some participants believed that many animal owners are unfamiliar with animal and zoonotic diseases (KII ETH02, KII FRA01), while others mentioned that subsistence livestock keepers were 'used to disease' (KI ETH01). These positions somewhat undermine communities' important role in acting against One Health threats at the front line (Henley et al., 2021). Other respondents emphasized that at the grassroots level communities 'live' the One Health concept (KII ETH03) and are often deeply connected with their animals and environment (KII ETH06). This makes community representatives important actors in surveillance for monitoring, and communicating changes in animal, human, and environmental health (Henley et al., 2021), in particular where veterinary and other health services are unavailable.

Discussion

POWER AND PARTICIPATION

Political and technical leadership is critical for effective One Health governance, which requires clear mandates with well-defined roles and responsibilities, and improved coordination across sectors (WB/FAO, 2022). A 'lack of political will' was identified as a main obstacle to the effective implementation of collaborative, multisectoral, and transdisciplinary approaches to One Health challenges (KII PAK02), with animal health remaining secondary to human health outcomes. This hierarchy was reflected in reduced opportunities for joint work and collaborative information sharing. In Ethiopia, gaps in institutionalizing and implementing the One Health agenda were attributed to a lack of intersectoral information sharing, lack of capacity, particularly at subnational level, and the continuing reliance on support and technical assistance from international organizations and experts (HEAL, 2021).

Good governance and intersectoral collaboration are essential for effective One Health surveillance systems (OIE, 2015). The operationalization of One Health is often politicized, whereby individual states, regions, and other stakeholders adapt their work to national and local political systems and contexts, however. Respondents identified governance gaps in both countries (KII ETH07) with specific reference to a lack of collaboration and communication across governance levels (KII KEN06) resulting in shortfalls in areas such as disease surveillance and control (KII KEN05). In Pakistan, challenges are exacerbated by an unclear division of responsibilities between the federal and provincial levels. The existing political landscape can create further barriers to the effective implementation of animal health programming, such as uncertainty generated between devolved federal and provincial responsibilities, and limited opportunities for cross-sectoral information sharing in both contexts. The effective political institutionalization of One Health requires improvements in the definition of sectoral roles and responsibilities, supported by effective operating procedures and technical collaboration.

The governance deficits were compounded by the mechanics of reporting systems; for example in Pakistan, local and provincial paper-based data collection systems were difficult to collate and integrate with federal systems (George et al., 2021). In Ethiopia, data collected by mobile animal health teams was centrally collated, but not widely shared beyond the Ministry of Agriculture. The interdisciplinary mobile teams consisting of CAHW, human health, and public and private service providers, increase integration when combining One Health surveillance and treatment activities. However, in both case study countries, technological literacy and equipment shortages limited the use of tools such as mobile phones or tablets, and laboratory facilities have limited diagnostic abilities. The underlying mechanisms affecting these reporting gaps are important social science questions that need to be further researched, for instance, what incentives and prerequisites are required for reporting and sharing disease data?

Community participation is essential for the effectiveness of many aspects of One Health programming such as the CAHW networks and other local initiatives (Duamor et al., 2021), which require further integration and future advocacy. It is vital to recognize that at the local level, and these initiatives operate as part of the complex, and often deeply political, networks (Tasker and Scoones, 2022) in which animal owners navigate a wide range of indigenous and state-supported animal health services (KII UK01). Community members are not always consulted in project development and implementation processes, limiting their participation and ownership (Ebata et al., 2020), and sustainability (KII FRA01) of One Health initiatives, introducing unhelpful misconceptions regarding local knowledge and capacity.

As One Health programmes and activities remain primarily driven by international donor organizations and their priorities (KII KEN01; KII KEN06), local priorities may not always be adequately reflected in programming, resulting in projects that are ill-suited to changing local needs (KII KEN02, KII KEN03). These power asymmetries are reinforced by historic and current dependencies on international donors for funding. To date, One Health projects and programmes are primarily led by international donor organizations, research institutions, and non-governmental organizations (NGOs) in collaboration with governments, which centre on national- and regional-level responses, rather than local prevention of zoonotic disease emergence, detection, and response through primary animal health services (Erkyihun et al., 2022).

PRIORITIZATION AND INCLUSION

Veterinary and other animal health services have a long history of contribution to human health, through areas such as enhancing food security and nutrition (KII FRA01). There is clear evidence that investments in animal health systems support not only global health security, but livelihoods as well, particularly those of smallholders. Preventive animal health measures have shown to be cost-effective means of protecting animal, human, and environmental health (KII KEN05; KII UK01); (Grace et al., 2017; OIE, 2019). There are positive signs that One Health is transitioning beyond a tight focus on zoonoses (Fasina et al., 2021) to include important connected issues such as climate change, nutrition and food safety, policy and planning, human and animal welfare, and well-being. As a result, global One Health funding opportunities are becoming increasingly contextualized and flexible, which may enable greater engagement with local communities and devolution of powers.

Direct investment to develop animal resource value chains is included in global and regional development plans such as AU-IBAR's vision for the Animal Welfare Strategy for Africa (AWSA), through cross-sectoral and multidisciplinary approaches (AU IBAR, 2017). Despite these broad aims, financial support for livestock still makes up less than 0.25% of Overseas Development Assistance (ODA), with even fewer resources allocated to animal health (Cornish, 2017). For illustration, in Kenya, where agriculture contributes 20% to GDP and 40% of employment, the sector receives less than 10% of public funds, of which an estimated 2% is allocated to animal health (KII KEN01).

In Ethiopia, the elimination and/or control of WOAH notifiable diseases falls under central government budgets, while the control of other non-notifiable animal and zoonotic diseases is the responsibility of regional authorities, supported by a resource-constrained private sector (KII ETH01). This results in poorer rural animal owners simultaneously facing a lack of access to animal health services, while also having the highest risk of negative impacts of animal diseases and zoonoses. It is clear that sectoral strengthening, expansion, and control are vital to rebalance these issues (KII FRA01).

In both case studies, the majority of animal health services were delivered in urban areas, while CAHW filled in the gaps elsewhere.

Limited coverage in rural areas means that the provision of resources such as vaccines and medicines is a significant challenge, shifting animal health efforts towards expensive disease outbreak prevention and control measures, rather than cost-effective prevention. This challenge is compounded by the gaps in the cold chain of public sector supply, resulting in many animal owners self-administering medication purchased from the private sector under variable monitoring and quality assurance (Braam *et al*., 2021).

Developing themes of funding further, KI believed that overall animal health funding was, in fact, declining across both case study countries due to governments refocusing on other priorities such as poverty reduction (KII PAK03) and mitigating conflict, while underestimating the important role animal health can play in achieving these goals. Many areas of global health and development are increasingly being seen as global public goods (Buchholz and Sandler, 2021), including addressing health interventions such as COVID-19 vaccine inequality (Hunter *et al*., 2022); we suggested that overlooking the role and contribution of animal health systems ultimately undermines the efficacy of these approaches. Until we are able to mount a coordinated and consistent global effort, we must consider what may be done with current resourcing. One KI suggested 'smarter' funding streams were required (KII KEN01). This linked to observations that public–private partnerships were important contributors to a more sustainable animal health system, ranging from small-scale pay-for-service fees for veterinary services (KII FRA01; KII ETH07) to connecting CAHW with private service providers such as pharmacists. Public–private partnerships may provide a solution for the delivery of veterinary services, including surveillance (Gizaw *et al*., 2021), the production and marketing of less profitable vaccines (Lubroth *et al*., 2007; Donadeu *et al*., 2019), and a further increase in private sector investments (OIE, 2019).

Overall, to improve the delivery of animal health services, the quality of animal health education, institutions, surveillance, vaccines, and medicines must be enhanced. This starts with improving the quality of animal health curricula and better alignment of taught veterinary skills with animal owners' requirements. Further resources are required for providing subsidies and/or incentives to veterinary professionals to establish themselves in rural areas and enhance their supporting infrastructure (KII FRA01; KII ETH07). Enhancing the quantity and quality of services will further increase trust and willingness to invest in animal health, contributing to better One Health outcomes.

LIMITATIONS

The qualitative research methodology employed in this study does not aim to provide generalizable research findings; instead, it explicitly seeks to understand the contextual nature of the people and phenomena explored in this work. While the primary aim is, therefore, not to identify universally applicable trends, it is likely that many of the thematic findings may inform work with similar groups in comparable situations.

CONCLUSION

One Health approaches are increasingly being adopted by national and international groups to address interconnected animal, human, and environmental health challenges. Multiple barriers must be overcome to enable animal health to fulfil its potential as part of a unified One Health approach to human–animal–environmental health threats. These barriers are far from straightforward, as they include the inequitable division of funding, resources, and decision-making power between the sectors at the global, national, and local levels.

To date, animal health remains underfunded and subordinate to human health in many One Health initiatives; to unlock the full potential of animal health in the One Health model, there is a pressing need for more equal distribution of resources both among disciplines, and between indigenous, local, national, and international stakeholders. Increased investment and commitment to animal health have the potential to make significant contributions to environmental and human health, and are therefore key factors in the successful implementation of One Health approaches. Better economic analysis is needed to estimate the required levels of investment in animal health.

While the internal power structures of One Health itself remain unbalanced, its potential will remain constrained. Animal health must be enabled to play its part in combatting global health threats. Communities must be included in animal welfare, disease prevention, and surveillance interventions. The use of inclusive participatory approaches has the potential to strengthen project impacts, existing local resources, and knowledge. The quality and control of animal health education, institutions, workforce, surveillance, vaccines, and medicines need strengthening to deliver decent services for all.

This begins by developing appropriate legislation and regulatory frameworks. Furthermore, better communication and data sharing across the One Health sectors is essential. Governments, donors, and implementing agencies should invest in animal health to combat global health threats, and for food security, nutrition, climate resilience, livelihoods, mental health, and general well-being.

CONFLICT OF INTEREST

ETHICS STATEMENT

This research study was conducted in accordance with the ethical guidelines set out by the Brooke Ethical Review Body and received approval from the University College London Research Ethics Committee (REC). The purpose of the research, the role of the researcher, what participating in the study involved, and the intended use of the data collected were shared before the start of each interview. The voluntary nature of the interviews was emphasized, and interviewees were given the opportunity to withdraw from the study at any point, without explanation. Participants were given the opportunity to select their level of confidentiality required. Interviews were audio recorded with the informed consent of the key informants, written notes taken, and key points and quotes transcribed. Data was stored on a secured account only accessible by the lead researchers. Interview notes were coded by the research team, to ensure all data is unidentifiable to external parties.

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AUTHOR CONTRIBUTIONS

All authors contributed to the conceptualization of the research design and protocol. The implementation of the study was conducted by DB and AT; coding was done by DB and analysis was reviewed by AT and EP. DB and AT wrote the draft manuscript, while EP and KS provided feedback on the manuscript and revisions. All authors approved the final version of the manuscript.

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DATA AVAILABILITY

All data generated or analysed during this study are included in this article.

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