



# ONE HEALTH CASES

July 2024

## Status of One Health Implementation in Botswana

The One Health (OH) baseline study was conducted through a desktop literature review, key informant interviews and a focus group discussion. Currently, Botswana does not have an OH platform, but there exist strong intersectoral and multisectoral committees constituted to address public health issues. The country implements the Libreville Declaration on health and environment.

Authors: Moathodi Kgosimore<sup>1</sup>, Nomsa Mokhondo<sup>1</sup>, Davies M. Pfukenyi<sup>1</sup>, Lebapotswe Tlale<sup>2</sup>, Boingotlo Sebolai<sup>1</sup>, Irene Segopolo<sup>3</sup>, Keneilwe Mmopi<sup>3</sup>, Kilano Ntshiamisang<sup>4</sup>, Nelson M. Tselaeesele<sup>1</sup>, Gaebonwe Baikitse<sup>5</sup>, Nlingisisi Babayani<sup>3</sup>, Setshego Phokoje<sup>6</sup>, Onalenna Ntshebe<sup>2</sup>, Goitseone Malambane<sup>1</sup>, Theo Knight-Jones<sup>7</sup>, Alexandre Caron<sup>8,9</sup>, Shauna Richards<sup>7</sup>, Flora Pule-Meulenberg<sup>1,10</sup>

Affiliations: <sup>1</sup>Botswana University of Agriculture and Natural Resources, Botswana

<sup>2</sup>Botswana Public Health Institute, Ministry of Health, Botswana

<sup>3</sup>University of Botswana, Botswana

<sup>4</sup>Ministry of Environment and Tourism, Namibia

<sup>5</sup>Ministry of Education and Skills Development, Botswana

<sup>6</sup>Ministry of Agriculture, Botswana

<sup>7</sup>International Livestock Research Institute (ILRI), Kenya

<sup>8</sup>ASTRE, University of Montpellier, CIRAD, INRA, MUSE, France

<sup>9</sup>Eduardo Mondlane Universidade, Mozambique

<sup>10</sup>BUAN Centres for Bioeconomy and Sustainable Resources, Botswana

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## Abstract

One Health (OH) is a collaborative, multisector and transdisciplinary approach to mitigate various issues related to the health of animals, plants, humans and ecosystems and their interactions for optimal health. In Botswana, the main goal of OH is to achieve resilient health outcomes that recognize the interrelationships between peoples, animals, plants and their shared environment. We conducted a desktop study, followed by key informants' interviews (KII) and focus group discussions (FGD) in Botswana to define the current OH state of affairs as well as to identify education, training, research and policy gaps that need filling to facilitate effective implementation of OH in the country. The study results revealed that the country does not have an institutionalized nor legislated OH platform but rather intersectoral and multisectoral structures coordinated by the line ministries to address OH-related issues on an ad-hoc basis. Furthermore, it was found that institutions of higher learning in the country do not have deliberate OH programmes to spur traction of OH approaches but rather snippets of OH content infused in certain taught programmes. It is recommended from this study that there is an urgent need to adopt and adapt OH approaches in the country and institutionalize OH platforms for operational purposes through enactment and promulgation of relevant statutory instruments in the affected sectors of the economy, like health, education, environment and research.

## What is the Incremental Value that Makes this a One Health Case?

Botswana is one of the few countries that implements the Libreville Declaration. The approach of this declaration emphasizes the impact of the environment on human health. Although there is no official OH platform to coordinate OH in Botswana, there is a technical working group that involves all ministries that are concerned with OH. Through the review of the situational analysis and needs assessment (SANA) workshop for the Libreville Declaration held in September 2023, the Country Coordinating Committee (CCC) was introduced to the OH approach. During the review, it became clear that there was no mechanism that linked issues of animal, plant, human and environmental health. The new SANA document was amended to include priority issues from agriculture, land and water management including pollution control and wildlife/human conflicts to strengthen the animal, health and environment linkages.

Although the CCC that was involved in the situational analysis of the Libreville Declaration was diverse with respect to government institutions, academia, non-governmental organizations, private sector, and the

community were not well represented. To have an enhanced collaboration, such groups will be included in the future, further strengthening the OH linkages. This incremental value that makes this an OH case is that it highlights the unique relationships between the human and environmental health sectors through the Libreville Declaration, and the work being done to engage animal and other sectors relevant to OH in Botswana.

The OH approach is needed for the effective containment and management of emerging infections exacerbated by climate change. Although there is a multisectoral committee that is coordinated through the Ministry of Health, gaps in the implementation of the Libreville Declaration, a vehicle through which Botswana implements OH. Currently, role clarity among the various entities is not very clear, for example, the Department of Public Health and the Botswana Public Health Institute (BPHI). Such a gap would not exist if there existed an OH policy, that could also simplify the operationalization and institutionalization of OH.

Furthermore, in order to control disease in humans and animals and to conserve the environment, early detection and surveillance of warning signs of infectious diseases are key (Mbugi *et al.*, 2012). An OH policy will, therefore, go a long way in the establishment of the necessary processes and structures. It will also ensure that the country does not react when situations arise but prepare and prevent disease.

## Learning Outcomes

1. Understand synergies and collaborative mechanisms for One Health (OH) implementation and capacity in Botswana.
2. Plan for the institutionalization and operationalization of existing or new OH platforms that involve cross-government collaboration and engagement of diverse OH stakeholders.
3. Assess OH challenges, gaps, capacities, bottlenecks and policy deficiencies in Botswana.
4. Assess and document the status of OH research and innovation.
5. Develop a framework for integration of OH in the curricula across all levels of education.

## Background and Context

Botswana is a middle-income country (MIC), with an estimated population of 2,4 million (PHCPR, 2022), of which at least 70% reside in urban areas. The country's economy is natural resource-based, dominated by diamonds and has a Gross Domestic Product (GDP) per capita of US\$7,123.00. The country has a well-established, -funded and -functioning health system. The bulk of service provision is by the government through an effective, heavily subsidized Primary Health Care (PHC) system (WHO, 2018). Despite the advancements in the country's PHC, there is hardly any integration with respect to line ministries that are essential in ensuring optimal human, animal, plant and environmental health. National committees are constituted as and when they are needed, thus, the concept of One Health (OH) is not institutionalized but rather ad-hoc. The country has several national legal frameworks and policies housed under portfolio ministries and departments as enablers for the implementation of their respective Libreville Declaration (Libreville, 2008) mandates. The objectives of the declaration are to: (i) demonstrate the importance of recognizing the interlinkages between the environment and human health to achieve sustainable development goals (SDGs); (ii) promote an integrated approach to policy making in the health and environment sectors that values the services that ecosystems provide to human health; and (iii) develop specific actions required to leverage the needed changes in institutional arrangements and investment frameworks for mitigating environmental threats to human health (Libreville, 2008). Precisely, the Libreville Declaration commits 48 African signatory countries to 11 priority areas addressing Africa's most pressing health and environment challenges through an integrated approach to policy making in the health and environment sectors.

Generally, different levels of implementation of OH exist in Africa. For example, Tanzania and Namibia incorporated OH into national rabies control strategies (Otu *et al.*, 2021). Zambia has developed and launched a 5 year OH strategy 2022–2026 to build a strategic, functional and sustainable OH platform (ZNPHI, 2022). Rwanda has an approved One Health strategic plan whose objects are to streamline the cross-sectoral and institutional interventions, minimize duplication of efforts and maximize the use of public resources (Nyatanyi *et al.*, 2017).

Other legislative instruments critical for managing health challenges include but are not limited to: (i) Integrated Health Service Plan 2010–2020 (IHSP, 2010); (ii) National Health Policy (NHP, 2011); (iii) Health Research Agenda (BNSRT, 2005); (iv) Botswana National Conservation Strategy: National Policy on Natural Resources Conservation and Development (NPNRCD, 1990); (v) Environmental Impact Assessment

Act 2005 repealed by the Environmental Assessment Act 2012; (vi) National Biodiversity Strategy and Action Plan (2007); (vii) National Implementation Plan of Stockholm Convention on Persistent Organic Pollutants; (viii) Botswana Strategy for Waste management (WMS, 1998); (ix) Agriculture and Food Security Policy brief; and (x) National Policy for Rural Development Policy. These instruments give an indication of environmental plans that indirectly address health issues to some extent. However, they do not deal with all linkages between health and environmental planning and management in terms of the Libreville Declaration, let alone other aspects of OH such as agriculture. Even though they adequately address the environmental risks that they are intended to address, they fall short of addressing the linkages to health issues (WHO, 2013). Additionally, Botswana has a vision of achieving prosperity for all by 2036. One of the vision's imperatives is that of sustainability, which the country aspires to "pursue sustainable development pathways, balancing social, economic and environmental objectives underpinned by good governance, measuring progress to reflect all forms of capital: social, human, economic and environment" (Vision, 2036). Constraints such as epidemics and pandemics such as HIV/AIDS, Avian Influenza, Malaria and COVID-19 diseases either originating from wild animals or environment or human medicine continue to impact these aspirations.

Botswana subscribes to several regional and international commitments and declarations to implement processes for mitigating epidemics and pandemics. These include but are not limited to: (i) United Nations Framework Convention on Climate Change (UNFCCC); (ii) Convention on Biological Diversity (CBD); (iii) United Nations Convention on Combating Desertification (UNCCD); (iv) Stockholm Convention on Persistent Organic Pollutants (POPs); (v) Basel Convention on the transboundary movements of hazardous wastes and their disposal; (vi) Vienna Convention on substances that deplete the Ozone layer; and (vii) Agenda 21 (WHO, 2013). Furthermore, the country participated in the joint external evaluation (JEE) and performance of veterinary services pathway (PVS) and compiled a report on assessment and gap analysis, and it is in the process of developing frameworks to address the identified gaps (BHDC, 2019). The latest JEE and PVS were conducted in 2017 and 2019, respectively. With respect to the JEE, it was concluded that an overarching public health emergency preparedness and response plan through the OH approach was needed to guide the linkages between the OH sectors including line ministries. This led to the conceptualization and establishment of the Botswana Public Health Institute (BPHI) as the Secretariat for OH activities.

Generally, the country scored low in most aspects because some legislations were not in place and in some cases, institutions such as the BPHI needed to be in place to serve as a coordination mechanism for OH. The institution is currently in place and serves as the secretariat for all OH issues in the country. For example, in a study by Zhang *et al.* (2022), Botswana had a global health index of 31.1 and ranked 139 out of 195 participating countries. This index is made up of various indicator components such as disease prevention, detection and reporting, rapid response, health system, compliance with international norms and risk environment.

With respect to disease prevention, the country scored below average with some areas such as biosecurity and biosafety scoring zeros, thus, these areas were recognized as gaps. This points to the lack of structures and systems to secure biological materials such as pathogenic organisms to prevent accidents or mischievous uses. The latest JEE also identified these as a threat. To close the gap, the Ministry of Health, the African Union in collaboration with the CDC Africa are in the process of developing a legal framework to address issues of biosecurity and biosafety (MOH, 2023).

Regarding disease detection and reporting, Botswana scored above average, 66.7 against a global average of 54.4 in laboratory systems and 40 in real-time surveillance and reporting against a global figure of 39.1. This implies that the country is somewhat capacitated to detect priority diseases for the identification of emerging epidemics before they become widespread. The real-time surveillance score shows that the country has some form of capacity to transport specimens to testing facilities for effectiveness. Despite the country implementing the Libreville Declaration for human and environmental health, a zero score was realized for data integration between human/animal and environmental health. This is done to share surveillance data on animal and human diseases for enhancing the country's capacity to mitigate zoonotic diseases. This was evaluated by assessing the data-sharing mechanism. This could reflect the lack of OH policy and strategy. However, there are standing country coordinating committees at all levels which draw their powers from the Public Health Act. For example, the Act has sections on notifiable communicable diseases and special provisions regarding diseases subject to the International Health Regulations. Perhaps, the zero score could reflect the lack of a digitized system where information is readily available (GHS, 2021).

Generally, the country also scored below average in the various aspects of rapid response as well as health systems with the only two areas scoring above average being trade and travel restrictions and the capacity

to test and approve new medical countermeasures respectively. Not every indicator was scored below average. For instance, the country performed better (above average) with many issues of compliance with international norms, particularly for IHR reporting and disaster risk reduction, JEE and PVS as well as financing. Interestingly, the country had an overall above-average score of 62.4 against a global average of 55.0 for risk environment. The score was made up of political and security risks (82.1), socio-economic resilience (73.9), infrastructure adequacy (58.3), environmental risks (60.8) and public health vulnerability (36.4), the only indicator that scored lower than the global average of 46.9. The public health vulnerability includes access to quality health care that may increase or decrease the exposure of communities to biological threats. To close this gap, the Botswana Health Data Collaborative Roadmap was developed (BHDC, 2019). The aim of the BHDC is to build a strong OH information and monitoring and evaluation system in a harmonized and more aligned approach by all relevant sectors. In 2019, the country ranked 139 out of 195 countries and 108 out of 195 countries in 2021 with global health index scores of 31.1 and 33.6, respectively (GHS, 2021).

The lack of a focused OH legal governance instrument has not hampered Botswana's ability to deal with epidemics and pandemics. The cases of the Avian Influenza epidemic and recent COVID-19 pandemic are good examples of the country's capability of implementing OH necessitated by circumstances. In both cases, strong intersectoral and multisectoral task teams were constituted. For example, with respect to the Avian Influenza outbreak, the team comprised members from the Ministries of Health, Agriculture, Environment, Wildlife and Tourism, Finance and Development Planning, Local government, State President, Works and Transport, Defence and Security, Civil society (Botswana Confederation of Non-Governmental Organizations, Botswana Red Cross Society) and developmental partners (UN, WHO, FAO). The committees for epidemics (e.g., Avian Influenza) were chaired by the Minister of Health and co-chaired by the Minister of Agriculture, while the committees for the pandemics were chaired by the State President (HPAI, 2006; BNTDMP, 2015).

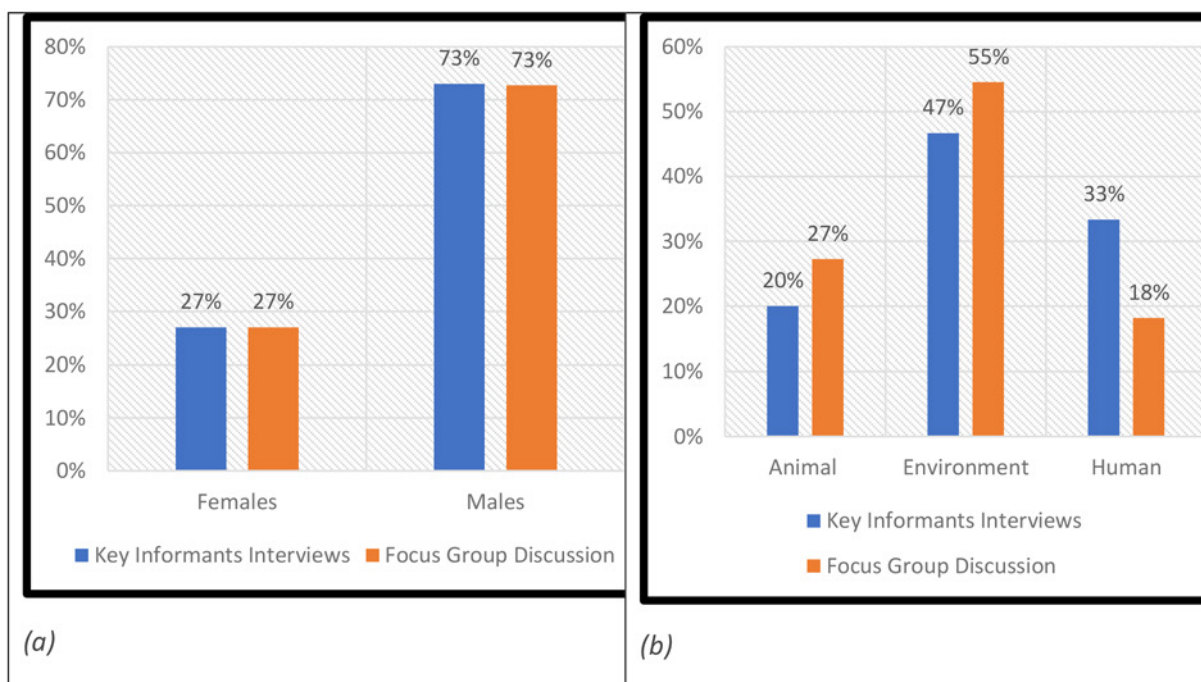
While OH is not a magic bullet, it can go a long way in addressing problems associated with humans, animals and the environment. The goal of the project Capacitating One Health in Eastern and Southern Africa (COHESA) is to identify OH gaps and needs and develop strategies to ensure an inclusive research and innovation ecosystem, facilitate rapid uptake, adaption and adoption of solutions to One Health (OH) issues, with the OH concept embedded across society in Botswana.

Thus, in this case study, we present an assessment of the status of OH to determine areas of support and capacity building. In addition, the assessment of OH in Botswana was done to establish appropriate structures needed to implement OH and inform curriculum development across all levels of education. A desktop literature review on the OH governance, education, research and implementation was carried out. This was followed by key informants' interviews (KII) and focus group discussions to obtain in-depth information on the status of OH in the country. The results of the study were tested through a validation workshop attended by 49 experts from various government ministries, academia and parastatals of which over 50% were females.

## Transdisciplinary Process

This case study integrates the results of three (3) studies namely, the desktop study, key informants' interviews (KII) and the focus group discussion (FGD). This is part of a bigger project called Capacitating One Health in Eastern and Southern Africa (COHESA). In all participating countries, the project aims at unravelling issues of OH in terms of urbanization, food insecurity, lack of diagnostic capacity and lack of trained personnel. In addition to these, for Botswana, other OH challenges include the human/wildlife interface as well as the lack of an official OH organization and training. This baseline assessment in OH in Botswana was conducted through key informants and FGD to collect information, validated by the multisectoral country coordinating committee (CCC) mandated to implement the Libreville Declaration. Purposive sampling, with snowballing (Naderifar *et al.*, 2017) was used to identify key informants in the One Health sector in Botswana, targeting individuals in academia, government, non-governmental organizations, and private institutions to account for the OH three sectors namely, animal, human and environment. These were selected in collaboration with OH portfolio ministries and the Botswana University of Agriculture and Natural Resources (BUAN). Fifteen (15) participants took part in the key informants' interviews (KIIs), while eleven (11) attended the focus group discussion (FGD). In both groups, females accounted for 27% and males 73% (Fig. 1a).

The majority of participants were environment health experts (47 and 55%, respectively) (Fig. 1b).



**Fig. 1.** Distribution of the participants by gender and field.

## Research and innovation

The desktop review revealed that the research and innovation done in the country related to OH have focused on zoonotic diseases, particularly at the wildlife-domestic and animal-human interface (Alexander *et al.*, 2012; Sharma and Busang, 2012, 2015, 2016; Kurenzvi *et al.*, 2020) targeting various animal species. The studies indicated the importance of the parasites on humans and domestic animals. This underlines the importance of creating awareness among the public on the risks of acquiring zoonotic infections from infected animals and environmental contamination. However, no comparative studies have been done in wildlife and further research is required to determine the transmission dynamics and molecular characterization of the parasite to elucidate the role of different hosts and public health implications. Bovine cysticercosis, a parasitic zoonosis has received much attention in the last decade (Oladele and Lesotho, 2010; Ochendu *et al.*, 2021a, b; Mazhani *et al.*, 2022). Despite the high awareness of the disease and its control and preventive measures, it has become a public health challenge with huge economic losses to the country. There are no available medical records and studies on human taeniasis in the country nor on hookworms (*Ancylostoma*) that are transmissible through soil from dogs to humans despite country deworming of school-age children against hookworms. The presence of bacterial zoonoses such as anthrax, brucellosis and leptospirosis in wildlife indicates the importance of bushmeat as a source of zoonotic diseases. One Health research studies are imperative for these bacterial zoonoses. Few studies have looked at profiles of human and animal diseases in relation to environmental, climate and micro-climate manmade and natural changes in the country (Babayani and Makati, 2021; Alexander *et al.*, 2013). The KIIs and FGDs have revealed that there are isolated sectoral research activities with limited integration of environment and non-animal/human sectors. This may be attributed to varying mandates across institutions, lack of trust, particularly in the private sector (competition) and bureaucratic processes. Botswana lacks a platform for knowledge exchange or sharing which results in duplication of effort and a dearth of critical information to inform policy and practice related to OH. There is a need to enhance the development of real-time surveillance and reporting systems (research management systems) and promote data access and transparency.

## Leadership and governance

Botswana does not have an explicit national OH platform, but there exist national legal frameworks and policies (IHR, 2013; MoH, 2020) housed under portfolio ministries and departments as enablers for the implementation of their respective OH mandates. Portfolio ministries include Health, Environment and Tourism, Agriculture, Lands and Water Affairs, and Local Government and Rural Development. Each

ministry has its own OH focal person and ministries meet through the CCC (or multisectoral committees), and each operates its own recurrent budget. There are no established platforms for both passive and active comprehensive public health threat surveillance. This has implications in terms of system inefficiencies, wastefulness and redundancies (World Bank, 2018). As a way forward, Botswana has established the Botswana Public Health Institute (BPHI), housed in the Ministry of Health to act as the Secretariat for OH and promote the adoption of OH approaches in building Health Security infrastructure. It is a state-owned enterprise established to ensure the system's ability to withstand any public health threats and preservation of citizens' lives. It is also there to promote indigenous knowledge to disease surveillance and patterns to inform the building of a resilient health care system. Furthermore, it serves as a coordination centre for all elements of public health threats and emergency response, integrated surveillance, research as well as leadership and governance for effective resource utilization.

The cornerstone of animal disease control in Botswana is the Diseases of Animals Act (1977). The Act forms the basis for the prevention and control of animal diseases, export and import regulation, the movement of animals and animal-related products and the quarantine of animals (Derah and Mokopasetso, 2005). This Act is housed in the Ministry of Agriculture and it is the responsibility of the Director of Veterinary Services. To be easily accepted, control and preventive measures should be identified and implemented through a participatory approach involving local communities (Ferguson *et al.*, 2013). In addition to the participatory approach, to reduce competitive interactions between wild and domestic herbivores; controlled access to grazing resources in protected areas, enhanced habitat by maximizing grassland structural heterogeneity, creation of nutrient hotspots in the landscape and facilitation of high-quality grazing associated with appropriate disease management are other pathways (Fynn *et al.*, 2015). In Botswana, the relevant ministries contribute to OH when needed (a case-by-case scenario), however, there are limited systems or activities in place to consider surveillance or preventative measures on OH (GHS, 2021). This is due to limited funding, varying ministerial mandates, awareness of ministries on the benefits of OH and fragmented OH-related processes or legal frameworks.

## Education and training

The World Bank identified the OH approach as an opportunity where Botswana can excel and set an exemplary framework for other countries in the region (MoH, 2020). Some of the key joint actions such as the mapping of the ongoing policy and institutional reforms to identify entry points for the integration of OH, and capacity building through inter-university undergraduate diplomas and other OH certificate programmes were identified. This is leveraged on existing capacities in human and environmental health to achieve similar improvements in animal health services and establish programmes for human-animal-environment nexus learning streams.

Botswana has a number of public and private universities/institutions with a mandate of offering academic and research programmes on or related to OH. The institutions offer different levels of qualifications and a range of transferable skills, knowledge and understanding in animal, human and environmental health. Thus, there is a need to develop an integrated approach or framework that pursue human and veterinary medical interventions, social and environmental determinants to address health issues.

The OH baseline assessment in Botswana revealed that there were no specific OH courses or programmes in the curriculum and/or deliberate plans to upscale the OH agenda in education. This has the potential to create barriers to the holistic treatment of OH issues. Some of the gaps identified in the educational landscape involved low levels of OH awareness, silo mentality, negligence of indigenous knowledge (traditional or alternative medicine) leading to inadequate implementation and inclusion of traditional medicine and indigenous knowledge systems (IKS) on OH programmes. Results of KII and FGD suggested priority topics or courses to advance OH approach including animal and aquatic zoonotic diseases, awareness on OH, human anatomy in the context of IKS, antimicrobial resistance (AMR), the role of animal, human and environmental health on OH, OH Approach, food systems, ecology and ecosystems, environmental impact assessment, animal and human health and impact of mycotoxins on animal and human health.

Botswana has strong technical higher education programmes for all stakeholders in OH; however, they have limited OH education within these programmes. Key informants and the FGD have reported there exists an academic programme development model that promotes specialization through isolated disciplines, which create barriers to the holistic treatment of OH issues. There is a need to develop an integrated approach or framework that pursues both human and veterinary medical interventions, social and environmental determinants to address health issues. If Botswana can leverage their strong technical sectoral capabilities and integrate OH principles and cross-cutting skills sets (like communication and collaboration between sectors), then the OH workforce will be able to tackle ongoing OH issues in the country.

Generally, the baseline study has revealed a general lack of awareness in terms of the OH approach. It is thus imperative to raise awareness that there is a need to incorporate OH in curricula at the primary and secondary levels. This would be followed by teacher training. For higher education, there is a window of opportunity because curricula for learning programmes get reviewed at regular intervals.

In line with existing regional and continental networks and programmes such as Africa One Health University Network (AFROHUN), the One Health for Humans, Environment, Animals and Livelihoods (HEAL) and Southern Africa Centre for Infectious Disease Surveillance (SACIDS), Botswana's aspiration of developing an OH next-generation workforce to tackle OH issues can be achieved.

## Implementation

Botswana subscribes to several regional and international commitments and declarations to implement processes for mitigating epidemics and pandemics. For instance, the International Health Regulations (IHR, 2013) provide an overarching legal framework that defines the country's rights and obligations in handling public health events and emergencies that have the potential to cross borders. There is no evidence of established cross-border agreements or protocols or memorandum of agreements/understanding with neighbouring countries on public health and animal emergencies (GHS, 2021). There is also no evidence of a financial planning framework to improve the capacity to mitigate against threats. However, there is a publicly identified special emergency public financing mechanism and funds that can be accessed in case of public health emergency. Botswana also has access to the African Public Health Emergency Fund to aid public health emergency responses. Thus, there are no protocols and dedicated budgets for risk communication during emergencies (GHS, 2021; WOA, 2023). To implement OH priorities, the Botswana Public Health Institute (BPHI) was established to coordinate and drive activities on OH. These results were echoed in Botswana's assessment and gap analysis reports (WHO, 2018).

Botswana does not have a national OH platform, but there exist national legal frameworks and policies housed under portfolio ministries and departments as enablers for the implementation of their respective OH mandates aligned to national and global strategic frameworks (Botswana Vision 2036, Libreville Declaration). Resources mobilization, personal and group skills, OH surveillance, risk assessment and preparedness and delivery of curative and preventive health services capacities were identified as critical gaps needed to optimize the issues around One Health. Both KII and FGD indicated that the main challenge was centred around the low levels of OH awareness leading to poor implementation. In addition, there were no specific OH courses in the curriculum but some aspects of OH integrated in some courses. Furthermore, it has been observed that individuals worked in silos, contrary to the concept of OH. Although a sizeable proportion of the community consults herbalists, they are often not included in studies such as this one let alone in decision making at a high level. The lack of clarity on the role of indigenous knowledge in terms of traditional or alternative medicine, was also identified as a gap.

Another key finding from the OH baseline study was that participants took part in a number of national, regional and global forums including Codex Alimentarius Commission Committees (Ministry of Health – MoH), Technical Working Group on Food Safety (MoH), Botswana Public Health Institute (BPHI – MoH), Institute of Microbial Systems and Society (Canada), Combat Antimicrobial Resistance, a collaboration between several African countries, International Union for Nature Conservation (IUCN). These fora advance aspirations of OH.

Despite the lack of an OH platform, during emergencies such as HIV/AIDS, COVID-19 and contagious bovine pleuropneumonia (CBPP) outbreaks, contingency plans are put in place. For instance, a multisectoral national taskforce led by the Ministries of Agriculture and Health was set up in 2005 during one of the outbreaks. In keeping with the Quadripartite guidelines, a high-level taskforce was constituted. The taskforce was co-chaired by Deputy Permanent Secretaries in the Ministries of Health and Agriculture, with Directors of Animal Health, Animal Production, Public Health and Clinical Services as co-secretaries. Other members included the Ministry of Environment and Tourism, Ministry of Finance, Ministry of Local Government, National Disaster Management Office, Ministry of Works and Transport, Civil Societies, Botswana Police, Department of Immigration and Botswana Unified Revenue Services (BURS). The taskforce was supported by a technical working group (TWG) composed of various departments representing sectors in the national taskforce. The TWG was co-chaired by the Director of Public Health and the Director of Animal Health. The role of the TWG was to develop materials for the public and a preparedness plan, in addition to monitoring the trend of Avian Influenza (AI) and reporting to the national taskforce (HPAI, 2006).



## Collaboration and networking

The study revealed the existence of strong coordinated interdisciplinary, multisectoral, or inter-ministerial networks at local, regional, and global levels to address public issues. The networks were generally coordinated by high-ranking officers in institutions, such as Permanent Secretaries (PS), Deputy Permanent Secretaries (DPS), Professors, Coordinators, Directors, Deputy Directors and Researchers. Strong connections were observed within OH fields and across academia and other institutions. There were, however, low interactions in areas of budget sharing and decision making. Key areas of activity or collaboration involved surveys and surveillance on pests and diagnostic services, laboratory services (toxicity testing), assessment of water quality and sanitation as well as monitoring pollution.

According to the baseline study, seventy percent (70%) of the participants reported the existence of multisectoral, interdisciplinary, or inter-ministerial networks within their institutions covering local and external partners. The networks were coordinated by high-ranking officers such as Chief Executive Officers (CEOs), Vice Chancellors (VCs), Permanent Secretaries (PS), Deputy Permanent Secretaries (DPS), Professors, Coordinators, Directors, Deputy Directors, Researchers or Senior Scientists.

Due to the multidisciplinary nature of institutional collaborations, they either have direct or indirect influence on the different components of OH. For instance, academic institutions contributed course offerings at various levels from short to tertiary diplomas and degrees as well as research. For non-academic institutions, experts contributed to the development and implementation of sound policies and legal frameworks.

The baseline study also revealed a number of institutional influences on OH components. With respect to animal health, it was highlighted that they were responsible for the implementation of consumer protection protocols, prevention of disease transmission from animal meat products to humans. In addition, they are also responsible for the management of animal waste effluents to environmental health from abattoirs, conservation and preservation of animals for spiritual health, promote game farming as well as the issuance of permission to conduct research on animal health.

Human health institutions were found to be responsible for the management of public health, research works on humans' interaction with organisms, microbiology, parasites and released waste to the environment. They also provide guidance and counselling in addition to the issuance of permits to conduct research.

It was revealed that environmental health institutions were conducting climate change research linked to environmental impact and changes in the transformation of vector (ticks and mosquitoes) population distribution and patterns. They also conducted research on the determination of microbial loads and heavy metal contents in areas where grey water is used for irrigation of crops and ensure adherence to safe practices to avoid contamination (effluent ponds management).

It can be inferred from the study that strong intra-discipline collaborations exist within institutions in which individuals talk or work together, share budget, policy sharing and decision making. For instance, individuals in animal health disciplines rarely talked or shared policies or budgets or made decisions with individuals in environmental health, pointing to weak inter-discipline linkages. However, a strong inter-discipline interaction was observed between non-academic and academic institutions leveraging on research activity.

## Project Impact

This study has contributed to the understanding of OH awareness and its implementation in Botswana, particularly the default implementation of various legal frameworks and plans belonging to different government ministries to mitigate epidemics and pandemics. The study identified synergies between the various entities driving OH in the country. Existing gaps and strengths were identified (Table 1).

Most of the respondents reported various forms of group dynamics leading to power imbalances which could be gender, religion and ethnicity. It was reported that institutions had robust recruitment systems with checks and balances mechanisms to detect issues of prejudice. For those who reported imbalances, it was observed that they varied from organization to organization, but they were not explicitly planned. This study supports the first pathway (Situational Analysis) of the OH Joint plan action (OH JPA) conceptualized by the quadripartite (WHO, FAO, WOA and UNEP). Precisely, this case study provided the initial phase of conducting the situational analysis for OH implementation as outlined in the OH JPA National implementation guideline. The desktop review demonstrated that challenges and gaps have been identified elsewhere in Africa (AFROHUN, 2021) and collaboration or participation in such networks will accelerate Botswana's aspirations to implement and institutionalize OH.

**Table 1.** Identified strengths and weaknesses for OH in Botswana.

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• Network coordination is at high level.</li> <li>• Networks cover a wide range of activities such as research that informs policy formulation, capacity-building in student and staff exchange programmes.</li> <li>• Exchange of knowledge on systems and issues of sanitary and phytosanitary (SPs) – value addition.</li> <li>• Improved access to funding opportunities.</li> <li>• Diversified approaches to problem-solving.</li> </ul>	<ul style="list-style-type: none"> <li>• Perceptions of gender imbalances.</li> <li>• Absence of coordination mechanisms for OH activities.</li> <li>• Fragmented policies and legal frameworks governing OH.</li> <li>• Low understanding and knowledge of OH – perceived as a new concept.</li> <li>• Resources and financial constraints.</li> <li>• Barriers due to stringent bureaucratic and stringent processes.</li> <li>• Segmented or varied strategies and understanding of the concepts.</li> <li>• Competition (use of shared information for competitive advantage by competitors or enhancement of competitiveness).</li> <li>• Disconnect in mandate and unsynchronized programmes and timeframes,</li> <li>• Inadequate and irregular platforms for information sharing (professional bodies meetings / conferences).</li> <li>• Difficulty in managing group dynamics needs.</li> <li>• Inadequate indigenous knowledge systems (IKS) research aligned to OH.</li> </ul>

## Project Outlook

The study provided a wider understanding of the OH concept at individual, institutional and national levels. The results of the baseline study were validated by the Country Coordination Committee (CCC) for the Libreville Declaration, made of representatives from government, parastatals and academic institutions with OH mandate. Generally, the findings of the baseline study concurred with the 2013 situational analysis and needs assessment survey for the Libreville Declaration. Although the report was well received, it was noted that there was not adequate representation from the government with respect to KIs. This gap will be closed by scheduling KIs with the government ministries and non-governmental organizations. Synthesis of the outcome of the baseline study and a separate higher education institution survey (ongoing work) also identified gaps in OH content in higher education. A review of the curriculum at all levels of education will provide an opportunity to address the deficiency. This project also provides a platform for the engagement of stakeholders and institutionalization of the OH platform. The study also informed the development of plans to conduct net-mapping exercises to establish OH critical players and associated network linkages and synergies. The country has started processes geared towards the development of the OH strategic plan to guide its implementation.

Analysis of how the project was received, what it achieved and what might happen next.

## Conclusions

In conclusion, the country has no intentional legal framework for the implementation of OH, but there are strong intersectoral and multisectoral committees constituted to address public health issues. These have contributed to the country's success stories in combating diseases such as HIV/AIDS, COVID-19, and contagious bovine pleuropneumonia (CBPP) outbreaks in the late 1990, where close to 320,000 cattle were stamped out to control the disease, resulting not only in – environmental health risks but human livelihood impacts.

It is recommended that the country should establish an OH platform through a carefully thought out legal framework that will institutionalize an official OH platform. More awareness and sensitization campaigns are required at all levels for the implementation of OH. The Libreville Declaration though it addresses issues of human and environmental health should be augmented so that issues of animal health and deliberately mentioned, even though they are supposed to be part of the environment. Further studies are needed on important topics such as antimicrobial resistance (AMR) and future pandemics. Issues of plant health as well as soil health in various agroecologies need to be highlighted in future studies.

## Group Discussion Questions

1. Who influences the successful integration and implementation of OH?
2. What are the critical enablers for the implementation of OH?
3. Who is resourcing/financing the implementation of OH in the country?

## Acknowledgements

Capacitating One Health in Eastern and Southern Africa (COHESA) is co-funded by the OACPS Research and Innovation Programme, a programme implemented by the Organization of African, Caribbean and Pacific states (OACPS) with the financial support of the European Union. The Botswana University of Agriculture and Natural Resources (BUAN) is thanked for hosting COHESA in Botswana. The Botswana Public Health Institute (BPHI) is acknowledged for facilitating the validation of the baseline study. We also thank Key Informant Interviewees and Focus Group Discussion participants.

## Conflict of interest

The authors have no conflicts of interest to declare.

## Funding statement

Capacitating One Health in Eastern and Southern Africa (COHESA) is co-funded by the OACPS Research and Innovation Programme, a programme implemented by the Organization of African, Caribbean and Pacific states (OACPS) with the financial support of the European Union., (Grant / Award Number: 'FED/2021/428-198')

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