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Published online: 20 May 2021
https://doi.org/10.1038/s41591-021-01368-9

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Author contributions

O.M., J.E.M. and J.S.R. conceptualized the manuscript, OM drafted the manuscript, JSR provided supervision, and all authors critically revised the manuscript for important intellectual content.

Competing interests

J.E.M. and J.S.R. receive research support through Yale University from the Laura and John Arnold Foundation to establish the Good Pharma Scorecard at Bioethics International. N.D.S. has received research support through Mayo Clinic from the Food and Drug Administration to establish the Yale-Mayo Clinic Center for Excellence in Regulatory Science and Innovation program (U01FD005938); the Centers of Medicare and Medicaid Innovation under the Transforming Clinical Practice Initiative; the Agency for Healthcare Research and Quality (R01HS025164, R01HS025402, R03HS025517 and K12HS026379); the National Heart, Lung and Blood Institute of the US National Institutes of Health (R56HL130496, R01HL131535 and R01HL151662); the National Science Foundation; and the Patient Centered Outcomes Research Institute to develop a Clinical Data Research Network (LHSNet). J.S.R. has received research support through Yale University from the Laura and John Arnold Foundation for the Collaboration for Research Integrity and Transparency at Yale; and receives research support through Yale University from Johnson & Johnson to develop methods of clinical trial data sharing, from the Medical Device Innovation Consortium as part of the National Evaluation System for Health Technology, from the Medical Device Innovation Consortium as part of the National Evaluation System for Health Technology (NEST), from the Food and Drug Administration for the Yale–Mayo Clinic Center for Excellence in Regulatory Science and Innovation program (U01FD005938); from the Agency for Healthcare Research and Quality (R01HS022882), and from the National Heart, Lung and Blood Institute of the US National Institutes of Health (R01HS025164 and R01HL144644).

Africa needs to prioritize One Health approaches that focus on the environment, animal health and human health

Urbanization, armed conflict, and deforestation in African countries have increased the risk of zoonotic infections, which requires a One Health approach focused on the environment, animal health and human health.

Akaninyene Otu, Emmanuel Effa, Clement Meseko, Simeon Cadmus, Chinwe Ochu, Rauna Athingo, Eve Namisango, Dimie Ogoina, Friday Okonofua and Bassey Ebenso

The past two decades have witnessed a global increase in the frequency of emerging and re-emerging infectious-disease epidemics. African countries have experienced the devastating impact of successive epidemics that are projected to have caused a loss of over 227 million years of healthy life and an annual productivity loss of over US$800 billion across the continent[1]. Between 2016 and 2018, over 260 infectious-disease epidemics, disasters and other potential public-health emergencies were identified in Africa, with 41 (79%) of the 52 countries in the region recording at least one epidemic during that period[2]. The five top causes of disease epidemics were cholera, measles, viral hemorrhagic diseases, malaria and meningitis.

The 2014–2016 West African outbreak of Ebola virus disease and the ongoing COVID-19 pandemic have further exposed the vulnerability of health systems in Africa[3] and have amplified the threat posed by zoonotic spillover of infectious diseases to the health and economic security of the continent. Increasing trade and migration of people between and among African nations increases the risk that disease outbreaks within Africa rapidly cross international borders to impact global health security[4].

Increasing interspecies interactions

There is compelling evidence linking the disruption of the human–animal–environment interface with

Fig. 1 | The negative influence of humans on the ecosystem, reflected by wildlife trapping, bushmeat displayed at a wet market in Africa, and deforestation. Credit: Clement Meseko and Daniel Otokpa.

infectious-disease outbreaks. Greater than 75% of emerging infectious diseases have been zoonotic in nature, transmitted from animal hosts to humans[5]. Africa is a hotbed for zoonotic diseases ranging from endemic zoonoses such as brucellosis and leptospirosis to neglected zoonoses such as rabies and onchocerciasis to emerging zoonoses such as anthrax, yellow fever, Ebola, Lassa fever and COVID-19. Key anthropogenic drivers of emerging zoonoses include increasing urbanization, armed conflict between countries, and deforestation. Rapid migration of people from rural areas to urban areas often generates high-density slums characterized by poor housing, lack of clean water and poor sanitation facilities. The overstrained infrastructure of urban cities such as Lagos (Nigeria), Freetown (Sierra Leone) and Dar es Salaam (Tanzania)[6] that are regional transit hubs for air, land and sea transport creates suitable conditions for the spread of Ebola virus disease[7] and diarrheal diseases such as cholera. The disruption of suboptimal water supplies, sanitation and hygiene infrastructure in conflict zones of Africa has also amplified the spread of infectious diseases, with conflict zones recording the highest case-fatality rates from cholera[8].

Deforestation drives disease transmission by triggering a complex array of events that force fauna such as rodents and resident fruit bats to migrate elsewhere in search of food, carrying with them a range of lethal pathogens such as Lassa virus, malaria parasites and the Lyme disease bacterium[9] (Fig. 1). For example, increased transmission of malaria has long been suspected of coinciding with deforestation. Studies conducted in Brazil indicate that clearing patches in the Amazon forest creates the optimal habitat for malaria by allowing mosquitos to breed[10]. These activities ultimately result in a loss of the biodiversity within the ecosystem that is required for ecological resilience. Animal husbandry has also expanded to meet the growing consumption of animal protein in Africa. The exploitation of wildlife and proliferation of wet markets (Fig. 1) to feed the culture of ingestion of bush meat and birds has increased contact with livestock and has enabled the spillover of animal pathogens to humans[11]. The practice of bush burning for subsistence farming in many West African and East African countries has displaced animal populations from their habitats, which has led to seasonal spikes in the incidence of zoonotic diseases[12]. These diseases include those spread from primates (AIDS), fruit bats (Ebola), multimammate rats (Lassa fever), camelids (Middle East respiratory syndrome) and birds (highly pathogenic avian influenza) (Fig. 1). Many vectors depend on permissive climatic conditions that amplify the transmission of vector-borne diseases, such as highly pathogenic avian influenza, which was introduced to Africa when migratory waterfowls migrated from extreme winter temperatures in Asia and Europe[13].

The complex interconnectedness of humans, animals and plants in a shared environment has led to promotion of the One Health approach, which demands collaboration across the three interdependent sectors—animal health, human health and ecosystems—to prevent, detect and respond to disease threats.

Africa endorses One Health

African ministers of health and environment demonstrated an early commitment to One Health when they signed the Libreville Declaration at the first Inter-Ministerial Conference on Health and Environment in 2008 and subsequently endorsed a 10-year Strategic Action Plan to scale up health and environment interventions in Africa from 2019 to 2029 at the third Inter-Ministerial Conference on Health and Environment in Gabon in 2018. Such collective continental endorsements have been combined with activities of organizations such as the International Livestock Research Institute to promote more-efficient, safer and sustainable livestock systems across Africa. Similarly, Africa One Health University Network, which involves eight countries in the Eastern and Central African region, was established to facilitate transformational multidisciplinary research, and community service in veterinary higher-education institutions and schools of public health[14]. The Africa Centres for Disease Control has established a One Health program with a cross-disciplinary working group to coordinate disease surveillance, prevention and control and epidemic preparedness to tackle antimicrobial resistance and zoonoses in the continent.

The policy adoptions and research initiatives described above have catalyzed action on One Health across Africa. A 2020 review commissioned by the International Livestock Research Institute identified a total of 315 One Health initiatives across the 46 countries in sub-Saharan Africa: 101 in East Africa, 85 in Southern Africa, 65 in Central Africa and 64 in West Africa, with some of the initiatives implemented across more than one region[15]. However, co-funding of One Health initiatives by national governments has been poor, with over 90% of the funding derived from stakeholders outside the continent.

One Health successes

Nigeria has had some experience in implementing One Health approaches. The National Inter-Ministerial Steering Committee on Avian Influenza and the National Technical Committee on Avian Influenza set up in Nigeria in 2005 involved multidisciplinary staff from multiple

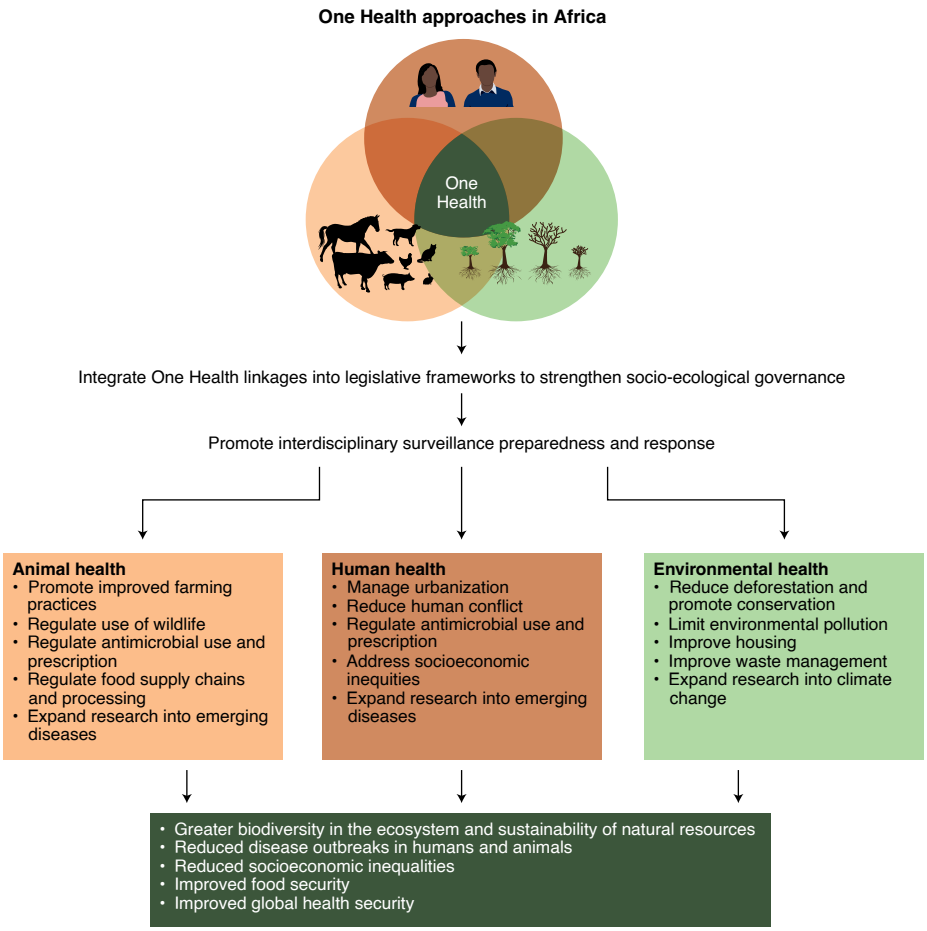

Fig. 2 | Proposed schema to guide the implementation of One Health strategies in Africa.

ministries (including agriculture and health), communicators and industry players. The One Health approach gave rise to a successful multi-sectoral emergency action plan that led to the elimination of the highly pathogenic avian influenza virus H5N1 in Nigeria in 2006 (ref. [16]).

In Southern Africa, Tanzania and Namibia have successfully incorporated One Health approaches into their national rabies-control strategies. Namibia, in close collaboration with the World Organisation for Animal Health and with the active support of the Friedrich Loeffler Institute, has rolled out a multi-sectoral rabies-control strategy consisting of post-exposure prophylaxis and parenteral vaccination against rabies, in addition to providing education to communities[17]. This approach aligns with the global strategic plan to eliminate human deaths from dog-mediated rabies by 2030, a collaborative effort by the United Against Rabies Alliance, consisting of the World Health Organization, the World Organisation for Animal Health, the Food and Agriculture Organization of the United Nations, and the Global Alliance for Rabies Control[18].

In Uganda, a strategic plan for One Health guides multi-sectoral response to epidemics implemented by a One Health Technical Working Group with cross-sectoral representation from the Ministry of Health, the Ministry of Agriculture, Animal Industry and Fisheries and the Ministry of Tourism, Wildlife and Antiquities to oversee the One Health approach[19]. Moreover, the strengthening of border health initiatives through training and the deployment interdisciplinary personnel has been instrumental in mitigating cross-border spread of COVID-19 and Ebola virus disease[20].

In Chad, an innovative strategy of joint campaigns to vaccinate livestock and children in pastoralist communities has broadened access and vaccination coverage of women and children and has resulted in financial savings for the Chadian human and animal health ministries[21].

Over the years, African-led multidisciplinary research to address One Health challenges in the continent has been promoted by the Afrique One program (funded by the Wellcome Trust) in East Africa and West Africa[22]. Between 2007 and 2009, the One Health approach was successfully used to control the outbreak of Rift Valley fever in Kenya, in part due to coordination between the Kenya Ministry of Health and the Ministry of Agriculture, Livestock, and Fisheries. The Division of Global Health Protection, which was birthed by a collaboration involving the Kenya Medical Research Institute, the Kenya Ministry of Health and the US Centers for Disease Control and Prevention, is at the forefront of the development of infectious-disease diagnostic capacity in East Africa.

Since 2010, the Africa One Health University Network has provided academic support for higher institutions that promote One Health approaches. This network involves 24 veterinary-medicine, public-health and environmental-health institutions and 16 universities in 8 countries in Central, East and West African regions (Kenya, Rwanda, Cameroon, Tanzania, Democratic Republic of Congo, Ethiopia, Senegal and Uganda)[23]. The African Field Epidemiology Network, an alliance of Field Epidemiology and Laboratory Training Programs established in 2005, has operated in over 31 countries in Africa to strengthen field-epidemiology and public-health laboratory capacity in order to address disease outbreaks in Africa.

Despite all this progress with One Health in Africa, the 2020 review by the International Livestock Research Institute identified gaps in implementation. This included a lack of awareness among policymakers and the public of One Health issues such as hygiene, biosecurity and antimicrobial resistance. Other gaps included inadequate contribution of financial, human and material resources by governments and a lack of One Health policies, guidelines and strategic plans in many African countries. The review also identified weak linkages and unhealthy rivalry between various sectors, poor data sharing and communication among relevant sectors, and a paucity of data about zoonoses to guide One Health policymaking[16].

Institutionalizing One Health in Africa

We propose a framework to guide the embedding of One Health practices into African communities (Fig. 2). Raising awareness and increasing understanding of One Health at all levels of society is critical. Advocacy, communication and social-mobilization strategies should be intensified to ensure buy-in by

policymakers and the public and thus catalyze collaborative and proactive One Health action. Although African countries have been quick to endorse the One Health approach and follow this up by leveraging donor funding, African governments need to demonstrate ownership of One Health processes through increased funding of One Health. Context-specific One Health guidelines and strategic plans need to be adopted and implemented across Africa. Public–private partnerships that promote resource sharing, collaboration, competitiveness and economies of scale for One Health should be established to reduce the financial burden on African governments. The Ibarapa Meje One Health Initiative in southwestern Nigeria, a coalition of veterinarians, physicians, laboratorians, pastoralists, academicians and government staff with the purpose of addressing zoonotic diseases, is the type of local public–private partnership initiative that should be encouraged.

Strong governance and leadership is required across all One Health sectors in Africa, with inter-ministerial, multi-sectoral and interdisciplinary collaboration, as is coordinating mechanisms to improve data sharing and limit territoriality.

Cross-border disease surveillance and response should be fostered through transnational networks that provide regulatory frameworks and instruments, including digital infrastructures to facilitate the identification of One Health threats. This is exemplified by the Treaty for Establishment of the East African Community, which has been pivotal in preventing the spread of COVID-19 via cross-border movements of people in countries such as Uganda, Rwanda and Kenya[24]. Further research and laboratory capacity building is needed to fully harness whole-genome sequencing to provide real-time information on the biology and evolution of infectious organisms in Africa[25].

One Health approaches will also help African countries contribute to the United Nations Sustainable Development Goals (SDGs). Sustainable food systems should be created in Africa through the provision of economic incentives, which would in turn encourage communities to develop ecofriendly alternatives for food security and would address SDG 2: zero hunger. Strategies that promote integrated management of the ecosystem should be prioritized in line with SDG 13, climate action, and SDG14, life below water. Finally, economic interventions, political agreements and social-justice policies that target addressing socioeconomic inequities that drive conflicts on the African continent would support SDG 10: reduced inequalities. Only by fully implementing One Health approaches will Africa, and indeed humanity, effectively and sustainably prevent and respond to epidemics and achieve global health and food security. ❐

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Published online: 20 May 2021
https://doi.org/10.1038/s41591-021-01375-w

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Acknowledgements

T. Ojumu designed the One Health flowchart in Fig. 2.

Author contributions

B.E. and A.O. conceived of this Comment; A.O. and B.E. wrote the original draft of the manuscript with contributions from all authors; and all authors reviewed and approved the final version of the manuscript.

Competing interests

The authors declare no competing interests.