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1 **Africa needs to prioritise One Health approaches that focus on the environment, animal health,**
2 **and human health**

3 Akaninyene Otu^{1,2,*}, Emmanuel Effa², Clement Meseko³, Simeon Cadmus⁴, Chinwe Ochu⁵, Rauna
4 Athingo⁶, Eve Namisango⁷, Dimie Ogoina^{8,9}, Friday Okonofua^{10,11}, Bassey Ebenso^{12,*}

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- 6 1. Department of Infection and Travel Medicine, Leeds Teaching Hospitals NHS Trust, Leeds, UK
7 2. Department of Internal Medicine, College of Medical Sciences, University of Calabar,
8 Calabar, Cross River State, Nigeria
9 3. National Veterinary Research Institute, Vom, Plateau State, Nigeria
10 4. Centre for the Control and Prevention of Zoonoses (CCPZ), University of Ibadan, Ibadan, Oyo
11 State, Nigeria
12 5. Nigeria Centre for Disease Control, Abuja, Federal Capital Territory, Nigeria.
13 6. Animal Disease Control, Subdivision - North West, Oshakati, Namibia
14 7. African Palliative Care Association, Makindye, Kampala, Uganda
15 8. Nigerian Infectious Diseases Society, Abuja, Nigeria
16 9. Niger Delta University Teaching Hospital, Niger Delta University, Yenagoa, Nigeria
17 10. The Nigerian Academy of Science, Abuja, Nigeria
18 11. College of Medical Sciences, University of Benin, Benin City, Nigeria
19 12. Nuffield Centre for International Health and Development, Leeds Institute of Health
20 Sciences, University of Leeds, Leeds, UK

21 * These authors contributed equally: Akaninyene Otu, Bassey Ebenso

22

23 **Corresponding author:**

24 Akaninyene Otu

25 Department of Infection and Travel Medicine

26 Leeds Teaching Hospitals NHS Trust, Leeds, UK

27 E mail: akanotu@yahoo.com

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29 **Word count**

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33 **Urbanization, armed conflict, and deforestation in African countries have increased the risk of**
34 **zoonotic infections, requiring a One Health approach that focuses on the environment, animal**
35 **health, and human health.**

36 **The rise and rise of disease epidemics**

37 The last two decades have witnessed a global increase in the frequency of emerging and re-
38 emerging infectious disease epidemics. African countries have experienced the devastating impact
39 of successive epidemics which are projected to have caused a loss of over 227 million years of
40 healthy life and an annual productivity loss of over \$800 billion across the continent¹. Between 2016
41 and 2018, over 260 infectious disease epidemics, disasters and other potential public health
42 emergencies were identified in Africa with 41 (79%) of the 52 countries in the region recording at
43 least one epidemic during that period². Five top causes of disease epidemics were cholera, measles,
44 viral haemorrhagic diseases, malaria and meningitis.

45 The 2014–2016 West Africa Ebola virus disease (EVD) outbreak and the ongoing COVID-19 pandemic
46 have further exposed the vulnerability of health systems in Africa³ and amplified the threat posed by
47 zoonotic spillover of infectious diseases to the health and economic security of the continent.
48 Increasing trade and migration of people between and among African nations increases the risk that
49 disease outbreaks within Africa rapidly cross international borders to impact global health security⁴.

50 **Increasing interspecies interactions**

51 There is compelling evidence linking the disruption of the human-animal-environment interface with
52 infectious disease outbreaks. Greater than 75% of emerging infectious diseases have been zoonotic
53 in nature, transmitted from animal hosts to humans⁵. Africa is a hotbed for zoonotic diseases
54 ranging from endemic zoonoses such as brucellosis and leptospirosis, to neglected zoonoses such as
55 rabies and onchocerciasis, to emerging zoonoses like anthrax, yellow fever, Ebola, Lassa Fever and
56 COVID-19. Key anthropogenic drivers of emerging zoonoses include increasing urbanization, armed
57 conflict between countries and deforestation. Rapid migration of people from rural to urban areas
58 often generate high density slums characterized by poor housing, lack of clean water, and poor
59 sanitation facilities. Overstrained infrastructure of urban cities like Lagos (Nigeria), Freetown (Sierra
60 Leone) and Dar es Salaam (Tanzania)⁶ that are regional transit hubs for air, land, and sea transport
61 create suitable conditions for the spread of EVD⁷ and diarrhoeal diseases like cholera. The disruption
62 of suboptimal water supplies, sanitation and hygiene infrastructure in conflict zones of Africa have
63 also amplified the spread of infectious diseases, with conflict zones recording the highest case
64 fatality rates from cholera⁸.

65 Deforestation drives disease transmission by triggering a complex array of events that force fauna
66 such as rodents and resident fruit bats to migrate elsewhere in search of food, carrying with them
67 a range of lethal pathogens like Lassa virus, malaria parasites and Lyme disease (Figure 1)⁹. For
68 example, increased malaria transmission has long been suspected of coinciding with deforestation.
69 Studies conducted in Brazil, indicate that clearing patches in the Amazon forest create the optimal
70 habitat for malaria allowing mosquitos to breed¹⁰. These activities ultimately result in a loss of
71 biodiversity within the ecosystem which is required for ecological resilience. Animal husbandry has
72 also expanded to meet the growing consumption of animal protein in Africa. The exploitation of
73 wildlife and proliferation of wet markets (Figure 1) to feed the culture of bush meat and bird
74 ingestion have increased contact with livestock and enabled spillover of animal pathogens to
75 humans¹¹. The practice of bush burning for subsistence farming in many West and East African
76 countries has displaced animal populations from their habitats which has led to seasonal spikes in
77 the incidence of zoonotic diseases¹². These diseases include those spread from primates (HIV-AIDS),

78 fruit bats (Ebola), multimammate rats (Lassa fever), camelids (MERS-CoV), and birds (highly
79 pathogenic avian influenza (HPAI)) (Figure 1). Many vectors depend on permissive climatic
80 conditions that amplify the transmission of vector-borne diseases, such as HPAI which was
81 introduced to Africa when migratory waterfowls migrated from extreme winter temperatures in Asia
82 and Europe¹³.

83

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

88

89 **Africa endorses One Health**

90 African Ministers of Health and Environment demonstrated an early commitment to One Health
91 when they signed the Libreville Declaration at the first Inter-Ministerial Conference on Health and
92 Environment (IMCHE) in 2008 and subsequently endorsed a 10-year Strategic Action Plan to scale up
93 Health and Environment Interventions in Africa from 2019 to 2029 at the third IMCHE in Gabon in
94 2018. Such collective continental endorsements have been combined with activities of organizations
95 such as the International Livestock Research Institute (ILRI) to promote more efficient, safer and
96 sustainable livestock systems across Africa. Similarly, the One Health Central and Eastern Africa
97 (OHCEA) involving eight countries in the Eastern and Central African region was established to
98 facilitate transformational multidisciplinary research, and community service in veterinary higher
99 education institutions and schools of public health¹⁴. The Africa Centres for Disease Control (ACDC)
100 has established a One Health programme with a cross-disciplinary working group to coordinate
101 disease surveillance, prevention, control, and epidemic preparedness to tackle antimicrobial
102 resistance (AMR) and zoonoses in the continent.

103 The above policy adoptions and research initiatives have catalyzed action on One Health across
104 Africa. A 2020 review commissioned by the International Livestock Research Institute (ILRI) identified
105 a total of 315 One Health initiatives across the 46 countries in sub-Saharan Africa: 101 in East Africa,
106 85 in Southern Africa, 65 in Central Africa and 64 in West Africa, with some of the initiatives
107 implemented across more than one region¹⁵. However, co-funding of One Health initiatives by
108 national governments has been poor with over 90% of the funding derived from stakeholders
109 outside the continent.

110 **One Health successes**

111 Nigeria has had some experience in implementing One Health approaches. The National Inter-
112 Ministerial Steering Committee on Avian Influenza (NISCAI) and the National Technical Committee
113 on Avian Influenza (NTCAI) set up in Nigeria in 2005 involved multidisciplinary staff from multiple
114 ministries (including agriculture and health), communicators and industry players. The One Health
115 approach gave rise to a successful multisectoral emergency action plan that led to the elimination of
116 the HPAI H5N1 in Nigeria in 2006¹⁶.

117 In Southern Africa, Tanzania and Namibia have successfully incorporated One Health approaches
118 into their National Rabies Control strategies. Namibia, in close collaboration with the World
119 Organisation for Animal Health (OIE) and with the active support of the Friedrich-Loeffler-Institut,
120 has rolled out a multisectoral rabies control strategy consisting of post-exposure prophylaxis (PEP)
121 and parenteral rabies vaccination, in addition to providing education to communities¹⁷. This
122 approach aligns with the global strategic plan to eliminate human deaths from dog-mediated rabies
123 by 2030, a collaborative effort by the United Against Rabies Alliance, consisting of the WHO, the OIE,

124 the Food and Agriculture Organization of the United Nations (FAO), and the Global Alliance for
125 Rabies Control (GARC)¹⁸.

126 In Uganda, a strategic plan for One Health guides multi-sectoral response to epidemics implemented
127 by a One Health Technical working Group with cross-sectoral representation from the Ministries of
128 Health, Animal Resources, Wildlife and Environment to oversee the One Health approach¹⁹.
129 Moreover, the strengthening of border health initiatives through training and deploying
130 interdisciplinary personnel has been instrumental in mitigating cross-border spread of COVID-19 and
131 EVD²⁰.

132 In Chad, an innovative strategy of joint livestock and child vaccination campaigns in pastoralist
133 communities has broadened access and vaccination coverage of women and children and resulted in
134 financial saving for the Chadian human and animal health ministries²¹.

135 Over the years, African-led multidisciplinary research to address One Health challenges in the
136 continent has been promoted by the Afrique One programme (funded by the Wellcome Trust) in
137 East and West Africa²². Between 2007 and 2009 the One Health approach was successfully used to
138 control the Rift Valley fever outbreak in Kenya, in part due to coordination between the Kenya
139 Ministry of Health (MoH) and Ministry of Agriculture, Livestock, and Fisheries (MALF). The Division of
140 Global Health Protection (DGHP) which was birthed by a collaboration involving the Kenya Medical
141 Research Institute (KEMRI), the Kenya Ministry of Health and the US Centres for Disease Control and
142 Prevention (CDC), is at the forefront of the development of infectious disease diagnostic capacity in
143 East Africa.

144 Since 2010, the Africa One Health University Network (AFROHUN) has provided academic support
145 for higher institutions which promote One Health approaches. The AFROHUN involves 24 veterinary
146 medicine, public health and environmental health institutions and 16 universities in eight countries
147 in Central, East and West African regions (Kenya, Rwanda, Cameroon, Tanzania, Democratic Republic
148 of Congo, Ethiopia, Senegal and Uganda)²³. The African Field Epidemiology Network (AFENET), an
149 alliance of Field Epidemiology and Laboratory Training Programs (FELTPs) established in 2005 has
150 operated in over 31 countries in Africa to strengthen field epidemiology and public health laboratory
151 capacity in order to address disease outbreaks in Africa.

152 Despite all this progress with One Health in Africa, the 2020 ILRI review identified gaps in
153 implementation. This included a lack of awareness on One Health issues such as hygiene,
154 biosecurity and AMR among policy makers and the public. Other gaps include, inadequate
155 contribution of financial, human and material resources by governments and a lack of One Health
156 policies, guidelines and strategic plans in many African countries. The review also identified weak
157 linkages and unhealthy rivalry between various sectors, poor data sharing and communication
158 among relevant sectors, and paucity of data about zoonoses to guide One Health policymaking¹⁶.

159 **Institutionalising One Health in Africa**

160 We propose a framework to guide the embedding of One Health practices in African communities
161 (Figure 2). Raising awareness and increasing understanding of One Health at all levels of society is
162 critical. Advocacy, communication and social mobilization strategies should be intensified to ensure
163 buy-in by policy makers and the public and thus catalyse collaborative and proactive One Health
164 action. While African countries have been quick to endorse the One Health approach and follow this
165 up by leveraging donor funding, African governments need to demonstrate ownership of One Health
166 processes through increased funding of One Health. Context-specific One Health guidelines and
167 strategic plans need to be adopted and implemented across Africa. Public private partnerships (PPP)

168 that promote resource sharing, collaboration, competitiveness, and economies of scale for One
169 Health should be established to reduce the financial burden on African governments. The Ibarapa
170 Meje One Health Initiative (TIMOHI) in southwestern Nigeria, a coalition of veterinarians, physicians,
171 laboratorians, pastoralists, academicians and government staff for the purpose of addressing
172 zoonotic diseases, is the type of local PPP initiative that should be encouraged.

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

176 Cross-border disease surveillance and response should be fostered through transnational networks
177 that provide regulatory frameworks and instruments including digital infrastructures to facilitate
178 identification of One Health threats. This is exemplified by the East African Community Treaty that
179 has been pivotal to preventing the spread of COVID-19 via cross-border movements of people in
180 countries like Uganda, Rwanda and Kenya²⁴. Further research and laboratory capacity building is
181 necessary to fully harness whole genome sequencing to provide real-time information on the
182 biology and evolution of infectious organisms in Africa²⁵.

183
184 One Health approaches will also help African countries contribute to the UN Sustainable
185 Development Goals (SDG). Sustainable food systems should be created in Africa through provision of
186 economic incentives, which in turn encourage communities to develop ecofriendly alternatives for
187 food security and will address SDG 2, zero hunger. Strategies that promote the integrated
188 management of the ecosystem should be prioritized in line with SDG 13, climate action, and SDG14,
189 life below water. Finally, economic interventions, political agreements, and social justice policies
190 targeted at addressing socioeconomic inequities that drive conflicts on the African continent will
191 support SDG 10 – reduced inequalities. Only by fully implementing One Health approaches will
192 Africa, and indeed humanity, effectively and sustainably prevent and respond to epidemics and
193 achieve global health and food security.

194

195 **Author contributions**

196 B.E. and A.O. conceived of the paper; A.O. and B.E. wrote the original draft of the manuscript with
197 contributions from all the authors. All authors reviewed and approved the final version of the
198 manuscript.

199 **Ethics Statement**

200 **Competing interests**

201 The authors declare no competing interests

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203 Tijesu Ojumu designed the One Health flowchart. Photo credit: Clement Meseko and Daniel Otokpa

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271 **Figure legend:**

272 Figure 1: The negative influence of humans on the ecosystem reflected by deforestation, wildlife
273 trapping and bushmeat displayed at a wet market in Africa

274

275 Figure 2: Proposed schema to guide the implementation of One Health strategies in Africa