One Health 4

Global and regional governance of One Health and implications for global health security

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The apparent failure of global health security to prevent or prepare for the COVID-19 pandemic has highlighted the need for closer cooperation between human, animal (domestic and wildlife), and environmental health sectors. However, the many institutions, processes, regulatory frameworks, and legal instruments with direct and indirect roles in the global governance of One Health have led to a fragmented, global, multilateral health security architecture. We explore four challenges: first, the sectoral, professional, and institutional silos and tensions existing between human, animal, and environmental health; second, the challenge that the international legal system, state sovereignty, and existing legal instruments pose for the governance of One Health; third, the power dynamics and asymmetry in power between countries represented in multilateral institutions and their impact on priority setting; and finally, the current financing mechanisms that predominantly focus on response to crises, and the chronic underinvestment for epidemic and emergency prevention, mitigation, and preparedness activities. We illustrate the global and regional dimensions to these four challenges and how they relate to national needs and priorities through three case studies on compulsory licensing, the governance of water resources in the Lake Chad Basin, and the desert locust infestation in east Africa. Finally, we propose 12 recommendations for the global community to address these challenges. Despite its broad and holistic agenda, One Health continues to be dominated by human and domestic animal health experts. Substantial efforts should be made to address the social–ecological drivers of health emergencies including outbreaks of emerging, re-emerging, and endemic infectious diseases. These drivers include climate change, biodiversity loss, and land-use change, and therefore require effective and enforceable legislation, investment, capacity building, and integration of other sectors and professionals beyond health.

Introduction

The emergence and spread of SARS-CoV-2, resulting in the unprecedented COVID-19 pandemic, has highlighted the weakness in public health systems worldwide. Despite the past decade's increasing focus on strengthening global capacities to prevent, prepare for, detect, respond to, and recover from threats from emerging infectious diseases,[1] the failures associated with COVID-19 have been alarming, noticeably in many well resourced states that were expected to respond much more effectively than they have.

As the global health community continues to reflect on the chain of events leading to the emergence, amplification, and global spread of SARS-CoV-2,[2] prevention of epidemic outbreaks clearly requires a much broader outlook that incorporates and unifies animal, plant, human, and ecosystem health when appropriate.[3] Several anthropogenic factors (figure) contribute to the likelihood of emergence of infectious diseases (and other public health hazards), including human and domesticated animal population growth, the climate change crisis, and land-use change[4,5] (eg, agricultural intensification, extractive industries, industrialisation, and unplanned urbanisation) that can bring wildlife populations into close proximity to humans and domestic animal populations.[6] More often than not, the brunt of these detrimental changes affects the most marginalised populations in low-income and middle-income countries (LMICs).

In the first paper in this Series, Zinsstag and colleagues[7] outline the historical and operational dimensions of a One Health approach. The approach has evolved over time and now explicitly considers health, welfare, and wellbeing within social–ecological systems, including the role of health-sustaining environments, and our sociocultural, material, and ecological circumstances.[8–10] The recently published definition[11] by the One Health High-Level Expert Panel (OHHLEP) explicitly recognises the integrative and transdisciplinary approach needed to coordinate actors from a wide range of disciplines beyond human and domestic animal health, while demonstrating the added value of collaboration by identifying cobenefits and trade-offs.[3,11]

Despite the traction gained over the past 20 years, including over the COVID-19 pandemic, there have been substantial challenges in both the operationalisation and governance of One Health.[12] Given the broad definition of One Health, several institutions, processes, regulatory frameworks, and legal instruments have direct and indirect roles in its global governance, including institutions and instruments related to human, animal (domestic and wildlife), plant, and environmental health, and those related to the trade and regulation of food, agriculture, natural resources, and medical and veterinary products.

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Key messages [Prod: bullet points seem to have vanished in this panel. Can you please put them back?]

- One Health approaches to global health security should expand beyond zoonoses and infectious diseases of pandemic potential. The entry points for One Health issues frequently begin with human behaviours, our interactions with the environment, and wider ecosystem stability. To address these points, the One Health community should bring on board environmental scientists, social scientists, and communities with lived experiences at the interface of ecosystem degradation, climate change, and marginalisation to address the divides in delivering a holistic One Health approach to global health security across academia, research, and implementation.
- A grounded theory analysis of the legal frameworks that are meant to guarantee and facilitate One Health multisectoral approaches reveal largely negative findings; the majority of the reviewed international legal instruments allow considerable flexibility in their interpretation of obligations, and they continue to uphold politically complex and poorly used compliance mechanisms in the fields of global health and global environmental governance. Conversely, treaties in international trade and finance have often had more defining roles in shaping health outcomes and are more robustly applied.
- Health-related legal instruments should be strengthened with real political commitment and protective mechanisms to ensure compliance, including addressing the economic disincentives to good implementation. Low-income and middle-income countries (LMICs) can take advantage of the slow-changing and fragmented global multilateral system by using the health-related provisions of non-health-related treaties. For example, legal instruments could include provisions for compulsory licensing, insisting more robustly on intellectual property waivers where relevant, leveraging the sovereignty principle, and pooling their resources for legal action.
- The UN Environment Programme (UNEP)'s recent addition into the Tripartite in early 2022, now known as the Quadripartite, is a step in the right direction. However, it will still need to integrate fully into activities, complementing national bridging workshops already undertaken by the World Organisation for Animal Health (WOAH), WHO, and the Food and Agriculture Organization of the UN (FAO), contributing to joint risk assessments and support for proactive One Health, and health impact assessments of large private sector land-use change projects, while providing resource surveillance data into existing systems (eg, FAO–WOAH–WHO Global Early Warning System). The operational launch of the global One Health Joint Plan of Action (2022–26) represents a clear opportunity to ensure this integration and move beyond the modest collaboration and modest achievements of the previous Tripartite configuration.
- Regionalism can create opportunities for LMICs who share geographical, biological, and infrastructural hazards but who have little political or financial power in the global multilateral system. However, care should be taken to ensure power imbalances prevalent at the global level are not simply replicated or perpetuated at the regional level.Overlapping and concurrent crises are likely to increase, and the global community should reflect on maximising yield from its interventions—flexible funding for prevention, preparedness, and response with adequate provisions around transparency and accountability should go to those countries or communities directly affected with no strings attached. For initiatives like the One Health Joint Plan of Action (2022–26) and other One Health implementing instruments, whether global or regional, the financing required to make a real impact on prevention and preparedness is in the billions (US$) per year. Funding that moves beyond subsidising a development industry and an academic industry in high-income countries and results in measurable technology transfer and self-sufficiency in LMICs is necessary. This funding should be made available with a view to ensuring access to global public health goods, human dignity, and real health-related outcomes across the Sustainable Development Goals, not through a primary focus on predetermined donor targets derived from economic and health security self-interest.

In this Series paper, using a grounded theory approach and in-depth case studies, we focus on four challenges to the global governance[13] for One Health: silos among disciplines and professions; weaknesses in the interfaces of global health public goods and the international legal system; asymmetrical power dynamics, regionally and globally; and flaws in crisis-driven financing. The detailed methods and results of our content analysis of 25 international legal instruments are included in the appendix. The case studies discussed in the panels show the interplay of these issues. Finally, we offer 12 recommendations to address these challenges.

See Online for appendix

Challenge 1: sectoral, professional, and institutional silos in One Health

At the global level, there are many agencies and actors with a remit relevant to One Health, including those directly related to human, animal, plant, and environmental health. Despite the theoretical emphasis on One Health offering a holistic approach, politics and professional legacies of dominance have shaped One Health networking and partnerships, as detailed in the second paper in this Series.[14] As such, there have been substantial challenges in attempting to break down silos and foster collaboration between sectors and between institutions. The establishment of the Tripartite in 2010,[15]

a collaboration between WHO, the Food and Agriculture Organization of the UN, and the World Organisation for Animal Health, was a key step towards promoting cross-sectoral collaboration and integration at a global scale. Initially, the Tripartite existed to address health threats at the human–animal–environment interface and prioritised zoonoses, food safety hazards, and antimicrobial resistance. Notably, in its first decade after establishment, the Tripartite did not include sufficient representation from agencies with a role in the environment, ecosystems, and wildlife. Issues such as climate change, land-use and water-use management, biodiversity, and wildlife health are all amenable to a One Health approach,[16] important in their own right, as well as being proximal factors that contribute to the likelihood of emerging infectious diseases (figure).[4,9] Although specialised UN agencies and programmes existed in these fields, they often acted as secondary implementing partners to the Tripartite rather than alongside it in steering and leadership roles.

The recent addition of the UN Environment Programme (UNEP), in early 2022, to form the Quadripartite has been a much welcomed and necessary step towards improving the coherence and implementation of One Health. Encouragingly, the Quadripartite has now developed a One Health Joint Plan of Action (2022–26) with six ambitious action tracks to strengthen coordination between the four agencies and support global efforts to operationalise the approach.[17] This plan will require a step-change in the funding envelope (in the order of billions of US$ per year) to achieve the desired global health security goals and move beyond the modest success of the previous Tripartite configuration, particularly on environmental issues and drivers of disease.

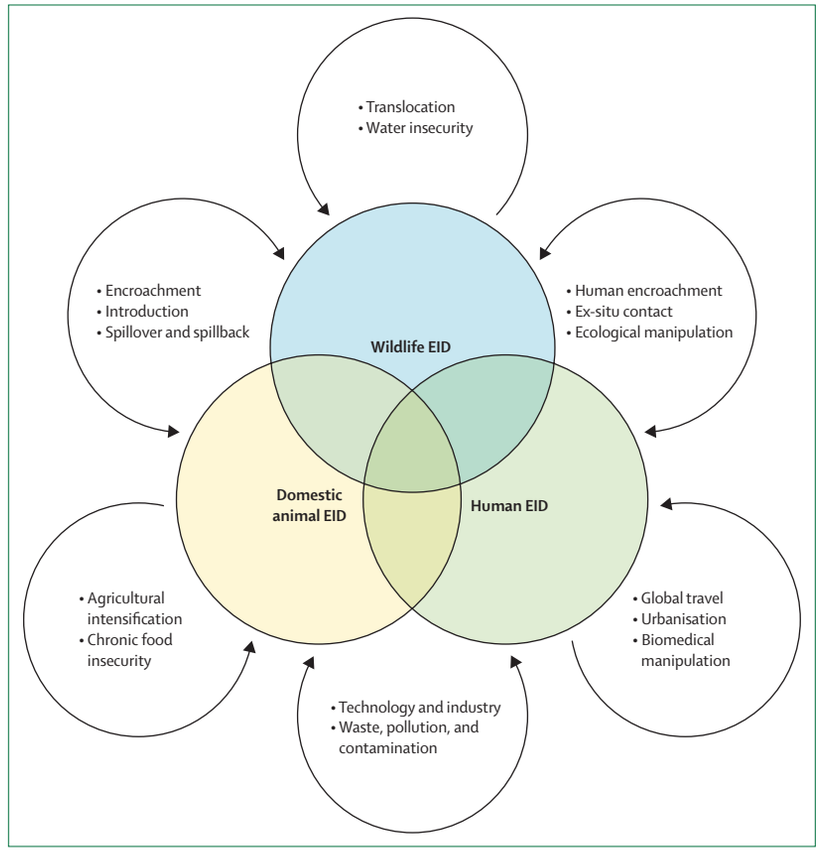

Figure: **Factors contributing to EIDs in animals (domestic and wildlife) and human populations**
EID=emerging infectious disease. Adapted from Daszak et al,[4] by permission of the American Association for the Advancement of Science.[4]

Despite the economic slow down caused by the current pandemic, urbanisation and industrialisation are continuing rapidly worldwide through grand initiatives such as China's Belt and Road Initiative. Ongoing degradation of air, soil, and water quality through so-called business-as-usual large-scale industrial activity, and inappropriate waste and hazard management (including that associated with pandemic response activities), continue to threaten health across species and the environment. One key role that UNEP and the broader environmental sector can have is to firmly support improving and embedding environmental and health impact assessment into large-scale industrial projects. This assessment should include components relating to the risks of disease emergence and propagation through land-use change and interventions to prevent or mitigate them. As such, groupings such as the Quadripartite should engage with development banks that provide financing and set standards for industrial projects, with relevant UN agencies that support them (eg, UN Industrial Development Organization, UN Human Settlements Programme, and UN Development Programme), and with sector-specific industry bodies that embed and encourage best practice (eg, the International Association of Impact Assessment).[18] Some success has already been achieved in this area with the collaboration between the International Association of Oil & Gas Producers and the International Petroleum Industry Environmental Conservation Association, forming a global oil and gas industry association, integrating modules on emerging infectious diseases into the most recent edition of their standards for health and environmental impact assessment.[19] The evidence base for cross-sectoral action should be strengthened, and new global initiatives launched in the wake of the pandemic, such as OHHLEP and the Quadripartite One Health Joint Plan of Action (2022–26), can have an important role in undertaking and promoting this work.

Historically, the work of UNEP, which anchors global environmental issues, has had mixed results in engaging on health matters. Structural issues with its governance, finance, and status have resulted in ineffective coordination and a fragmented global system, undermined by other institutions and agendas.[20] Despite these structural challenges, UNEP has collaborated with the Tripartite on some priority areas, such as antimicrobial resistance,

and has been successful in establishing and monitoring some health-related international environmental laws in the past, most notably the 1987 Montreal Protocol (to phase out ozone-depleting substances) and the 2012 Minamata Convention on Mercury.[20] Part of the challenge in trying to strengthen the governance of environmental health issues through the global multilateral system is the centrality of trade, production, finance, and market actors in environmental governance and politics.[21] Often transnational companies are both producers and regulators of environmental problems, meaning that an exclusive focus on end-result environmental damage ignores the upstream politics, industry actors, and market factors that produce them in the first place. The laws and frameworks governing downstream global public goods in One Health, such as international regulations of food safety, animal welfare, and food security, mirror these same politics and remain subordinate to wider trade objectives in agrobusiness, for example. For its part, the One Health Joint Plan of Action (2022–26) will attempt to address these challenges through an action track dedicated to sectoral integration, collaboration, and coordination.[17] However, how well these solutions will be resourced and actively supported remains to be seen.

The implications are potentially severe for all nations; the lack of integration explains, in part, the mismatch in performance of even well resourced countries in managing COVID-19. Had more consideration been given to the voices of social scientists and grassroots organisations, spread in marginalised or socially vulnerable communities without the social or financial capital to isolate and protect themselves could possibly have been better mitigated.[22] Without overcoming these institutional and sectoral silos, One Health governance will remain patchy and incomplete, and will exacerbate existing health inequalities.

Challenge 2: the international legal system and state sovereignty

The international legal system is considered a powerful tool in the governance of global issues, with the potential to enhance health and influence its socioeconomic determinants.[23] Several legal instruments exist with a direct or indirect role in One Health, and their bindingness and stringency have been explored in the appendix (pp 4–6). Overall, our analysis shows that the power of a legal tool remains subject to which sector it regulates and what instruments are available to enforce judgements. Furthermore, legal tools can be used to provide opportunity for radical change; alternatively through their years-long development processes and procedural intricacies, legal tools can merely delay substantive action.

International trade law generally succeeds more consistently in shaping economic matters, while health and social justice laws consistently do not achieve social progress.[24] Trade treaties offer politically appealing gains; are backed by strong global institutions for monitoring, evaluation, and compliance; and have a powerful lobby of non-state actors to support their goals. Contrastingly, international legal instruments for health often do not substantially advance health matters due to their economic disincentives, poor compliance and punitive action mechanisms, a reliance on discretionary actions, and a scarcity of financing arrangements to support their successful implementation.[25]

The extent to which an international health treaty (human, animal, or plant) affects trade is linked to its success. Treaties that financially penalise states, despite good implementation, show the conflict between national interest and a global public good. For example, there are financial losses associated with the loss of travel-related business or animal trade restrictions when a state reports an infectious disease outbreak in accordance with the International Health Regulations (IHR).[24,26] However, prioritising the national economy above IHR commitments might have negative health externalities including suppressed reporting, delayed action, diluted outbreak response, and eroded public trust. These perverse incentives should be acknowledged and prevented with timely and relevant protections,[27] which could include the guaranteed provision of speedy assistance (eg, a committed vaccine supply) or the disbursement of sufficient emergency funding to affected states without strings attached. These mechanisms can reduce economic disruption and help secure investor confidence in early containment, thereby ensuring market stability. Without linking positive economic incentives to implementation, global health-related treaties could undermine their own objectives. The proposed WHO pandemic preparedness treaty might suffer the same challenges as the IHR if it ignores some crucial reasons for poor compliance and merely adds additional administrative and financial burdens to the parties and institutions implementing the treaty.[28]

Economic pressures can also be strategically applied to sanction non-compliance, as is used more commonly in trade treaties. For example, within the World Trade Organization (WTO), member states work together to assess breaches of WTO law when friendly negotiations stall between disputing parties. However, the strength of an actor in international law remains as important as the discipline being regulated. The effect of this strength is well shown in the appendix (pp 4–6) and in panel 1, which focuses on the compulsory licensing of pharmaceuticals, a public health provision within a WTO legal instrument known as the Agreement on Trade-Related Aspects of Intellectual Property Rights.

As our analysis shows, states continue to erode the legitimacy of the international legal system by choosing to avoid or actively contest it at whim, and despite the theoretical threat of economic sanctions (panels 1, 2; appendix pp 4–6). At the same time, this flaw presents an

opportunity to exploit international legal instruments in the interests of a One Health approach. Treaties that show consistent alignment and positive engagement, largely those in trade, can be leveraged for wider global public goods when selectively used at the right time by a group of states working together. LMICs can pool their legal expertise and finances to sustain disputes, establish consistent applications of legislation regionally as foundation for new customary law, and opportunistically use emergency provisions to establish an evidence base for longer-term change. LMICs should also exploit the gap in regulation on wildlife health and trade by becoming early advocates for it to shape the landscape in their favour. Additionally, One Health practitioners should expand their scope to legal instruments that are useful but largely ignored, such as environmental treaties that contain health provisions, of which there are many (eg, the 2012 Minamata Convention on Mercury). Even environmental treaties with no explicit health-related provisions could still have positive effects on global governance for One Health[51]—eg, through air and water pollution reduction measures. Various databases and

Panel 1: Legal tools to support local and regional manufacturing of diagnostics, vaccines, and therapeutics

For less economically developed states, without the capacity to produce their own diagnostics, vaccines, and therapeutics, or compensate others for theirs, the avenues to expand access to medicines, whether for humans or animals, remain insufficient (as shown in case study 1; panel 2).[29] Without the help of manufacturing states, such as India, their security relies on collaborative goodwill in the spirit of the Doha Declaration or improving their bargaining power through expensive long-term investment in local supply chains. From a One Health perspective, such long-term investment will probably yield cross-sectoral benefit and will offer shared use for both human and animal health diagnostics,[30] vaccines, and therapeutics that might have similar raw materials, active pharmaceutical ingredients, excipients, machinery and production processes, packaging materials, and even knowledge bases.[31,32] For low-income and middle-income countries with uncompetitive pharmaceutical industries, many of these listed items are imported, before being finished into their final market-facing product more locally, with additional costs associated such as freight, customs, and value-added tax increasing overheads.[33] Nonetheless, when done correctly, local manufacturing can be more cost-competitive than imports. However, this process requires both scale and use to be held constant; pharmaceutical talent being skilled and retained; and strong coordination and regulation among ministries of health, agriculture, finance, industry, and trade.[34]

For continents like Africa, regional manufacturing hubs could offset the substantial investment needed in scaling up its overall manufacturing capacity by providing economies of scale. This regionalised approach can also feed into wider pharmaceutical regulation and harmonisation strategies, such as the newly signed Africa Medicine Agency treaty.[34,35] These regional hubs combined with an effective regional regulator could also provide solutions to uniquely local problems, such as counterfeit or specific substandard therapeutics that are disseminated through informal networks, creating sustainable internal markets at affordable prices, and targeting endemic diseases that would be otherwise ignored.[36,37]

As COVID-19 has shown, times of acute crisis can provide the political impetus and pushback in an uneven multilateral system, potentially influencing international customary law. India and South Africa's application for intellectual property waivers relating to COVID-19 technologies in late 2020, supported by the majority of countries, was stalled at the World Trade Organization (WTO) with fierce opposition from the EU and the UK in particular. The argument put forth by opponents of an intellectual property waiver is that mechanisms such as compulsory licensing are already available to improve access to medicines under the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights. However, the history of compulsory licensing use would suggest that it remains a complex and administratively burdensome procedure (particularly for medicines for export), with limits on marketing exclusivity and data sharing, and an inability to address technology transfer. Examples of these issues are outlined in case study 1 (panel 2). By contrast, an intellectual property waiver would overcome many of these issues, without the delays of individual product-by-product compulsory licensing and the procedural burdens linked to exporting to countries with underdeveloped manufacturing capacities.[38]

WHO, the Government of Costa Rica, the Medicines Patent Pool, and other partners have launched the COVID-19 Technology Access Pool, initially intended to support technology transfer, expanded manufacturing, and access to medical tools in low-income and middle-income countries.[39] The first and only licensing agreement, since it was established in 2020, has been for COVID-19 serological antibody technology from the Spanish National Research Council, under a global, non-exclusive, and transparent voluntary license.[40,41] Although this move from the public sector is promising, it should be accompanied by a call to encourage large corporations to do the same.

The momentum of the Trade-Related Aspects of Intellectual Property Rights waiver, technology transfer, and compulsory licensing could provide an opportunity to invest and scale up local and regional manufacturing capacity in low-income and middle-income countries; over time, this action might guarantee both a reliable local supply and bargaining power on the global stage. Meanwhile, countries should not expect this opportunity to last forever in an increasingly complex web of trade relations, intellectual property law, and innovative research and development elsewhere.[42,43]

reports summarise and highlight best practice from the application of such treaties—eg, the Health and Environment Interplay Database or UNEP's Annual Law Division Report.[52] Given the limitations of global health-related treaties, decision makers might find both international trade and environmental law a useful cross-disciplinary tool to secure political commitment for One Health.[53]

The sovereignty principle of nation states should not always be perceived as a hindrance; it can redress power imbalances between countries by allowing less powerful states to identify more favourable legal tools, venues, and jurisdictions with which to engage, for example, to contest a law on the basis of an alternative binding law.[54] An example of the use of this principle is Indonesia's claim to viral sovereignty under the Convention of Biological Diversity, contesting the obligation to share biological samples under the revised IHR 2005. As retaliation to unfair and exploitative practices by some high-income states and pharmaceutical vaccine developers during the avian flu crisis,[55] Indonesia successfully argued that the viral samples were its sovereign property under the Convention of Biological Diversity and therefore could over-ride the IHR. This discussion led to an intergovernmental process that eventually produced the Pandemic Influenza Preparedness Framework, a more equitable and sustainable attempt at sample-sharing and vaccine manufacture.[56] Indonesia's ability to take advantage of the misalignment between international treaties highlights the contemporary challenges and opportunities in governing One Health through the fragmented global multilateral system. Thus, although sovereignty principles pose a great challenge to the international legal system, with the right legal expertise they can potentially empower smaller states to challenge the dominance of high-income countries in health security. This paradox is aptly summarised by Suárez and Aubry:[57] "Global governance is a relatively recent development and a highly fluid and contested game that is determined more by power politics than by law. This explains the existence of soft-law instruments that are powerful mainly because powerful actors impose them, while some hard-law instruments tend to be weak because the powerful refuse to abide by them."

Challenge 3: priority setting in the global multilateral system and regional economic communities

In relation to One Health and global health security, health threats have to cross multiple borders, and therefore regions, unchecked and unmitigated, to become politically and economically relevant enough for global discussion. Regionalism in this field is therefore unsurprising given the importance of shared geography in One Health; states might share environmental risks, cultural practices, cross-border security risks, infrastructural limitations, and the same political and economic vulnerabilities in their relationships with other actors on the global stage.[58–61] Furthermore, more immediate legacies of people, and shared histories and resources can provide stronger cultural and political pushes towards commitment and accountability.[61]

One similarity between regionalism and internationalism is the challenge posed by the asymmetry of power, finance, and information between the states represented in multilateral institutions.[62,63] Decision-making bodies that require majority vote operate very differently to those where only a select few retain permanent veto power. States with veto powers do not need to compromise with others, although there is diplomatic benefit in doing so. States without such powers need numbers on their side and need to appease many. Because funding remains a key priority for many LMICs, wealthy states in high-income countries have leveraged and might continue to leverage this need for financial assistance to set their own agendas at international levels.

In One Health, this need has meant that emerging infections and zoonotic diseases with pandemic or epidemic potential have been prioritised above endemic infectious diseases and other neglected diseases (in both humans and animals) that disproportionately burden LMICs. This prioritisation of zoonoses has tended to be combined with a focus on surveillance, detection, and containment of emerging pathogens rather than prevention, in line with the perception that these activities are primarily to protect populations in high-income countries. Like global health and international development more broadly, One Health is subject to the same long-standing tensions in reconciling country priorities, donor expectations, and global standards.[64]

For LMICs, particularly for small states, forming alliances and blocs with political allies, economic partners, or regional neighbours is an important way to strengthen capacity and power internationally. For example, the Africa Centre for Disease Control and Prevention (Africa CDC), a specialised technical institution of the African Union, mobilised an early continent-wide response to COVID-19.[65] By Feb 22, 2020, just 1 week after Africa reported its first COVID-19 case, health ministers from African Union member states had met and adopted the Africa Joint Continental Strategy for COVID-19 Outbreak. Africa CDC, African Union member states, WHO Regional Office for Africa, and other partners then established the African Taskforce for Coronavirus Preparedness and Response, responsible for implementing seven key priorities, from surveillance to communications to stockpiling.[66] Despite initial concerns that African nations were the least prepared for the COVID-19 pandemic, many African countries have been relatively successful in containing the virus thus far.[67]

Panel 2: Case study 1: compulsory licensing—a legal tool designed to fail?

Compulsory licensing is a legal way of expanding access to medicines under the World Trade Organization (WTO) Agreement on Trade-Related Aspects of Intellectual Property Rights.[43] It involves the issue of a license by a government for a third-party manufacturer to develop generic equivalents of patented pharmaceutical products. This issue usually occurs in the interest of public health during a health emergency or due to unreasonably high prices for in-demand patented drugs. Historically, most of the successful attempts to pursue compulsory licensing have been for the supply of antiretroviral medications for the treatment of HIV/AIDS in low-income and middle-income countries.[44] Even when compulsory licensing does not materialise, attempts to pursue it directly by government or through pressure from non-government entities can still yield positive results, including successful price negotiation with the original holders of the patent or the issue of a voluntary license instead.[29] Nonetheless, the law is designed in favour of strong patent protection and tends to favour alternative outcomes to compulsory licensing at all costs, including price negotiation or even legal action at international level.[42,45]

As the COVID-19 pandemic has shown, the pharmaceutical industry's argument that compulsory licensing and intellectual property waivers reduce incentives for future drug development does not stand up to scrutiny. In particular, COVID-19 vaccine development was a direct result of investment and breakthroughs from publicly funded academic institutions (eg, the US National Institutes of Health and Oxford University) with most of the risk borne by the public sector and taxpayers.[46,47] Furthermore, the private sector was protected from this risk through guaranteed purchasing of developed vaccines and indemnified by governments against legal action from any adverse effects. Meanwhile, all profits from vaccine sales are awarded to the pharmaceutical companies.

The perceived economic losses to established pharmaceutical manufacturers, usually based in high-income countries, from the use of compulsory licensing elsewhere have been used to threaten competitor states with unfavourable terms in other economic and political negotiations. In such cases, less developed countries have had to balance access to medicines with their wider diplomatic and economic needs. They might feel obliged to comply with the coercive tactics of countries wielding greater power on the global stage.

For example, despite Colombia's threats to issue compulsory licensing in 2016 for the leukaemia drug Glivec (Novartis, Basel, Switzerland), the country opted to pursue a 44% price drop instead. Novartis claimed there were other generics freely available to the Colombian market, while the government claimed Novartis had thwarted those offerings through threats to sue generic manufacturers for patent infringement.[48] The fraught negotiations between the nation and the patent holder were mired for several months; they included a formal threat of legal action against the Colombian Government in an international arbitration tribunal for breach of a separate investment treaty with Switzerland as well as an indirect suggestion by concerned embassy officials in the USA that such unilateral moves could threaten the USA-backed Paz Colombia Initiative peace efforts, an upcoming bilateral free trade agreement, and Colombia's ascension to the Organisation for Economic Co-operation and Development.[48,49] Under such pressure, and the potential loss of US$450 million, Colombia had to yield.[49]

Despite its experienced pharmaceutical sector and strong legacy of generics production and export, even India has only once issued a compulsory license for domestic use. Although India can deliver on any of its threats to produce a generic product, pressure to fully comply with wider intellectual property rights systems and to maintain a predictable investor-friendly and research-friendly economy has resulted in infrequent attempts at compulsory licensing.[50]

Perversely, the race for treatment for COVID-19 has seen several developed states attempt to secure the patented antiviral remdesivir for their populations through legislation that aims to facilitate compulsory licensing; sometimes these have been the very same states that have historically warned against its use.[43] Thus, powerful nations are willing and allowed to undermine intellectual property rights in the interests of their public health emergencies. Incentives in the pharmaceutical industry should move beyond patent protection and towards measures that offer compensation without threatening access to medicines. Unsurprisingly, alternative mechanisms, such as voluntary patent pools, have had poor success due to their voluntary nature and the pressure of vested interests. Clearer mechanisms for all countries to invoke their rights under the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights equally and fairly, and to be protected from threats of punitive actions by high-income industry stalwarts, should be ensured hrough binding obligations, committed leadership, and solidarity from other states.

The COVID-19 pandemic appears to have shifted the balance; countries such as India and South Africa that have proposed (in October, 2020) the use of some of the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights have found support from a wide range of states recently, from Bolivia to Egypt, and regional blocs such as the African group at the WTO. Empowering a wave of support, particularly from regional economic blocs, can apply a sense of pressure and urgency to changing the intellectual property environment to better serve public health; nowadays, support for the adoption of emergency intellectual property waivers represents a key step in this direction.[38] Conclusively, an acknowledgment that intellectual property needs to change and will change, with or without high-income players, should be boldly and consistently declared by all sides.

Panel 3: Case study 2: One Health and regional health security—politics and governance of shared water resources in the Lake Chad Basin

The Lake Chad Basin is situated in northern central Africa, centred around Lake Chad, a freshwater body providing sustenance to more than 30 million people in the populations of its four surrounding countries (Chad, Cameroon, Niger, and Nigeria).[67] Although now partly recovered from shrinkages in size due to severe droughts in the 1970s and 1980s, pressures on local resources have intensified. This pressure can be attributed to increased migration into the basin (both forced and voluntary), poorly planned upstream hydrological and agricultural projects, climate change, and increasing militarisation.[70] An estimated 10·7 million people in the area require humanitarian assistance, with 5 million acutely food insecure.[67] Joint management of water resources therefore remains of paramount importance to regional health security.

The Lake Chad Basin Commission (LCBC) was originally set up in 1964, to coordinate access and use of resources in and around the lake.[41,71] Initially composed of the aforementioned four countries, it has since expanded to include the Central African Republic, Libya, and four observer countries (Sudan, Egypt, Republic of the Congo, and the Democratic Republic of the Congo).[72,73] Members of the LCBC have acceded to a legally binding Water Charter in 2012, which aims to address fair water-use management; establish rules for surrounding wetlands and fish stocks; maintain water quality; prevent water-related disease and ecological harm; harmonise monitoring, evaluation, and communication tools; and support civil society participation in the aforementioned aims.[74] Failure to comply with the legally binding Water Charter can result in political and legal ramifications.[72]

However, the LCBC has met with political and technical limitations in its ability to manage the complex situations present in the basin area. It is a political body straddled between African Union Regional Economic Communities that represent west African states and central African states, and it should therefore contend with competing economic interests and low-resource pools to operate, frequently relying on funding raised through international multilateral mechanisms instead.[74,75] Sustainable economic development has not materialised, and the LCBC is mainly notable for providing a high-level platform for cross-border military cooperation, including joint military efforts against militant groups such as Boko Haram, through its Multinational Joint Task Force.[76]

The political interest in managing the securitisation of the area reflects the interests of the region's hegemonic powers. Nigeria remains the most influential member in the LCBC—it contributes to nearly half of the Commission's operating budget, commands the Multinational Joint Task Force, and has supplied all nine Executive Secretaries in the Commission's history.[74,77] Although the LCBC is supervised and controlled by a Council of Ministers, and directed by heads of state at biannual summits, its decisions are executed by a centralised Executive Secretariat where power is ultimately rooted in the personality and agenda of the Executive Secretary.[74] As a result, Nigeria has had key influence in policy, agendas, and settlements, and has historically tried to maintain that sphere of influence.

The regional hegemony by Nigeria has also driven support for panacea technical solutions in their favour, such as the Oubangui Interbasin Water Transfer project—an ambitious and expensive 2400 km long canal construction to replenish Lake Chad to the cost of roughly US$14 billion, with support from Italian and Chinese engineering companies.[74,78] This project would re-establish a historical shoreline for Nigeria, allowing for new agricultural and fishing opportunities and presenting a politically attractive, visible, and marketable technical solution, despite the governance challenges it masks and might perpetuate.[74,79,80]

The climate-conflict trap in the region has only exacerbated governance challenges for the LCBC. High rainfall and wide temperature variability have made it difficult for pastoralists and their livelihoods, pushing them closer to urban areas. This migration has brought them in conflict with farmers or into contact with armed opposition groups that provide the promise of financial security. Food and water scarcity is then compounded by those forcibly displaced by conflict, and by military and opposition group restrictions on the movement of peoples.[70,78] The historical failure of the state to provide basic services, allowing such issues to flourish, undermines the legitimacy of any future governance mechanisms in a region where social trust is weak, and corruption and human rights abuses abound.[70] The issues are too broad to be tackled by the mandate of the LCBC alone, which cannot provide the climate-sensitive economic packages that would improve the adaptive capacity of the local population.[75,81] These packages should ideally come from national ministries or regional economic bodies, although these bodies also have their own funding, governance, and infrastructural challenges.[77]

Despite many challenges, the LCBC has shown efforts to address longer-term recovery and resilience in their Regional Stabilisation Strategy.[76] In 2019, $60 million was raised by UN Development Programme for the strategy, with smaller sums of funding provided by several European countries.[82,83] The ultimate cost-effectiveness and cobenefits should not be ignored, where maximum yield of One Health-focused interventions on integrated water resource management, climate resilience, social cohesion, and peace building can dramatically improve overall availability of food, health care, and basic human rights, while reducing the associated expenditure in tackling conflict and insecurity.[70] With substantially more funds generated for a climate-sensitive and market-sensitive package of interventions, the LCBC has real potential to secure regional health security for some of the world's most vulnerable communities and continue propagating the successes of both technical and political regionalism.

Beyond COVID-19, regionalism could support One Health goals in the long term through pooled power and resources, such as standardising approaches to capacity, building national public health institutes, manufacturing capacity, and developing multidisciplinary workforces. Despite some successes in Africa that are worth applauding, such as Kenya's well established Zoonotic Disease Unit, most of these efforts are still funded by external donors and thus heavily influenced by their priorities. For example, donor-sponsored zoonoses prioritisation processes in sub-Saharan African countries resulted in highly pathogenic avian influenza being the most highly prioritised (89% of countries), despite the disease having a minimal disease burden (in terms of morbidity, mortality, and prevalence) or substantial economic impact in any of the listed countries.[68] Until domestic and regionally pooled financing becomes more readily available, sustainability and a continuing battle over priorities will remain enduring challenges.

Regionalism, however, is not a panacea without failures or risks. Many regional institutions within LMICs are impaired by poor institutional capacity building, destabilising members, and the aforementioned emphasis on extraversion to draw external funding flows rather than prioritising local needs.[69] In case study 2 (panel 3) on the Lake Chad Basin Commission we present some of the challenges of regionalism and how it can affect health security, particularly with the chronic and dangerous mix of climate change, conflict, militarisation, and sociopolitical imbalances at community and leadership levels. With the prime solution offered being a hugely ambitious and costly technical replenishment project using channelled water from the Congo Basin, this case study shows the complexity of issues relating to shared resources and priority-setting in regional organisations. Despite the many challenges and setbacks over the decades since its creation, the Commission's relative success shows that it has potential to leverage large-scale cooperation, even when the political will to apply more horizontal programmes remains variable.[30]

Panel 4: Financing response to concurrent complex emergencies—the nexus of food and health security

Food security and food safety globally remain a major risk to global health security: in 2021, 345 million people were acutely food insecure (a rise from 135 million in 2019) across 55 countries and territories, and hunger has risen to 828 million people worldwide.[94] This food insecurity has been further exacerbated during 2022, with food price rises as a result of war in Ukraine. Access, availability, safety, and nutritional values of food provisions show substantial variations across regions,[95] and are susceptible to conflict, insecurity, and economic shocks, as well as events such as drought, the desert locust plague, and COVID-19. As such, recovery funding should take into account the nature of these concurrent crises and the vulnerabilities they amplify. It should consider the calls that have already been made to embed food security in social protection systems in food-crisis-prone countries, to preserve crucial humanitarian support, to scale up support for supply chain stability, and to continue to monitor food security in real time.[95] Multilateral mechanisms that provide resources directly to states should allow them to adapt response funding from previous and current crises to address overlapping ones. Recovery should be holistic, with coordinated measures across regional and global structures that govern agriculture, food security, climate change, and trade.[3] At national levels, local ministries will have to work together on cohesive government strategies for food security and safety, and health security, that are strengthened by One Health links that already exist between agriculture and veterinary medicine. This multi-sectoral coordination should allow new links to develop, which integrate human health practitioners, environmental scientists, meteorological services, and social scientists. Pegging these strategies against human nutritional outcomes, and animal health, climate change mitigation, and economic outcomes will ensure alignment and synergy towards true One Health, taking into account the momentum and the range of the Sustainable Development Goals.[3]

Challenge 4: underinvestment in prevention, mitigation, preparedness activities, and infrastructure—harmonising and integrating strategies

Within global health security, most funding is reactive in response to outbreaks, such as avian influenza, severe acute respiratory syndrome, and Ebola, in a "cycle of panic and neglect"[84,85] that often means prevention, mitigation, preparedness, and recovery activities are neglected. Funding sources and streams are patchy overall, both within nations and from external donors, across a range of key One Health issues. In the same way that there is longstanding recognition of the value of investing in broader health system strengthening, global health security should recognise the need to strengthen environment and animal health systems in the selfish interest of human health. Evidence of the chronic underinvestment in health systems was unfortunately shown during the Ebola virus outbreak of 2014–15, at a devastating cost to human life. Attempts to redress this underinvestment have been modestly successful but still have far to go. For example, in 2016, the World Bank launched the Regional Disease Surveillance Systems Enhancement (REDISSE) programme in west Africa, aiming to develop the necessary technical infrastructure, laboratory capacity, and trained staffing needed for the surveillance of animal and human infectious diseases.[86] The programme finances risk reduction, largely through loans, with some positive outcomes, but is yet to show sustained success. Similarly, Africa CDC has established the Regional Integrated Surveillance and Laboratory Network (RISLNET) to coordinate and integrate public

Panel 5: Case study 3: no way out? The overlapping crises of desert locust infestation and COVID-19 in sub-Saharan Africa and southwestern Asia, 2019–20

The 2019–20 east Africa and southwest Asia desert locust infestation destroyed large expanses of pasture and cropland. Although locusts do not harm humans or animals, a single 1 km² swarm can decimate an expanse of crops that would have fed 35 000 people. Consequently, the recent infestation has resulted in an acute nutrition emergency and jeopardised the food security of 25 million people across west Africa, the Sahel, the Greater Horn of Africa, and southwestern Asia.[91]

For many years, the Food and Agriculture Organization of the UN (FAO)'s Desert Locust Information Service, working together with national Locust Information Officers, has had rigorous monitoring measures for nations on the endemic front line of locust invasions, including producing daily bulletins and 6-week forecasts, and operating an early warning system for desert locust plagues.[96] However, extraordinary wet weather events in the Indian Ocean, secondary to climate change, have allowed back-to-back locust swarms to form and breed from 2018 onwards, migrating westwards from Asia to Africa. They have also allowed the crises to prolong, minimising recovery time between infestations and making previously consistent forecasting highly unpredictable. In some nations, such as Kenya and Pakistan, the recent outbreak represents the first locust plague in several decades. Extreme weather events continue to jeopardise harvesting, fishing, and pastoral conditions throughout these regions.[96,97] This added challenge comes on a background of chronic global health security risks in these areas, including childhood malnutrition, infectious disease (eg, meningitis in the African meningitis belt region and malaria), pockets of armed conflict, and natural disasters. The upsurge of migration across areas in east Africa where desert locusts are less common has applied pressure to already fragile states that are largely underprepared and underfunded with poor access to biopesticide control.[98]

Furthermore, the COVID-19 pandemic has weakened the ability to contain this crisis by disrupting the movement of migrant agricultural labour, pesticide product supplies, and even humanitarian packages due to requirements for social distancing and movement restrictions.[99] The pandemic has further impaired the availability of funding to handle such shocks, due to the reprioritisation of foreign aid by states towards pandemic control. The effects of economic standstill and recession, including mass unemployment, have reduced the purchasing power and crisis resilience of individuals and states alike. Substantial crop losses that have occurred have only further contributed to malnutrition, hunger, surging food prices, and natural resource conflicts.[91,95]

More than 1 million hectares of land have been treated with ground or aerial pesticide sprays, but the crisis is far from over. The FAO has requested US$121 million from the international community to manage this issue, but only $72 million is currently funded (as of December, 2020). The World Food Programme estimates that long-term recovery costs could exceed more than $1 billion; elsewhere conservative estimates by the World Bank for locust losses within the Greater Horn of Africa alone reach $8·5 billion.[91] Although the World Bank has approved $500 million for programmes aimed at safeguarding livelihoods and promoting recovery, the ability of this financing to mitigate the long-term damage of overlapping crises is low.[91,97] There have been some innovative local attempts at preserving the integrity of the food supply chain in the short term, such as a successful government-endorsed pilot project in Pakistan in June, 2020, where local farmers were paid to collect locusts overnight for conversion into chicken feed, a project also mimicked by a private start-up in Kenya. However, these initiatives remain of small scale because they cannot rely on locusts collected from areas where pesticides have already been used and where cash-strapped national authorities have low funds for reimbursing collectors.[100,101] These initiatives also might represent perverse incentives for ongoing crises should they become the only route to financial support for deprived populations in times of famine or food scarcity. Second-order consequences of conditional funding should be considered in the long term, although they should not dissuade innovation that aims to be multifunctional and cross-sectoral in One Health. In the meantime, however, the increasing evidence of the value of direct cash transfer to socioeconomically marginalised households, allowing for both flexibility and dignity in its use, should be emphasised to financial donors to ensure access to basic goods on the ground.[102,103] Response financing should move beyond donor targets or predetermined thresholds set by proprietary modelling software.

health laboratory, surveillance, and emergency response assets, and to support prevention, rapid detection, and response to current and emerging public health threats within defined geographical regions of Africa.[87] RISLNET facilitates close networking among national public health institutes, academic institutions, public health laboratories, and veterinary networks for the development and implementation of regionally appropriate plans for health security. Currently, this networking is financed by the World Bank's Africa CDC Regional Investment Financing Project, but to sustain and build on its success, initiatives like RISLNET need further financing support from African Union member states themselves.

Furthermore, the substantial gap between requirements, commitments, and disbursements is evidence of the challenge in relying on donor countries' willingness to finance response and recovery. The Ebola Recovery Tracking Initiative, a partnership between the governments of Guinea, Liberia, Sierra Leone, and various UN agencies, calculated that the total assistance required after

Ebola would be US$9·1 billion. Pledges of $4·5 billion were made, but they only materialised as $1·8 billion of commitments and $1·4 billion of disbursements.[88]

In response to this challenge, the World Bank established the Pandemic Emergency Financing Facility (PEFF)[89] as a mechanism to quickly release funds to the poorest countries in the event of a pandemic. By using pandemic bonds, the World Bank has brought in money from private investors, with the private sector taking on the pandemic risk and donor countries paying the interest of 10–12% each year that is paid to investors for assuming this risk. During the COVID-19 pandemic, the PEFF insurance window (which gives coverage of up to $500 million) was used with modest success, for the first time, to allocate $195·84 million to 64 countries in April, 2020—a paltry sum given the substantial ongoing costs associated with the pandemic response. By contrast, the WHO's COVID-19 Response Fund, which relies on voluntary contributions from governments and other agencies, had estimated a need for $1·96 billion, received $0·99 billion, and was awaiting $544 million (as of July, 2022).[90] One of the difficulties in relying on the private sector to finance global health security is that the predetermined disbursement criteria depend on the World Bank's contract with private investors and their priorities, rather than measures of impact on the population.[91,92] Given the opaqueness of these contracts, and the fact that any associated surveillance or modelling could be considered proprietary, it is difficult for professionals or civil society to challenge these decisions.

The African Risk Capacity—established by the African Union in 2012 as an index-based weather risk insurance pool and early response mechanism that combines the concepts of early warning, disaster risk management, and risk finance—is similar to the PEFF in that it offers coverage for emergencies. Unlike the PEFF, it requires African Union member states to complete a 9–12-month capacity building programme to meet the eligibility for coverage, thus helping countries to both prepare and respond to disasters. Despite disbursement criteria that are informed by risk modelling, the African Risk Capacity has shown it can be swayed by political and civic pressure; in 2016, after substantial delay, it paid out $8 million to Malawi despite an initial decision of no payout.[93] This delay of funding can leave communities devastated in the immediate aftermath of a disaster, highlighting the importance of both technical and community-based input into any financing mechanisms and the need for agile forms of payment release across hazard and emergency categories (panel 4).

In case study 3 (panel 5), we outline the impact of concurrent emergencies, the desert locust infestation, and the COVID-19 pandemic on communities in Africa and Asia. The cost of recovery has been estimated to be as high as $8·5 billion,[104] with only a small portion of this received so far. Given the damage acute health emergencies can inflict on already overwhelmed health systems, poor and unsustainable recovery efforts in regions suffering from other chronic emergencies such as food or nutrition insecurity only increases the vulnerability of these systems to further fracture and collapse. As described in the third paper in this Series,[105] the importance of evaluating One Health cobenefits and the potential trade-offs of investments and financing becomes even more crucial in calibrating the response to multiple concurrent emergencies and should be integral to the eligibility assessment criteria used for the release of such funds (panel 4).

Despite many financial innovations and instruments existing for pandemics, most do not strengthen prevention and preparedness for crises. This challenge is acknowledged by the World Bank's International Development Association and its Crisis Response Window that proposes to "pivot to prevention [when crisis risks can be mitigated] and preparedness [when they cannot]". Importantly, the International Development Association includes climate change mitigation as one of its five priorities, and promotes investment in public health infrastructure.[106] Another key challenge in prioritising prevention, mitigation, and preparedness activities is that if cheap resources are available after a crisis, their availability could actually lead to a perverse incentive against spending scarce domestic resources on these areas.[107] Proponents of a new pandemic preparedness treaty emphasise the potential opportunity of explicitly creating a clear global financial mechanism in a specialised binding instrument for pandemics, although the potential for such a mechanism to sit outside the WHO once again raises concerns about the ongoing fragmentation of global health financing and governance.[108,109] For its part, the World Bank, in response to the COVID-19 pandemic, has announced the launch of a Financial Intermediary Fund for pandemic prevention, preparedness, and response.[110,111] Touted as the World Bank's bold new instrument for supporting UN member states to build relevant health security capacities, this multibillion US$ facility promises to adopt a One Health approach (not dissimilar to the REDISSE fund)—as with past initiatives, the details of the eligibility criteria, associated conditionalities, structures (eg, loans, grants, and co-financing), inclusion of LMICs and civil society in its governing bodies, and agility of the instrument will ultimately establish its success or absence thereof.

Spending on prevention and preparedness is associated with a high cost–benefit ratio. It has been estimated that a yearly investment in animal and human health of US$1·9 billion to $3·4 billion would generate $30 billion of savings each year.[46] This potential saving is likely to be an underestimate given the astronomical economic impact of COVID-19; for comparison, the EU's post-pandemic recovery fund is €2·02 trillion (or US$2·06 trillion), and is still considered to be insufficient for the level of damage.[112] Importantly, there is an urgent need to make the economic case for investment in environmental and wildlife health, including climate change mitigation. As our case studies

Panel 6: **Recommendations**

Recommendation 1
Strengthen the role of the environment and wildlife sector in governing and operationalising One Health, including through political, technical, and financing support for the One Health Joint Plan of Action (2022–26)

Recommendation 2
Engage social scientists, economists, legal experts, and communities in cross-disciplinary and participatory research and policy to ensure equitable representation of stakeholders in priority setting, policy making, and implementation

Recommendation 3
Strengthen the role of global One Health coordination platforms such as One Health High-Level Expert Panel and the Quadripartite, and advocate for One Health goals, including representing One Health at legal and trade forums—supported by experts, particularly in international, environmental, trade, and health law

- For recommendations 1–3, similar to current World Organisation for Animal Health (WOAH)–WHO National Bridging Workshops ensuring continuity and synergy between the Joint External Evaluation and the Performance of Veterinary Services activities, UN Environment Programme (UNEP) should be encouraged to integrate workplans with a focus on joint risk assessments, expanded One Health impact assessments, strategic environmental assessments, surveillance, and implementation of the Convention of Biological Diversity. Additionally, specific resource-based UNEP focal points can help provide the additional arguments for financing and sustainability where the conservation of shared global public goods in One Health is concerned (eg, water resource management) and can help identify how wildlife and environment expertise can be linked to existing surveillance systems. UNEP and the Food and Agriculture Organization of the UN, for example, already work together on the Sustainable Food Systems Programme and have released joint publications such as the Legislative Approaches to Sustainable Agriculture and Natural Resources Governance—these existing linkages should be capitalised on. Lessons learned in managing wildlife health for pandemic prevention and preparedness should be assessed at multisectoral workshops, for example, drawing on the South Korea's National Wildlife Disease Control Center or Brazil's virtual Center for Information on Wildlife Health, and then adequately reported in national reports and action plans. WOAH's Wildlife Health Framework is a useful resource to promote multisectoral coordination for wildlife health. Support for the implementation of the One Health Joint Plan of Action (2022–26) will be key for coordinating and accelerating collaboration and capacity building in the run up to the Sustainable Development Goals 2030.

Recommendation 4
Strengthen the legal expertise and bargaining power of small states and low-income and middle-income countries (LMICs) through improved use of non-health legal instruments, opportunistic use of emergency provisions, and pooled resources at the regional level

- For recommendation 4, consideration should be given to the following four areas: previous successes of forum shopping (eg, selecting the most favourable jurisdiction or instrument to pursue litigation) and consubstantial contestation (eg, Indonesia and the Convention of Biological Diversity); regional conventions that are stricter than their international counterparts (eg, Bamako Convention compared with Basel Convention) that LMICs can enforce as a bloc; exemptions that force the hands of larger organisations such as getting a price drop under the threat of a compulsory licence; and case studies and customary laws worldwide that can galvanise proposals in LMICs (eg, deaths linked to air pollution as reported by the Working Group on Health in Climate Change).

Recommendation 5
Increasing the regulatory and legal pressure on research and development industries supplying technologies in times of a health emergency and widening global intellectual property reform should be rapidly coordinated and applied by political leaders, civic society, and One Health professions to improve technology transfer and access to diagnostics, vaccines, and therapeutics

- For recommendation 5, respect and reward for the private sector should not be secondary to access to medicines and health technologies in times of acute crisis, particularly when financial risks around development remain largely publicly funded. Coordinated application of pressure, with legal tools such as waivers of World Trade Organization obligations or novel whole-scale intellectual property reforms, should form a key part of global efforts to build a more effective and equitable global health security architecture. Industry lobby groups defending industry profit over population health and equity should be subject to greater scrutiny and regulation of their activities.

Recommendation 6
Use economic incentives (including financial safety nets and insurance schemes) and address established disincentives to promote good implementation of international commitments

- For recommendation 6, the African Risk Capacity and other similar instruments should be more flexible in terms of modelled thresholds for payout of risk insurance schemes and contingency funds to actually deliver on its stated goals, stop negative perceptions of its function, and help increase uptake of these schemes, and should consistently engage with ministries of finance (who pay into these schemes and take money out of these schemes) regarding proactive One Health capacity building around disaster risk reduction and avoidance of perverse incentives.

(Panel 6 continues on next page)

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Recommendation 7

Academic institutions should systematically analyse the existing legal frameworks across health and non-health domains, and identify all the legal tools that can empower One Health advocates who have been taught and trained in cross-disciplinary settings

- For recommendation 7, this action can be facilitated by the Health and Environment Interplay Database,[51] UN Information Portal on Multilateral Environmental Agreements e-learning platform on international environmental law, the Global Judicial Portal, and UNEP's Law Division 2020 annual report, which highlights best practice and tools for advancing environmental rights. UNEP itself can provide advisory services to nations and legal bodies, for example through the Montevideo Environmental Law Programme, which is running from January, 2020, to December, 2029, underpinned by the Law and Environment Assistance Programme.[113]

Recommendation 8

Build institutional and professional capacities and capabilities in LMICs through strengthened peer-to-peer, regional, and international collaboration and investment in workforce and One Health career development initiatives

Recommendation 9

Strengthen regional governance and regulatory infrastructure for medical countermeasures and preventive measures, particularly in drug and vaccine manufacturing, licensing, and procurement in human, animal, and plant health

- For recommendations 8–9, accelerated funding for, and full establishment of, the African Medicines Agency, for example, could help increase regional manufacturing capacity, create quality assurance mechanisms for the internal market, support the sharing of intellectual property and technology transfer, harmonise regulation in times of emergency, and facilitate access to the raw materials needed for medical countermeasures across human, animal, environment, and plant health. This institutional infrastructure could be replicated in other global geographies. Similarly, support should be given to regional initiatives such as the Lake Chad Basin Commission in west Africa, whose wider stabilisation strategy, if implemented transparently, could support the sustainability of development goals across health, food, and water security, while protecting against acute crises and providing employment and safety for local communities. Reducing an over-reliance on external donors and funders for such initiatives is integral to sustained success

Recommendation 10

Urgent investment in the upstream determinants and drivers of disease and optimal human, animal, and environmental health, particularly in climate change mitigation, land use, disaster risk reduction, and joint multisectoral disease control activities

- For recommendation 10, the fostering of joint environmental, human, and animal health surveillance activities should build on current examples of funding models for capacity building, such as the Regional Disease Surveillance Systems Enhancement in west Africa and the Regional Integrated Surveillance and Laboratory Network in central Africa. At a global level, increasing the role of the environment within surveillance systems (eg, integrating UNEP into the Global Early Warning System) and monitoring drivers of disease emergence across ecosystems and society will address more comprehensively the prevention of One Health disasters and emergencies. Adopting a One Biosecurity approach to harmonise and promote resource use efficiency across human, animal, and plant front-line services will reduce stress on national budgets and present more consistent public-facing messaging.

Recommendation 11

Flexible funding to be made available for countries to use for prevention, preparedness, mitigation, and response to crises, including where relevant for addressing overlapping issues across food, water, and health security while ensuring transparency and accountability

- For recommendation 11, the wider vulnerabilities amplified by the COVID-19 crisis, such as food security, should be addressed, by redirecting response funding transparently and accountably towards overlapping crises, earmarking funds towards Sustainable Development Goal outcomes, not procedural actions, and providing direct cash transfer and relief assistance to promote flexible and relevant usage by affected households. At national levels, local ministries will have to work together to integrate government food security and health security strategies, strengthened by One Health links that already exist between agriculture and veterinary medicine, and where new links integrating human health practitioners, environmental scientists, meteorological services, and social scientists can develop as well. New instruments like the World Bank Financial Intermediary Fund[110] should consider carefully how to make such instruments sufficiently agile and flexible while adhering to principles of good governance, equitable inclusiveness, and accountability.

Recommendation 12

Assess and appraise existing and proposed global legal and financial health security instruments against a framework of One Health principles

- For recommendation 12, relevant global health security instruments undergoing reforms such as the International Health Regulations, or that are currently being proposed such as World Bank Financial Intermediary Fund or the potential Pandemic Treaty, should all be appraised against a framework assessing equity, sociopolitical parity, social–ecological equilibrium, stewardship, and transdisciplinarity. This appraisal will ensure that any instruments purporting to adopt a One Health approach are consciously considering and embedding all its underlying principles.[11]

have shown, the acute crisis often masks the underlying environmental issues and upstream determinants.

The way forward

The global governance of One Health is affected by the same sectoral, institutional, political, and financial inefficiencies and power imbalances that the global health sphere has yet to successfully tackle. However, these challenges in combination pose a greater barrier to coalition-building between human, animal, and environmental health that sits at One Health's core. Without increasing involvement of environmental health practitioners; wildlife biologists; economists; social scientists; legal expertise; and researchers and practitioners from low-income countries, marginalised communities, and society as a whole, key areas of focus will be missed. These areas include the ecological drivers of emerging, re-emerging, and endemic infectious diseases, the benefits gained through rapid flexible financing measures, the need for long-term cost-effectiveness studies of One Health, and the acknowledgment that until One Health is perceived as locally driven and locally understood, it will remain as part of a prescribed globally-driven package. Our recommendations (panel 6) outline mechanisms for addressing the inequality currently built into the global multilateral system—for example, leveraging non-health treaties in the trade and environmental sectors to achieve positive externalities in health, or use of regional bodies to share the responsibility and commitments of investment without the loss of locally responsive processes. These mechanisms, however, require substantial investment in capacity building in technical, legal, and political spheres for the successful translation into One Health practice. Above all, commitments should be tangible, proactive, grounded in equity, and sustained.[11] They should reflect in their social–ecological system the very real threat that hazards across the whole socioeconomic spectrum pose, both in generating and amplifying global health emergencies and through their debilitating effect on the resilience of all living species and the planet.

Contributors

OD, DLH, RK, and AZ conceptualised the Series theme of One Health and developed the outline for the articles. AE, OM-A, and OD searched the literature, analysed the data, and developed the first draft. RK, AZ, and DLH edited and contributed to several drafts of the manuscript. All authors contributed to the writing and finalisation of the manuscript.

Declaration of Interests

We declare no competing interests. The views and opinions expressed in this paper are those of the authors and not of their institutions.

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