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[Prod: Mamoudou Harouna first names, Djingarey last name]
[Prod: Yahaya firs name, Ali Ahmed last names]
[Prod: Amadou Bailo first names, Diallo last name]
[Prod: Ibrahim Soce first names, Fall last name]

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One Health 3

How prepared is the world? Identifying weaknesses in existing assessment frameworks for global health security through a One Health approach

Tieble Traore, Sarah Shanks, Najmul Haider, Kanza Ahmed, Vageesh Jain, Simon R Rüegg, Ahmed Razavi, Richard Kock, Ngozi Erondu, Afifah Rahman-Shepherd, Alexei Yavlinsky, Leonard Mboera, Danny Asogun, Timothy D McHugh, Linzy Elton, Oyeronke Oyebanji, Oyeladun Okunromade, Rashid Ansumana, Mamoudou Harouna Djingarey, Yahaya Ali Ahmed, Amadou Bailo Diallo, Thierno Balde, Ambrose Talisuna, Francine Ntoumi, Alimuddin Zumla, David Heymann, Ibrahima Soce Fall, Osman Dar

The COVID-19 pandemic has exposed faults in the way we assess preparedness and response capacities for public health emergencies. Existing frameworks are limited in scope, and do not sufficiently consider complex social, economic, political, regulatory, and ecological factors. One Health, through its focus on the links among humans, animals, and ecosystems, is a valuable approach through which existing assessment frameworks can be analysed and new ways forward proposed. Although in the past few years advances have been made in assessment tools such as the International Health Regulations Joint External Evaluation, a rapid and radical increase in ambition is required. To sufficiently account for the range of complex systems in which health emergencies occur, assessments should consider how problems are defined across stakeholders and the wider sociopolitical environments in which structures and institutions operate. Current frameworks do little to consider anthropogenic factors in disease emergence or address the full array of health security hazards across the social–ecological system. A complex and interdependent set of challenges threaten human, animal, and ecosystem health, and we cannot afford to overlook important contextual factors, or the determinants of these shared threats. Health security assessment frameworks should therefore ensure that the process undertaken to prioritise and build capacity adheres to core One Health principles and that interventions and outcomes are assessed in terms of added value, trade-offs, and cobenefits across human, animal, and environmental health systems.

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Emergency Preparedness and Response Programme, WHO Regional Office for Africa, Dakar Hub, Dakar, Senegal (T Traore DVM MSc, A B Diallo MD); **Institute of Zoology, Zoological Society of London, London, UK** (S Shanks MPH); **Royal Veterinary College, University of London, London, UK** (N Haider PhD, Prof R Kock PhD); **School of Life Sciences, Keele University, Keele, UK** (N Haider); **Global Operations, UK Health Security Agency, London, UK** (K Ahmed MSc, A Razavi MBBS MPhil, O Dar MBBS MSc); **Institute for Global Health, University College London, London, UK** (V Jain MBBS, M H Djingarey MD, Y Ali Ahmed MD, T Balde PhD, A Talisuna PhD); **Vetsuisse Faculty, University of Zurich, Zurich, Switzerland** (S R Rüegg PhD); **O'Neill Institute for National and Global Health Law, Georgetown University Law Center, Washington, DC, USA** (N Erondu PhD); **Global Health Programme, Royal Institute of International Affairs, London, UK** (A Rahman-Shepherd MSc, O Dar); **Infectious Disease Informatics, Institute of Health Informatics, University College London, London, UK** (A Yavlinsky PhD); **Southern African Centre for Infectious Disease Surveillance Foundation for One Health, Morogoro, Tanzania** (L Mboera PhD); **Ekpoma and Irrua Specialist Teaching Hospital, Ambrose Alli University, Irrua, Nigeria**

Introduction

The use of assessment and monitoring frameworks is widely perceived as a way of guiding investment and capacity building to improve preparedness for public health crises.[1] Standard indicators have been described as a tool to highlight gaps in country preparedness to inform investment decisions, maintain political interest between crises, and as a method of measuring progression towards improved health security.[2–5] However, the COVID-19 pandemic is the latest and most substantial in a series of global public health crises to highlight the gaps and limitations in current assessment approaches. The global response to these events has been to institute urgent measures to control the outbreak followed by diminishing political interest and investment as memories quickly fade.[1]

In this Series paper, we seek to critically review the global assessments used for measuring a multisectoral approach to preparedness for global public health emergencies. Specifically, we pay attention to narratives adopted, including the problem definitions that are explicitly or implicitly used, and the ideas and assumptions that inform the discourse on One Health, highlighting omissions, priorities, and areas of consideration. This approach recognises that these narratives and who controls them can have social and environmental consequences as it serves to frame what is regarded as true and worthy of action.

We consider the implications of our findings, placing them within wider discussions on the need for greater recognition of the political and social drivers of major global health issues.[6] This approach is intended to enable constructive debate on existing assessment frameworks and facilitate the development of thinking towards systems-based, all-hazards frameworks that acknowledge the wider complexities within which public health operates. Because of the difficulty in describing preparedness and the expansive range of factors that influence health capacities and metrics, the evidence to inform performance measures in public health preparedness is scarce in many contexts.[7,8] The International Health Regulations (IHR, 2005)[9] define core capacities to prevent, detect, assess, report, and respond to potential public health emergencies. IHR theoretically adopt an all-hazards approach; however, in reality, the all-hazard, cross governmental approaches to IHR implementation have been weak[9] and insufficient work has been done to develop One Health-relevant capacities across the wider social–ecological system.[10–12] The threat of international spread of infectious disease has dominated the discourse on global health security, enhanced by the introduction of the US-driven Global Health Security Agenda (GHSA) in 2014. However, recognised tensions exist between perceived threats to high-income nations that have introduced initiatives like the GHSA, and the health security needs of low-income

(D Asogun MD); **Centre for Clinical Microbiology** (Prof T D McHugh PhD, L Elton PhD) **and Department of Infection** (Prof A Zumla PhD), **Division of Infection and Immunity, University College London, London, UK; Nigeria Centre for Disease Control, Abuja, Nigeria** (O Okunromade MPH); **School of Community Health Sciences, Niala University, Bo Campus, Bo, Sierra Leone** (Prof R Ansumana PhD); **Fondation Congolaise pour la Recherche Médicale, Brazzaville, Republic of the Congo** (Prof F Ntoumi PhD); **Institute for Tropical Medicine, University of Tübingen, Tübingen, Germany** (Prof F Ntoumi); **National Institute for Health and Care Research Biomedical Research Centre, University College London Hospitals NHS Foundation Trust, London, UK** (Prof A Zumla); **Faculty of Infectious and Tropical Diseases** (O Oyebanji MSc) **and Department of Infectious Disease Epidemiology** (Prof D Heymann MD), **London School of Hygiene & Tropical Medicine, London, UK; Emergency Response, WHO, Geneva, Switzerland** (Prof I S Fall PhD)

Correspondence to: Dr Tieble Traore, Emergency Preparedness and Response Programme, WHO Regional Office for Africa, Dakar Hub, Dakar, Senegal
traoret@who.int

Key messages

- The COVID-19 pandemic has exposed weaknesses of the assessment frameworks evaluating preparedness for national, regional, and global public health crises. Although crossovers exist between assessment tools and indicators, these frameworks are undermined by their inability to sufficiently consider the role and complexities of social, economic, political, regulatory, and ecological factors that enable effective One Health preparedness and response.
- Matrix models for capacity assessment of health security will be needed, which monitor and assess the achievement of outcomes, as well as ensure that the processes undertaken reflect the One Health approach and adhere to its underlying principles. For existing instruments undergoing reform (eg, the International Health Regulations Monitoring and Evaluation Framework and the Joint External Evaluation tool) and for new initiatives such as the global One Health Joint Plan of Action (2022–26), it will be important to ensure that the processes of implementation comply with One Health principles and that intervention and outcome assessments include analysis of added value, cobenefits, and trade-offs across sectors.
- Global assessment and indicator frameworks have historically been developed to assess the capacity of countries to detect, prevent, and respond to public health events. However, these tools have not produced reliable assessments of the effects and risks of various interventions, particularly the wider effects of response strategies on other sectors. Although quantitative data are easier to present for summary comparisons, they do not consider context, which might require the inclusion of qualitative information and participatory engagement of local communities most affected by crises.
- Existing assessment and indicator frameworks should be reviewed via a whole-system, all-hazards approach, taking into account the lessons learnt from previous and current public health crises, and acknowledging the political, social, economic, and ecological complexities facing countries at both national and subnational levels. There is a need to rationalise and harmonise the plethora of existing frameworks to enable a sustainable approach. Furthermore, agencies and countries should have the ability to identify and select hazards relevant to One Health on the basis of local risk to enable pragmatic solutions and monitoring.
- A sustainable assessment process needs to be developed to reduce the burden on countries, which are expected to simultaneously respond to existing public health crises and prepare for future incidents, while reporting on current progress against several hundred indicators with little financial investment and low-resource capacities.
- Despite being a potential political impetus to act, assessment frameworks and indicators should not be used as mechanisms to make spurious inter-country comparisons because of the differing contexts characterising each country. Focus should instead be on individual countries and regions to establish baseline assessments of capacity by use of harmonised tools and indicators to monitor self-progress and inform future policy and investment.

countries. Therefore, the concept of global health security remains difficult to standardise in all contexts.[13] The Ebola virus disease epidemic in west Africa in 2014–16 highlighted substantial shortcomings of the IHR, including the assessment process, but did not adequately problematise and politicise why these gaps exist,[14,15] or critique the influences and structures that determine and maintain the current global distribution of benefits, risks, industrial production, manufacturing capacity, farming practices, and burden of mitigation. A previous study highlighted that lessons had not been learnt after the Ebola virus outbreak and that simple additions to the IHR to improve technical capacities to detect and contain infectious diseases would be inadequate.[13] A subsequent review of the IHR during the COVID-19 pandemic has identified similar gaps.[16] Changes made to assessment tools as a result of the IHR Review Committee's recent work are welcome and positive; however, to truly prepare for the future, more ambitious and cross-disciplinary thinking is required.

Public health crises are biological, social, economic, and political events.[12,17] Because of the interconnection among societies and disciplines, and the sectoral allocation of resources, these challenges cannot be addressed by the human medical or public health sector alone, and it has been widely recognised that a transdisciplinary approach is needed.[18–20] The One Health approach was adopted by the Tripartite (ie, the partnership among WHO, the Food and Agriculture Organization of the UN, and the World Organisation for Animal Health [WOAH]) in 2010, for "managing and responding to risks related to zoonoses and some high impact diseases".[21] However, One Health was not clearly conceptualised when it was adopted[22] and was at the time narrowly focused on human health, domestic animal health, and food systems without embracing the ecological, socioeconomic, cultural, and political contexts within which the agenda was framed.[23] At present, no formally recognised objectives or standards for the implementation of One Health exist, nor rigorously derived and validated metrics to assess performance or added value, trade-offs, and either positive or negative effects.[24–26] With the creation of a Quadripartite inclusive of the environmental sector after the formal inclusion of the UN Environmental Programme (UNEP) into the Tripartite in 2022, and with the subsequent launch of the global One Health Joint Plan of Action (2022–26), there is now

an opportunity to address these shortcomings.[27–30] An important first step has already been taken in this regard with the publication of a Quadripartite-endorsed and widely acclaimed definition for One Health and, importantly, an accompanying elucidation of its underlying principles.[31]

In 2016, the Joint External Evaluation (JEE)[32] was launched by WHO to consolidate the existing IHR Monitoring and Evaluation Framework (IHR MEF)[11,33] and the GHSA's country assessment tool.[2,34] The purpose of the JEE is to measure country-specific status and progress in achieving capacity to prevent, detect, and respond to public health threats whether they are naturally occurring, deliberate, or accidental.[32,35,36] The JEE is an objective, voluntary, independent peer-to-peer multisectoral assessment of a country's health security preparedness and response capacity across 19 IHR technical areas.[32,35,36] As part of the IHR MEF, the JEE is used together with the IHR State Party Self-Assessment Annual Reporting tool (a framework comprising 24 indicators across 13 IHR capacities measured annually), after-action reviews, and simulation exercises. Both IHR and JEE were revised during the COVID-19 pandemic. As of July, 2022, 116 countries completed a JEE, making it arguably the most substantial global tool being used to inform capacity building in health security.[37] In this Series paper, we focus our analysis on the first and second editions of the JEE tool, which have been most widely used across WHO member states. The most recent version (third edition) of the JEE framework, released in 2022, includes changes to broaden the scope of the tool and considers capacities in new and important areas such as health financing and health services.[36] However, as we argue in this Series paper, the JEE tool can be further improved or complemented with alternative assessment frameworks. Countries are expected to use the results from the assessment tools to develop or update national action plans for health security so that compliance gaps can be addressed in collaboration with donors, partners, multilateral agencies, and the public–private sector through financial or technical assistance. As recognised by Rein and Schön,[38] "The questions we ask [ie, indicators] shape the answers [ie, policy solutions] we get". Forster and van Walraven[39] suggest that, in most instances, indicators are chosen on the basis of what can be measured, rather than what should be measured, and the resulting indicators are then reverse-engineered into "whatever construct happens to be in fashion".[39] Leach and colleagues[40] suggest a less passive approach, proposing that narratives are created and promoted by powerful actors and institutions.

The power of using indicators to assess highly complex and political contexts has been examined in depth in other areas of health and development (eg, through the Sendai Framework for Disaster Risk Reduction 2015–2030 [Sendai][41] and the Sustainable Development Goals [SDGs][42]). However, the SDGs have not been explicitly applied to measures of public health preparedness, although some SDG targets can be cross referenced with the Sendai targets (appendix p 2).[43] The Sendai Hazard Definition and Classification Review, developed by the UN Office for Disaster Risk Reduction and the International Science Council,[43] used an iterative process to develop a list of hazards, which notably included eight societal hazards. However, their inclusion is only a step towards acknowledging the role of complex ecological, political, social, and economic issues, and stronger coherence across the field of disaster risk reduction and health emergency preparedness should still be developed (appendix p 3).

See Online for appendix

Simplified metrics have been used to measure capacity and progress towards prevention and preparedness without crucial debate of their role in implementation or acknowledgment of the complexity of systems and challenges.[44] There has been little public discussion on how these metrics should be constructed, how their development might shape discourse, and what the underlying normative assumptions are.[45,46]

Available health security preparedness tools

A range of tools and frameworks exist that assess the capacity of public health preparedness to prevent and respond to global health security risks (figure). Most have a focus on human health, but some adopt cross-sectoral One Health approaches that can sometimes overlap or even contradict one another, adding further challenges and confusion for resource-constrained ministries and national public health institutes (NPHIs). Consequently, at the national level, governments, ministries, and NPHIs often use tools that are linked to donor priorities or current popular thinking. Because of the short-term nature of donor funding and high turnover of civil service staff in many countries, such approaches can affect the institutional memory and consistency of strategies used to prepare for long-term public health challenges. These and other types of challenges that NPHIs face when attempting to access, analyse, and act on One Health and preparedness data are detailed in panel 1.[54,55] NPHIs—often the national focal points for the IHR and by extension global health security—are typically not sufficiently empowered either by legislation or through their capacity to fulfil their functions. This issue is exacerbated in low-income and middle-income countries (LMICs), in which large vertical programmes collect data and often make the analysis outside of these countries, thus hindering the ability of LMICs to analyse and act on the data. Additionally, in all countries, the reduced empowerment of NPHIs is exacerbated when it comes to accessing data from the private sector because of propriety, data protection, and ownership issues. The most used range of tools, frameworks, and indicators can be applied to the national, regional, and global levels, and principally cover four functions: understanding of the problem, assessment of capacity, capacity development, and

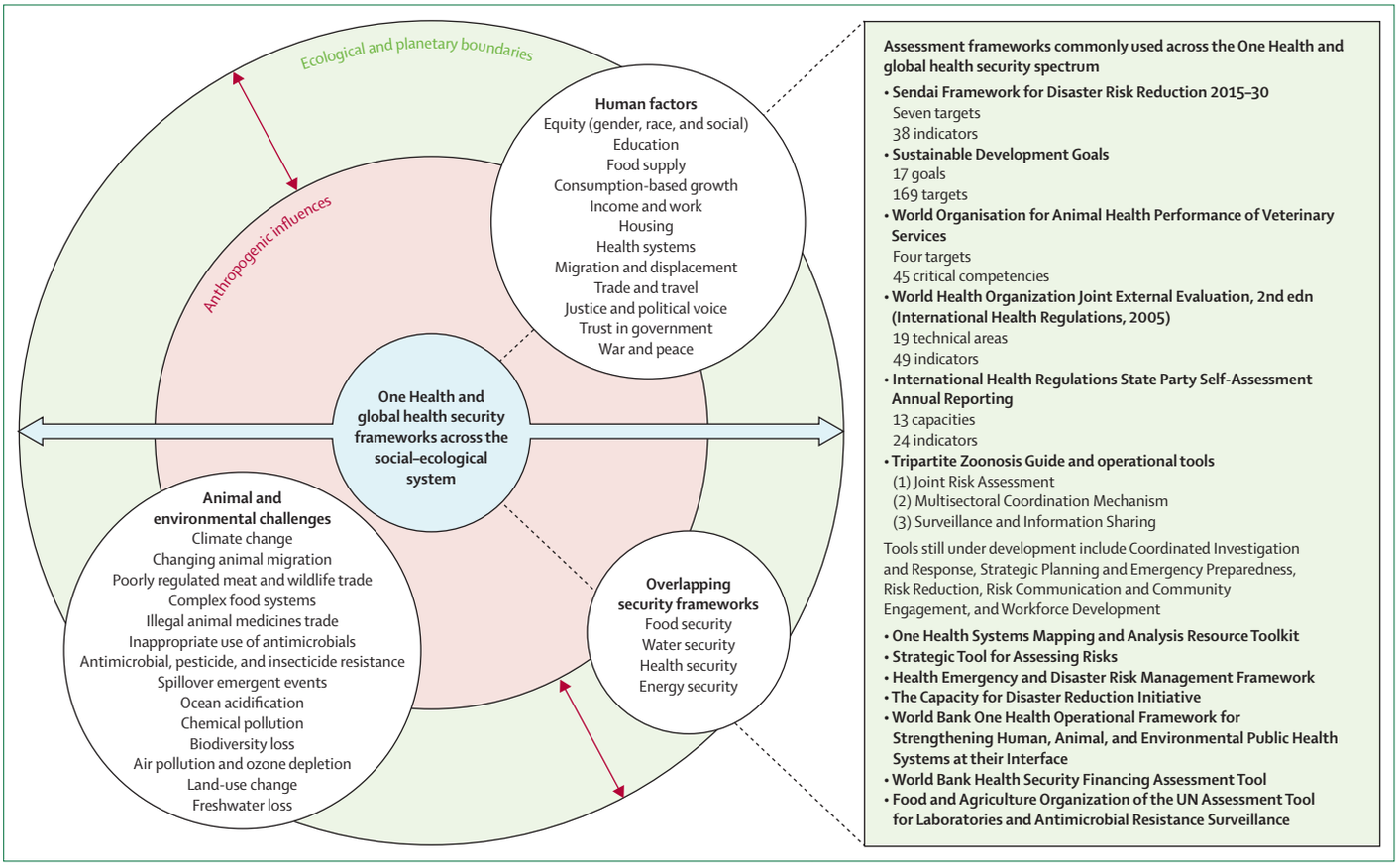

Figure: **Commonly used UN and World Bank assessment tools and frameworks for global health security and One Health causing pressure on ministries and national public health institutes**[47–53]

The green circle represents the ecological and planetary boundaries, whereas the red circle corresponds to anthropogenic influences, including economic, political, cultural, social, regulatory, and technological. The red arrows indicate the interdependence and interconnection of anthropogenic influences (ie, factors influencing each other in a systemic model rather than a linear model) and their potential to result in breaches of the ecological and planetary boundaries, thus negatively affecting health security. The smaller circles correspond to interacting factors and conditions that are interdependent and influence global health security.

monitoring and evaluation. However, the frameworks often duplicate data or contain gaps, such as the ignoring of political and social contexts. Furthermore, assessment frameworks often do not work together or build on existing plans, therefore increasing the burden on resource-constrained government institutions.[55] WHO and WOAH have taken measures to address these aspects by developing the IHR–Performance of Veterinary Services (PVS) National Bridging Workshops (NBW) and attempt to integrate findings of the WOAH's PVS tool and JEE assessments.[56–58] These frameworks are then meant to inform national action plans for health security. However, as of July, 2022, 40 countries worldwide have completed NBWs, often after the country has already drafted or developed its national action plans for health security.[59] Going forward, NBW should take place well in advance of the final national action plans for health security in every country to fully realise the benefit of this harmonised operational One Health approach.[56–58,60]

Because the JEE was never intended to be used for inter-country comparisons, attempts have been made to develop independent metrics to assess national preparedness and make inter-country comparisons, such as the Global Health Security Index[2,34,57,61] and the Epidemic Preparedness Index.[44] However, these tools are often driven or heavily influenced by donor interests (for both indices the US Government aid and security sectors were the primary sponsors), and are implemented without sufficient validation. Our analysis of the JEE and Global Health Security Index reveals poor correlation between scores and mortality outcomes during the COVID-19 pandemic (panel 2), a finding reflected by other studies and additional analyses highlighting the spurious nature of inter-country comparisons.[64,68,69] Current tools are weak in assessing good leadership, public trust in government and experts, a sense of community solidarity, underlying population healthiness, and demographic structure (panel 2)—key elements in managing response and assessing health system resilience. Because the JEE is a national-level assessment tool, important differences and nuances apparent at the subnational level can also be lost in the

Panel 1: Health security frameworks with indicators relevant to One Health

In 2018, several national public health institutes (NPHIs) and key implementation partners codeveloped a pilot project to strengthen national accountability for preparedness. The project's primary objective was to identify priority indicators (eg, percentage of primary care facilities with electronic health records) that could complement traditional sources of health security metrics, such as the Joint External Evaluation tool, but would be part of frameworks not currently included in preparedness monitoring. The hope was to strengthen public health intelligence by integrating these indicators into existing national reporting systems. These so-called non-traditional sources of health security metrics included sources outside of the health sector (eg, climate and agriculture) and existing information that is regularly collected by non-NPHI entities (eg, immunisation coverage and infectious disease surveillance), to test whether NPHIs could access these indicators. The first step in this method involved identifying existing health security frameworks, from which to select high-quality and relevant (ie, priority) indicators. The full description of this method is described by Erondu and colleagues.[48]

Beyond gap areas in public health preparedness, as part of the pilot project we looked at three cross-cutting areas, namely subnational preparedness, cross-border coordination, and One Health. The frameworks that were identified represented diverse data sources, including multilateral and single government agencies, vertical disease programmes, non-government organisations and academic institutions, international donors, and private health or non-health industries. Of 21 frameworks with cross-cutting indicators, nine frameworks were relevant to One Health and were included in the pilot project: five at the global level, one at the regional level, and three at the national level. The majority of these frameworks were developed and pilot tested before their operationalisation between 2017 and 2019, and have a strong health security focus or mandate, such as the World Bank's Health Security Financing Assessment Tool (2018), US Agency for International Development's Preparedness and Response Planning Toolkit—One Health in Action (2018), or the Harvard Global Health Institute's Global Monitoring of Disease Outbreak Preparedness framework (2018).

Country-specific health security frameworks were identified to supplement the scoping results, and indicators were prioritised through a Delphi method that was executed through in-country, multi-stakeholder workshops in three partner NPHIs (ie, in Ethiopia, Nigeria, and Pakistan). The participants in these workshops were from multiple sectors, including representatives from the Food and Agriculture Organization of the UN (FAO); National One Health Platform; ministries of agriculture or livestock from the three countries; Veterinary Public Health Directorate, Ministry of Agriculture (Ethiopia); Agriculture Knowledge, Learning, Documentation and Policy Project (Ethiopia); Livestock and Dairy Development Department (Pakistan); Khyber Pakhtunkhwa province (Pakistan); Pakistan Agricultural Research Council (Pakistan); and Emergency Centre for Transboundary Animal Diseases (Nigeria).

The participants selected an average of 15 indicators per country, which were designated as core to monitoring preparedness. In each of the three countries, priority indicators to strengthen a One Health approach to preparedness were included. In Ethiopia, the indicators reflected the impact of extreme weather events and climate change on national security (eg, number of climate information centres established, which were extracted from the National Meteorological Agency). In Nigeria, the indicators relevant to One Health focused on disease surveillance, but one priority indicator stood out by recognising the environmental component of a One Health approach: proportion of health-care facilities with basic water supply. This indicator was extracted from the WHO Vulnerability and Risk Analysis and Mapping framework. Finally, in Pakistan, participants selected total agricultural exports (US$) from the FAO agriculture census as a distinct priority indicator related to One Health, thus reflecting the crucial role of the export agricultural sector to the nation's sense of wellbeing.

Although One Health frameworks and indicators were a small proportion of the datasets identified, the indicators that were prioritised represented diverse data sources, sectors, and interests. The small number of indicators relevant to both One Health and preparedness might be reflective of expert input into the prioritisation process, rather than a lack of such existing indicators. When replicating this process, stakeholders from various ministries and the private sector should be involved and engaged. Their inclusion might result in a need for legislation and agreements between NPHIs and these entities to share data for preparedness purposes. Disaggregating measures of One Health are important to provide a contextual understanding of the factors at play; however, equally, compiling metrics that reflect a country's public health, economic, and social realities is what will result in a process that decision makers can use to achieve improved One Health and health security preparedness aims. Technical subject matter experts should have access to the underlying contextual information that underpins data integration, monitoring, and evaluation, whereas policy makers need an aggregated summary dataset to enable decision making.

aggregated scoring processes that are applied during the assessment (panel 3). The experience we showcase from Nigeria underlines the need for subnational engagement and assessments to facilitate targeted support, and the need for countries to invest in data-gathering processes across all their jurisdictions. [55]

Panel 2: Joint External Evaluation (JEE) and Global Health Security Index (GHSI) scores and outcomes during the COVID-19 pandemic

The JEE is a formal component of the WHO International Health Regulations (IHR) Monitoring and Evaluation Framework, which all UN member states are committed to implementing. 96 countries participated in the JEE scoring exercise in 2019,[62] and, in this Series paper, we use ReadyScore (0–100), which is the average of the scores obtained in the 19 technical areas included in the JEE, as presented by Shahpar and colleagues.[62] Canada (93), Singapore (93), Australia (92), Japan (92), and South Korea (92) were the countries with the highest scores (appendix pp 5–6). The GHSI is a comprehensive assessment and benchmarking of health security and related capabilities of 195 countries that make up the state parties to the IHR. The GHSI is a project of the Nuclear Threat Initiative and the Johns Hopkins Center for Health Security; it was funded by the Bill & Melinda Gates Foundation, Open Philanthropy, and the Robertson Foundation, and it was developed jointly with the Economist Intelligence Unit in 2019.[61] The GHSI comprises six categories, 34 indicators, and 85 subindicators based on 140 questions.[61] The overall mean GHSI score is 40·2 out of 100.[2] The USA (83·5), the UK (77·9), the Netherlands (75·6), Australia (75·5), and Canada (75·3) are the countries with the highest scores in overall GHSI (appendix pp 5–6). For countries that reported at least one COVID-19 case and had either a GHSI or JEE score, we plotted the countries' response to the COVID-19 pandemic (cases per million and deaths per million) until Dec 31, 2020 against the GHSI and JEE scores (appendix p 4) and we estimated the Pearson's correlation coefficients. We collected COVID-19 data on cases and deaths from the first records on COVID-19 in Jan, 2020, to Dec 31, 2020, from Worldometer.[63] We used data from the first year of the pandemic because this period would correlate most closely with GHSI and JEE assessments that were already performed—a period before most countries had radically adapted their health systems and response capacity to better manage the pandemic.

Results

The two indices, JEE and GHSI, are strongly correlated (r=0·84), indicating a good agreement between them. However, the JEE had a moderate correlation with countries' reported cases (r=0·52) and deaths (r=0·46) due to COVID-19. Similarly, GHSI also had a moderate correlation with countries' reported cases (r=0·51) and deaths (r=0·52) due to COVID-19, indicating that countries with better GHSI or JEE score had reported more COVID-19-related cases and deaths than countries with a lower GHSI or JEE score. Of the 20 countries with the highest scores in GHSI, ten of them were among the countries with the highest number of cases due to COVID-19, and seven of them were among the countries with the highest mortality rates (deaths per million) during the studied period (appendix pp 5–6).

Discussion

More than 200 countries and territories have been affected by the COVID-19 pandemic, resulting in more than 579 million cases and 6·4 million deaths worldwide as of July 28, 2022.[63] The countries with higher GHSI scores reported more cases per million and more deaths per million due to COVID-19 than countries with lower scores. There are limitations in comparing data on the number of cases and deaths due to COVID-19 in each country, because differences exist in countries' responses, including the number and types of tests being done, and case definitions of COVID-19 infection. Mortality data are generally more accurate for purposes of comparison than data on reported cases. Earlier studies showed that higher numbers of reported cases and deaths were directly correlated with higher numbers of tests.[64,65] Additionally, countries' capacities during the pandemic have also changed considerably with increased investment in pandemic response. However, despite considering the limitations of the COVID-19-related numbers of cases and deaths, both the GHSI and JEE indicators appear to be better suited for small outbreaks of known diseases, compared with pandemics of unknown pathogens.[66]

Of the top 20 countries with the highest rates of COVID-19-related mortality (deaths per million), eight countries are also listed among the top 20 countries with the highest GHSI score and six countries are listed among the top 20 countries with the highest JEE score (appendix pp 5–6). These findings mirror the analysis of the Independent Panel for Pandemic Preparedness and Response.[67] What is missing from the assessment tools but is important in pandemic management are good leadership, public trust in government and experts, a sense of community solidarity, underlying population healthiness, and demographic structure.[64,65] Thus, the indicators and their respective weighting in the GHSI and the JEE will need to be radically revised in the future, by taking into account the lessons learnt from the COVID-19 pandemic.

This Series paper focuses in greater depth on the JEE framework because it is the only capacity assessment grounded in international legal agreement and is the primary tool of the IHR MEF, in which external peer involvement (ie, subject matter experts for each technical area of the IHR) is part of the process to assess preparedness. The overarching approach of this Series paper is to generate inductive insights by identifying existing narratives and ideas from observations, rather than a systematic review of every JEE indicator, all of which are detailed in the appendix (pp 7–8). An initial focus on zoonotic diseases is used to show the complexities of the use of indicators to assess capacity within a specified technical area, then a wider look across the breadth of the framework is used to identify key issues that are not captured by the JEE metrics.

***Panel 3:* Challenges associated with the use of the Joint External Evaluation (JEE): assessing subnational capacities with a national tool**

Nigeria is a signatory to the International Health Regulations (IHR, 2005).[70] Although the individual federal states in Nigeria are not directly a party to the IHR, the capacity for detection and response at the state level has a direct effect on determining Nigeria's capacity to fulfil its obligations under this law.[71]

The levels of outbreak preparedness and response capacity vary across the federal states in Nigeria. Nigeria's first JEE was carried out in 2017, with the involvement of only national experts, focusing on the capacity at the national level.[72] By contrast, during the mid-term JEE in 2019, epidemiologists from the federal states were also invited to participate in the process.[73]

The first edition of the JEE used in 2017 in Nigeria and several other countries did not include indicators to assess subnational level capacities. The scoring of capacity across technical areas was therefore not representative of what could be obtained across Nigeria's states. These capacity differences were particularly obvious during the response to disease outbreaks, when there was an overdependence on the capacity provided by national institutions.

For example, although Nigeria has an average score of 2 (ie, limited capacity) for zoonotic diseases during the JEE done in 2017, in a 2020 study (Oyebanji O, unpublished) carried out by the Nigeria Centre for Disease Control with the second edition of the JEE, the same indicators were used in five states and the results showed that all the five states had a mean score of 1 (ie, no capacity) for zoonotic diseases. Specifically, none of the states assessed had carried out an assessment to identify priority zoonotic diseases. Similarly, in 2019, Nigeria carried out a self-assessment exercise using a slightly modified version of the second edition of the JEE tool. This exercise involved epidemiologists from the federal states and showed differences in health security capacity at national and subnational levels.[73] Although all epidemiologists from the federal states disclosed that they had responded to previous outbreaks of Lassa virus (which is endemic in Nigeria) and the ongoing COVID-19 pandemic, none of them had established, functional, or sustainable structures in place to identify and respond to zoonotic diseases as defined in the JEE.[73] Nigeria experiences annual outbreaks of diseases of zoonotic origin including Lassa fever, yellow fever, and mpox (formerly known as monkeypox). On the basis of a spatial modelling exercise, Nigeria has one of the highest risks of outbreaks of emerging zoonotic infectious diseases globally.[74]

The limitation in the JEE tool to assess subnational IHR technical capacity in Nigeria has spurred discussions in the country on the need to carry out an assessment of health security capacities at the subnational level. The need for this type of granular assessment is even more evident with the varied response to the COVID-19 pandemic in Nigeria. Importantly, IHR evaluation tools should be more granular to capture the nuances on preparedness within subnational components versus having a national representative scoring, which, instead, might be erroneous and could give a false sense of preparedness.

Zoonotic disease

Zoonotic disease is a technical area grouped under the prevent theme, which is one of the four core areas of the JEE framework (the other three being detect, respond, and IHR-related hazards and point of entry). Two indicators in the second edition of the JEE tool (panels 4, 5; appendix pp 7–8) and three in the first edition (appendix pp 9–10), informed by both contextual and technical questions, are designed to assess the following target performance: "Functional multisectoral, multidisciplinary mechanisms, policies, systems and practices are in place to minimize the transmission of zoonotic diseases from animals to human populations"[36] (panels 4, 5).

Major differences exist between mitigating zoonotic diseases that arise from animals domesticated for food production and mitigating emerging infectious diseases that arise from spillover events involving wildlife. Specific guidance has been developed to integrate the PVS pathway into the JEE assessment process, highlighting similarities and complementarities between the two tools,[57] because the JEE mirrors the narrow framing of One Health at the (primarily) domestic animal and human interface, which is rooted in veterinary public health. A broader inclusion of wildlife, environmental, social, and economic indicators requires a much deeper reflection on common values, aims, and their measurement. Although PVS indicators can contribute to the implementation of IHR in particular areas, such as workforce development for the detection of diseases, applying a single definition of animal health sector can be misleading and assumes responsibilities of state veterinary services and ministries of agriculture that often do not apply.

Omissions across the framework

It is not uncommon for indicators to omit qualitative issues, and frameworks are often developed without explicit consideration of their ethical basis or the moral assumptions embedded in their construction.[39] The act of measuring is active, shaped by and in turn shaping, policy discourse by directing attention to those dimensions captured by the indicator. Little time is afforded to critically analyse the problem definitions formed and adopted in guiding the selection of indicators and construction of frameworks. Often, the problem is thought to be an

Panel 4: **Joint External Evaluation indicator: P.4.1 coordinated surveillance systems in place in the animal health and public health sectors for zoonotic diseases and pathogens identified as joint priorities**

The process of assessment requires comparisons of actual performance against standards that describe the ideal or desired performance. One of the contextual questions used to assess country capacity against indicator P.4.1 includes whether there has been a World Organisation for Animal Health (WOAH) Performance of Veterinary Services (PVS) Evaluation mission or a PVS Gap Analysis, to assess the capacities of veterinary services and their compliance with WOAH established standards, as well as the fundamental competencies of these services, grouped into four components (human, physical, and financial resources; technical authority and capacity; interaction with stakeholders; and access to markets). The PVS tool uses internationally accepted crucial competencies (eg, professional and technical staffing of the veterinary services, competencies of veterinarians and veterinary paraprofessionals, risk analysis, veterinary laboratory diagnosis, emergency response, and epidemiological surveillance and early detection) to assess state veterinary services and it aligns these competencies with the WOAH's international standards for terrestrial animal health and welfare, and veterinary public health.[75] However, unlike domestic animals, wildlife and feral animals do not typically fall under the direct authority of state veterinary services and ministries of agriculture; instead, their surveillance requires multisectoral involvement across conservation, public health, agriculture, and environmental management. Wildlife surveillance poses extraordinary logistical and economic challenges,[76] and, unlike structured public health and domestic animal health programmes, which are well described in policy and legislation, there is no recognised standard (eg, performance standards for surveillance) for the core competencies and functions of a national wildlife health programme.[77,78] Furthermore, the WOAH Terrestrial Animal Health Code provides standards for the surveillance of listed zoonotic diseases with a recognised case definition, but no guidance currently exists for the surveillance and detection of invasive or emerging pathogens in animals before they become named diseases.[79] When considering requirements for human and animal surveillance, it is essential to differentiate between diseases caused by known pathogens that require a non-human animal host for survival and persistence, and diseases caused by pathogens that might originate in animals but independently persist in humans as a result of a chance spillover or evolutionary jump from animals to humans (eg, yellow fever, HIV, and Ebola virus). COVID-19 has provided a vivid example of why it is important to distinguish between zoonoses, which are typically endemic, and emerging infectious diseases of animal origin, which might become pandemics.[80] In 2004, a Tripartite consultation on emerging zoonotic diseases recognised that "New mechanisms of surveillance and response are required: using new approaches (e.g. syndromic surveillance), using new tools (e.g. geographic information systems, remote sensing data and molecular epidemiology) and bringing together different sectors and disciplines (e.g. medical, veterinary, population biology, information technology, economics, social science and diagnostics)."[81] However, this consultation has not translated into universally agreed measures for surveillance or intervention for emerging infectious diseases originating from wild animals.[80]

external entity that exists outside of the policy-making process, whose definition and parameters are predefined. This absence of explicit recognition of the problem definition and transparency regarding the provenance of the definition is a challenge because the problem definition might differ greatly between different actors and perspectives and can be highly contested. For example, global priorities relating to zoonoses of interest, food safety, and environmental hazards can vary greatly from priorities at a subnational or community level, as these focus on addressing the prevailing burdens present locally.[88,89]

The JEE toolkit is described as a "Technical framework in support to IHR (2005) monitoring and evaluation".[32] The assertion that such frameworks are purely technical in nature is problematic because it potentially conceals the fact that the evidence that has informed the construction of the frameworks is related to specific value judgements, research paradigms, and world views. Furthermore, such assertion serves to depoliticise issues and concepts that are in many situations highly politicised, such as land use, food systems, and systems of trade and travel—all important issues in the COVID-19 pandemic. Although the third, most recent iteration of the JEE (released in 2022) includes increased assessment of zoonotic disease, community engagement, health financing, and health service capacities in an attempt to address some of these issues, it does not systematically consider the wider social, economic, political, regulatory, and ecological environments in which health security exists.[36] For instance, there is little consideration of the macroeconomic and societal factors and policies relating to food security, trade, migration, climate change, and multisectoral governance. These aspects should not be ignored in a technical assessment tool. By contrast, the PVS tool includes sections on institutional independence from commercial, financial, and political interests, and on how transparent institutions and services are in their reporting and communications.[90] Exploring such factors can also help to address the power imbalances involved in the inequitable distribution of resources and the effects of this inequity.[91] Further deliberation is required to understand whether such factors should be considered as part of the JEE, while keeping in mind the already demanding

***Panel 5*: Joint External Evaluation (JEE) indicator: P.4.2 mechanisms for responding to infectious and potential zoonotic diseases established and functional**

For each indicator of the JEE, a country receives a single score on the basis of their current capacity, ranging from 1 (no capacity) to 5 (sustainable capacity). Capacity against indicator P.4.2 is considered sustainable when "The multisectoral operational mechanism for the response to zoonotic events and emerging diseases is regularly tested for continuous improvement".[35] A subtle difference exists in use of the terms zoonotic diseases and zoonotic events in the indicator and capacity assessment; although this difference might appear a trivial nuance, the interchangeable use of these terms can have wide-reaching health, political, and socioeconomic consequences, because it might oppose sustained efforts to contain zoonoses by use of capacities that are deployed in times of crisis. Although high-income countries prioritise outbreaks of emerging infectious diseases and zoonotic diseases that might lead to pandemics, lower-middle-income countries continue to experience endemic zoonoses, which are responsible for a greater burden of global mortality and morbidity.[82] By removing contextual information, indicators are often overly reductive thereby exposing a particular set of political priorities and beliefs. Policy development in lower-middle-income countries is highly influenced by external donors and the political economy, and the contrasting, dominant international narratives do little to address the under-reporting and inadequate prioritisation of endemic zoonotic diseases in the current health agendas of many lower-middle-income countries.[83] The JEE is intended to inform policy and funding decisions; the prioritisation of infectious disease outbreaks, as implied through the use of the term events, can have wide-reaching detrimental effects by diverting funding away from diseases that are not of immediate global concern, or marginalising other sectors such as food and trade.[84] An increasing body of evidence shows that interventions targeted at endemic zoonotic diseases can strengthen community trust and harmonise the ongoing needs of disadvantaged communities with the concerns of the broader global community.[82] However, this harmonisation requires political motivation and investment, and autonomy of countries to set their own priorities. For example, rabies, zoonotic tuberculosis, and brucellosis, which are caused by pathogens that can infect a wide range of hosts including wildlife, domestic animals, and humans, are still poorly controlled in animal reservoirs and continue to represent hazards to human health in most African countries. However, we often overlook the fact that their spread and distribution are politically and socially defined, that these are often diseases of poverty, and that current global incentive structures and global economic approaches contribute to settings in which these diseases thrive.

Additionally, the metrics used to inform indicator P.4.2 specify public and animal health sectors for assessing capacity to respond to zoonotic events; however, stakeholders and actors from other sectors (eg, the environmental sector, local municipalities, and local communities) should also be involved. In times of crises due to emerging infectious diseases, political leaders are required to make complex decisions at speed with high levels of uncertainty.[85]

Because of the diversity of possible transmission pathways and the complexity of the social–ecological systems in which interventions are to be put in place to reduce risk, single interventions might not be capable of addressing the pathways of highest risk, and might create unintended, difficult to predict outcomes.[85,86] Environment or wildlife ministries responsible for wildlife and their habitat often have little to no technical capacity for researching the source of microbial spillover events or ecosystem management.[86,87] Wildlife has received much attention during the COVID-19 pandemic, with a focus largely on the role of illegal wildlife trade and markets in SARS-CoV-2 emergence, which is still uncertain. However, little consideration has been given to the roles of legal wildlife trade, wildlife habitat, land-use changes and industrialised action (eg, deforestation, extractives industries, and expansion of agricultural land), and domesticated animal populations as drivers of viral transmission from animal (wild and domestic) to human populations.[86]

burden on users, or whether other complementary assessment frameworks (eg, the UN Development Programme Capacity for Disaster Reduction Initiative tool[50]) can be used instead of or together with it. Encouragingly, the JEE tool and other elements of the IHR MEF have been open to regular review and iterative improvements and it would be important that this process continues in an equitable, collaborative, multisectoral, and evidence-informed manner to achieve robust and sustainable preparedness for health emergencies.[92]

Global context and structural influences

Despite being rich in technical content, the JEE and PVS frameworks poorly consider the context in which the indicators have been developed and therefore when and how they should best be used. There is also an absence of in-depth analysis of the drivers that contribute to an increasing risk of the events that these frameworks seek to address. With these important limitations, there is a risk of foreclosing opportunities that prioritise a more preventive, and therefore a potentially more cost-efficient, effective, beneficial, and ethical approach within the One Health agenda.[68]

Zoonotic disease is one of seven technical areas grouped under the prevent theme area. However, the existing indicators for zoonotic disease are very heavily in favour of reactive rather than proactive infrastructure to prevent future emerging infectious diseases. Multiple

strategies to address complex social, economic, and political factors have been proposed in existing tools[90] and the wider literature,[93] such as upstream surveillance of disease emergence at sources in wildlife and the monitoring of social and economic factors (eg, land-use change, unregulated agricultural expansion, or poorly managed urbanisation) that increase the risk of spillover events. However, instead of guiding the development of relevant strategies, existing frameworks reflect a predilection of global responses to focus on containment instead of prevention; they do little to reflect the health effects resulting from anthropogenic activity, or the need to integrate approaches that address the wildlife trade, biodiversity loss, and ecosystem disruption, degradation, and fragmentation. Similarly, existing frameworks overlook the powerful vested interests that benefit from, and act to maintain, many of the structural and contextual drivers of ecological and health crises. For example, economic policies designed to benefit the fossil fuel industry such as subsidies are widely used across countries. This discomfort with addressing the underlying consumption-driven model of economic growth will need to be resolved to achieve the core aims of a One Health approach and yet none of the existing assessment tools attempt to capture country-level progress on this.

Food and nutrition insecurity

Mackenzie and colleagues[88] describe food security as one of the biggest global issues facing the planet, proposing that increasing livestock numbers without increasing productivity can probably lead to ecosystem disaster and eventual protein scarcity. Globally, hunger is rising, with insufficient investment in, and progress towards, SDG 2 (zero hunger).[94] Largely influenced by the bovine spongiform encephalopathy crisis in the UK in the 1980s and 1990s, food safety is nowadays included in the global health security narrative and two indicators exist in the JEE assessment that address food safety (appendix pp 7–8); however, the wider implications of food insecurity are not considered in any of the existing frameworks.[88] Consideration is not given to the wider requirements needed to ensure nutrition security for women, children, and other vulnerable groups. Such needs include access to healthy food, which implies a redistribution of current global production of livestock-derived products, and ensuring the safeguarding of biodiversity rather than simply fuelling the ever-increasing growth of monocultures and the food industry to the detriment of the planet. The existing narrow focus on technical issues of foodborne outbreaks and surveillance marginalises other pressing needs, such as the broader economic and environmental reforms necessary to create sustainable food systems. These shortcomings in the currently available assessment tools show the power that the selected indicators have in shaping the global health security narrative.[95] Food systems, agricultural practices, and food access and availability all have implications for the One Health agenda through their interplay with the emergence of infectious diseases, the nutritional wellbeing and resilience of communities to withstand infectious outbreaks, and countries' ability to respond to epidemics. Furthermore, despite not being well implemented, WHO's Framework of Engagement with NonState Actors has at least brought attention to the need to consider how to manage the partnering with non-state actors and the conflicts of interest that might in turn arise,[96] with a prominent example being how to navigate engagement with the food industry and related private sector entities. The existing indicators such as those on food safety are yet to address the issue of partnerships, conflicts of interest, engagement with the private sector, and asymmetric distribution of risks.

Community empowerment

Community engagement can help to build social networks, increase trust, and foster community ownership of global health security initiatives.[97] Collaborative transdisciplinary efforts assessing local risks are a necessary component of an improved system for early detection and response to emerging infectious diseases and other public health hazards. Engagement with local human populations is also crucial,[98] yet the benefit of integrating community engagement into national efforts to mitigate threats to public health is not sufficiently considered within the JEE core capacities. Community engagement has been advocated as a useful strategy for health promotion and has proven to be key to the success of outreach One Health initiatives such as rabies control programmes, as detailed in the second paper in this Series.[99] Communities, through the use of participatory approaches, should play an integral role in the design of indicator and analytical frameworks, the recognition of a problem, the formation of interdisciplinary teams, the analysis of the affected community and stakeholders, the development of a common vision and language, and the subsequent assessment of One Health initiatives. When implemented, community engagement and educational outreach can be cost-effective and sustainably financed.[100]

In addition to emergency response, community empowerment involves participation in the political, economic, and social context in which public health emergencies occur. A 2022 observational study found that countries with high participatory governance indices were associated with reduced rates of excess mortality during the COVID-19 pandemic.[101] Some features of participatory governance might be beneficial during protracted public health emergencies, particularly when considering both direct and indirect deaths through changes in all-cause mortality. These features include community participation in politics and policy, a culture of evidence-based decision making (eg, through public consultations and cross-government processes to consider trade-offs), systems of accountability, and a

long-term focus on social inequalities and public welfare. Efforts to assess capacities for community engagement should therefore extend beyond involvement in outbreak response and consider the role and agency of communities within wider social, economic, and political systems.

Health inequities in pandemic preparedness

The JEE assessment is limited in how it considers health inequities within and among country populations. Past pandemics and the current COVID-19 pandemic have disproportionately impacted disadvantaged populations and the need to address these negative outcomes has been well articulated, for example by the Bellagio Group checklist,[102] which, however, needs to be integrated into countries' national pandemic preparedness plans.[103] Although plan developments can be improved at the national level to better consider inequities, these should also be considered at the international level. For instance, capacity for vaccine procurement or production, the size of vulnerable populations, and cultural attitudes towards government restrictions have all played a role in the variable global impact of COVID-19. Current indicators do little to understand either international or subnational equity factors as part of an assessment of preparedness. Largely because of such a limited scope, pandemic and emergency plans have been described as "false symbols of security"[104] reflecting policy makers' overconfidence in themselves and in the associated capacity assessments that do not necessarily reflect real-world vulnerabilities or capabilities.

The COVID-19 pandemic has been worsened by, and has in turn worsened, many existing economic, social, gender, and racial health inequities both within and among countries as well as by complicating response efforts to other health emergencies. From a One Health perspective, these disparities included access to medical countermeasures, such as COVID-19 vaccines, and access to sufficient clean water or pesticides to respond to the concurrent drought emergency and locust plague devastating food systems across east Africa.[105,106] Recognising and addressing inequities in our societies, including drivers and barriers, are therefore integral to improved preparedness.[105,107,108] Disparities can arise because of gender, for example, and, depending on the setting, gender might determine key groups of front-line workers essential to the response. During the Ebola virus outbreak in west Africa, delayed recognition of gender disparities had devastating impacts on families, with a failure to consider the needs of women who already faced difficulties accessing obstetric and maternity care, and who constituted the majority of the front-line health workforce.[109] Similarly, in southeast Asia, the inability to recognise the fact that women constituted a crucial front-line defence during the 2008 avian influenza outbreak meant that the opportunity to benefit from their potential role in prevention and response was lost.[23] An analytical approach should involve assessing national and subnational vulnerabilities by including the size of specific population groups (eg, by gender, ethnicity, socioeconomic status, or comorbidities). For instance, this approach was used to estimate the size of populations in need of COVID-19 vaccines globally, but such contextual analysis is typically not considered in processes like the JEE or alternative assessment frameworks.[110]

Conclusions

We are currently facing unprecedented challenges that threaten human and animal health and environmental sustainability in complex and interdependent ways. We cannot afford to overlook important contextual factors, or the determinants of these socioeconomic and political contexts in which threats to human, animal, and planetary health emerge and are sustained.

Radical shifts in our thinking are needed, away from models that are based on the conceptualisation of public health threats as apolitical, simplistic, linear, or additive disease interactions among humans, animals, and the environment. Greater recognition of the substantial number and diversity of actors and agents involved is needed, many of whom are not within the human and veterinary public health sectors.[25] The narrow framing of core competencies (eg, food safety equating to foodborne outbreaks and surveillance with no consideration of access to food and water or nutrition security) as the measures needed to prevent, detect, and respond to public health threats has diverted attention from the breadth of socioeconomic, political, regulatory, and ecological factors that are driving the cycle of crises that threaten health across all sectors.

We should reflect on the assumptions made to develop performance frameworks and analyse more critically the problem definitions being adopted and the solutions being proposed. The issue that should be prioritised is not a shortage of frameworks, indicators, and metrics but rather a scarcity of transformational thinking about how, why, when, and by whom such tools are developed, who benefits, who is disadvantaged, and how to mitigate inequity. Technical working groups with involvement of regional bodies, UN agencies, and, crucially, civil society organisations and communities themselves, are required to harmonise the many existing frameworks in a sustainable and coherent way. Calls have already been made to integrate existing frameworks and targets such as through the Convention on International Trade in Endangered Species of Wild Fauna and Flora and the Aichi Biodiversity Targets as a means of addressing the imbalance currently afflicting the One Health approach. However, adopting pre-existing indicators simply because they exist does not allow for crucial examinations of the underlying assumptions, barriers, and enablers associated with the achievement of the required transformational actions. With revisions of the current IHR MEF underway, including of the JEE,[36] and the launch of the global One Health Joint Plan of Action (2022–26), a real opportunity exists to ensure future monitoring and

evaluation tools for health security properly reflect application of the One Health approach.[27–30,111] Matrix models of assessment are therefore necessary, which assess both the process of implementation—ensuring One Health principles[111] are being adhered to—and evaluate interventions and outcomes more holistically (ie, in terms of added value and trade-offs across the human, animal, and environmental sectors).[111]

Furthermore, there is an urgent need to reduce the assessment burden on countries.[112] Countries are currently at risk of duplicating capacity assessments, thus increasing the reporting burden and potentially affecting assessment and reporting quality, with knock-on implications for the implementation of recommendations.

The explicit reason for emphasising the importance of the environmental sector in global health security is justified in the World Bank's One Health Operational Framework for Strengthening Human, Animal, and Environmental Public Health Systems at their Interface:[12,47,112] "The importance of the environment for human well-being and economies is well established (Millennium Ecosystem Assessment). Ecosystems provide critical public health-promoting services, and thus ecosystem degradation may present consequences for human health."[47] The formal inclusion of UNEP into the Tripartite is a welcome attempt to remedy this omission and should allow for sufficient prioritisation of, and investment in, wildlife and environmental science. Community participation has been shown to provide powerful insights to frame health challenges at the human–animal–environment interface.[113] By framing One Health as a contributor towards sustainable health outcomes, community participation could then become an important aspect to improve the relevance, and enable stewardship, of health policies for all.[24] A holistic, One Health approach could be compromised by the absence of indicators for community participation, or by the insufficient consideration of trust between the government and the population (panel 2).

Although all-hazards approaches are useful for taking into account the complex interactions among human, animal, and environmental health, experts on disaster risk reduction working with the experts on health security should support NPHIs to assess and categorise which hazards are most important and what interventions are most likely to be effective in mitigating risk. Such an approach would allow countries to prioritise and focus on immediate concerns and be clear on which sector (human, animal, or the environment) should lead on which hazard. It also enables the selection of relevant indicator frameworks to suitably assess capacity and development. Furthermore, this approach entails an important shift away from the use of assessment frameworks as a tool for inter-country comparison (and competitiveness) and moves the focus on the establishment of baselines and measures of self-progress in preparedness and health capacity.

Indicators can facilitate a reconceptualisation of knowledge[114] and the assessment process provides an opportunity to further understand the wider societal issues and the complex dynamics of human, animal, and ecosystem health that affect the ability to mitigate global public health threats. By embracing complexity, assessment frameworks can be more effective and equitable.

As the world emerges from the COVID-19 pandemic, important decisions will have to be made in terms of which paths and which tools (eg, indicators, frameworks, and measures) are best to improve our collective interventions addressing the health of people, animals, and the planet on which they depend.[92] Independent of whether future actions are implemented by use of a One Health approach or through other means, complexity, detail, and debate that involves challenging old assumptions and welcomes new ideas should all be at the core of establishing an effective, equitable, and dynamic approach to achieving health for all living creatures and the planet.

Contributors

OD, AZ, DH, and RK ideated the Series theme of One Health and global health security, developed the articles' outlines, and selected lead authors. TT, SS, KA, and OD developed the first and subsequent drafts; led the writing of this Series paper; and contributed to content collection and planning. All authors contributed to the writing of the manuscript and finalisation of the paper.

Declaration of interests

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

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