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The One Health path to infectious disease prevention and resilience

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The research and views presented in this special edition of Transactions of the Royal Society of Hygiene and Tropical

Medicine take us to the human–animal interface, where human exposure to zoonotic and vector-borne diseases occurs. From mobile pastoralism in the Sahel¹ and small-scale farming in Vietnam² to hospital stays in South Korea,³ a wide range of interactions with varied ecologies and pathogens is described. Where standard data sources and methodologies fall short, the authors have consulted sources such as news media reports.⁴ While some of the authors consider relatively recent infectious disease emergence, like Middle East Respiratory Syndrome,³ others examine longer-standing public health risks. These include schistosomiasis,^{1,5} which continues to exact a large burden in sub-Saharan Africa despite affordable and effective prophylaxis and treatment options, in part because infected livestock are kept near human water sources. Still other contributions examine global efforts to combat emerging antimicrobial resistance (AMR). While the use of antimicrobials in humans and animals helps drive AMR, there is not necessarily a simple causal relationship between AMR in food animals and people, as commonly thought. Kahn describes more cryptic pathways and linkages that are emerging and not monitored, such as through the open defecation of billions of humans and domestic or feral animals like the dog, which regularly receive antibiotics and which may seed the environment with resistant bacteria.⁶ Given this spectrum of zoonotic and infectious disease threats, both national and global solutions are required across many sectors including human health, agriculture and the environment. National systems must be robust enough to detect, assess risks and respond rapidly to major changes in risk; and to address known risk factors that threaten people every day, especially the most vulnerable populations, in order to prevent infection. A paradigm shift in our understanding of the drivers of emerging diseases is shifting focus from reaction and reliance on technical and pharmaceutical solutions to promoting structural changes in our society, health systems and the approach to environment and development. A principal change arises from the knowledge that resilience in ecosystems—whether in the intestine of humans or the global landscape—has a stabilizing effect on pathogen behavior. This is illustrated in the Ross River and Murray Valley in Western Australia, where the risk of infection appears to shift with both natural climatic patterns and human-made environmental manipulations; and for which Mackenzie and colleagues describe a robust architecture of monitoring climate, animal and vector populations, water sources and other ecological factors determining human risk in order to prevent

outbreaks.⁷ The shift away from viewing the host and pathogen in isolation, to understanding the crucible in which they live, increases complexity and requires a more integrative scientific method that we now refer to as One Health. In this context, Machalaba and colleagues report on an interdisciplinary collaboration investigating how best to evaluate the economic value of investing in One Health approaches to better control and prevent zoonotic infections. On the same theme, Phelan and Gostin discuss how global-level legal strategies for tackling antimicrobial resistance, such as global regulations or a treaty, could strengthen multisectoral, multi-institutional collaboration on infectious disease, with important benefits for pandemic preparedness at the global level.⁸ Canavan and colleagues point out that managing infectious disease risk in the food system, without considering other sectors, such as nutrition and sustainability, appears an ineffective and inefficient strategy for preventing infectious disease outbreaks; they argue for an integrated approach instead.⁹

Recent pandemic threats like Ebola and Zika viruses have spurred a global conversation around resilience in health systems. Their ability to react and rebound when dangers arise.¹⁰ The contributions to this special issue illustrate a One Health approach to the risk assessment of and response to infectious diseases, emphasizing connections among human health, animal health and the environment. This strategy is essential to infectious disease resilience writ large, and resilience of health systems in particular. In addition to organizing systems for rapid detection and response, the broader One Health view urges us to rethink prevention. In particular, we should reject an economic paradigm exclusively focused on production or economic development at any cost, especially in areas like agriculture, where emerging zoonotic disease risk is significant.

Author contributions: JJ and DH drafted the manuscript. DH and RK critically revised the manuscript for intellectual content. All authors read and approved the final manuscript. RK is guarantor of the paper.

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