

Editorial: Emerging, zoonotic, and vector-borne diseases: crossing boundaries to improve health

Juliet Pulliam - Director of SACEMA.

Emerging, zoonotic, and vector-borne diseases are often lumped together in a seemingly hodge-podge “other” category of infectious diseases. For example, the mandate for South Africa’s National Centre for Emerging Zoonotic & Parasitic Diseases (CEZPD) includes pathogens as diverse as plague (a bacterial pathogen transmitted by fleas), Rift Valley Fever Virus (a mosquito-borne virus that predominantly affects cattle), and *Toxoplasma gondii* (a protozoan parasite transmitted by cats and other animals), to name just a few. All of these pathogens can infect and cause disease in humans, though clinical diagnosis is often difficult because the symptoms resemble those associated with many other infections.

If these pathogens are so different, why are they grouped together? I think the answer initially lay in idiosyncrasies of their epidemiology. Emerging infections characteristically cause infrequent outbreaks that are unpredictable in space and time – and most are zoonotic in origin (i.e., transmitted from animals to humans). In addition, zoonotic diseases (zoonoses) are most common in rural areas, where human contact with other animals, particularly wildlife and farm animals, is relatively frequent. Rural communities are frequently underserved, particularly in resource-poor regions, often making the recognition of these infections sporadic, whether or not this reflects an underlying pattern of sporadic incidence. Vector-borne diseases are also often zoonotic (with some major exceptions – e.g., *falciparum* malaria), and are typically highly seasonal, reflecting environmental drivers of vector abundance and activity. In their own ways, diseases in each of these three overlapping groups are therefore ‘occasional’ problems, such that – at least from a medical perspective – they command only part-time attention. As a result, it is efficient to allocate resources in a way that they can be shared across multiple pathogens. The resulting institutional structures developed to reflect these allocations and ultimately provided researchers, public health workers, and clinicians with experience working on a highly diverse set of pathogens. Working across these pathogens has allowed researchers to generalize and begin to identify broader patterns that point towards common underlying drivers of, as well as differences between, emerging, zoonotic, and vector-borne infections.

Another factor that these pathogens have in common, aside from their intermittent detection, is that only limited headway can be made in understanding and addressing them through medical science alone. It has long been recognized that addressing zoonotic and vector-borne diseases requires veterinary and entomological perspectives, which has forced collaboration across disciplines in a non-traditional way relative to other areas of medicine and public health. This history has perhaps made the area particularly receptive to influences of and interactions with other disciplines, including ecology and the social sciences.

Finally, emerging diseases require rapid intersectoral cooperation for effective intervention. The ongoing epidemic of Ebola in the Democratic Republic of Congo highlights the advances that have been made in this arena since the 2014-2016 Ebola epidemic in West Africa. Whereas the latter eventually saw involvement from government, business, academia, and the civil sector (including philanthropic and nonprofit organizations), all of these actors were engaged within the first 10 days of the response to the current epidemic [1].

The combination of the generalization that emerges from working across pathogens, the necessity of interdisciplinary perspectives, and the need for a multisectoral response, all under the umbrella of ‘emerging, zoonotic, and vector-borne infections,’ has led this area of epidemiology to become a testing ground for pushing boundaries in public health. Recently, a further step has been taken – this time, attempting to push temporal boundaries by preparing to combat highly lethal zoonotic infections with the capability for human-to-human transmission – such as Nipah virus, Middle Eastern Respiratory Syndrome Coronavirus, and Lassa virus – before they cause self-sustained epidemics. The central player in this endeavour is the Coalition for Epidemic Preparedness Innovations (CEPI), which is bringing together expertise and resources from across sectors to develop pipelines for vaccine discovery, development, and eventual deployment. While it may be many years before we know whether the investment has paid off, this bold initiative shows that the history of collaboration and broad perspectives developed through the study of emerging, zoonotic, and vector-borne diseases still has a lot to offer in terms of innovative approaches

to public health.

In this issue of the Quarterly, you will find articles from authors who have crossed many types of boundaries in their work on emerging, zoonotic, and vector-borne diseases. Gabriela Blohm, of the University of Florida, describes how her cross-cultural childhood experiences have shaped her scientific goals and her passion for improving arbovirus surveillance in Venezuela. David Hayman investigates various hypotheses regarding how Ebola virus is maintained in wild animals and potential mechanisms of how the virus has spread through the African continent. Michel Counotte explores conceptual and quantitative frameworks for understanding Zika virus epidemiology in endemic and epidemic settings. Samuel Alizon describes methods in phylodynamics that bring together epidemiological and evolutionary perspectives to infer epidemiological parameters from genetic sequence data. Finally, Thumbi Mwangi and Katie

Hampson discuss their work towards the global elimination of canine-mediated rabies, which requires both international and intersectoral cooperation on a broad scale. Together, the authors represent a diverse array of scientific perspectives from around the world, bringing a wide range of epidemiological approaches to bear on emerging, zoonotic, and vector-borne diseases.

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Reference:

1. World Health Organization. Ebola Virus Diseases Democratic Republic of Congo: External Situation Report 3. 18 May 2018. [http://apps.who.int/iris/bitstream/handle/10665/272607/SITREP-EVD-DRC-20180518.pdf?ua=1] Accessed on 26 June 2018.