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COVID-19, zoonoses, and physical geography

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COVID-19 is enmeshed in human and environmental geography. The multiscale nature of the phenomenon is geographic. From its potential entry into the human population through interaction with wild animals to its diffusion across the planet, geographic patterns and processes have been engaged. The potential for transmission of disease from animals to humans is multifaceted, including both animals as obligate vectors and as reservoirs from which diseases can jump to independence in humans. These facets are part of human-environment interaction ranging from daily life to globalized drivers of land use change. Geographers have advanced our knowledge (perhaps too little – time will tell) of the dynamics of zoonoses. Physical geography can also contribute to understanding and addressing these pathogens.

Covid-19 and other viruses are biota with their own geographies, and biogeographic theories and methods are relevant to understanding them (Reperant 2010; Escobar and Craft 2016; Jean et al. 2016; Dallas et al. 2019). These concepts and methods are already prevalent in academic health geography. The ecological niche concept has been used to identify the geographies of vectors and reservoirs of human viral pathogens. Examples include Pigott et al. (2004) for Ebola and Messina et al. (2016) for Zika. Niche modeling, a widely used methodology in biogeography, has been applied in several cases (e.g., Peterson et al. 2006, for Marburg hemorrhagic fever; Young et al. 2017, for avian influenza).

Research has been focused on the macroorganisms that serve as reservoirs and vectors for the pathogens. These are often investigated in relation to environmental geography such as land use change (e.g., Goodin et al. 2006 for Hantavirus). More organismic population ecology is also relevant (Alexander et al. 2012, for Ebola, inter alia). The geography of these macroorganisms is also affected by climate change, and these populations will potentially shift or expand their ranges and increase or at least change the human populations with which they are in contact (e.g., Morin et al. 2013, for dengue).

The biogeography of viruses per se will be an emerging field. Patterns of existing genetic diversity and development have been examined within reservoirs (e.g., Carrel et al. 2010, for avian influenza). Even in predominantly human settings (i.e., with domestic animals) and in human hosts and vectors, viruses have biogeographies. For example, Young et al. (2016) showed patterns of diffusion for genetic variants of avian influenza. Virus diversity and evolution can reveal processes relevant to potential

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control, and the fundamentals of phylogeography (cf. Gaunt et al. 2001) will increasingly be part of the toolkit for health geographers (e.g., Young et al. 2018).

Understanding the geography of zoonoses will be important in addressing their impacts on society. While biogeography can contribute (e.g, Murray et al. 2018), climatology and hydrology are also developing zoonoses-oriented research programs. To be effective for promoting human health, further integration with the work of human geographers with similar interests will be sensible. Talk to your colleagues – from a safe distance.

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