



Perspective

One health education for future physicians in the pan-epidemic “Age of Humans”



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ABSTRACT

We propose the term “pan-epidemic Anthropocene” to refer to multifocal infectious disease epidemics related to human-caused (anthropogenic) forces such as urbanization, globalization, industrialization and the growing populations of humans and animals. The integrated framework of One Health (human, animal, and environmental health) helps both to understand why epidemics occur when and where they do, and also how to respond, mitigate, and sometimes prevent them. We suggest a collaborative mechanism for increasing One Health in medical education to create a synergy of strengths between the growing number of contributing One Health organizations in the US and internationally.

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On November 3, 2016, over 150 educational events in 37 countries across five continents observed the first One Health Day (One Health Commission, 2016). This event was designed to illustrate the importance of “One Health”, defined by the Director of the One Health Office at the US Centers for Disease Control and Prevention (CDC) as “a collaborative approach that connects health experts from human, animal, and environmental health disciplines at the local, national, regional, and global levels”. The goal of One Health is “to prevent diseases that pose a threat to the health of people and animals . . . (and) also prevent economic disruptions that accompany these disease outbreaks” (Behraves, 2016). This inaugural One Health Day was organized by three international groups- the One Health Commission, the One Health Initiative, and the One Health Platform Foundation – and planning is underway for the second One Health Day on November 3, 2017.

This One Health collaborative model to prevent disease has been slow to gain acceptance in US medical schools. In 2017, however, Rabinowitz and colleagues proposed a set of One Health competencies for human health professionals. While recognizing that US medical school curricula are already full, they propose that

“an initial step is to incorporate an introduction to One Health principles in the teaching of zoonotic disease during infectious disease coursework early in medical school.” (Rabinowitz et al., 2017). We agree and argue from the perspective that doing so fits within a larger context of a compatible concept, the Anthropocene or “Age of Humans” (Ruddiman et al., 2015).

One health in the pan-epidemic anthropocene

One of the greatest achievements in medical history was the global eradication of smallpox in 1980, after the virus had killed hundreds of millions of people around the world. Although smallpox was contained to the Old World for thousands of years, Europeans brought the disease to the Americas in the 16th century. It quickly spread among the American Indians who had no resistance to it, reducing the New World population to a fraction of its pre-contact size within centuries. Smallpox and other epidemic diseases, as well as famine and warfare, are postulated to have contributed to a major decline in atmospheric CO₂ between 1570 and 1620, due to an uptake in vegetation following the human population crash in the Americas (Lewis and Maslin, 2015). This CO₂ dip, the so-called “Orbis spike”, is perhaps the most dramatic example of pan-epidemic infectious disease affecting the global environment.

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The Orbis spike is only one of the proposed markers of the “Anthropocene” – a new epoch in Earth history in which humans have replaced nature as the dominant force of global environmental change (Ruddiman et al., 2015). On August 29, 2016 at the International Geological Congress, the Working Group on the Anthropocene recommended a formal starting date for the Anthropocene around 1950 with the initial atomic bomb detonations (Kaplan, 2016). Other proposed dates include the late 1700 s (with the invention of the steam engine and the initiation of the Industrial Revolution) and 11,700 years ago (with the origins of agriculture and plant and animal domestication) (Waters et al., 2016). Recognizing the many ways and times that humanity has transformed the Earth, it has been suggested that an informal “anthropocene” term could be used without capitalization and with specific modifiers such as industrial or agricultural (Ruddiman et al., 2015). We here propose the novel term “pan-epidemic anthropocene” to emphasize that large but not “pandemic” epidemics, or what have been termed “pan-epidemics” (Lucey, 2016), are direct consequences of recent human activities that continue to impact and transform our planet. Of note, the US CDC One Health Office, like others, states that “3 out of every 4 new or emerging infectious diseases in people are spread from animals” (CDC, 2016a,b).

The Anthropocene concept is only starting to be used within medical disciplines (Hotez, 2016; Lucey et al., 2017), but its public recognition is growing rapidly. Regardless of its formal definition as a geologic epoch, we view the “pan-epidemic anthropocene” as a potentially powerful communication tool to raise public awareness of pan-epidemic threats. For example, the Anthropocene concept is highly compatible with the One Health premise that epidemics can be predicted, detected, mitigated, and sometimes prevented by understanding the interconnectedness of human, animal, and environmental health. For zoonoses in particular, applying the One Health concept might have lowered the risk of infectious diseases that have caused many of the pan-epidemics since 1950 e.g., Ebola, Nipah, SARS, MERS, avian influenza, HIV/AIDS, Lassa Fever, Zika, Yellow Fever, and more yet-unrecognized and yet-undiscovered.

Growing high-level acceptance of one health

Although the concept of One Health is decades old, it has recently been gaining more mainstream support. For example, One Health is an integral part of the infectious disease-focused Global Health Security Agenda (GHSA) launched in February, 2014 with multisectoral support including the World Health Organization (WHO, Geneva), the World Animal Health Organization (OIE, Paris), the Food and Agriculture Organization of the United Nations (UN) (FAO, Rome), and many more organizations. GHSA, which now includes 59 nations, works closely with the WHO to coordinate national “Joint External Evaluations” (JEEs) to assist nations with achieving their health capacities required under the WHO International Health Regulations, many of which are to prevent, detect, and respond to outbreaks. Of the 11 GHSA “action packages”, the first two (1) antimicrobial resistance (AMR) and (2) Zoonoses advocate a One Health approach. Near the end of his second term, President Obama signed an Executive Order to improve coordination of the US component of the GHSA (White House Press Secretary, 2016).

The importance of One Health was also emphasized when the President of the UN General Assembly convened an all-day high-level meeting on antimicrobial resistance (AMR) September 21, 2016 (United Nations 2016). Complex AMR issues, including links between animals and humans, have been widely discussed and reviewed (Marston et al., 2016; Kahn 2016). Recently, a multi-sectoral U.S. Government Task Force, coordinated at the White House, issued a

“National Action Plan for Combating Antibiotic-Resistant Bacteria”, with the second of five goals of this plan to “Strengthen National One-Health Surveillance Efforts to Combat Resistance.” (The White House, 2016).

In the US Congress, an initial version of a bill titled “One Health Act of 2016” (S.2634) was introduced by Senator Al Franken of Minnesota. This bill proposed a National US One Health Framework that included One Health National Centers of Excellence, leveraging international support with the WHO, FAO, and OIE and direct involvement with the UN (S.2634, 2016). Although this bill has not been enacted as of June 2017, it highlights the increasing visibility of One Health in policy actions.

Advocating for one health education for future physicians in the USA and internationally

The principle of “*Cura Personalis*,” translated as “care for the whole person,” is the ethos of Georgetown University School of Medicine (GUSOM), guiding students and faculty to provide skilled and compassionate care to patients (Georgetown University School of Medicine, 2017). In order to care for patients in a manner consistent with this ideal, one must look beyond the biomedical model and turn to the biopsychosocial model, taking into account patients’ individual circumstances, concerns, and characteristics. For GUSOM, One Health is thus a natural extension of *Cura Personalis*, as it further incorporates, and holistically considers “significant interactions patients have with their environment in our continually globalized world,” and “expands our thinking and understanding of patients and health” (Rabinowitz et al., 2017).

For this reason, GUSOM medical students (co-authors HD, JW) are advocates of One Health skill sets proposed by Rabinowitz and colleagues, such as the ability to recognize and treat zoonotic and vector-borne diseases and to elicit a history of human-animal-environmental interactions. In November 2016 GUSOM held a One Health Symposium bringing together medical students, physicians, veterinarians, leaders of international NGOs, and public health officials, the White House, Capitol Hill (senior staff from Senator Franken’s office), Princeton University’s Laura Kahn (MD) and more (Georgetown University, 2016). This event facilitated dissemination of interdisciplinary best practices and conversation that demonstrated the connectivity of human, animal, and the environmental health. Medical students left with a clearer understanding of the importance for emphasizing animal contacts and environmental exposures with patients as well as need for the broader medical community to adopt a One Health approach. Two of our medical faculty (DRL, SRM) participated, both of whom serve on the Board of the US One Health Commission and have organized One Health conferences at GUSOM since 2013.

In Spring of 2017 GUSOM (HD, JW) formed the One Health-Infectious Disease (OHID) Interest Group in order to further expose medical students to the One Health approach early in their medical training. Lueddeke (2016) argues early exposure to One Health framework is critical for achieving a healthier world. Guest speakers have included both physicians and veterinarians. Through such events students can learn to “better assess and manage interactions between patients, animals, and their shared environment.” (Rabinowitz et al., 2017). Furthermore, these events afford students opportunities to actively engage to better understand issues they will face when combating determinants of health that are linked to the One Health triad of human, animal and environmental health.

Georgetown is one of a small but growing number of US medical schools beginning to appreciate the One Health model, for example by creating a One Health Club. Despite endorsement from the American Medical Association, these institutions remain in the minority of those to expose students to the One Health framework.

To our knowledge, less than 10 US medical schools sponsored/co-sponsored an event for the inaugural One Health Day, in contrast to veterinary medical schools and schools of Public Health (One Health Commission, 2016). A comprehensive review of US One Health educational efforts found few medical schools involved among the multiple Schools of Public Health, Veterinary Schools, and Masters graduate programs (Stroud et al., 2016).

We propose that future physicians and their faculty interested in One Health enhance information-sharing across the US and internationally in order to build a synergy of shared strengths. One potential mechanism to facilitate such connections would be through the US-based One Health Commission's "Students of One Health" international network. A second mechanism could be through the GHSA "Next Generation" of leaders. In October, 2015 two co-authors (DRL, SRM) organized a conference at Georgetown Medical School with international panelists from both the Students of One Health and the GHSA Next Generation leaders.

Finally, US medical students interested in the One Health model could reach out to international colleagues in Europe, Africa, Asia, and the Americas. Two examples include networks such as that of "One Health Central and East Africa (OHCEA)" based in Uganda, and the "Southeast Asia One Health Network (SEAOHUN)" based in Thailand. Both networks use training modules for One Health education. Both are supported by the US Agency for International Development as part of their effort to prevent, detect, and respond to emerging pandemic threats. Of note, the SEAOHUN website provides online training for at least 14 course topics. These topics cover a spectrum ranging from epidemiology and risk analysis, infectious disease management, Public Health, ecosystems health, behavior change, to culture, beliefs, values, and ethics.

Conclusion

In the last century, anthropogenic forces of urbanization, globalization, and industrialization have made the world more vulnerable to pan-epidemics than ever before. As the global population of both humans and animals grows in size, density, and proximity, the predictable potential effects of pan-epidemics could be devastating to human, animal, and environmental health. One Health can help provide an effective international antidote to such pan-epidemics. For the US and international medical community, in collaboration with global health and political leaders, to adopt a One Health approach to fighting pan-epidemics would send a powerful and unifying message to the world. We propose a mechanism for strengthening One Health in medical education by collaborating to create a synergy of strengths between the growing number of contributing organizations in the US and internationally.

Conflict of interest

None.

Ethics approval was not required.

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