Re-emergence of infectious diseases associated with the past

Diseases thought to have been left behind in the early 20th century have worryingly begun to re-emerge over the past few years, especially in vulnerable populations and low-income and middle-income countries. In 2018, an outbreak of diphtheria in Rohingya refugee campsites in Cox's Bazar (Bangladesh) caused nearly 8000 cases, with heavy monsoon rains contributing to reduced access to health care. More recently, trench fever and associated heart problems, caused by the bacterium *Bartonella quintana* spread via body lice, which was rife among armies during World War 1, was identified in four homeless men in Winnipeg (Canada) in 2020. Additionally, Brazil, which reported no cases of measles in 2015–16, had more than 8000 confirmed cases during 2020 and has, so far, had 144 confirmed and 448 reported cases of the disease in 2021.

The reasons for the re-emergence of diseases that had been under control or substantially declining are myriad. The nature of the disease-causing microbe itself might change, becoming more transmissible or pathogenic. Scarlet fever, another disease that had been viewed as being almost eradicated by the 1940s, has had a resurgence globally, including an unexplained spike in cases in England (UK) in 2014–16, reaching 19 206 cases in 2016, the highest incidence for more than 50 years. A possible explanation for the resurgence might be through the acquisition of prophage exotoxins by scarlet-fever-causing *Streptococcus pyogenes* through viral infections; these toxins might have enabled the bacterium to form so-called supercharged clones that can out-compete other strains and are possibly behind the present-day scarlet fever outbreaks. Additionally, resistance to antimicrobials has increased, primarily under the pressure of widespread antibiotic use, contributing to the re-emergence of several diseases that were no longer considered a public health problem.

However, a major contributor to the re-emergence of diseases is human behaviour. Population growth, crowding, and movement of human beings through migration can all contribute to or result in new ecological niches for diseases to re-emerge. A breakdown of effective public health measures and immunisation activities has been seen during times of conflict and civil wars, and more recently during the COVID-19 pandemic when access to health-care resources was severely restricted (eg, around 41 countries have had their measles vaccination campaigns compromised for 2020 or 2021, leading to a rise in measles outbreaks). Disturbances to the environment caused by human activity and imbalances in the complex ecosystem between humans, animals, pathogens, and the environment can also create conditions under which established diseases can reappear or, indeed, new diseases can emerge. Many prevalent infectious diseases in human beings are caused by pathogens that emerged from animal hosts moving to new environments, a contemporary example being SARS-CoV-2. One study of climate change and the emergence of SARS-CoV-2 suggests that bats in China whose habitats were altered through climate change were forced to then move on to new environments, changing not only the location of the viruses that they took with them, but also enabling new interactions between bats and pathogens, potentially affecting viral evolution and transmissibility to other animals. Understanding the variables in the dynamic balance between the environment, pathogens, and hosts could be important when considering measures to control outbreaks.

Two of the biggest drivers of re-emerging infectious diseases, however, are social and health inequities. The active outbreaks of measles in Brazil are particularly prevalent in areas such as Amapá, one of the poorest states in the country. Similarly, the outbreaks of trench fever and diphtheria have been in homeless individuals and refugees, respectively—two of the most vulnerable populations in society who encounter barriers to health care, live in overcrowded conditions that lead to spreading of disease, and do not have a large support network. It is important to acknowledge the role that such inequalities play in the spread of disease, not only for older diseases that are reappearing, but also as a warning for new outbreaks such as the COVID-19 pandemic, which has been shown to have taken the greatest toll in the USA in areas with the highest rates of sociodemographic risk factors, such as low income and high percentages of non-white residents. As human beings increasingly interact with each other, improving conditions for vulnerable people and poorer areas, and providing access to quality health care to individuals with the highest disadvantages are surely necessary steps in controlling devastating disease emergences and re-emergences for all.

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For more on the **2018 diphtheria outbreak in Rohingya refugees** see https://www.humanitarianresponse.info/sites/www.humanitarianresponse.info/files/documents/files/iscg_-_situation_report_-_21_june_2018.pdf

For more on **cases of trench fever in homeless men in Canada** see *CMAJ* 2020; published online Dec 20. https://doi.org/10.1503/cmaj.201170

For more on **outbreaks of measles in Brazil** see https://www.who.int/teams/immunization-vaccines-and-biologicals/immunization-analysis-and-insights/surveillance/monitoring/provisional-monthly-measles-and-rubella-data

For more on the **2014–16 resurgence of scarlet fever in the UK** see **Articles** *Lancet Infect Dis* 2018; **18:** 180–87

For the **study of supercharged *Streptococcus pyogenes* clones** see *Nat Commun* 2020; **11:** 5018

For more on the **growing resistance of microbes to antimicrobials** see *J Physiol Anthropol* 2020; **39:** 29

For more on **postponed measles vaccination campaigns** see https://www.cdc.gov/globalhealth/measles/data/global-measles-outbreaks.html

For the **study of climate change and the emergence of SARS-CoV-2** see *Sci Total Environ* 2021; **767:** 145413

For the **study of sociodemographic factors and Covid-19 incidence** see *JAMA Netw Open* 2021; **4:** e2036462