Opinion

COVID-19: should we really be surprised?

Aisha Elahi
Year 2, Medicine, University of Plymouth
Email: aisha.elahi@students.plymouth.ac.uk

Abstract

The article discusses causes of zoonotic disease such as COVID-19, with an emphasis on deforestation as a cause. Climate change and ecology is of growing importance, especially relating to human and animal health. The growing incidence and variation of zoonotic diseases highlights the need to explore this relationship further to gain understanding of the cause. This paper aims to describe some of the reasons why human health is dependent on successful ecosystems and how disease transmission may increase due to deforestation, as well as providing potential preventative methods.

Abbreviations

COVID-19 - Coronavirus disease
SARS - Severe Acute Respiratory Syndrome
MERS - Middle East Respiratory Syndrome

In December 2019, a new infectious disease spread through the city of Wuhan, China, before quickly spreading around the world, infecting almost every country and causing a worldwide pandemic. The causative agent was found to be Beta coronavirus which is genetically related to SARS-CoV and other bat-borne SARS viruses.[1] Diseases that are transferred from animals to humans are referred to as zoonotic diseases. These types of zoonotic diseases, such as Ebola, SARS and MERS,[2] have been increasing rapidly over the past decade due to human activities[3] which push people closer to animals, thus increasing the risk of contracting such diseases.

Understanding why rates of these diseases have been increasing is vital in order to prevent future outbreaks. A major cause for the SARS-CoV-2 outbreak is increased exposure to wild animals. The virus has a similar structure to that of bat and Malayan pangolin coronaviruses, yet strains sampled from these animals lack polybasic cleavage sites, structural components that enable the SARS-CoV-2 strain[4] to produce illness in humans. This difference in structure may suggest that the strain causing the pandemic stemmed from elsewhere, however, it is more likely that natural selection occurred within animal populations to produce these changes, before the virus was transferred to the human population. This highlights the need to understand the mechanisms of spread of zoonotic diseases and the factors that increase human exposure to wildlife. Alternatively, the virus may have developed genetic changes through transmission between humans after zoonotic transfer. This hypothesis suggests that the initial coronavirus from bats and pangolins may not have produced the disease symptoms, implying exposure to animals will not always produce illness. However, the root of the disease is still of animal origin, highlighting the need to reduce human exposure to animal pathogens.

A major cause of increased exposure to zoonotic disease is deforestation, mainly occurring in tropical climates for land to be used for agriculture, palm oil and timber. Many studies draw strong correlations between forest loss and disease such as Ebola outbreaks in Africa since 1976 and Dengue in South East Asia,[5] suggesting that continuation of deforestation would expose people to new diseases. In fact, 60% of emerging infectious diseases are shown to be zoonotic,[6] which emphasises the danger from forest removal. This link to deforestation could be explained by the 'dilution effect':[7] a higher biodiversity in an ecosystem effectively 'dilutes' the risk of transmission of diseases due to varied susceptibility to infection from a higher number of species. Activities which reduce biodiversity, such as deforestation, increase risk of zoonotic diseases as disease-carrying animals are able to reproduce with less competition, creating a greater likelihood of transmission to the human population. Additionally, there are positive correlations between deforestation and increases in vector-borne diseases, namely, malaria.[8] Deforestation allows accumulation of water and thus new areas for mosquitoes to breed, leading to higher populations and risk for disease to spread thereby threatening millions of people. In combination with increasing temperatures, this could mean mosquitoes may be able to survive and infect people in areas which were cooler prior to climate change.[9] In this way, there is a greater risk of, not only new diseases, but also transmission of current diseases. Hence, it is unsurprising another zoonotic outbreak occurred given the increasing rates of deforestation and increased exposure to wild animals.

It is difficult to identify a direct relationship between deforestation and the COVID-19 outbreak. Wuhan markets displayed a vast range of wildlife, already potentially carrying a multitude of diseases. Animals were kept in non-hygienic conditions,[10] providing zoonotic pathogens room to flourish. This offers an alternative cause for the outbreak: poor control of the species and the conditions in which they were sold. However, in China, the value of bushmeat remains high, giving poachers reason to continue capturing wild species to supply markets. This element of poaching sheds light on the relationship between deforestation and the pandemic. For example, one effect of deforestation is a reduction in habitats, which increases interactions between animals and humans thus giving poachers access to more wildlife and previously inaccessible parts of the landscape.

A suggested approach to tackle problems of zoonotic diseases is to adopt the 'One Health' approach:[11] a concept that relates human health, animal health and the health of the ecosystem. It ensures specialists from multiple disciplines work together at local, national and global levels to achieve the best healthcare outcomes. This can be exemplified by sharing resources between medical and veterinary sectors, therefore enabling greater understanding of zoonotic disease and methods for prevention. Reforestation has been found to reduce the risk of Hantavirus in Brazil[12] and may act as a plausible method to reduce risk from zoonoses in other tropical areas, potentially through the 'dilution' effect.

Overall, it is unsurprising another disease outbreak has taken place. Human activities have pushed people and animals closer together, reduced competition for disease and created an environment that facilitates disease transmission. Accepting that human and animal health depend on a healthy ecosystem, and constructing a framework to ensure the ecosystem is protected, are vital to ensure future risk is minimised. If human activities continue with little consideration for the environment, it can be assumed pandemics will continue to occur, threatening the lives of millions.

References

1. Mackenzie JS, Smith D W. COVID-19—A novel zoonotic disease: a review of the disease, the virus, and public health measures. Asia Pacific Journal of Public Health; 2020; 32: 145-153
2. The Lancet. Zoonoses: beyond the human–animal–environment interface. The Lancet; 2020; 396: 1
3. Lindahl JF, Grace D. The consequences of human actions on risks for infectious diseases: a review. Infection Ecology & Epidemiology, 2015; 5 (1): 30048.
4. Andersen K.G, Rambaut A, Lipkin W.I et al. The proximal origin of SARS-CoV-2. Nature Medicine; 2020; 26: 450-452
5. Morand S, Lajaunie C. Outbreaks of vector-borne and zoonotic diseases are associated with changes in forest cover and oil palm expansion at global scale. Frontiers in Veterinary Science; 2021; 8
6. Jones KE, Patel NG, Levy MA et al. Global trends in emerging infectious diseases. Nature; 2008; 451:990-993
7. Khalil H, Ecke F, Evander M, et al. Declining ecosystem health and the dilution effect. Scientific Reports; 2016; 6: 31314
8. Gottwallt A. Impacts of deforestation of vector-borne disease incidence. Journal of Global Health Science; 2013; 3: 16-19
9. Chua TH. Modelling the effect of temperature change on the extrinsic incubation period and reproductive number of Plasmodium falciparum in Malaysia. Tropical Biomedicine; 2012; 29: 121-128
10. Xiao X, Newman C, Buesching CD et al. Animal sales from Wuhan wet markets immediately prior to the COVID-19 pandemic. Scientific Reports: 2021; 11:11898
11. WHO EMRO. (2016) Zoonotic disease: emerging public health threats in the region. Available from: http://www.emro.who.int/about-who/rc61/zoonotic-diseases.html Accessed: 14 May 2022
12. Prist PR, Prado A, Tambosi LR et al. Moving to healthier landscapes: forest restoration decreases the abundance of Hantavirus reservoir rodents in tropical forests. Science of the Total Environment; 2021; 752: 141967

Aisha Elahi

My name is Aisha Elahi, I'm a medical student at Plymouth University. My current research interests include the possible therapeutic effects of different food groups on neurological disorders and the impact planetary changes will have on our health.