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*Biodiversity and Disease Communication*

# Making of a pandemic

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## Introduction

The world's population is growing rapidly, and it is especially the urban areas that develop fast. Urbanization refers to the mass movement from rural to urban areas of the population and the changes in urban settlements (Kuddus, Tynan, og McBryde 2020). Globalization and urbanization are setting its footprint on the earth with movements of humans, commodities through trading, economies, and food all over the world. The United Nations estimated that in 2041 6 billion people will live in urban areas (Kuddus, Tynan, og McBryde 2020). The consequences of these movements are disturbance of ecosystems, emigrating species, biodiversity loss, pollution, climate change and the emergence of zoonotic diseases. It is mostly poor people in developing countries that have the greatest health burden of zoonoses (Grace 2015). As an example, many migrants from rural areas that settles in an urban slum area, bring with them, their animals, both pets and livestock. This mix of humans and animals leads to vulnerability to infectious diseases (Kuddus, Tynan, og McBryde 2020). When one also considers the degradation of nature and habitats, challenges with water supplies, temporary housing and dense concentrations of people in peri-urban areas, the emergence of zoonotic diseases increases (Waldman 2015). With the Covid-19 pandemic fresh in mind as a shining example of a zoonotic disease caused by humans interfering in nature and how rapidly it spread due to globalization.

## The Biodiversity-Disease Relationship: A complex problem

The scientific community is struggling between two ideas. If biodiversity increases or decreases the infectious disease risk. This question is important because it directly affects the political decision on biodiversity conservation and public health (Rohr et al., 2020).
In consequence, the relationship between biodiversity and disease is a critical point to understand, first to be able to reduce the impacts of likely future diseases but also because human activities continue to damage this biodiversity and at the same time disease outbreaks increase (Halliday & Rohr, 2019).

Studies indicate that the richness of infectious diseases is positively correlated with the richness of mammals/birds but on the contrary, the number of zoonotic disease outbreaks is positively correlated with the number of threatened mammals and birds. The number of vector-borne outbreaks is negatively correlated with forest cover. That suggests that of course biodiversity is a source of pathogens, the richness of mammals and birds gives the richness of parasites and pathogens if there are more hosts there are more places for pathogens to develop, but the loss of this biodiversity is measured by the number of threatened species or forest cover seems to be linked to the increment of zoonotic diseases outbreaks (Rohr et al., 2020).

If we consider that infectious diseases will become a strong problem in the next few years, being able to predict when and where they will appear by understanding the relationship with biodiversity could have considerable value in terms of prevention and reduction of disease outbreaks (Rohr et al., 2020). But zoonosis itself is a complex problem, and there are many drivers which influence its emergence, incidence, and persistence (Ahmed et al, 2019). Concerning the biodiversity, the composition and structure of



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the community, in particular, the frequency and the mechanism of how communities assemble and disassemble which is still unclear and remain to be understood, may play a role in the spread of infectious disease and not only the number of species in the community (Morand et al, 2014; Rohr et al., 2020).

A hypothesis suggests the role of biodiversity as a buffer of pathogen spread through a dilution effect, which proposes that biodiversity reduces the abundance of a parasite per host and in consequence the risk of infectious disease that it can cause. It is important to notice that the general mechanism of this dilution effect remains unclear for the moment (Rohr et al, 2020). If it's the case, then biodiversity loss will harm humans and of course wildlife (Morand et al, 2014; Halliday & Rohr, 2014). But there is another hypothesis that suggests that if biodiversity is context-dependent, means that biodiversity increase the risk of disease then loss of biodiversity will not have an effect or in the case of amplification effect can have a good effect by decreasing the risk of diseases for human. Context dependence in the biodiversity-disease relationship can arise when the relationship is nonlinear, studies suggest that the relationship is nonlinear, but the degree of context-dependence remains unknown for the moment. In consequence, the capacity of biodiversity to be a buffer for diseases is interrogated (Halliday & Rohr, 2014).

Two effects seem to be observed, one at a small spatial scale (local) where the increment of biodiversity may cause a reduction in parasite abundance and disease emergence as a dilution effect (4, 5) and another effect this time at larger spatial scales (regional) the disease risk increase with the increment of biodiversity, cancel the dilution effect or even can result in an amplification effect. This observation underlines the fact that spatial scale, but also temporal scale, can moderate the biodiversity-disease relationship (Halliday & Rohr, 2014). Finally, we have a relationship between biodiversity and disease that is nonlinear and scale-dependent. The general finding indicates that biodiversity loss could lead to an increment in disease outbreaks at scales where humans have a risk to encounter diseases. Better conservation of biodiversity might be the most useful thing to do for minimizes the consequence and prevent diseases (Halliday & Rohr, 2014; Rohr et al, 2020). Most of the studies agree on the fact that it is necessary to conduct more studies and that the current literature is probably insufficient to predict how biodiversity loss will affect disease risk (Morand et al, 2014; Ahmed et al., 2019; Halliday & Rohr, 2019).

**The role of urbanization and human development in increasing zoonosis**

What is the relation between what drives urbanization and zoonosis in the Global South? This section will explore several relations concerning this question. To begin, habitat fragmentation of wild species leads to an increment in the wildlife-human interaction (Morand et al., 2014). This interaction is affected by species richness and community composition. In addition, climate changes or environmental perturbations, often in link with human perturbations can lead species to leave their natural habitats toward humans areas (Grace, 2015).

Additionally, some of the main reasons for diseases in cities were increased exposure to open drainage and proximity to refuse dumping sites (Ahmed et al., 2019). These resulted in higher prevalence of rodent and parasite-born diseases. These borders where humans and other animals, come into contact are seen throughout the literature as risk-factors. More contact with animals, such as livestock, and more migration between rural and urban areas, as well as transportation of animal products, also increases spread of disease (Ahmed et al., 2019).

Interestingly, the myth that living in an urban area leads to better health outcomes is a myth when you take a closer look at the various socioeconomic groups and risk factors (Ahmed et al., 2019). The incidence of both disability or morbidity arising from malnutrition, and child mortality related to respiratory and water-borne illness, tends to be higher in many urban neighborhoods than in rural areas (Ahmed et al., 2019. This could be due to a number of reasons, many already described above. Better infrastructure, equality, and services are needed to close this gap (Ahmed et al., 2019).

Urbanization specifically affects the ecosystem, and either directly or indirectly influences disease prevalence and transmission in several ways. When expanding cities, building on flood-prone land that has been drained leads to prolonged waterlogging after heavy rainfall, which increases water-borne infectious disease risk (Ahmed et al., 2019). Next, encroaching onto wild habitat via agricultural and urban land use exposes people and livestock to more risks and vectors. Habitat destruction, land use change and fragmentation has been cited as leading to 22 per cent of emerging infectious diseases. However, it is easy to miss the big picture if only specific urbanization drivers in relation to zoonoses are considered. The complex interactions at varying scales playing out in various scales and times are inherent to the food–animal–human–environment nexus (Ahmed et al., 2019).

However, It's important to remember that "The majority of studies reviewed in this particular field rely on realist or techno-scientific (statistical or modelling) approaches for knowledge generation and focus on particular zoonotic diseases without considering their context. This in turn often leads to certain knowledge generation pathways that can only produce apolitical knowledge outcomes: those that can be measured independently of wider socioeconomic processes."(Ahmed et al., 2019).

## Conclusion

How are we going to respond to zoonotic diseases in the future and what are our solutions? It is the poor countries that have the greatest burden of zoonotic diseases (Grace 2015). In regard of the rapid urbanization rate, the importance of tackle the socio-economic situation for the urban poor in developing countries are essential (Kuddus, Tynan, and McBryde 2020). As Kuddus, Tynan and Mcbryde (2020) argues, since the conditions in rural areas don't improve, people will continue to move to urban areas. The accessibility to clean water, distance to the sewers, proper housing and job opportunities are necessary. With urbanization there is also the p ossibility of economic growth which can lead to building better cities, infrastructure, make the cities resilient to climate change and c ooperation between communities, locals, gover nments, and nations. By providing for social justice and ensuring that poor people also can cover their needs, maybe some of the zoonotic diseases could be avoided? Additionally, the proper education of society is important for the prevention from new outbreaks of the diseases. The connection between the poor maintenance of the health and hygiene are the causes of the pandemics. The urbanisation and rapid growth of the population number contribute to the development of the slums, which are known to have severe input in the zoonotic diseases' outbreaks. The responsible planning as well as education are crucial in the zoonotic disease prevention.



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**References:**

Abodunrin, Oyinlola, and Bola Adesola. 2020. «CORONAVIRUS PANDEMIC AND ITS IMPLICATION ON GLOBAL ECONOMY». Accessed 10.may 2022. Available at: CORONAVIRUS-PANDEMIC-AND-ITS-IMPLICATION-ON-GLOBAL-ECONOMY.pdf (researchgate.net)

Ahmed, S., Dávila, J. D., Allen, A., Haklay, M. M., Tacoli, C., & Fèvre, E. M. (2019). Does urbanization make emergence of zoonosis more likely? Evidence, myths and gaps. *Environment and urbanization*, *31*(2), 443–460. https://doi.org/10.1177/0956247819866124

DirtyBiology (Léo Grasset). (2021). Les futures épidémies que nous vivrons - DBY #68. Youtube. Les futures épidémies que nous vivrons - DBY #68

Grace, Delia. 2015. «Zoonoses of Poverty: Measuring and Managing the Multiple Burdens of Zoonoses and Poverty». In *Zoonoses - Infections Affecting Humans and Animals: Focus on Public Health Aspects*, edited by Andreas Sing, 1127–37. Dordrecht: Springer Netherlands. https://doi.org/10.1007/978-94-017-9457-2_46.

Halliday, F.W., Rohr, J.R. (2019). Measuring the shape of the biodiversity-disease relationship across systems reveals new findings and key gaps. *Nat Commun* 10, 5032 https://doi.org/10.1038/s41467-019-13049-w

Kuddus, Md Abdul, Elizabeth Tynan, og Emma McBryde. 2020. «Urbanization: a problem for the rich and the poor?» *Public Health Reviews* 41 (1): 1. https://doi.org/10.1186/s40985-019-0116-0.

Morand S, Jittapalapong S, Suputtamongkol Y, Abdullah MT, Huan TB (2014) Infectious Diseases and Their Outbreaks in Asia-Pacific: Biodiversity and Its Regulation Loss Matter. PLOS ONE 9(2): e90032. https://doi.org/10.1371/journal.pone.0090032

Parr, Scott, Brian Wolshon, John Renne, Pamela Murray-Tuite, og Karl Kim. 2020. «Traffic Impacts of the COVID-19 Pandemic: Statewide Analysis of Social Separation and Activity Restriction». *Natural Hazards Review* 21 (3): 04020025. https://doi.org/10.1061/(ASCE)NH.1527-6996.0000409.

Rohr, J.R., Civitello, D.J., Halliday, F.W. *et al.* (2020) Towards common ground in the biodiversity–disease debate. *Nat Ecol Evol* 4, 24–33. https://doi.org/10.1038/s41559-019-1060-6

Waldman, Linda. 2015. "Urbanization, the peri-urban growth and zoonotic disease". In *Institute of development Studies.* Accessed 10. May 2022. Available at: ID563 Online.pdf (ids.ac.uk)