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Born in 1989 in Washington, D.C.

Studied Statistical Epidemiology at the University of Oxford and Harvard University

FELLOWSHIP
College for Life Sciences

PROJECT

Analytical Framework for Pandemic-Resilient & Sustainable Cities

The COVID-19 pandemic has made visible the deficiencies in how we imagine, plan, and manage our cities and live together in them. Cities became the hotspots of COVID-19 transmission, and incidence variation within cities highlighted social and health inequalities. Also, cities are the main sources of carbon emissions today. On the other hand, cities in all their diversity have become the dominant form of human settlement and are the major driving force behind innovation, social change, and cultural and economic activity. Yet, little is known about which city forms are most resilient to absorbing shocks like those from infectious disease outbreaks and/or epidemics. I propose to build an interdisciplinary research programme at the intersection of pandemic sciences and environmental sustainability. This project aims to develop the backbone theory to enable future city planning to be more adaptive so the cities can be more liveable.

Recommended Reading

Kraemer, Moritz U. G., Robert C. Reiner Jr., Oliver J. Brady, Jane P. Messina, Marius Gilbert, David M. Pigott, Dingdong Yi, et al. (2019). "Past and Future Spread of the Arbovirus Vectors Aedes aegypti and Aedes albopictus." Nature Microbiology 4: 854–863. https://doi.org/10.1038/s41564-019-0376-y.

Kraemer, Moritz U. G., Chia-Hung Yang, Bernardo Gutierrez, Chieh-Hsi Wu, Brennan Klein, David M. Pigott, Open COVID-19 Data Working Group, et al. (2020). "The Effect of Human Mobility and Control Measures on the COVID-19 Epidemic in China." Science 368: 493–497. https://doi.org/10.1126/science.abb4218.

Kraemer, Moritz U. G., Verity Hill, Christopher Ruis, Simon Dellicour, Sumali Bajaj, John McCrone, Guy Baele, et al. (2021). "Spatiotemporal Invasion Dynamics of SARS-CoV-2 Lineage B.1.1.7 Emergence." Science 373: 889–895. https://doi.org/10.1126/science.abj0113.

COLLOQUIUM, 18.04.2023

Digital and Genomic Epidemiology of Viruses

The control of emerging infectious diseases is a defining problem of our age. Growing global trade and mobility are connecting pathogens with new populations, and as a result, outbreaks of disease have become increasingly frequent. Disturbances to our ecosystems mean that spillover events between animals and humans increase.

Predicting which virus will cause the next epidemic is currently not possible. Instead, we must detect and analyze new human pathogens as soon as they emerge and plan their control using all the information at our disposal during these early moments of an outbreak.

Since the 1980s, the science of infectious disease dynamics has developed a sophisticated mathematical framework, which is widely used to inform pandemic control and support policy decisions. This framework uses data on the number of cases through time and space to quantify past spread, predict future transmission, and calculate the intensity of interventions and vaccinations needed to end an epidemic. However, current approaches do not always fully exploit new sources of information about epidemic behavior. Incorporating these promising data sources into epidemiological models has the potential to improve the accuracy and certainty of epidemic predictions.

Two new types of information relating to epidemics have become increasingly available. Firstly, genome sequences from emerging pathogens can be generated almost as fast as cases are counted. Viruses evolve as they spread, so their genomes contain a record of who-infected-whom – a 'genetic footprint' of past transmission events. Secondly, digital data sets that describe human population density and mobility in unprecedented detail are now accessible.

I will draw on concepts from mathematical epidemiology, pathogen phylodynamics, and network science to explain a new body of theory capable of co-analyzing these distinct sources of information. I will use examples from past outbreaks to illustrate the concept and show that tracking viruses using modern approaches can guide decisions and future planning on resource allocation.

PUBLICATIONS FROM THE FELLOWS' LIBRARY

Kraemer, Moritz ([Cambridge, Mass.],2023)

Dispersal patterns and influence of air travel during the global expansion of SARS-CoV-2 variants of concern

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1853554928

Kraemer, Moritz (Washington, DC [u.a.],2021)

Spatiotemporal invasion dynamics of SARS-CoV-2 lineage B.1.1.7 emergence

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=181311014X

Kraemer, Moritz (Washington, DC [u.a.],2020)

The effect of human mobility and control measures on the COVID-19 epidemic in China

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1813108390

Kraemer, Moritz (London,2019)

Past and future spread of the arbovirus vectors Aedes aegypti and Aedes albopictus

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1813106509