Introduction to Stochastic Epidemic Models with Inference

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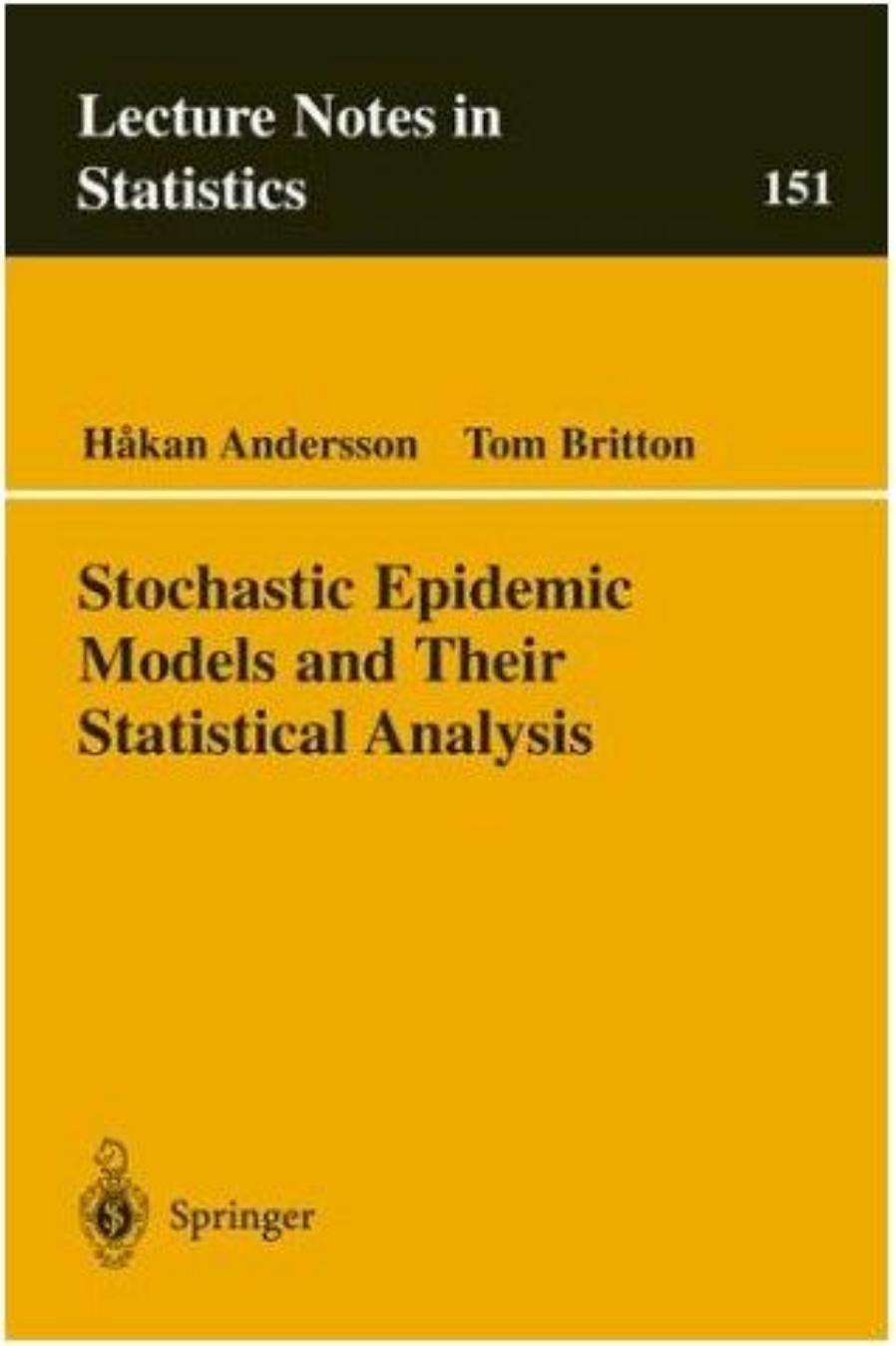
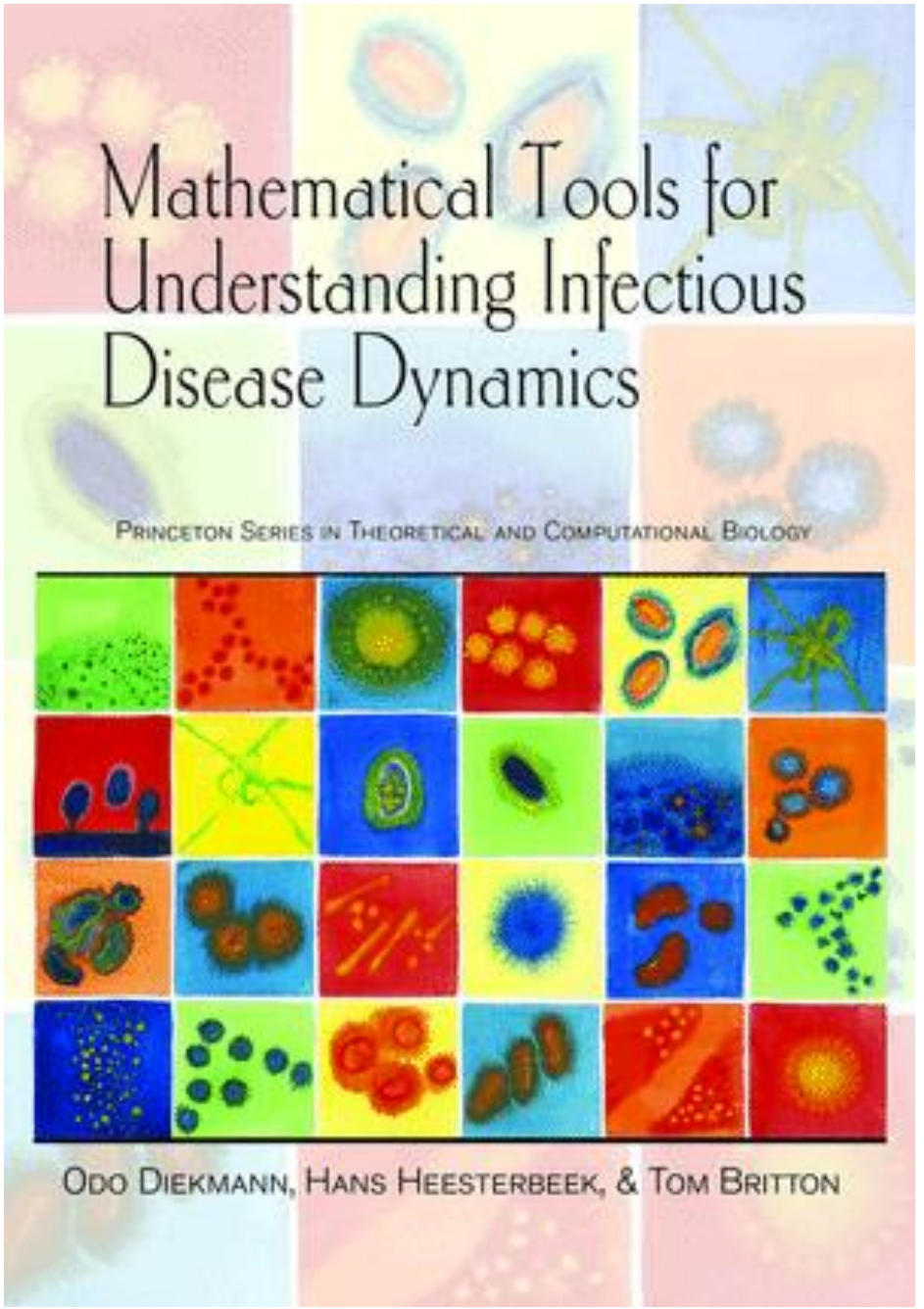
Philosophy of this course (i.e., Reductionist statements)

- Analytic work on the transmission and control of infectious diseases depends on an understanding of epidemic theory
- A technical understanding of the underlying non-linear, stochastic dynamics of infectious disease transmission is the basis for this understanding
  - This almost always involves non-linear functions for the interaction of ***x*** susceptible and ***y*** infected people at time *t*.
- This technical understanding leads to sound inferential structures for estimation of governing parameters and functions

Some Books of Interest for This Course





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csquid CENTER FOR STATISTICS & QUANTITATIVE INFECTIOUS DISEASES

Stockholm University

Statistics for Biology and Health

M. Elizabeth Halloran • Ira M. Longini, Jr. • Claudio J. Struchiner

Design and Analysis of Vaccine Studies

Widespread immunization has many different kinds of effects in individuals and populations, including in the unvaccinated individuals. The challenge is in understanding and estimating all of these effects. This book presents a unified conceptual framework of the different effects of vaccination at the individual and at the population level. The book covers many different vaccine effects, including vaccine efficacy for susceptibility, for disease, for post-infection outcomes, and for infectiousness. The book includes methods for evaluating indirect, total and overall effects of vaccination programs in populations. Topics include household studies, evaluating correlates of immune protection, and applications of casual inference. Material on concepts of infectious disease epidemiology, transmission models, casual inference, and vaccines provides background for the reader. This is the first book to present vaccine evaluation in this comprehensive conceptual framework.

This book is intended for colleagues and students in statistics, biostatistics, epidemiology, and infectious diseases. Most essential concepts are described in simple language accessible to epidemiologists, followed by technical material accessible to statisticians.

Elizabeth Halloran and Ira Longini are professors of biostatistics at the University of Washington and the Fred Hutchinson Cancer Research Center in Seattle. Claudio Struchiner is professor of epidemiology and biostatistics at the Brazilian School of Public Health of the Oswaldo Cruz Foundation in Rio de Janeiro. The authors are prominent researchers in the area. Halloran and Struchiner developed the study designs for dependent happenings to delineate indirect, total, and overall effects. Halloran has made contributions at the interface of epidemiological methods, causal inference, and transmission dynamics. Longini works in the area of stochastic processes applied to epidemiological infectious disease problems, specializing in the mathematical and statistical theory of epidemics. Struchiner has contributed to understanding the role of transmission in interpreting vaccine effects.

EPIDEMIOLOGY

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› springer.com

Halloran • Longini
Struchiner

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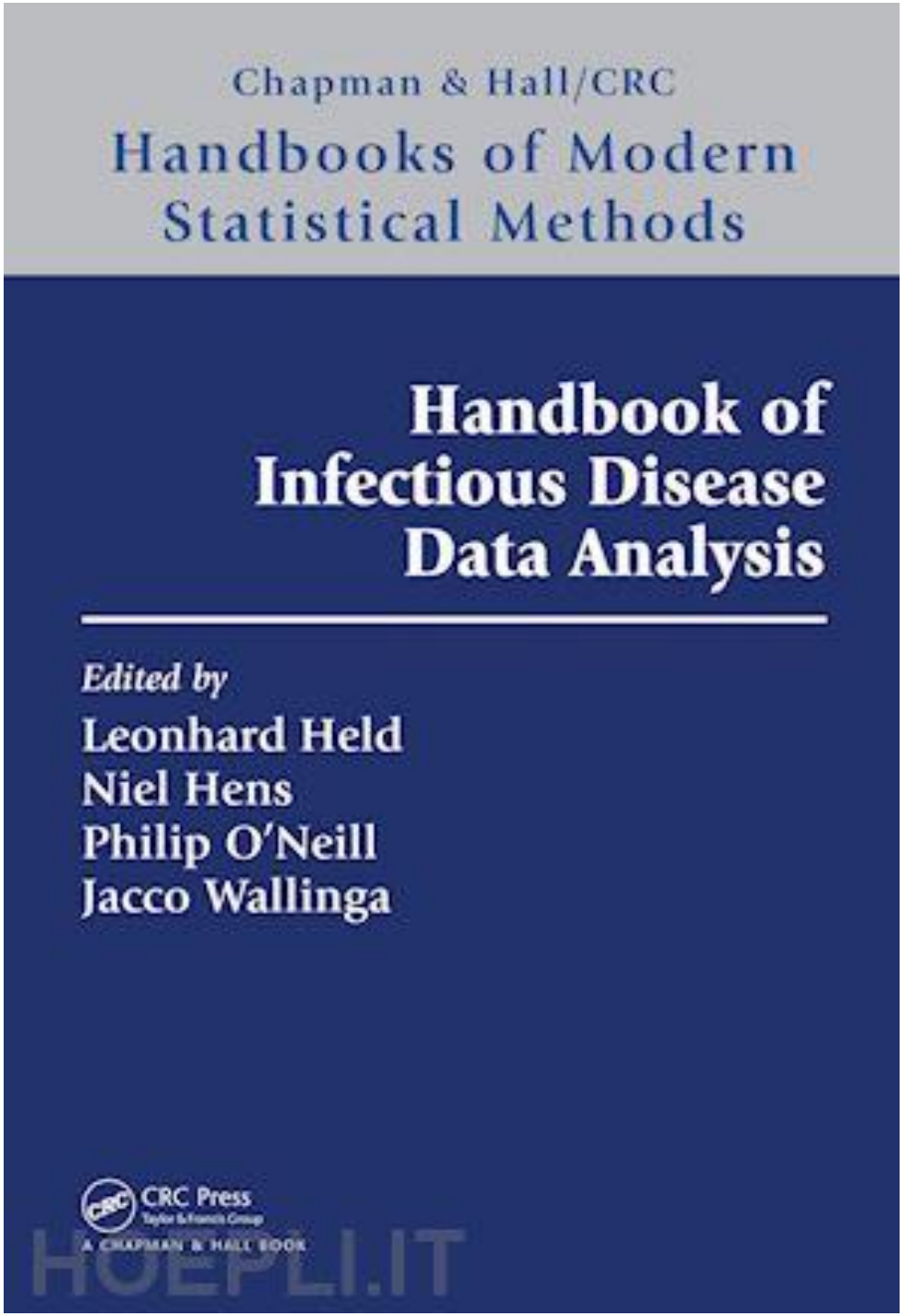

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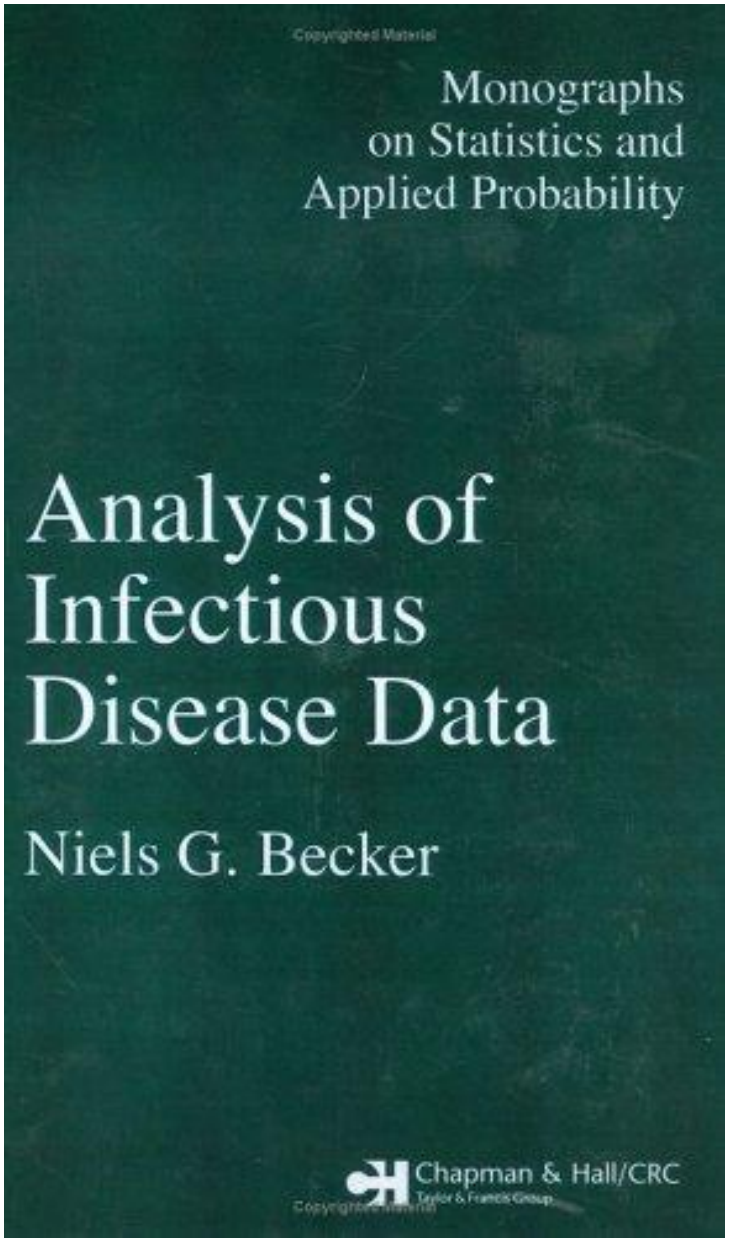
The Mathematical Theory of Infectious Diseases
and its Applications

Norman T. J. Bailey, M.A., D.Sc.
Unit of Health Statistical Methodology, World Health Organization, Geneva. Formerly Professor of Biomathematics, Cornell University Graduate School of Medical Sciences, and Member of the Sloan-Kettering Institute for Cancer Research

Second edition

CHARLES GRIFFIN & COMPANY LTD
London and High Wycombe



1975, 1st addition 1957

WHO Blueprint

World Health Organization

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Targeting research on diseases of greatest epidemic and pandemic threat

Prioritizing viruses of greatest epidemic and pandemic threat to accelerate R&D on safe and effective medical countermeasures.
The WHO list of priority pathogens of epidemic and pandemic threat is expected to be publicly release in the first half of 2024.

In a proactive approach to bolster global readiness and response to potential future epidemics and pandemics, the Research and Development (R&D) Blueprint maintains its commitment to expediting research on emerging disease threats. The overarching goal is to reduce the time required for the development of safe and effective medical countermeasures—both curative and preventive.

To strategically channel collaborative research efforts with the worldwide scientific community, the World Health Organization (WHO) regularly issues an official list spotlighting pathogens with the highest epidemic and pandemic potential. This list specifically targets

21 November 2022 | News release

WHO to identify pathogens that could cause future outbreaks and pandemics

21 February 2023 | Call for experts

https://www.who.int/teams/blueprint/who-r-and-d-blueprint-for-epidemics

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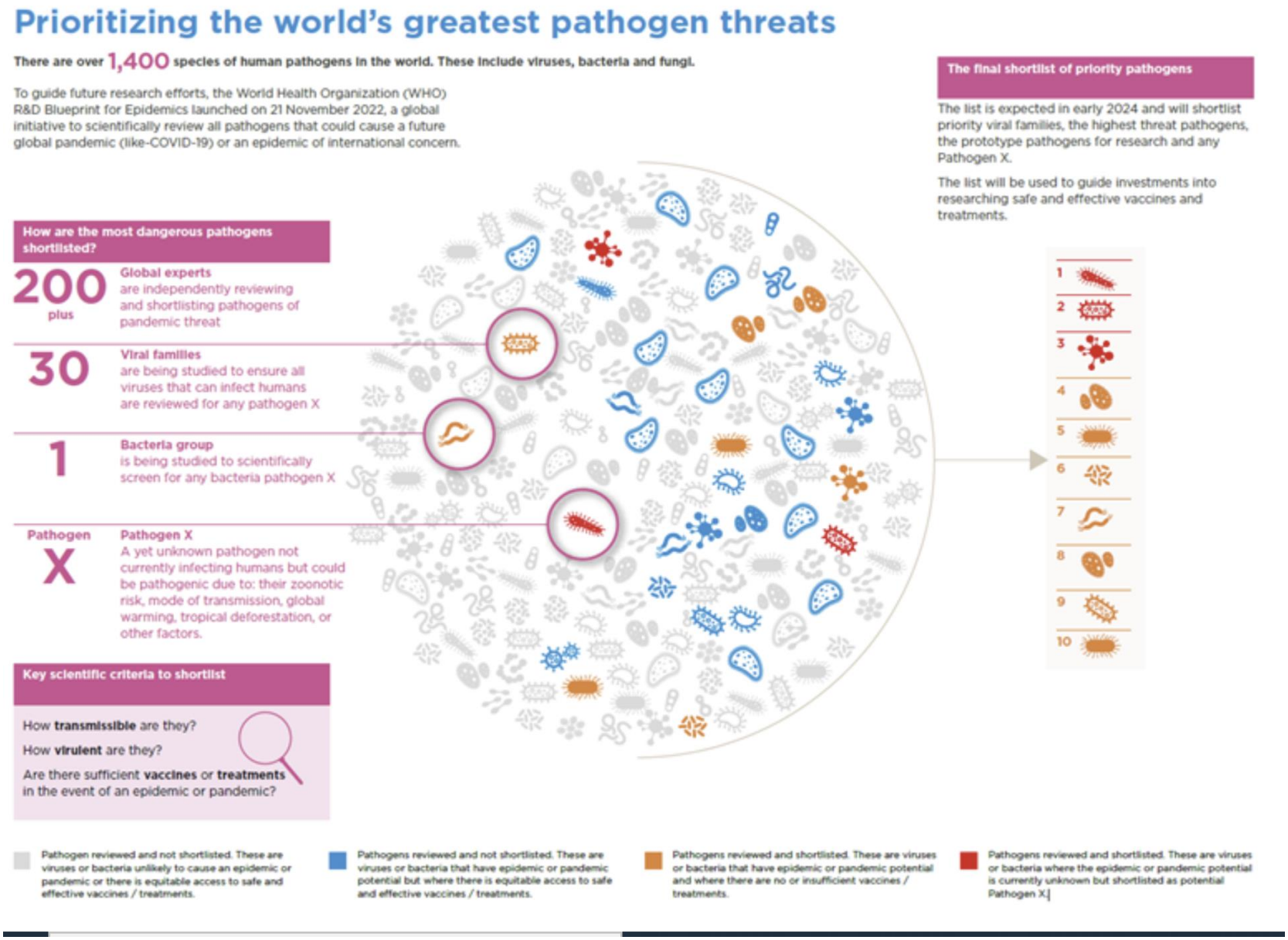

Current trial design: filoviruses (Sudan, Marburg), mpox, COVID-19, maybe pandemic influenza soon.

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World Health Assembly

77th World Health Assembly

Daily updates

The Seventy-seventh World Health Assembly is being held in Geneva, Switzerland, on 27 May – 1 June 2024. The theme of this year's Health Assembly is: All for Health, Health for All.

Proceedings will be webcast live from this web page. Simultaneous interpretation will be available in Arabic, Chinese, English, French, Russian and Spanish.

This content was last updated on 28 May 2024.

WHO and the WHA – an explainer

Media resources

Watch the World Health Assembly sessions

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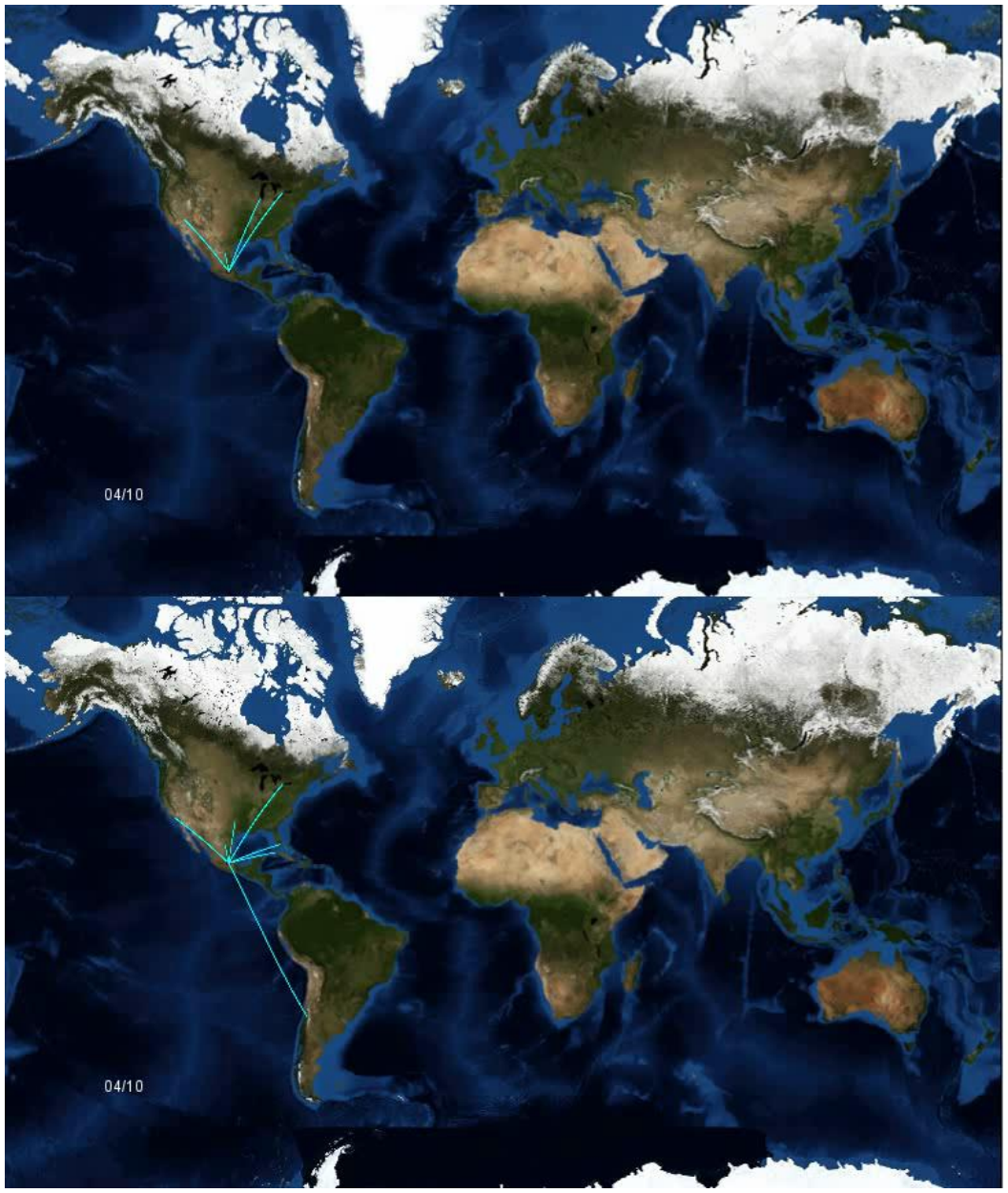
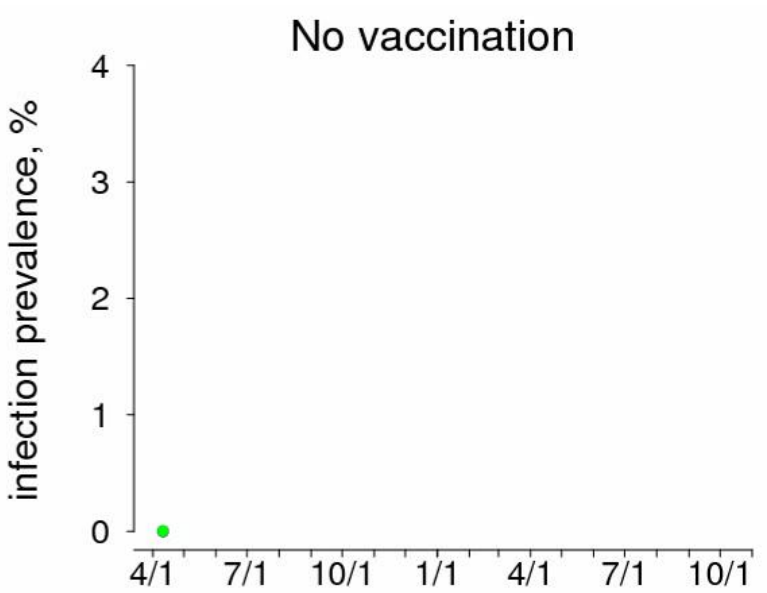
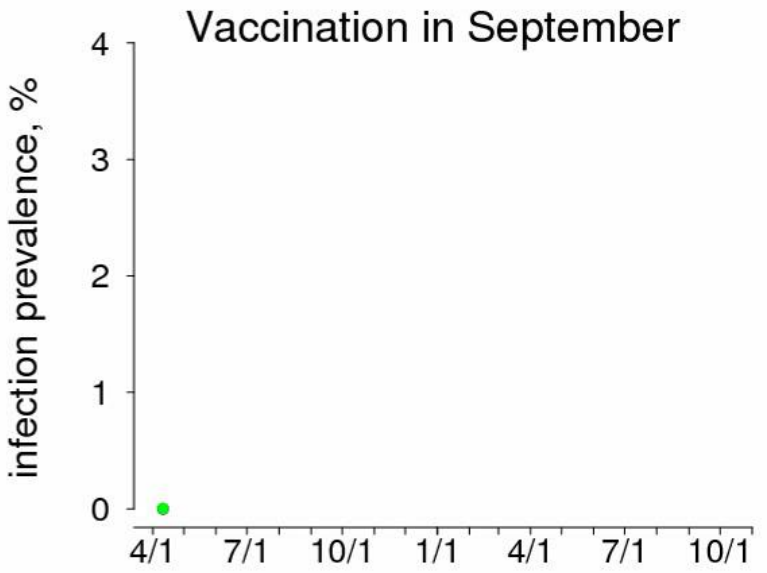
An example

Pandemic H1N1, 2009-2010: Stochastic, Compartmental, Patch Model







Kenah, E., Chao, D.L., Halloran, M.E., Matrajt, L., Longini, I.M.: The global transmission and control of influenza. PLoS One 10.1371/journal.pone.0019515 (2011). https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0019515

Thanks

On with the course!

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