Book proposal: Infectious Disease Epidemiology - A modern systems approach

2017-12-19

<< DRG comments 2017-12-20>>

# Author

* Andreas Handel1, Department of Epidemiology and Biostatistics, The University of Georgia, Athens, GA, USA

# Working book titles

* Infectious Disease Epidemiology - A modern systems approach
* Modern Infectious Disease Epidemiology - A (dynamical) systems approach

# Rationale and scope

Modern infectious disease epidemiology makes heavy use of computational model-based approaches and a dynamical systems perspective. The importance of analyzing infectious diseases in such a way keeps increasing. However, infectious disease epidemiology is still often taught mainly from a medical and classical epidemiological study design (e.g., cohort, case- control) perspective. A number of textbooks exist that approach infectious disease epidemiology from that perspective (e.g. (Magnus 2008; Nelson and Williams 2013; Giesecke 2017)).

While textbooks that teach a systems/model based approach to infectious diseases exist (e.g. (Anderson and May 1991; Diekmann and Heesterbeek 2000; Keeling and Rohani 2008; Vynnycky and White 2010)), those books are meant to teach students how to become modelers. As such the books require students to work with mathematical models and write computer code. This is a significant barrier for students who do not have a strong mathematical background or prior coding experience, which applies to many students in public health and related biomedical disciplines. It limits the number of students who can or want to engage with infectious disease epidemiology by using modern, systems modeling-based approaches.

There is currently (as far as I am aware) no book that teaches infectious disease epidemiology from a systems perspective while at the same time being approachable to students without the need of doing a good bit of math and/or computer programming. Thus the idea for this book, which is meant to fill the gap between 'classical' ID Epi books and the modeling books.

<<Although you don't intend to write a standard adoptable textbook, your goal is pedagogical; so I find it useful to think in terms of courses on "infectious disease modeling" and "infectious disease epidemiology" because the bulk of your audience is somewhere in the union of the people taking those courses. You currently describe your book as filling the gap between classical books and modeling books. Who is in that gap? The implication seems to be that someone might read your book after taking a typical IDE course or maybe use it as a supplement for an IDM course if they're struggling. Is it also the case that you want your book to be a successor to classical books for people who want to teach/learn IDE as a systems/computational subject? (Although maybe this isn’t compatible with assuming familiarity with basic study design and other epidemiological concepts; see below.) If so, the proposal should be more forthright about it. – DRG>>

Some more (and overlapping) thoughts on how this book fits in can be found in the overview chapter of the current draft: <https://ahgroup.github.io/DSAIDEbook/overview-of-this-book.html>.

<<It’s helpful for reviewers to make this document as self-contained as possible. If there is information in the overview that you want to be sure reviewers know, put it in this document. – DRG>>

<<I’d recommend ending this section is a list of “learning objectives” as you might have created for your course. The idea is to give a concrete sense of what the book covers but also what additional skills it enables. – DRG>>

# Readership

The main audience are students in public health and related biomedical disciplines who want to learn about infectious disease epidemiology from a modern, systems-based perspective, while not (yet) wanting to engage deeply with the math and computational aspects related to the topic.

Students who have some basic understanding of epidemiological and infectious disease concepts will have a better starting point, but with a bit of 'filling the gaps' using Wikipedia, the book should be accessible to any interested student.

<<The overview is more precise about prerequisites: “We assume readers are familiar with basic ideas such as incidence and prevalence, basic study design such as cohort and case-control studies and clinical trials, and other basic epidemiological concepts.” Which is correct? It’s important to have a very clear vision of who you’re writing for and what they already know and what they want/need to know. – DRG>>

The main goal of the book is to equip students with the knowledge to think about ID Epi in a systems way and to 'consume/interpret' results from infectious disease modeling studies. If students, after having worked through this book, want to proceed toward becoming modelers themselves, they could continue with the modeling textbooks mentioned above.

<<The information in this paragraph can be worked into the learning objectives that I suggest be added above. – DRG>>

# Competing/related books

The rationale and scope describes how I believe this book differs from existing books and covers a gap that isn't covered by any current book.

Another book worth mentioning is (Krämer, Kretzschmar, and Krickeberg 2010), which is an edited volume. It's a mix of ID topics, more conceptual/less medical than (Nelson and Williams 2013). Since each chapter is written by a different set of authors, it has the usual problem of edited books that each chapter/topic is somewhat stand-alone, with authors writing at different levels of difficulty and discussing whatever they find relevant for a given topic. Thus the whole book is not that cohesive and I consider it suitable to assign specific chapters as additional reading but wouldn't use it as a stand-alone book for teaching/learning.

A somewhat older book similar to (Krämer, Kretzschmar, and Krickeberg 2010) seems to be (Thomas and Weber 2001). It is also an edited volume and based on the TOC, convers broadly similar ground to (Krämer, Kretzschmar, and Krickeberg 2010). I do not own (Thomas and Weber 2001), thus have not yet seen/reviewed the full text.

To my knowledge, the resources that are most similar to the book in content/spirit are not textbooks but 2 online courses on Coursera, one called 'Epidemics - the dynamics of infectious diseases' developed by faculty from Penn State (State 2014), and one called 'Epidemics', developed by faculty from Hong Kong University (University 2015).

The Penn State course is 8 week long, features many very good and short videos, and is somewhat broader regarding content and discusses topics than my book. For instance 1 week of the course is devoted to within-host infection and immune response processes, something I do not cover explicitly. Almost all content is taught through the videos, with some optional reading drawn from the primary literature

The Hong Kong Course is 10 weeks long and also mainly video-based, with some optional reading drawn from the primary literature. The course discusses some topics my book doesn't touch on (e.g. communication strategies for ID interventions) while conversely I discuss topics (e.g. extinction and evolution) that are not/barely covered in the course.

I consider the relation between these courses and my proposed book somewhat complementary, i.e. those are 2 different ways of teaching similar material. In fact, in my course on this topic (see below), for every topic I cover I assign both a chapter of my book and suitable videos, many of which come from these online courses.

I have not yet performed a very thorough and systematic review of all the books out there. It is possible that I missed some that are related/similar to my proposed book. I plan to shortly do a very thorough review of what is out there. Still, I believe that whatever I find, my book will be different enough to warrant its existence.

<<I’m assuming this, last paragraph will be dropped from the finished proposal document. As useful, maybe even more useful, than surveying many more books would be to survey what people are using for teaching, because those tend to be the books recommended for independent study as well. For example, you mention Vynnycky and White briefly above; it’s probably one that merits further attention in this section. – DRG>>

# Content

A first version of the book is already written and is currently available on Github at:

<https://ahgroup.github.io/DSAIDEbook/>

<<Please also append to this document a table of contents with all the chapters you expect to have in the finished book. - DRG>>

The book currently has 18 chapters, some longer than others. Each chapter has the same structure, with a short section of suggested exercises at the end. Those exercises usually involve the computer package described below, and suggestions for reading and critically discussing papers from the primary literature.

<<Say a bit more about what the DSAIDE exercises are like. What kinds of things will readers do? Does each chapter have one extended practical, or does each chapter have a series of tasks? [Related comments: (1) Chapter 6 doesn’t really have exercises. Are these to come? (2) A lot of the exercises say “Pick an ID.” I suggest adding a section on infectious diseases to the overview that points people to useful sources of information – e.g. a few authoritative sources as well as wikipedia. (3) Lots of the exercises have people read a particular paper, then find another paper or papers or consider a different ID. But, for a book intended to be usable for independent study, the first step of these exercises feels underdeveloped. I think readers would welcome more scaffolding, e.g. leading questions, in learning how to extract pertinent information/insights from published papers before they then try to bring those insights to bear on other papers.] – DRG>>

The current form of the book was written as part of my teaching of a course on this topic. This is an online graduate level course with mostly public health students and some students from other disciplines (e.g. Ecology, Veterinary Infectious Disease, Forestry, etc.). Each chapter was covered in a week (together with other assigned materials). Students were assigned some or all of the exercises listed at the end of the chapter as weekly homework.

# Special features

Color figures are likely not needed. The book contains text boxes that are set apart from the main text and that contain more advanced material (e.g. show sets of differential equations) that students can skip without losing the ability to understand the rest.

<<The current draft feels light on visuals (leaving aside the cartoons). I’d give some thought to adding graphical representations – perhaps produced by DSAIDE? – that will help readers build up their intuition about relations between variables, parameters, etc. These would play the role filled by equations in a more mathematical book. – DRG>>

# Description of ancillary material

I have written an R package that allows students to actively explore the topics covered in the book. In the exercise section of each book chapter, the students are pointed toward the appropriate simulation in the R package. This R package is fully developed and available, a description of it can be found in (Handel 2017).

<<Say a bit more about the package: its name, DSAIDE, that it’s available on CRAN and on github. Mention briefly the four levels of use and that the book assumes “level 1” use. Is it correct that the package is all simulations i.e. there’s no analysis of real data sets? It’s worth making this clear one way or the other. At the end cite Handel (2017) for details. – DRG>>

# Proposed length of the book and its proposed completion date

A very crude word count (including TOC and references) gives around 40,000 words currently. A pdf version of the book is 106 pages. I expect the final version to grow by around 50-100% through addition of a few more chapters and adding more details to several existing chapters.

My aspirational completion date is end of summer. I have a light teaching load in spring and time over summer. This should give me enough time to finish a version that is suitable to undergo peer review. If I can't finish by end of summer, I hope to get it done at least end of year.

# Planned next steps

* I have a few topics/chapters that I want to add, I have started working on those. They are in the book draft but currently empty/incomplete.
* I want to re-visit various pertinent books/courses/resources and review them to see if there are any topics that I think should be added to my book.
* Some of the existing chapters are a bit too short, I plan to flesh them out some more.
* Everything needs further editing and cleaning up.

# Brief credentials of the author

Andreas Handel  
Associate Professor  
Assoc. Dept. Head &  
Graduate Coordinator  
Department of Epidemiology and Biostatistics  
College of Public Health, University of Georgia  
Athens, Georgia 30602, USA  
<http://handelgroup.uga.edu/>

See website for my research and further information.

# Some other comments

The book is written in bookdown (<https://bookdown.org/>) and lives in the "R ecosystem" (markdown, pandoc, bibtex, etc.)

# References

Anderson, Roy M, and RM May. 1991. “Infectious Disease of Humans.” *Dynamics and Control*.

Diekmann, Odo, and Johan Andre Peter Heesterbeek. 2000. *Mathematical Epidemiology of Infectious Diseases: Model Building, Analysis and Interpretation*. Vol. 5. John Wiley & Sons.

Giesecke, Johan. 2017. *Modern Infectious Disease Epidemiology*. CRC Press.

Handel, Andreas. 2017. “Learning Infectious Disease Epidemiology in a Modern Framework.” *PLoS Computational Biology* 13 (10). Public Library of Science: e1005642.

Keeling, Matt J, and Pejman Rohani. 2008. *Modeling Infectious Diseases in Humans and Animals*. Princeton University Press.

Krämer, Alexander, Mirjam Kretzschmar, and Klaus Krickeberg. 2010. *Modern Infectious Disease Epidemiology: Concepts, Methods, Mathematical Models, and Public Health*. Springer.

Magnus, Manya. 2008. *Essentials of Infectious Disease Epidemiology*. Jones & Bartlett Learning.

Nelson, Kenrad E, and Carolyn Williams. 2013. *Infectious Disease Epidemiology*. Jones & Bartlett Publishers.

State, Penn. 2014. “Epidemics - the Dynamics of Infectious Diseases.” <https://www.coursera.org/learn/epidemics>.

Thomas, James Conley, and David J Weber. 2001. *Epidemiologic Methods for the Study of Infectious Diseases*. Oxford University Press.

University, Hong Kong. 2015. “Epidemics.” *edX*. <https://www.edx.org/course/epidemics-hkux-hku01x-0>.

Vynnycky, Emilia, and Richard White. 2010. *An Introduction to Infectious Disease Modelling*. Oxford University Press.