Epidemiology

- To learn epidemiology, **<u>an excellent textbook</u>** is used. Technical terms are explained in both English and Japanese, since knowing Japanese terms is needed to read epidemiological research papers in Japanese and reports from MHLW.
- The textbook is Kenneth J. Rothman "Epidemiology: An Introduction, 2nd ed.", Oxford University Press, Oxford, 2012.
- As another textbook, Bonita R, Beaglehole R, Kjellström T & WHO (2006). "Basic epidemiology, 2nd ed." can also be recommended https://apps.who.int/iris/handle/10665/43541 (freely available in English, Japanese, and several other languages)
- Basically each chapter is assigned for one of the participants. The assigned student must prepare handouts and distribute them, and explain it in English. Other participants also should read the chapter in advance. Additional information is also given, if any. After that, open discussion will be done among all participants. Questions in the end of each chapter will be solved, if there is enough time.

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Preface to second edition

- What is epidemiology?
  - Application of statistical methods to the problems of disease occurrence and causation = Applied statistics
  - A scientific discipline rooted in biology, logic, and the philosophy of science. Statistical methods are important tools, but not foundation
- This book aims to present a simple overview of the principles and concepts
- Epidemiology is misunderstood as too simple or too convoluted. Both incorrect
- Chapter 1 illustrates
  - Epidemiology is more than "common sense"
  - Confounding (understanding this can let us avoid fallacious inferences)
  - "Too complicated" misunderstanding can be avoided by unifying set of ideas that extended across the many separate topics within epidemiology

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Preface to second edition (cont'd)

- Chapter 2 (new to 2nd ed.) shows a historical perspective. There were many contributors to epidemiology.
- Chapter 3 addresses causation with general model
- Chapter 4 describes basic epidemiologic measures including disease occurrence and effects
- Chapter 5 covers the main study types, such as case-control study, cohort study, cross-sectional study: Focusing on how to reduce or describe measurement error
- Chapter 6 (new to 2nd ed.) describes infectious disease epidemiology
- Chapter 7 shows how to treat systematic error (bias)
- Chapter 8 shows how to treat random error, basically applying statistical methods: Including p-value function
- Chapter 9 introduces the basic analytic methods including mathematical equations
- Chapter 10 extends the analytic methods to stratified analysis

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Preface to second edition (cont'd)

- Chapter 11 explains how to consider interaction
- Chapter 12 explains regression models
- Both Chapter 11 and 12 will be explored more in advanced courses in epidemiology. If you have any interest in those topics, please read Lash TL, VanderWeele TJ, Haneause S, Rothman KJ (2020) Modern Epidemiology, 4th ed., Wolters Kluwer Health.
- Chapter 13 explains clinical epidemiology, mostly addresses screening, randomized clinical trials, and pharmacoepidemiology
- Newer and supporting information for this textbook is provided via the companion site [https://www.oup.com/us/epi/]

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Contents

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Chapter 1. Introduction to Epidemiologic Thinking

- Epidemiology is the core science of public health
- This textbook presents the basic concepts and methods of epidemiology
- The definition of epidemiology
  - The study of the distribution and determinants of disease frequency (MacMahon B, Pugh TF, 1970)
  - The study of the occurrence of illness (Anderson G, cited in Cole P, 1979)
  - The study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to the prevention and control of health problems (Last JM "Dictionary of Epidemiology, 4^{th} ed.", OUP, 2001)
- Sometimes it's misunderstood as too simple or too complicated, and thus, by showing an example of *confounding* (details are given in Chapter 7) and basic fallacies, the book corrects such misunderstanding

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Example of confounding (1)

- Sweden's standard of living is generally high.
- Panama suffers from poverty and more limited health care.
- Common sense tells us that Sweden's death rates are lower than Panama.
- However, a greater proportion of Swedish residents than Panamanian residents die each year.
- The population pyramids (Figure 1-1) shows the difference of age structures between the 2 countries
  - For people of the same age in the 2 countries, the death rates among Swedes is lower than those among Panamanians
  - In both countries, older people die at greater rate than younger
  - Sweden has older population than Panama, so that a greater proportion of all Swedes die in a given year compared with Panama
- Age differences between the countries are confounding the differences in death rates.

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Example of confounding (2)

- Based on interview, women in Whickham were asked for smoking in 1972-74 and tracked the survival over 20 years
- Smokers showed lower risk of death than non-smokers (see Table 1-1)
- Smokers fared better than non-smokers? Not necessarily
  - Smoking information was only obtained once in the beginning of the study, actually smoking habits may change
  - More realistic explanation is confounding by age (Table 1-2)

Table 1-1. Risk of death in a 20-year period among women in Whickham, England, according to smoking status at the beginning of the period.

	Smoking		
Vital Status	Yes	No	Total
Dead	139	230	369
Alive	443	502	945
Total	582	732	1314
Risk (Dead/Total)	0.24	0.31	0.28

* Data from Vanderpump et al. 1996. https://doi.org/10.2307/2684931

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Example of confounding (2) cont'd

Table 1-2. Risk of death in a 20-year period among women in Whickham, England, according to smoking status at the beginning of the beriod, by age

		Smoking		
Age	Vital Status	Yes	No	Total
18-24	Dead	2	1	3
	Alive	53	61	114
	Risk	**0.04**	**0.02**	**0.03**
25-34	Dead	3	5	8
	Alive	121	152	273
	Risk	**0.02**	**0.03**	**0.03**
35-44	Dead	14	7	21
	Alive	95	114	209
	Risk	**0.13**	**0.06**	**0.09**
45-54	Dead	27	12	39
	Alive	103	66	169
	Risk	**0.21**	**0.15**	**0.19**
55-64	Dead	51	40	91
	Alive	64	81	145
	Risk	**0.44**	**0.33**	**0.39**
65-74	Dead	29	101	130
	Alive	7	28	35
	Risk	**0.81**	**0.78**	**0.79**
75+	Dead	13	64	77
	Alive	0	0	0
	Risk	**1.00**	**1.00**	**1.00**

- Age distributions are quite different between smokers and non-smokers (Smokers include more younger, non-smokers include more older)
- Risks are quite different by age
- Smoking is related to a higher risk of death, but confounding by age obscured this relation in the crude data (Table 1-1)
- Stratified analysis to tackle this issue will be shown in Chapter 10

Boston Globe's story

- So many well-known orchestra conductors have lived extremely old
  - Otmar Suitner died on 8 Jan 2010 at age 87
  - Leonard Bernstein died on 14 Oct 1990 at age 72
  - Karl Böhm, died on 14 Aug 1981 at age 86
  - Herbert von Karajan died on 16 Jul 1989 at age 81
- Conducting orchestra must be good for health? → No
- Alternative causation from epidemiologic viewpoint
  - Well-known conductors are well-known because they lived longer "anecdotal episodes" → Such information is not suitable as epidemiologic data
  - To be an orchestra conductor, long-term training is needed, therefore nobody can be a conductor before age 40. Even if all conductors' ages at death were collected, those cannot be compared with the age at death of other jobs
    - The average age at death in nursery school students may be 4 years, and that in firefighters may be 38 years: It doesn't mean the higher risk of nursery school students than firefighters (Fallacy of comparing average age at death or disease onset)

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