Exercise Answers

Exercise 1.1
1. B
2. B
3. A
4. A
5. C
6. A

Exercise 1.2
1. Having identified a cluster of cases never before seen in the area, public health officials must seek additional information to assess the community’s health. Is the cluster limited to persons who have just returned from traveling where West Nile virus infection is common, or was the infection acquired locally, indicating that the community is truly at risk? Officials could check whether hospitals have seen more patients than usual for encephalitis. If so, officials could document when the increase in cases began, where the patients live or work or travel, and personal characteristics such as age. Mosquito traps could be placed to catch mosquitoes and test for presence of the West Nile virus. If warranted, officials could conduct a serosurvey of the community to document the extent of infection. Results of these efforts would help officials assess the community’s burden of disease and risk of infection.

2. West Nile virus infection is spread by mosquitoes. Persons who spend time outdoors, particularly at times such as dusk when mosquitoes may be most active, can make personal decisions to reduce their own risk or not. Knowing that the risk is present but may be small, an avid gardener might or might not decide to curtail the time spent gardening in the evening, or use insect repellent containing DEET, or wear long pants and long-sleeve shirts even though it is August, or empty the bird bath where mosquitoes breed.

3. What proportion of persons infected with West Nile virus actually develops encephalitis? Do some infected people have milder symptoms or no symptoms at all? Investigators could conduct a serosurvey to assess infection, and ask about symptoms and illness. In addition, what becomes of the persons who did develop encephalitis? What proportion survived? Did they recover completely or did some have continuing difficulties?

4. Although the cause and mode of transmission were known (West Nile virus and mosquitoes, respectively), public health officials asked many questions regarding how the virus was introduced (mosquito on an airplane? wayward bird? bioterrorism?), whether the virus had a reservoir in the area (e.g., birds), what types of mosquitoes could transmit the virus, what were the host risk factors for infection or encephalitis, etc.
Exercise 1.3
1. A
2. E
3. F
4. B
5. D
6. C

Exercise 1.4
1. Confirmed
2. Probable
3. Probable
4. Probable
5. Possible

Exercise 1.5
1. Third criterion may be limiting because patient may not be aware of close contact
2. Probably reasonable
3. Criteria do not require sophisticated evaluation or testing, so can be used anywhere in the world
4. Too broad. Most persons with cough and fever returning from Toronto, China, etc., are more likely to have upper respiratory infections than SARS.

Exercise 1.6
The following tables can be created from the data in Tables 1.5 and 1.6:

Table A. Deaths and Death Rates for an Unusual Event, By Sex and Socioeconomic Status

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th></th>
<th>Male</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Middle</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Persons at risk</td>
<td>143</td>
<td>107</td>
<td>212</td>
<td>179</td>
</tr>
<tr>
<td>Survivors</td>
<td>134</td>
<td>94</td>
<td>80</td>
<td>59</td>
</tr>
<tr>
<td>Deaths</td>
<td>9</td>
<td>13</td>
<td>132</td>
<td>120</td>
</tr>
<tr>
<td>Death rate (%)</td>
<td>6.3</td>
<td>12.1</td>
<td>62.3</td>
<td>67.0</td>
</tr>
</tbody>
</table>

Table B. Deaths and Death Rates for an Unusual Event, By Sex

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persons at risk</td>
<td>462</td>
<td>851</td>
<td>1,313</td>
</tr>
<tr>
<td>Survivors</td>
<td>308</td>
<td>142</td>
<td>450</td>
</tr>
<tr>
<td>Deaths</td>
<td>154</td>
<td>709</td>
<td>863</td>
</tr>
<tr>
<td>Death rate (%)</td>
<td>33.3</td>
<td>83.3</td>
<td>65.7</td>
</tr>
</tbody>
</table>
Table C. Deaths and Death Rates for an Unusual Event, By Age Group

<table>
<thead>
<tr>
<th></th>
<th>Child</th>
<th>Adult</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persons at risk</td>
<td>83</td>
<td>1,230</td>
<td>1,313</td>
</tr>
<tr>
<td>Survivors</td>
<td>52</td>
<td>398</td>
<td>450</td>
</tr>
<tr>
<td>Deaths</td>
<td>31</td>
<td>832</td>
<td>863</td>
</tr>
<tr>
<td>Death rate (%)</td>
<td>37.3</td>
<td>67.6</td>
<td>65.7</td>
</tr>
</tbody>
</table>

By reviewing the data in these tables, you can see that men (see Table B) and adults (see Table C) were more likely to die than were women and children. Death rates for both women and men declined as socioeconomic status increased (see Table A), but the men in even the highest socioeconomic class were more likely to die than the women in the lowest socioeconomic class. These data, which are consistent with the phrase “Women and children first,” represent the mortality experience of passengers on the Titanic.


Note: the precise number of passengers, deaths, and class of service are disputed. The Encyclopedia Titanica website includes numerous discussions of these disputed numbers.

Exercise 1.7
1. D
2. B
3. C
4. A

Exercise 1.8
1. 
   a. Agent - *Bacillus anthracis*, a bacterium that can survive for years in spore form, is a necessary cause.
   b. Host - People are generally susceptible to anthrax. However, infection can be prevented by vaccination. Cuts or abrasions of the skin may permit entry of the bacteria.
   c. Environment - Persons at risk for naturally acquired infection are those who are likely to be exposed to infected animals or contaminated animal products, such as veterinarians, animal handlers, abattoir workers, and laboratorians. Persons who are potential targets of bioterrorism are also at increased risk.

2. 
   a. Component cause
   b. Necessary cause
   c. Component cause
   d. Sufficient cause
**Exercise 1.9**
Reservoirs: humans and possibly monkeys
Portals of exit: skin (via mosquito bite)
Modes of transmission: indirect transmission to humans by mosquito vector
Portals of entry: through skin to blood (via mosquito bite)
Factors in host susceptibility: except for survivors of dengue infection who are immune to subsequent infection from the same serotype, susceptibility is universal

**Exercise 1.10**
1. E
2. C
3. D
4. A
5. B

**Exercise 1.11**
1. C
2. B
3. A
SELF-ASSESSMENT QUIZ

Now that you have read Lesson 1 and have completed the exercises, you should be ready to take the self-assessment quiz. This quiz is designed to help you assess how well you have learned the content of this lesson. You may refer to the lesson text whenever you are unsure of the answer.

Unless instructed otherwise, choose ALL correct answers for each question.

1. In the definition of epidemiology, “distribution” refers to:
   A. Who
   B. When
   C. Where
   D. Why

2. In the definition of epidemiology, “determinants” generally includes:
   A. Agents
   B. Causes
   C. Control measures
   D. Risk factors
   E. Sources

3. Epidemiology, as defined in this lesson, would include which of the following activities?
   A. Describing the demographic characteristics of persons with acute aflatoxin poisoning in District A
   B. Prescribing an antibiotic to treat a patient with community-acquired methicillin-resistant *Staphylococcus aureus* infection
   C. Comparing the family history, amount of exercise, and eating habits of those with and without newly diagnosed diabetes
   D. Recommending that a restaurant be closed after implicating it as the source of a hepatitis A outbreak

4. John Snow’s investigation of cholera is considered a model for epidemiologic field investigations because it included a:
   A. Biologically plausible hypothesis
   B. Comparison of a health outcome among exposed and unexposed groups
   C. Multivariate statistical model
   D. Spot map
   E. Recommendation for public health action

5. Public health surveillance includes which of the following activities:
   A. Diagnosing whether a case of encephalitis is actually due to West Nile virus infection
   B. Soliciting case reports of persons with symptoms compatible with SARS from local hospitals
   C. Creating graphs of the number of dog bites by week and neighborhood
   D. Writing a report on trends in seat belt use to share with the state legislature
   E. Disseminating educational materials about ways people can reduce their risk of Lyme disease

*Introduction to Epidemiology*

*Page 1-85*
6. The hallmark feature of an analytic epidemiologic study is: (Choose one best answer)
   A. Use of an appropriate comparison group
   B. Laboratory confirmation of the diagnosis
   C. Publication in a peer-reviewed journal
   D. Statistical analysis using logistic regression

7. A number of passengers on a cruise ship from Puerto Rico to the Panama Canal have recently developed a gastrointestinal illness compatible with norovirus (formerly called Norwalk-like virus). Testing for norovirus is not readily available in any nearby island, and the test takes several days even where available. Assuming you are the epidemiologist called on to board the ship and investigate this possible outbreak, your case definition should include, at a minimum: (Choose one best answer)
   A. Clinical criteria, plus specification of time, place, and person
   B. Clinical features, plus the exposure(s) you most suspect
   C. Suspect cases
   D. The nationally agreed standard case definition for disease reporting

8. A specific case definition is one that:
   A. Is likely to include only (or mostly) true cases
   B. Is considered “loose” or “broad”
   C. Will include more cases than a sensitive case definition
   D. May exclude mild cases

9. Comparing numbers and rates of illness in a community, rates are preferred for: (Choose one best answer)
   A. Conducting surveillance for communicable diseases
   B. Deciding how many doses of immune globulin are needed
   C. Estimating subgroups at highest risk
   D. Telling physicians which strain of influenza is most prevalent

10. For the cruise ship scenario described in Question 7, how would you display the time course of the outbreak? (Choose one best answer)
    A. Endemic curve
    B. Epidemic curve
    C. Seasonal trend
    D. Secular trend

11. For the cruise ship scenario described in Question 7, if you suspected that the norovirus may have been transmitted by ice made or served aboard ship, how might you display “place”?
    A. Spot map by assigned dinner seating location
    B. Spot map by cabin
    C. Shaded map of United States by state of residence
    D. Shaded map by whether passenger consumed ship’s ice or not
12. Which variables might you include in characterizing the outbreak described in Question 7 by person?
   A. Age of passenger
   B. Detailed food history (what person ate) while aboard ship
   C. Status as passenger or crew
   D. Symptoms

13. When analyzing surveillance data by age, which of the following age groups is preferred? (Choose one best answer)
   A. 1-year age groups
   B. 5-year age groups
   C. 10-year age groups
   D. Depends on the disease

14. A study in which children are randomly assigned to receive either a newly formulated vaccine or the currently available vaccine, and are followed to monitor for side effects and effectiveness of each vaccine, is an example of which type of study?
   A. Experimental
   B. Observational
   C. Cohort
   D. Case-control
   E. Clinical trial

15. The Iowa Women’s Health Study, in which researchers enrolled 41,837 women in 1986 and collected exposure and lifestyle information to assess the relationship between these factors and subsequent occurrence of cancer, is an example of which type(s) of study?
   A. Experimental
   B. Observational
   C. Cohort
   D. Case-control
   E. Clinical trial

16. British investigators conducted a study to compare measles-mumps-rubella (MMR) vaccine history among 1,294 children with pervasive development disorder (e.g., autism and Asperger’s syndrome) and 4,469 children without such disorders. (They found no association.) This is an example of which type(s) of study?
   A. Experimental
   B. Observational
   C. Cohort
   D. Case-control
   E. Clinical trial

17. A cohort study differs from a case-control study in that:
   A. Subjects are enrolled or categorized on the basis of their exposure status in a cohort study but not in a case-control study
   B. Subjects are asked about their exposure status in a cohort study but not in a case-control study
   C. Cohort studies require many years to conduct, but case-control studies do not
   D. Cohort studies are conducted to investigate chronic diseases, case-control studies are used for infectious diseases

18. A key feature of a cross-sectional study is that:
   A. It usually provides information on prevalence rather than incidence
   B. It is limited to health exposures and behaviors rather than health outcomes
   C. It is more useful for descriptive epidemiology than it is for analytic epidemiology
   D. It is synonymous with survey

19. The epidemiologic triad of disease causation refers to: (Choose one best answer)
   A. Agent, host, environment
   B. Time, place, person
   C. Source, mode of transmission, susceptible host
   D. John Snow, Robert Koch, Kenneth Rothman

20. For each of the following, identify the appropriate letter from the time line in Figure 1.27 representing the natural history of disease.
   _____ Onset of symptoms
   _____ Usual time of diagnosis
   _____ Exposure

   Figure 1.27 Natural History of Disease Timeline

21. A reservoir of an infectious agent can be:
   A. An asymptomatic human
   B. A symptomatic human
   C. An animal
   D. The environment
22. Indirect transmission includes which of the following?
   A. Droplet spread
   B. Mosquito-borne
   C. Foodborne
   D. Doorknobs or toilet seats

23. Disease control measures are generally directed at which of the following?
   A. Eliminating the reservoir
   B. Eliminating the vector
   C. Eliminating the host
   D. Interrupting mode of transmission
   E. Reducing host susceptibility

24. Which term best describes the pattern of occurrence of the three diseases noted below in a single area?
   A. Endemic
   B. Outbreak
   C. Pandemic
   D. Sporadic

   Disease 1: usually 40-50 cases per week; last week, 48 cases
   Disease 2: fewer than 10 cases per year; last week, 1 case
   Disease 3: usually no more than 2-4 cases per week; last week, 13 cases

25. A propagated epidemic is usually the result of what type of exposure?
   A. Point source
   B. Continuous common source
   C. Intermittent common source
   D. Person-to-person
Answers to Self-Assessment Quiz

1. A, B, C. In the definition of epidemiology, “distribution” refers to descriptive epidemiology, while “determinants” refers to analytic epidemiology. So “distribution” covers time (when), place (where), and person (who), whereas “determinants” covers causes, risk factors, modes of transmission (why and how).

2. A, B, D, E. In the definition of epidemiology, “determinants” generally includes the causes (including agents), risk factors (including exposure to sources), and modes of transmission, but does not include the resulting public health action.

3. A, C, D. Epidemiology includes assessment of the distribution (including describing demographic characteristics of an affected population), determinants (including a study of possible risk factors), and the application to control health problems (such as closing a restaurant). It does not generally include the actual treatment of individuals, which is the responsibility of health-care providers.

4. A, B, D, E. John Snow’s investigation of cholera is considered a model for epidemiologic field investigations because it included a biologically plausible (but not popular at the time) hypothesis that cholera was water-borne, a spot map, a comparison of a health outcome (death) among exposed and unexposed groups, and a recommendation for public health action. Snow’s elegant work predated multivariate analysis by 100 years.

5. B, C, D. Public health surveillance includes collection (B), analysis (C), and dissemination (D) of public health information to help guide public health decision making and action, but it does not include individual clinical diagnosis, nor does it include the actual public health actions that are developed based on the information.

6. A. The hallmark feature of an analytic epidemiologic study is use of an appropriate comparison group.

7. A. A case definition for a field investigation should include clinical criteria, plus specification of time, place, and person. The case definition should be independent of the exposure you wish to evaluate. Depending on the availability of laboratory confirmation, certainty of diagnosis, and other factors, a case definition may or may not be developed for suspect cases. The nationally agreed standard case definition for disease reporting is usually quite specific, and usually does not include suspect or possible cases.

8. A, D. A specific or tight case definition is one that is likely to include only (or mostly) true cases, but at the expense of excluding milder or atypical cases.

9. C. Rates assess risk. Numbers are generally preferred for identifying individual cases and for resource planning.

10. B. An epidemic curve, with date or time of onset on its x-axis and number of cases on the y-axis, is the classic graph for displaying the time course of an epidemic.

11. A, B, C. “Place” includes location of actual or suspected exposure as well as location of residence, work, school, and the like.
12. A, C. “Person” refers to demographic characteristics. It generally does not include clinical features characteristics or exposures.

13. D. Epidemiologists tailor descriptive epidemiology to best describe the data they have. Because different diseases have different age distributions, epidemiologists use different age breakdowns appropriate for the disease of interest.

14. A, E. A study in which subjects are randomized into two intervention groups and monitored to identify health outcomes is a clinical trial, which is type of experimental study. It is not a cohort study, because that term is limited to observational studies.

15. B, C. A study that assesses (but does not dictate) exposure and follows to document subsequent occurrence of disease is an observational cohort study.

16. B, D. A study in which subjects are enrolled on the basis of having or not having a health outcome is an observational case-control study. 


17. A. The key difference between a cohort and case-control study is that, in a cohort study, subjects are enrolled on the basis of their exposure, whereas in a case-control study subjects are enrolled on the basis of whether they have the disease of interest or not. Both types of studies assess exposure and disease status. While some cohort studies have been conducted over several years, others, particularly those that are outbreak-related, have been conducted in days. Either type of study can be used to study a wide array of health problems, including infectious and non-infectious.

18. A, C, D. A cross-sectional study or survey provides a snapshot of the health of a population, so it assesses prevalence rather than incidence. As a result, it is not as useful as a cohort or case-control study for analytic epidemiology. However, a cross-sectional study can easily measure prevalence of exposures and outcomes.

19. A. The epidemiologic triad of disease causation refers to agent-host-environment.

20. C Onset of symptoms  
D Usual time of diagnosis  
A Exposure

21. A, B, C, D. A reservoir of an infectious agent is the habitat in which an agent normally lives, grows, and multiplies, which may include humans, animals, and the environment.

22. B, C, D. Indirect transmission refers to the transmission of an infectious agent by suspended airborne particles, inanimate objects (vehicles, food, water) or living intermediaries (vectors such as mosquitoes). Droplet spread is generally considered short-distance direct transmission.

23. A, B, D, E. Disease control measures are generally directed at eliminating the reservoir or vector, interrupting transmission, or protecting (but not eliminating!) the host.
24. A Disease 1: usually 40–50 cases per week; last week, 48 cases  
   D Disease 2: fewer than 10 cases per year; last week, 1 case  
   B Disease 3: usually no more than 2-4 cases per week; last week, 13 cases

25. D. A propagated epidemic is one in which infection spreads from person to person.