New (Additional) Chapter 3 Exercises

26. Identify whether each of the following is an incidence proportion (IP), incidence rate (IR), or point prevalence (P). Note: We will consider point prevalence only; period prevalence is an ambiguous concept that should generally be avoided.

    a. Percentage of girls that become pregnant during high school.
    b. Lifetime risk of prostate cancer
    c. Percentage of 6^{th} graders that are obese.
    d. Number of live-births who die of SIDS during the first year of life per 100,000 person-years of follow-up.

27. Which measures of disease frequency covered in Chapter 3 are "unit-free" dimensionless numbers? [Hint: See Chapter addendum, pp. 101 – 102.]

28. During a given year there were 30 new cases of disease X in population A and 3 new cases in population B. Based on this finding, is it accurate to say that the rate of disease is higher in population A? Why or why not?

29. In a class of 26 people, none had upper respiratory symptoms at the beginning of the semester. One week later, 3 students reported having upper respiratory symptoms. One week after that (beginning of week 2), 1 student had recovered but there were 2 new cases.

    a. Calculate the prevalence of upper respiratory symptoms at the beginning of week 2.
    b. Calculate the risk (incidence proportion) of developing upper respiratory symptoms.
    c. Calculate the rate of upper respiratory symptoms per 100 student-weeks.

30. The incidence rate of a disease is 50 per 100,000 person-years. The average duration of the disease is 2 years, after which patients fully recovers. Estimate the prevalence of the disease in the population assuming the population is stationary and disease occurrence is in a steady state.

31. 200 healthy men are followed for the occurrence of prostate cancer. After 5 years, 30 cases occur. Calculate the incidence rate of prostate cancer in this cohort with and without an actuarial correction.

32. Say whether each of the following is an open population or cohort.

    a. San Jose State students.
    b. Students entering the distance MPH program at San Jose State in August of 2013.
    c. Children vaccinated against polio in Syria in 2013.
    d. Practicing veterinarians.

33. The anticoagulant warfarin reduces the risk of stroke in patients with atrial fibrillation but may cause fatal and life threatening hemorrhages of various sorts. A non-blinded randomized clinical trial compared the safety and efficacy of warfarin to a new anticoagulant called dabigatran (Connnolly et al., 2009). The rate of major bleeding was 3.36% per person-year in the warfarin group compared to 3.11% per person-year in the group receiving 150 mg. of dabigatran (P = .31).

a. Use these data to calculate the rate ratio of major bleeding in patients who used warfarin versus those that used dabigitran.
b. State in layman terms your interpretation of the rate ratio calculated in part *a*.
c. Calculate the rate difference in the warfarin group versus the dabigitran group.
d. State your interpretation of the rate difference you calculated in part *c*.
e. If the rate of major hemorrhage was the same in warfarin users and dabigatran users, would be the numeric value of the rate ratio? What would be the numeric value of the rate difference?
f. Interpret the *P* for the problem.

34. In 1976, a number of people at the 58th annual convention of the American Legion held in Philadelphia, PA fell ill with a type of pneumonia that was ultimately named Legionnaires' disease. The convention was attended by official American Legion delegates and non-delegates (e.g., family members) alike. The number of delegates and non-delegates who developed Legionnaires' disease during of shortly after the convention was as follows:

	Developed Legionnaires' Disease	
Status	+	–
Delegate	125	1724
Non-delegate	3	759

a. Compute the average risk (incidence proportion) of Legionnaires' disease among the delegates and nondelegates.
b. Calculate the risk ratio of Legionnaires' comparing delegates and nondelegates.
c. State in plain language you're your interpretation of the statistic you calculated in part *b*.
d. Now calculate the odds ratio associated with being a delegate. Why was the odds ratio bigger than the risk ratio? Is your conclusion *materially* different?
e. Calculate the attributable fraction of exposed cases associated with being a delegate.
f. Interpret the statistic in part *e*.
g. Calculate the attributable fraction among the population of attendees associated with being a delegate.
h. Interpret the statistic in part *g*. How does it differ from the statistic in part *e*?

35. ***Direct age-adjustment, fictitious State***. Here are vital statistics for the fictitious state of *X* for the year *1991*.

Vital statistics, fictitious State *X*		
Age	**Deaths**	**Population**
0 - 4	952	400,000
5 -24	640	1,000,000
25 - 44	1040	500,000
45 - 64	2023	250,000
65 - 74	4442	200,000
75+	6887	100,000
Total	15,984	2,450,000

a. Using a population multiplier of 100,000, calculate the crude mortality rate for the state. By comparison, recall that the crude mortality rate for Florida is 1026 (Table 7.5 p. 146).
b. Calculate age-specific death rates in fictitious state X. (Use a population multipliers of 100,000 throughout this problem.) Compare these age-specific rates to Florida's (Table 7.6, p. 146).
c. Using the standard million reported in Table 7.3 (p. 145) as the reference population distribution, adjust state X's death rate using the direct method. How does the adjusted rate compare to Florida's age-adjusted rate (which was 784 per 100,000)?
d. Why did Florida have a higher crude rate than X?

36. ***Mortality in Latkaland, indirect adjustment*.** The table below reports vital statistics for Latkaland for the year 1990.

TABLE. Vital statistics, Latkaland, 1990		
Age	**Deaths**	**Population**
0 - 4	?	7909
5 - 24	?	24,560
25 - 44	?	13,764
45 - 64	?	6921
65 - 74	?	1485
75+	?	524
Total	300	55,163

a. Calculate the crude mortality rate in Latkaland. (Note: By comparison, the crude mortality rate for the US was approximately 860 per 100,000 in 1990.)
b. Using the vital statistics for the US reported in Table 7.10 (p. 149), calculate the expected number of deaths *in each age group* in Latkaland.
c. Determine the total number of expected deaths in Latkaland for all ages combined.
d. Calculate the SMR for Latkaland. Interpret this statistic.

37. **Source: Ahlbom & Norell, 1990, p. 44, #10 (modified without permission; fair use only).** Among the male employees in a certain occupational group there were 40 cases of myocardial infarction in a year. This table shows the number of male employees according to age and the age-specific incidence rates for the male population in the country as a whole. Compare the incidence of myocardial infarction in the occupational group and the general population by calculating the SMR. Interpret this finding.

Data		
Age	**No. of employees**	**Rate for country**
35-44	8000	0.5 / 1000
44-54	2000	4 / 1000
55-64	2000	9 / 1000

38. **Source: Ahlbom & Norell, 1990, p. 44, #11.** In an epidemiologic study, male vulcanization workers were compared to all working men with regard to the cumulative incidence of esophageal cancer during a 13-year period. Results are shown in the table below. Perform an indirect age adjustment by calculating the SMR. Interpret this finding.

	Vulcanization Workers		Comparison Group	
Age	**Cases**	**No.**	**Cases**	**No.**
15- 24	?	651	0	337,000
25 - 34	?	518	6	431,000
35 - 44	?	500	90	522,000
45 - 54	?	465	381	507,000
55 - 64	?	211	626	367,000
Total	8	2345	1103	21,640,000

39. **Source: Ahlbom & Norell, 1990.** A group (group A) of 6000 people participated in a program for prevention of disease. Another group (group B) of 5000 people did not participate and serve as a reference group. During the course of a year there were 36 cases of the disease in Group A and 35 cases in group B. Results are shown in the table below according to two age categories. Calculate age-specific rates within the two groups. Then, make a direct age adjustment (standardization) by using equal weights for the two age groups (i.e., w1 = w2 = 0.5) to compare the two groups.

	Group A		Group B	
Age	**Cases**	**P-yrs**	**Cases**	**P-yrs**
Younger	4	2000	20	4000
Older	32	4000	15	1000
Total	36	6000	35	5000

40. **Source: Ahlbom & Norell, 1990, p. 45, #12.** Random samples of men between the ages of 30 – 69 are taken from the catchment are of two hospitals. The occurrence of chronic bronchitis was recorded using a validated questionnaire about current symptoms. Results are shown in the table below. Perform a direct age-adjustment between the two population with equal weights for the different age groups (i.e., w1 = w2 = w3 = w4 = 0.25).

	Population A		Population B	
Age	**No. w/ bronchitis**	**No. in sample**	**No. w/ bronchitis**	**No. in sample**
30 - 39	5	1000	25	5000
40 - 49	20	2000	40	3000
50 - 59	50	4000	20	1000
60 - 69	50	3000	20	1000
Total	125	10000	105	10000

References

Ahlbom, A., & Norell, S. (1990). *Introduction to Modern Epidemiology (2nd ed.)*. Chestnut Hill, MA: Epidemiology Resources.

Fraser, D. W., Tsai, T. R., Orenstein, W., Parkin, W. E., Beecham, H. J., & Sharrar, R. G. (1977). Legionnaires' disease: description of an epidemic of pneumonia. *New England Journal of Medicine, 297*, 1189-1197.