**EPID 573A HW3: Measures of Excess Risk Dominic D. LaRoche – CPH573A – 01/27/15**

**Measures of Excess Risk:**

A. You are the epidemiology consultant to a cotton candy making factory. Because of some suspicion on the part of local physicians, you conduct a study of the occurrence of respiratory disease among the workers and obtain the following results:

i) Incidence of respiratory disease among workers exposed to the cotton candy = 200 per 100,000 per year.

ii) Incidence of respiratory disease among workers not exposed to cotton candy = 20 per 100,000 per year.

iii) Incidence in general population = 21 per 100,000 per year.

1. What are the rate ratio (RR), attributable rate (AR), and population attributable rate percent (PAR%)?

The RR = 200/100000/20/100000 = 200/20 = 10.

The AR = 200/100000 – 20/100000 = 0.002-0.0002 = 0.0018 = 180/100000

The PAR% = 100\*(21-20)/(21)= 4.76%

1. How can you account for the low PAR% in view of the high AR and high RR?

Since workers exposed to cotton candy are only a very small portion of the population it is possible that they do not account for a large percentage of the population rate even though they may have a much higher rate than the general population.

3. Based on the high RR and other available information, you believe that the association between occupational cotton candy exposure and the incidence of respiratory disease to be a causal one.

a) If an exposed worker develops respiratory disease, what is the likelihood that the disease occurred as a result of his employment?

100\*(200-20)/200 = 90%

b) in making your recommendations to management and labor concerning the desirability of extra protection for the workers, which measure of excess risk would you use? Why?

I would use the risk difference because this includes the risk ratio and the frequency of disease in the population. This would give policy makers information on the increase in risk associated with exposure.

B. The following is excerpted from a recently published article.

We have identified 13 asbestos workers with lymphoplasmacytic neoplasms: six with chronic lymphocytic leukemia, four with IgG myeloma, two with IgA myeloma, and one with histiocytic lymphoma. The subjects' occupations were varied, but all had experienced protracted asbestos exposure (ranging from 3-37 years). Tumor latency periods were similar to other known asbestos-related malignancies and ranged from 16-41 years. Stigmata of asbestos-related pulmonary disease were evident in 12 subjects . . . . It has been speculated previously that asbestos may be a lymphoid system carcinogen. Our findings strongly support this view.

Do these results support the hypothesis that asbestos is a lymphoid system carcinogen? If yes, in what way? If no, why not?

No. There is no control for additional exposures that may have caused the lymphplasmacytic neoplasms. These cases may have asbestos exposure in common but they may also have many other exposures in common as well.

C. Here are some measures of disease frequency. For each, name the kind of measure being described.

1. Percentage of 16‑year‑old driver's license applicants who are found to have visual acuity impairment severe enough to require corrective lenses while driving.

Prevalence

1. Percentage of University of Iowa students aged 18‑21 with an intact appendix at the start of 1996 and enrolled continuously during 1996 who undergo appendectomy for acute appendicitis during the year.

Cumulative Incidence

1. Number of sudden infant deaths occurring in Johnson County during 1996, divided by the estimated number of live infants residing in the county at mid‑year.

Incidence Density

1. Percentage of Iowa State babies born during 1996 who have congenital limb deformities at birth.

Cumulative Incidence

1. Proportion of patients with chronic glomerulonephritis who eventually die of that disease.

Case Fatality

D. If a hen and a half lay an egg and a half in a day and a half, how many eggs can one hen lay in three days?

Eggs are laid at a rate of 1 egg/hen-day so 1 hen will lay 3 eggs in 3 days.

E. Answer the following questions. Note, that the outcome is mortality instead of incidence, but this does not change the calculation of RR, AR, AR%, PAR, or PAR%. When answering the following questions consider the appropriate measure and include calculations when appropriate.

|  |  |  |
| --- | --- | --- |
|  | Cause-specific mortality rate\* | |
| **Smoking category** | **Heart Disease** | **Lung Cancer** |
| Non-smokers | 7.32 | 0.07 |
| Heavy smokers\*\* | 9.93 | 2.27 |

\*Deaths per 1000 person-years at risk

\*\*25 or more cigarettes smoked per day

1. Do these data provide stronger evidence of a causal link between heavy smoking and heart disease or between heavy smoking and lung cancer?

(Assume for the remaining parts that both diseases are causally related to smoking.)

Heart Disease RR = 9.93/7.32 = 1.36

Lung Cancer RR = 2.27/0.07 = 32.43

Clearly these data provide stronger evidence for a link between heavy smoking and lung cancer.

2. According to these data, what proportion of lung cancer deaths occurring among physicians who smoked 25 or more cigarettes/day could have been prevented if these physicians had not smoked at all? (What is the measure and calculate it)

This is the Attributable Risk proportion = (Ie – Io)/Ie = (2.27-0.07)/2.27 = 0.969

3. Assuming that study participants were representative of all British physicians in the respective smoking categories, what proportion of heart disease deaths among British physicians could be attributed to cigarette smoking?

We don’t know the mortality rate of British physicians due to heart disease or the proportion of British physicians who were heavy smokers so we cannot estimate the population attributable risk proportion.

4. Would avoidance of smoking among heavy-smoking British physicians have prevented more deaths due to heart disease or more deaths due to lung cancer?

We can compare the attributable risk for the two diseases.

Heart disease AR = 9.93-7.32 = 2.61

Lung Cancer AR = 2.27- 0.07 = 2.2

Since the AR for heart disease is higher, avoidance of smoking would have prevented more deaths due to heart disease.