Lab 5 -

Relating Risk Factors to Health

Goals: calculate and understand epidemiologic measures of association and impact

Background

Several well-designed and executed epidemiologic studies have implicated enviroxide as a potential cause of environitis, a newly recognized disorder in a small country called Carolina (pop. 10,000). In addition, a hitherto-unseen form of influenza, influenza J, has also been discovered and is believed to be associated with exposure to birds as household pets. Although they are unrelated, the two disorders have similar clinical pictures, with a two-week acute phase for which the most prominent symptom is a profound feeling "like being back in graduate school". Fortunately symptoms resolve quickly and completely, with apparent immunity to further episodes. Recent survey data indicates that 15% of the population are exposed to high levels (>100ppm) of enviroxide; 40% of the population have a pet bird in the household. There is no association between these two exposures.

Separate research teams conduct two-year cohort studies of these disorders. Thanks to Carolina's very low mortality rate and restrictive emigration policies, there is no loss to follow-up in either study. The first study recruits 1,000 persons living in buildings with enviroxide levels>100ppm ("exposed") and 1,000 persons living in buildings with enviroxide levels $\leq$100ppm ("unexposed"); 700 exposed participants develop environitis, as do 500 unexposed participants. In the second study 2,000 bird owners ("exposed") and 2,000 persons who do have any contact with birds ("unexposed") are recruited; 400 exposed participants contract influenza J; 160 unexposed participants do also.

Questions Part A. Measures of association

1. Create a 2 x 2 table for each cohort study.

2. For each study calculate the following measures. For rate computations, assume that cases occurred uniformly during the follow-up period.

   a. incidence proportions (cumulative incidences, CI)

   b. incidence rates (incidence densities, ID)

   c. cumulative incidence ratios (CIR)

   d. incidence density ratios (IDR)

   e. odds ratios (OR)

   f. risk differences (cumulative incidence differences, CID)

   g. incidence rate differences (incidence density differences, IDD).

3. Compare and contrast the ratio measures in each cohort, why do differences exist?

Part B. Measures of impact – adverse exposures

1. For which associations do the data provide stronger evidence that the association is causal?

2. In preparation for the next election, the Carolina government is seeking a public health success. Assuming that resources and intervention expertise are available to eliminate either enviroxide or pet birds, but not both, which of these two exposures should be chosen for the prevention program in order to have the most visible results? What epidemiologic measure(s) can assist you in this decision?

Part C. Measures of impact – preventive exposure

Eliminating pet bird ownership will not be popular, however. Seeking a biomedical solution, the government launches a crash program to develop a vaccine. In the subsequent double-blind, randomized efficacy trial of the candidate vaccine, among 162 persons receiving the vaccine 9 subsequently develop influenza J; of the 169 receiving placebo, 24 contract influenza J.

1. What is the efficacy of the new vaccine? (i.e. in what percent of the study group was disease prevented?)

2. Focus groups suggest that only 30% of the population will accept the vaccine, however. If this projection is correct, what will the population effectiveness of the vaccine be?

3. Given the low effectiveness due to the behavioral aspect of vaccine administration, Carolina public health strategists opt instead for environmental modification and preventing environitis. They propose a crash enviroxide abatement program to completely eliminate enviroxide exposure. What proportion of environitis cases will be prevented?

   a. In persons living in buildings with enviroxide?

   b. In the population:

Part D. Interpretation of odds ratios

Suppose a case-control study examining influenza J and pet bird ownership found an OR=3.0. At the end of the flu season, all reported influenza J cases are interviewed and compared with persons chosen from a sample of all others in the population. Examine the following statements and comment on why the statement correctly or incorrectly reflects the meaning of the above odds ratio.

1. The odds of developing Influenza J for a pet bird owner are 3 times higher than those for a person who does not have contact with birds.

2. The risk of developing influenza J in pet bird owners is 3 times that of developing influenza J in nonowners.

3. The odds of bird ownership among persons who contract influenza J are 3 times those for persons who do not contract influenza J.