Homework 4, due 11 Nov 2009

1. In each of six labs, twenty chicks were randomly divided into a treatment group and a control group. The treatment (T) group were exposed to pulsed electro-magnetic radiation, and the control (C) chicks were placed in the presence of a similar apparatus which was not turned on. The chicks were examined for deformities, and the results were tabulated below:

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<th>Lab</th>
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Healthy Chicks
Unhealthy Chicks

Note that most of the labs have fewer than 20 chicks classified, because some of the chicks were lost to causes unrelated to the presence or absence of radiation during the experiment. This data is a subset of that collected by Berman, et. al. (1990).

a. Using logistic regression, test the null hypothesis that the same odds ratio for the relationship between healthy/damaged chicks and treatment/control holds in all of the labs.

b. Suppose for the purpose of this question that the total numbers of healthy and damaged chicks for each lab (namely, 11 and 7 for lab 1, 13 and 5 for lab 2, 16 and 4 for lab 3, et cetera) were set by design. Estimate a common value for the ratio of the odds that a treated chicken will be damaged to the odds that a control chicken will be damaged, regardless of your answer to part (a). Report a 95% confidence interval for this odds ratio.

2. Caroll, Gail, and Lubin (1993) describe a case–control study in which 39 women with cervical cancer and 76 women without cervical cancer were screened for exposure to Herpes simplex virus. Investigators expect that roughly 30% of the controls will have Herpes simplex virus exposure, and expect under their alternative hypothesis to see an elevated proportion of the cases to have Herpes simplex virus exposure, with an odds ratio of 1.4.

a. Calculate the power for detecting an effect this large for a one-sided test of size .025.

b. Suppose that the investigators wanted 80% power under the above alternative, and planned to use the same number of cases and controls. How many women would be necessary in each group?

c. Suppose that the investigators wanted 80% power under the above alternative, and planned to use ten times as many controls as cases. How many women would be necessary in each group? Compare your answer to part (b).