

**Homework #11 – Measures of association: estimates, standard errors, confidence intervals**

<u>Protective factor</u>	<u>Risk factor</u>	Cold	No cold	Total
No	Yes	31	109	140
Yes	No	17	122	139
	Total	48	231	279

The above table shows data from a randomized, double blind, controlled clinical trial involving 279 skiers. The investigators chose 139 at random to take vitamin C tablets daily during the ski season and the other 140 were given placebo (fake vitamin C) tablets. The response is whether the skier experienced symptoms of the common cold sometime during the ski season as determined by the study team physician who was kept blind as to the treatment status of the skiers. Assume it is known that vitamin C cannot make a person more susceptible to colds. Although this is an experiment and not an observational cohort study, the analysis of epidemiological measurements can be applied to these data.

For each of the following measurements of association for 2x2 table cohort study data, using the formulas presented in class, calculate the estimate of the parameter, the standard error of the parameter, and an (approximate) 95% confidence interval for the parameter. Use a calculator, spread sheet, or a programming language such as R or matlab. Then analyze the data using SAS (proc freq tables) and compare the estimates and confidence intervals provided by SAS to the answers you calculated.

1. Excess risk or risk difference:  $\delta$
2. Relative risk or risk ratio:  $\psi$
3. Odds ratio or cross-product ratio:  $\psi'$
4. Think of the administration of vitamin C as the equivalent of a vaccine and estimate the parameter: Vaccine efficacy = VE. [Not calculated by SAS; this measure is called the MacMahon & Pugh attributable risk in Hamilton's 1979 *AJE* paper.]
5. Suppose that the data in the table were the results of a case-control study in which 48 cases and 231 controls were interviewed see whether they were exposed to the risk factor and suppose a different, rare disease; for example, pneumonia rather than the common cold. By rare, I mean  $\delta \ll v$ . Estimate the etiologic fraction = population attributable risk = Levin's  $\lambda$ . [ Not calculated by SAS.]