Tutorial: Inference for Matched Data using McNemar's Test

To incorporate more individual information into our analysis, we match individuals who were below the poverty line to an individual who was above the poverty line based on: age, urban vs. rural location, race, and gender. (Note that we could incorporate more covariates to improve the matches.)

We conduct McNemar's test to examine the relationship between poverty and doctor visits among matched pairs. Open the dataset `chis_matched.dta`.

```
. mcc doctor_0 doctor_1
```

1. State the null and alternative hypothesis for McNemar's test.

   Null: there is no association between poverty and visiting the doctor in the past 12 months
   Alternative: there is an association between poverty and visiting the doctor in the past 12 months.

   (A subtle sidenote: we are now generalizing to a slightly different population. Because of the way we implemented our matching scheme, we are no longer making inference about all California residents. Rather, we are making inference with respect to the population with a covariate pattern (age, race, location, and gender) similar to the population below the poverty level.

2. How many pairs contribute to the test statistic?

   Only discordant pairs contribute to the test statistic.

   2 + 15 = 17

   Due to the small sample size (number of discordant pairs less than 20), the normal approximation is dubious in this instance. There is an exact test based on the binomial distribution, which does not rely on large sample approximations.

3. Using a large sample test, what is the test statistic? Null distribution? P-value? Compare to the exact test.

   $\chi = 9.94 \sim \chi^2_1$

   p = 0.0016

   Note that the more conservative exact test results in a p-value of 0.0023 (similar to the large-sample result).

4. What is the odds ratio? Compare to the OR from the non-matched analysis.

   7.5 (1.7, 67.6)

   From the non-matched analysis, the OR was 2.0, with 95% CI (1.1, 3.5).

5. Comparing the results of the McNemar's test to the Pearson Chi-square test, consider the following question. Even though we have decreased the sample size, do we gain power by matching? Which test provides stronger evidence that poverty impacts whether or not someone goes to the doctor each year?

   Because we are comparing doctor visits among similar individuals, we gain some power by matching.