PHS2000B Lab 3

Sensitivity Analysis and Measurement Error

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To gain familiarity with some of the equations presented during the sensitivity analysis and measurement lab, let's consider a few examples.

1 Sensitivity Analysis

Let's say we are interested in the effect of low educational attainment on risk of dementia. In a recent study, you estimated an adjusted risk ratio of 1.8 (95% CI: 1.4, 2.2) for the association between low educational attainment and risk of dementia conditional on a set of covariates. You are concerned that there is another variable U, household income, that may confound the association you observed. A recent meta-analysis of the effect of low household income on dementia suggests that it increases the risk of dementia by a factor of 2.3.

> How large must the association between low household income and educational attainment be in order for this unmeasured confounder to i) completely explain away the observed association and ii) shift the observed 95% CI to include the null?

> Calculate the E-value using the risk ratio and 95% confidence interval.

> Interpret the E-value for the point estimate and the E-value for the 95% confidence interval.

A colleague boasts that, in their recent study of educational attainment and cognitive impairment, they obtained an E-value of 6 for the point estimate! Can the magnitude of this E-value be directly compared to the E-value we calculated in our study? Why or why not?

Now, let's say we have some additional information. We know that the prevalence of our unmeasured confounder, low household income, is 0.70 in the exposed. The risk ratio comparing low household income and dementia among both exposed and unexposed is $\gamma = 2.70$

What would the prevalence of low household income among the unexposed have to be to fully explain away the point estimate of 1.8?

What would the bias factor be if $\gamma = 4$ and, using subject matter knowledge, we know that the prevalence estimates for the unmeasured confounder were 0.55 among the exposed and 0.10 among the unexposed? Using this bias factor, what would the corrected point estimate be?

2 Measurement Error

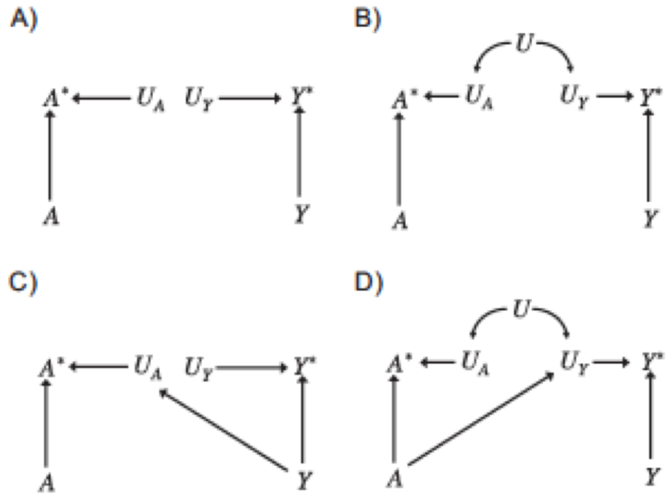

Figure 1: Types of Measurement Error.

For each of the above DAGs, identify the types of measurement error (include both independent vs dependent and differential vs non-differential in your answers).

If you're testing for a rare disease, even with a highly specific test, there's a good probability that any given positive test result is a false positive. To see this in action, work through the following example

Let's say you have a test for disease X, which affects 1% of the population. This test is 97% sensitive and 98% specific. You test 1000 people. Because the prevalence of disease X is 1%, we know that 10 of these people truly have the disease; 990 do not.

What is the positive predictive value of the test?

What is the negative predictive value of the test?