Biostat 578A: Evaluating Vaccine Efficacy

Exercise 2: Sensitivity Analysis of the Causal Vaccine Effect on Set-Point Viral Load

Due Tuesday February 7

The data are available at http://faculty.washington.edu/peterg/Vaccine2006.html

Define the set-point viral load as the log10 plasma RNA viral load measured from a blood sample drawn at the 30-day post-infection diagnosis visit.

1. Based on Gilbert, Bosch, Hudgens (2003) and/or on the slides in the file SelectionBias.GBH.05.pdf, write a function (in R or another language) that inputs data and a fixed sensitivity parameter β, and outputs GBH's estimate of the average causal effect $ACE(\beta)$ of vaccination on the set-point viral load. Exclude from the analysis viral loads measured after ART was initiated. The input variables for the function should be:

   - Nv, the number of subjects randomized to vaccine

   - Np, the number of subjects randomized to placebo

   - y1, a vector of pre-ART set-point viral loads for the infected vaccine recipients

   - y0, a vector of pre-ART set-point viral loads for the infected placebo recipients

   - beta, a fixed constant that may be positive, negative, or zero

   Note that each infected subject contributes exactly one value to either y1 or y0. For subjects with more than one pre-ART set-point viral loads, use a summary of these repeat measure. For subjects with zero pre-ART set-point viral loads, set the value to NA.

Note that the function does not need to output confidence intervals for $ACE(\beta)$, it only needs to output a point estimate.

2. For the mock VAX004 data, create a plot showing the estimate of $ACE(\beta)$ for several values of β ranging between -3 and 3. Include the point $\beta = 0$.

3. What is the average net effect of vaccine on viral load? What do you conclude about the average causal vaccine effect on viral load?

4. EXTRA FOR THE ESPECIALLY INTERESTED: Re-do the sensitivity analysis using a different selection bias weight function $w(\cdot)$ (other than the anti-logit used in GBH).