**Statistical Interpretation of the RV144 HIV Vaccine Efficacy Trial in Thailand: A Case Study for Statistical Issues in Efficacy Trials**

**Appendix. Online-Only Supplementary Material**

Bayes theorem shows how to combine the prior evidence for vaccine efficacy– codified as Pr(VE = 0%) (e.g., 0.5) and the prior density p(VE) assigned to nonzero values of VE (e.g., all values of VE between -20% and 60% are given equal weight, with other values of VE given no weight) – with the evidence obtained from the experiment; for the RV144 trial, the experimental evidence is summarized in the likelihood function L(data | VE) arising (in the simplest analysis) from assuming that the data in the control and treatment populations are binomial observations from each population. Bayes theorem then says that

Pr(VE=0 | data) =

Pr(VE =0)L(data | VE=0)/[ Pr(VE =0)L(data | VE=0)+(1- Pr(VE =0))∫ L(data | VE)p(VE)dVE],

where the integral is over all nonzero values of VE.

There is the technical complication that these binomial distributions are described by two parameters: VE and the infection rate for the control population, p0. We considered two priors for p0, the uniform prior on (0,1) (highly unrealistic) and a prior centered on values of p0 that were viewed as likely prior to the conduct of the trial; formally, it was a Beta(5,440) density, chosen to reflect the prior beliefs that annual infection rates would have some chance (about 10%) of being ≥ 0.65%, a 50% chance of being ≥ 0.34%, and essentially no chance of being below 0.1%. The expression for Bayes theorem would then also involve integration over p0 as well as VE. It was found that the choice of prior for p0 made essentially no difference in the analysis, e.g. Pr(VE = 0% | RV144 data). In small trials, however, the choice of this prior could be important. Note that there often is considerable scientific knowledge about the infection rate in the control population, so coming up with a realistic scientific prior for p0 should typically be possible.