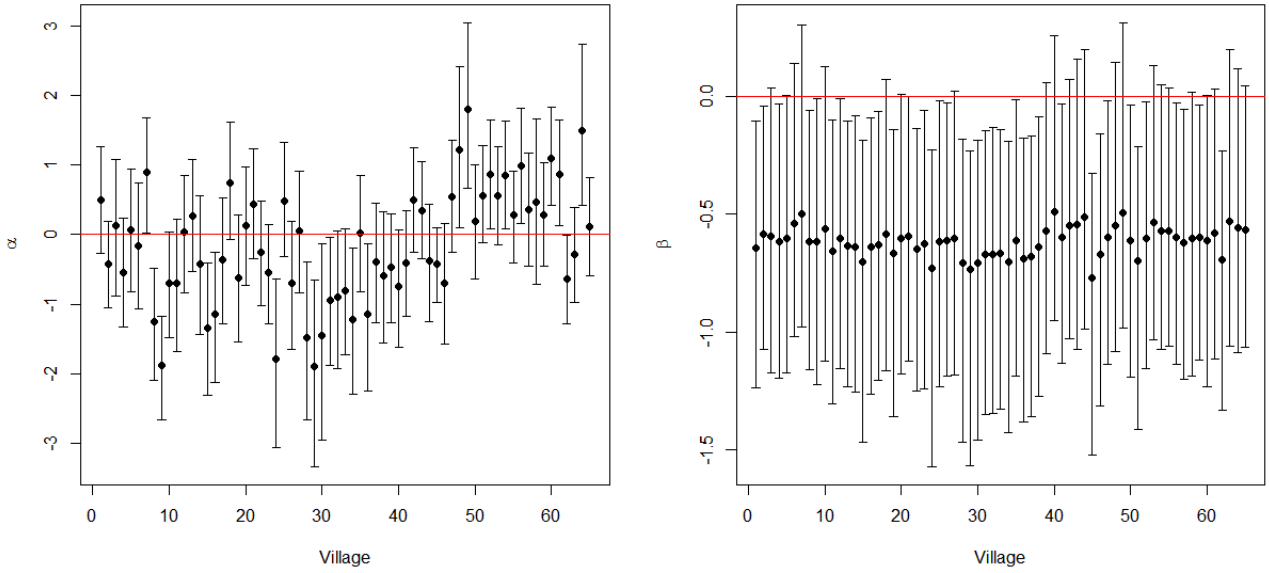
ST495/590 Assignment 8 - Solutions

(1) *Scientifically, why might the effect of bed-net vary by village?*

(2) *Convergence check.*

(3) *Do you see evidence that the slopes and/or intercepts vary by village?*



From the 95% posterior credible intervals of α_j's and β_j's ($j = 1, \cdots, 65$), we found that the intercept α_j varies in village, while the slope β_j does not vary significantly by village.

(4) *Which village has the largest intercept? Slope? Does this agree with the data in these villages?*

The 49th village has the largest intercept with posterior mean $\alpha_{49} = 1.801$. This agrees with the data. The intercept measures mean of the logit$[P(Y = 1)]$ when $X = 0$, the logit probability of malaria contracted when there is no bed-net. By calculating the mean probability of individuals contracting malaria, we found village 49 has about 93.3% individuals got contracted, the maximum among the 65 villages. Furthermore, if we calculate the mean probability of individuals contracting malaria only when no bed-net is used, for 49th village, the proportion is 1, which is the highest. So the Bayes estimator and data agrees very well.

The 40th village has the largest slope, with posterior mean $\beta_{40} = -0.488$. The slope measures the relationship between the logit probability of malaria contracted and net usage. As slopes are all negative for the 65 villages, the largest slop thus means the smallest absolute correlation between the malaria and net usage. In village 40, there are about 57.1% bed-net usage, the malaria contracted rate is about 25%. It seems that bed-net usage does not necessarily reduce the malaria rate.

The 45th village has the largest absolute value of slope, with posterior mean $\beta_{45} = -0.769$. From the data, there are about 33.9% bed-net usage, the malaria contracted rate is about 33.95%. It seems the bed-net usage does have a effect on the malaria contracted rate.

(5) *Are the results sensitive to the priors for the hyperparameters?*

The results does not seem sensitive to the priors for the hyperparameters. This is conduct by changing hyperpriors for hyperparameters, and do the same process as (3) and (4). The village 49 still has the largest intercept, and the 95% posterior credible interval plots look similar.