BIOSTAT724 Project 4: Student Rubric

Total Points: 100

1. Write Bayesian Logistic Regression Model **(10 points)** 
   1. Write data model -- mathematical notation *(1 point)* and English description *(1 point)*
   2. Write model for prior *(8 points)* 
      1. Prior for Beta0 -- explain/show work *(2 points)*
      2. Prior for Beta1 -- explain/show work
         1. Prior *(2 points)*
         2. Interpretation of the mean (log odds and odds scales) *(2 points -- one for each)*
         3. 95% CI (log odds and odds scale) (*2 points -- one for each)*
2. Simulation of Priors **(15 points)**



* 1. Show code for simulations *(3 points)*



* 1. Plot theoretical priors and MCMC simulated priors *(4 points)*



* 1. State mean, median, 95% CI for priors and write interpretations *(3 points)*



* 1. Simulate 100 models that represent prior belief about effect of prior history of fracture on risk at 1 year *(5 points)*



* + 1. Show code *(1 point)*
    2. Plot *(2 points)*
    3. Describe *(2 points)*



1. Update prior belief using OSTEO data (include code for all steps) **(15 points)** 
   1. Plot posterior distribution for changes in log odds of fracture at 1 year associated with prior history *(2 points)*



* 1. Interpret median and 95% HPD CI *(2 points)*
  2. Repeat (a) and (b) on odds ratio scale *(2 points -- 1 each)*



* 1. What is the posterior probability that OR > 1? What does this imply? *(3 points)*
  2. What is the posterior probability that OR > 2? *(2 points)*



* 1. What is the value of the OR at which the posterior probability exceeds 80%? *(2 points)*



* 1. Summary sentence *(2 points)*

1. Including Age in Model **(13 points)** 
   1. Writing data model -- follow format from 1a. *(2 points)*
   2. Prior distributions for regression parameters *(5 points)* 
      1. Create MCMC simulation of weakly informative priors -- include code *(2 points)*
      2. Write priors that rstanarm has identified *(3 points)*



* 1. Posterior *(6 points)* 
     1. Plot posterior for prior history of fracture (Beta1) *(2 points)*
     2. State median and 95% HPD CI on odds ratio scale *(2 points)*
     3. What happened to posterior for Beta1 now that age is included? *(2 points)*

1. Evaluating Interaction between Age and Prior History of Fracture **(17 points)** 
   1. Write data model -- follow format from 1a. *(2 points)*
   2. Prior distributions for regression parameters -- follow format from 4b. *(5 points)*



* 1. Posterior *(10 points)* 
     1. Plot posterior for the interaction term *(2 points)*



* + 1. Interpret median and 95% HPD CI *(2 points)*
    2. What impact does older age have on relationship between fracture risk in those with and without prior history? *(2 points)*
    3. What is the posterior probability that the interaction is < 0? *(2 points)*



* + 1. Summary sentence *(2 points)*

1. Predicting Fracture Risk based on Prior History and Age **(10 points)** 
   1. Make a plot that shows the posterior predicted probability of fracture at 1 year post-diagnosis with osteoporosis by age at diagnosis 55-80 in increments of 5, and prior history of fracture -- show code



1. Posterior Predictive Check **(10 points)**
   1. Perform check using 100 datasets *(5 points)*
   2. Explain how posterior predictive check works and what you conclude from results *(5 points)*



1. Identifying Women at High Risk of Fracture **(10 points)**
   1. Use cutoff for predicting woman is at high risk to evaluate the model based on the data available. State and interpret the following *(5 points)* 
      1. sensitivity



* + 1. Specificity
    2. Overall accuracy
    3. Positive predictive value
  1. Use cross validation to evaluate the future performance of the model. State and interpret the same values as part a. *(5 points)*