setwd("C:/R files BHMRA")

attach("DS\_10\_7.Rdata")

library(jagsUI)

library(loo)

options(scipen=999)

**# MODEL 1**

cat("model {for (i in 1:n) {for (t in 1:T) {y[i,t] ~ dpois(mu[i,t])

# full data replicates

ynew[i,t] ~ dpois(mu[i,t])

# mixed predictive replicates

ynew.mx[i,t] ~ dpois(mu.new[i,t])

exc.mx[i,t] <- step(ynew.mx[i,t]-y[i,t])-0.5\*equals(ynew.mx[i,t],y[i,t])

# likelihood and deviance terms

LL[i,t] <- -mu[i,t]+y[i,t]\*log(mu[i,t])-logfact(y[i,t])

y0[i,t] <- equals(y[i,t],0)

y0new[i,t] <- equals(ynew[i,t],0)

dv[i,t] <- y[i,t]\*log((y[i,t]+y0[i,t])/(mu[i,t]+y0[i,t])) -(y[i,t]-mu[i,t])

dvnew[i,t] <- ynew[i,t]\*log((ynew[i,t]+y0new[i,t])/(mu[i,t]+y0new[i,t])) -(ynew[i,t]-mu[i,t])}}

# random effects

for (i in 1:n) {b[i,1:3] ~ dmnorm(B[1:3],invD[1:3,1:3])

b.new[i,1:3] ~ dmnorm(B[1:3],invD[1:3,1:3])

age.c[i] <- age[i]-mean(age[])

log(mu[i,1]) <- beta1[1]\*age.c[i]+ beta1[2]\*Trt[i]+b[i,1]

log(mu.new[i,1]) <- beta1[1]\*age.c[i]+ beta1[2]\*Trt[i]+b.new[i,1]

for (t in 2:T) {log(mu[i,t]) <- beta[1]\*age.c[i]+beta[2]\*Trt[i] +beta[3]\*Trt[i]\*t +phi\*y[i,t-1]+b[i,2]+b[i,3]\*t

log(mu.new[i,t]) <- beta[1]\*age.c[i]+beta[2]\*Trt[i] +beta[3]\*Trt[i]\*t + phi\*y[i,t-1]+b.new[i,2]+b.new[i,3]\*t}}

Fit[1] <- 2\*sum(dv[,])

Fit[2] <- 2\*sum(dvnew[,])

**# Posterior Predictive Check**

PPC <- step(Fit[2]-Fit[1])

**# Priors**

for (j in 1:3) {beta[j] ~ dnorm(0,0.1)}

for (j in 1:3) {B[j] ~ dnorm(0,0.1)}

for (j in 1:2) {beta1[j] ~ dnorm(0,0.1)}

phi ~ dnorm(0,0.1)

**# Random Effects Covariance**

invD[1:3,1:3] ~ dwish(Q[,],3)

D[1:3,1:3] <- inverse(invD[,])

sigb <- sqrt(D[2,2])

rho.b <- D[1,2]/sqrt(D[1,1]\*D[2,2])}

", file="epil1.jag")

# initial values and estimation

b0 <- matrix(0,59,3)

init1 <- list(beta=c(0,0,0), b=b0,phi=0,beta1=c(0,0),B=rep(0,3),invD=diag(3))

init2 <- list(beta=c(0,0,0), b=b0,phi=0.5,beta1=c(0,0),B=rep(0,3),invD=diag(5,3))

inits <- list(init1,init2)

pars <- c("Fit","beta","beta1","phi","rho.b","PPC","B","LL","exc.mx")

R1 = autojags(DS\_10\_7, inits, pars,model.file="epil1.jag",2,iter.increment=2500, n.burnin=500, Rhat.limit=1.1, max.iter=10000, seed=1234,codaOnly=c("LL","exc.mx"))

R1$summary

**# LOO-IC**

loo(matrix(as.array(R1$sims.list$LL),5000,59\*5))

**# mixed predictive checks**

exc.mx.mn =apply(as.array(R1$sims.list$exc.mx),c(2,3),mean)

sum(exc.mx.mn < 0.05)

sum(exc.mx.mn > 0.95)

**# Model 2**

cat("model {for (i in 1:n) {xi[i] ~ dgamma(2,2);

for (t in 1:T) {y[i,t] ~ dpois(mu[i,t])

ynew[i,t] ~ dpois(mu[i,t])

y0[i,t] <- equals(y[i,t],0)

y0new[i,t] <- equals(y0[i,t],0)

LL[i,t] <- -mu[i,t]+y[i,t]\*log(mu[i,t])-logfact(y[i,t]);

dv[i,t] <- y[i,t]\*log((y[i,t]+y0[i,t])/(mu[i,t]+y0[i,t])) -(y[i,t]-mu[i,t])

dvnew[i,t] <- ynew[i,t]\*log((ynew[i,t]+y0new[i,t])/(mu[i,t]+y0new[i,t])) -(ynew[i,t]-mu[i,t])}}

for (i in 1:n) {b[i,1:3] ~ dmnorm(B[1:3],invD[1:3,1:3])

**# student t skew random effects**

for (j in 1:3) {b.t[i,j] <- b[i,j]/sqrt(xi[i])+delta[j]\*w[i,j]

w[i,j] ~ dnorm(0,1) I(0,)}

age.c[i] <- age[i]-mean(age[]);

log(mu[i,1]) <- beta1[1]\*age.c[i]+ beta1[2]\*Trt[i]+b.t[i,1]

for (t in 2:T) {log(mu[i,t]) <- beta[1]\*age.c[i]+beta[2]\*Trt[i]+beta[3]\*Trt[i]\*t

**+phi\*y[i,t-1] +b.t[i,2]+b.t[i,3]\*t}}**

**# Fit**

Fit[1] <- 2\*sum(dv[,])

Fit[2] <- 2\*sum(dvnew[,])

**# Posterior Predictive Check**

PPC <- step(Fit[2]-Fit[1])

**# Random effects covariance**

invD[1:3,1:3] ~ dwish(Q[,],3)

D[1:3,1:3] <- inverse(invD[,])

rho.b <- D[1,2]/sqrt(D[1,1]\*D[2,2])

**# Priors**

for (j in 1:3) {beta[j] ~ dnorm(0,0.1)

B[j] ~ dnorm(0,0.1)

delta[j] ~ dnorm(0,0.1)}

for (j in 1:2) {beta1[j] ~ dnorm(0,0.1)}

phi ~ dnorm(0,0.1)}

", file="epil2.jag")

**# Initial values and estimation**

b0 <- matrix(0,59,3)

init1 <- list(beta=rep(0,3),B=rep(0,3),b=b0,phi=0,beta1=rep(0,2),invD=diag(3),delta=c(0,0,0),

W1=rep(0.1,59), W2=rep(0.1,59))

init2 <- list(beta=rep(0,3),B=rep(0.5,3),b=b0,phi=0.1,beta1=rep(0,2),invD=diag(5,3),delta=c(0.2,0.2,0.2),

W1=rep(0.2,59), W2=rep(0.2,59))

inits <- list(init1,init2)

pars <- c("Fit","beta","beta1","phi","rho.b","delta","xi","PPC","B","LL")

R2 = autojags(DS\_10\_7, inits, pars,model.file="epil2.jag",2,iter.increment=2500, n.burnin=500, Rhat.limit=1.1, max.iter=20000, seed=1234,codaOnly=c("LL"))

R2$summary

**# LOO-IC**

loo(matrix(as.array(R2$sims.list$LL),5000,59\*5))