setwd("C:/R files BHMRA")

options(scipen=999)

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

library(jagsUI)

library(loo)

**# MODEL 1**

cat("

model {for (i in 1:n) {b.h[i]~ dnorm(alpha,1/D)

b[i] <- b.h[i]-alpha

ln.base[i] <- log(y0[i]/4);

ln.age[i] <- log(age[i])

Base[i] <- ln.base[i]-mean(ln.base[]);

Age[i] <- ln.age[i]-mean(ln.age[])

LLsubj[i] <- sum(LL[i,])

log(Lsub[i]) <- LLsubj[i]

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

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

u[i,t] ~ dnorm(b.h[i],tau2u)

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

log(L[i,t]) <- LL[i,t]

devnew[i,t] <- ynew[i,t]\*log((ynew[i,t]+equals(ynew[i,t],0))/(mu[i,t]

+equals(ynew[i,t],0))) -(ynew[i,t]-mu[i,t]);

dev[i,t] <- y[i,t]\*log((y[i,t]+equals(y[i,t],0))/(mu[i,t]

+equals(y[i,t],0))) -(y[i,t]-mu[i,t]);

log(mu[i,t]) <- u[i,t]+beta[1]\*Base[i]+beta[2]\*Trt[i]+beta[3]\*Base[i]\*Trt[i]

+beta[4]\*Age[i]+beta[5]\*V4[t]}}

alpha ~ dnorm(0,0.001)

for (j in 1:5) {beta[j] ~ dnorm(0,0.001)}

Fit[1] <- 2\*sum(dev[,]); Fit[2] <- 2\*sum(devnew[,]); PPC <- step(Fit[2]-Fit[1])

sqrtD ~ dunif(0,100)

D <- sqrtD\*sqrtD;

sig2u <- (D-phi\*D)/phi

tau2u <- 1/sig2u

phi ~ dunif(0,1)}

", file="epilr1.jag")

# initial values and estimation

u0 <- matrix(0,59,4)

b0 <- rep(0,59)

init1 <- list(beta=c(0,0,0,0,0), u=u0,b.h=b0,phi=0.1,alpha=0,sqrtD=1)

init2 <- list(beta=c(0,0,0,0,0), u=u0,b.h=b0,phi=0.5,alpha=0.5,sqrtD=2)

inits <- list(init1,init2)

pars <- c("Fit","beta","sig2u","D","LL","L","PPC")

R1 = autojags(DS\_10\_10, inits, pars,model.file="epilr1.jag",2,iter.increment=2500, n.burnin=500, Rhat.limit=1.1, max.iter=10000, seed=1234,codaOnly=c("LL","L"))

R1$summary

loo(matrix(as.array(R1$sims.list$LL),5000,59\*4))

# Model 2

cat("model {for (i in 1:n) {G[i] ~ dcat(pi.G[1:K])

ln.base[i] <- log(y0[i]/4);

ln.age[i] <- log(age[i])

Base[i] <- ln.base[i]-mean(ln.base[]);

Age[i] <- ln.age[i]-mean(ln.age[])

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

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

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

u[i,t] ~ dnorm(alpha[G[i]],tau2u)

dev[i,t] <- y[i,t]\*log((y[i,t]+equals(y[i,t],0))/(mu[i,t]+ equals(y[i,t],0))) -(y[i,t]-mu[i,t])

log(mu[i,t]) <- u[i,t]+beta[1]\*Base[i]+beta[2]\*Trt[i]+beta[3]\*Base[i]\*Trt[i]

+beta[4]\*Age[i]+beta[5]\*V4[t]}}

# Fit

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

# Priors

for (j in 1:5) {beta[j] ~ dnorm(0,0.001)}

pi.G[1:K] ~ ddirch(prpi.G[1:K])

# Intercept Mixture

for (k in 1:K) {alpha.s[k] ~ dnorm(0,0.01)}

alpha=sort(alpha.s)

tau2u ~ dgamma(1,0.001)}

", file="epilr2.jag")

# initial values and estimation

u0 <- matrix(0,59,4)

init1 <- list(beta=c(0,0,0,0,0), u=u0, alpha.s=rep(0,2),tau2u=1)

init2 <- list(beta=c(0,0,0,0,0), u=u0, alpha.s=rep(-1,2) ,tau2u=5)

inits <- list(init1,init2)

pars <- c("alpha","beta","Fit","LL","pi.G")

**# Discrete Mixture Parameters**

DS\_10\_10$K=2

DS\_10\_10$prpi.G <- rep(0.5,2)

R2 = autojags(DS\_10\_10, inits, pars,model.file="epilr2.jag",2,iter.increment=5000, n.burnin=500, Rhat.limit=1.1, max.iter=20000, seed=1234,codaOnly=c("LL"))

R2$summary

loo(matrix(as.array(R2$sims.list$LL), dim(as.array(R2$sims.list$LL))[1],59\*4))

**# Model 3**

cat("

model {for (i in 1:n) {b[i,1:2] ~ dmnorm(B[1:2],invD[1:2,1:2])

delta[i] ~ dbern(0.1)

ln.base[i] <- log(y0[i]/4);

ln.age[i] <- log(age[i])

Base[i] <- ln.base[i]-mean(ln.base[]);

Age[i] <- ln.age[i]-mean(ln.age[])

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

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

u[i,t] ~ dnorm(0,tau2u)

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

dev[i,t] <- y[i,t]\*log((y[i,t]+0.5)/(mu[i,t]+0.5)) -(y[i,t]-mu[i,t]);

log(mu[i,t]) <- b[i,1]+b[i,2]\*t+beta[1]\*Base[i]+beta[2]\*Trt[i]+

beta[3]\*Base[i]\*Trt[i]+beta[4]\*Age[i]+beta[5]\*V4[t]+delta[i]\*u[i,t]}}

# Fit

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

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

# Priors

for (j in 1:5) {beta[j] ~ dnorm(0,0.001)}

for (j in 1:2) {B[j] ~ dnorm(0,0.001)}

invD[1:2,1:2] ~ dwish(Q[,],2);

for (j in 1:2) { for (k in 1:2) {Q[j,k] <- equals(j,k)}}

tau2u ~ dgamma(1,0.001)}

", file="epilr3.jag")

# initial values and estimation

b0 <- matrix(0,59,2)

init1 <- list(beta=c(0,0,0,0,0), b=b0,B=c(0,0),invD=diag(2),tau2u=5)

init2 <- list(beta=c(0,0,0,0,0), b=b0,B=c(0,0), invD=diag(5,2),tau2u=1)

inits <- list(init1,init2)

pars <- c("B","beta","Fit","delta","LL")

DS\_10\_10$K=NULL

DS\_10\_10$prpi.G=NULL

R3 = autojags(DS\_10\_10, inits, pars,model.file="epilr3.jag",2,iter.increment=5000, n.burnin=500, Rhat.limit=1.1, max.iter=20000, seed=1234,codaOnly=c("LL"))

R3$summary

loo(matrix(as.array(R3$sims.list$LL), dim(as.array(R3$sims.list$LL))[1],59\*4))

# Model 4

cat("

model {for (i in 1 : n) { ln.base[i] <- log(y0[i]/4);

ln.age[i] <- log(age[i])

Base[i] <- ln.base[i]-mean(ln.base[]);

Age[i] <- ln.age[i]-mean(ln.age[])

b1[i] <- b[1,i]

b2[i] <- b[2,i]

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

log(mu[i, t]) <- b[1,i]+beta[1]\*Base[i]

+beta[2]\*Trt[i]+beta[3]\*Base[i]\*Trt[i]+beta[4]\*Age[i]+b[2,i]\*Visit[t]

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

dev[i,t] <- y[i,t]\*log((y[i,t]+equals(y[i,t],0))/(mu[i,t]+ equals(y[i,t],0))) -(y[i,t]-mu[i,t])}}

# Fit Measues

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

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

# Select cluster

for (i in 1:n) {G[i] ~ dcat(p[1:Kmax])

for (k in 1:Kmax) {Sr[i,k] <- equals(k,G[i])}

# realised random subject effects

for (j in 1:2) {b[j,i] <- bstar[G[i],j]}}

kappa ~ dgamma(2,4) I(0.1,)

V[Kmax] <- 1

p[1] <- V[1]

# Truncated Dirichlet

for (k in 1:KM){V[k] ~ dbeta(1,kappa)

p[k+1] <- V[k+1]\*(1-V[k])\*p[k]/V[k]}

# Base Density

for (k in 1:Kmax) { bstar[k,1:2] ~ dmnorm(B[], invD[,])

# total non-empty clusters

clusn[k] <- sum(Sr[,k])

nonempty[k] <- step(clusn[k]-1)}

K <- sum(nonempty[])

# priors:

invD[1:2,1:2] ~ dwish(R[ , ], 10);

D[1:2,1:2] <- inverse(invD[,])

for (j in 1:2) {B[j] ~ dnorm(0,0.001)}

for (j in 1:4) {beta[j] ~ dnorm(0,0.001)}}

", file="epilr4.jag")

# initial values and estimation

bstar0 <- matrix(0,20,2)

init1 <- list(beta=c(0,0,0,0),B=c(0,0),invD = diag(2),G=rep(1,59),bstar=bstar0)

init2 <- list(beta=c(0,0,0,0),B=c(-0.5,-0.5),invD = diag(2,2),G=rep(1,59),bstar=bstar0)

inits <- list(init1,init2)

pars <- c("B","beta","K","Fit","kappa","LL")

DS\_10\_10$Visit = c(-0.3,-0.1,0.1,0.3)

DS\_10\_10$R = diag(20,2)

DS\_10\_10$Kmax=20

DS\_10\_10$KM=19

R4 = autojags(DS\_10\_10, inits, pars,model.file="epilr4.jag",2,iter.increment=5000, n.burnin=500, Rhat.limit=1.1, max.iter=20000, seed=1234,codaOnly=c("LL"))

R4$summary

loo(matrix(as.array(R4$sims.list$LL), dim(as.array(R4$sims.list$LL))[1],59\*4))