require(jagsUI); require(rube) ; options(scipen=999)

Sys.setenv(BUGSDIR="c:\\users\\p congdon\\documents\\WINBUGS14")

setwd("C:/R files BHMRA")

attach("DS\_4\_5.Rdata")

n <- DS\_4\_5$n

# Model 1

cat("model { for (j in 1:n) {# likelihood

y[j] ~dpois(o[j]\*mu[j])

# stage 2 model

mu[j] ~dgamma(alpha,beta)

reliab[j] <- sigma2.mu/(sigma2.mu+mu[j]/o[j])

# checks using mixed replicates

y.new[j] ~dpois(m.new[j]);

m.new[j] <- o[j]\*mu.new[j];

mu.new[j] ~dgamma(alpha,beta)

exceed[j] <- step(y.new[j]-y[j]-0.001)+0.5\*equals(y.new[j],y[j])}

#priors

rank.mu <- rank(mu)

alpha ~ dgamma(1,0.01); beta ~ dgamma(1,0.01)

sigma2.mu <- alpha/beta^2}

", file="model1.jag")

**# initial values and estimation**

inits <- function(){list(mu=rexp(131,1))}

pars <- c("alpha","beta","sigma2.mu","reliab","rank.mu","exceed")

R1 <- autojags(DS\_4\_5, inits, pars,model.file="model1.jag",2,

iter.increment=1000, n.burnin=100,Rhat.limit=1.1, max.iter=25000, seed=1234)

R1$summary

exc.mn <- numeric(n)

for (i in 1:n) {exc.mn[i] <- mean(as.array(R1$samples[,3+2\*n+i,]))}

**# total rate of mixed exceedance over tails**

sum(exc.mn>0.95)+sum(exc.mn<0.05)

**# plot 90% credible interval of ranks against mean reliabilities**

reliab.mn <- rank.95 <- rank.05 <- rank.lengthCRI <- numeric(n)

for (i in 1:n) {reliab.mn[i] <- mean(as.array(R1$samples[,3+i,]));

rank.95[i] <- quantile(as.array(R1$samples[,3+n+i,]),0.95);

rank.05[i] <- quantile(as.array(R1$samples[,3+n+i,]),0.05)}

**# CRI of percentile ranks**

rank.lengthCRI <- (rank.95-rank.05)/(n-1)

plot(reliab.mn,rank.lengthCRI)

**# MODEL 2**

model2= "model { for (j in 1:n) {# likelihood

y[j] ~dpois(mn.y[j])

mn.y[j] <- o[j]\*mu[j]

# stage 2 model

mu[j] ~dgamma(zeta,b)

# checks using mixed replicates

y.new[j] ~dpois(m.new[j]);

m.new[j] <- o[j]\*mu.new[j];

mu.new[j] ~dgamma(zeta,b)

exceed[j] <- step(y.new[j]-y[j]-0.001)+0.5\*equals(y.new[j],y[j])

# MLE relative risks

r[j] <- y[j]/o[j]

# shrinkage measures

B[j] <- zeta/(zeta+o[j]\*m.mu)}

#priors

B0 ~dunif(0,1)

zeta <- B0\*ranked(o[],1)\*mean(r[])/(1-B0)

b <- zeta/m.mu

m.mu ~dgamma(1,0.001)}

"

**# initial values and estimation**

inits <- function(){list(B0= runif(1,0,1),m.mu=rexp(1,1))}

pars <- c("m.mu","B0","B","zeta","mu","exceed")

C2 = rube(model2, DS\_4\_5, inits)

summary(C2)

R2 = rube(model2, DS\_4\_5, inits, pars, n.burn=500, n.thin=1, n.chains=2,n.iter=5000)

summary(R2,limit=n)

exc.mn <- numeric(n)

for (i in 1:n) {exc.mn[i] <- mean(R2$sims.array[,,i+2\*n+3])}

# total rate of mixed exceedance over tails

sum(exc.mn>0.95)+sum(exc.mn<0.05)

**# Model 3**

# define groups based on patient numbers

G <- numeric(n)

G <- c(rep(1,37),rep(2,94))

DS\_4\_5$G <- G

model3= "

model { for (j in 1:n) {# likelihood

y[j] ~ dpois(m[j])

m[j] <- o[j]\*mu[j]

# stage 2 model

mu[j] ~ dgamma(zeta[G[j]],b[G[j]])

# checks using mixed replicates

y.new[j] ~dpois(m.new[j])

m.new[j] <- o[j]\*mu.new[j]

mu.new[j] ~dgamma(zeta[G[j]],b[G[j]])

exceed[j] <- step(y.new[j]-y[j]-0.001)+0.5\*equals(y.new[j],y[j])

# MLE relative risks

r[j] <- y[j]/o[j]}

z0[1] <- ranked(o[1:37],1)\*mean(r[1:37])

z0[2] <- ranked(o[38:131],1)\*mean(r[38:131])

for (k in 1:2) {B0[k] ~ dunif(0,1)

zeta[k] <- B0[k]\*z0[k]/(1-B0[k]);

b[k] <- zeta[k]/m.mu[k]

m.mu[k] ~ dgamma(1,0.001)}}"

**# initial values and estimation**

inits <- function(){list(B0= runif(2,0,1),m.mu=rexp(2,1))}

pars <- c("m.mu","B0","zeta","mu","exceed")

C3 = rube(model3, DS\_4\_5, inits)

summary(C3)

R3 = rube(model3, DS\_4\_5, inits, pars, n.burn=500, n.thin=1, n.chains=2,n.iter=5000)

summary(R3,limit=n)

for (i in 1:n) {exc.mn[i] <- mean(R3$sims.array[,,i+n+6])}

**# total rate of mixed exceedance over tails**

sum(exc.mn>0.95)+sum(exc.mn<0.05)