

wk4-hw kenwan bayes

Biomial output with two groups

Data are panel data containing columns: sex, race, age, education, state and y. The output y is the binary version of the original data. It reflects opinion (positive-1, negative-0) about President Barak Obama during his 2012 campaign for reelection.

Consider problem of identifying responses of two gender groups (column sex).

Decide what is the right model and analyze it using JAGS. I'll use stan instead.

Consider different prior distributions.

Load in data

```
myData = read.csv(paste0(dataPath, "/wk4/MScA_32014_BayesianMethods_CourseProjectData.csv"))
head(myData)
```

```
##      sex    race  age      education state y
## 1 1.Male 1.White 18-24    1.NoCollege   GA 0
## 2 1.Male 1.White 25-34    1.NoCollege   AZ 0
## 3 1.Male 1.White 25-34    2.SomeCollege SD 0
## 4 1.Male 1.White 18-24    3.CollegeOrMore SC 0
## 5 1.Male 1.White 18-24    3.CollegeOrMore SC 0
## 6 1.Male 1.White 18-24    3.CollegeOrMore SC 0
```

```
dim(myData)
```

```
## [1] 23223      6
```

```
#positive
unique(myData$y)
```

```
## [1] 0 1
```

```
sum(myData$y)
```

```
## [1] 8514
```

```
(dataList<-list(y=myData$y,Ntotal=length(myData$y)))
```

```
## $y
##      [1] 0 0 0 0 0 0 1 0 1 0 0 1 0 0 1 0 1 0 0 0 1 0 0 0 1 0 1 0 0 0 0 0 0 0
##      [35] 0 0 1 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 1 0 0 0
##      [69] 0 1 0 1 1 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 1 0 0 1
##     [103] 1 1 0 0 0 1 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 1 1 1 1
##     [137] 0 0 1 1 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 1 1
##     [171] 1 0 0 1 0 1 0 1 0 0 0 0 1 0 1 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 1 0 0 0 0 0
##     [205] 1 1 0 1 0 1 0 0 0 0 0 1 0 0 1 0 1 0 1 1 1 0 0 0 1 0 0 0 0 0 0 0 1 1 0 0 0
##     [239] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1
##     [273] 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##     [307] 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 1 1 1 0 0 0 0
##     [341] 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0
##     [375] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 1 1 0 0 0 1 0 1 0
##     [409] 0 0 0 0 0 0 0 1 0 1 0 0 1 0 1 0 1 0 0 1 1 0 0 0 1 0 0 0 0 0 0 0 0 1 1 1
##     [443] 1 0 0 0 1 0 1 0 1 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 0 1 0 0 0 1 0 0 0
##     [477] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 1 0 0 0 0 0 0 0 0 1 0 1 1 0 0 1 0 0
##     [511] 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 1 0 0 0 1 1 0 0 0 0
##     [545] 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0
##     [579] 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 1 1 0 0 0
##     [613] 0 0 0 0 0 0 0 1 0 0 0 1 0 0 1 0 0 1 1 0 1 0 0 0 0 1 1 0 0 1 0 0 0 1
##     [647] 0 0 0 0 1 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
##     [681] 0 0 1 1 0 0 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0
```

```
## [715] 0 0 0 1 0 1 0 1 1 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 1 0 0 0 0 0
## [749] 0 0 0 1 0 0 0 0 0 1 1 1 0 0 0 1 0 1 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0
## [783] 0 0 0 0 0 0 0 0 1 0 1 0 0 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1 0
## [817] 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 1 0 1 0 0 1 0 0 0 0 1 0 0 1 0 0 0
## [851] 0 0 0 0 0 0 1 0 0 1 0 1 0 1 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 1
## [885] 1 0 1 0 1 0 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 1 1
## [919] 0 0 0 1 0 1 1 0 0 1 0 1 0 0 0 1 1 1 0 0 0 0 1 0 0 0 0 0 0 0 1 0 0 0
## [953] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 1 0 0 1 0 0 0 1 0 0 1 0
## [987] 1 0 0 0 0 0 1 0 0 0 1 1 0 1 0 0 0 0 0 0 1 0 0 0 0 1 1 0 1 0 0 0 0
## [1021] 0 0 1 0 0 0 0 0 0 0 0 1 1 0 0 0 0 1 1 1 1 0 0 0 0 0 1 0 1 1 0 0 1
## [1055] 1 0 0 0 1 0 0 1 0 0 0 1 1 0 0 0 1 0 0 0 1 1 1 0 0 0 0 0 0 0 1 1 0 0
## [1089] 0 0 0 0 0 1 0 1 1 0 0 0 0 0 0 0 0 0 1 1 1 0 1 0 0 0 0 1 0 0 1 0 0 0
## [1123] 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 1 0 0 0 0 0 0
## [1157] 0 0 1 0 1 0 0 0 1 1 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 1 0
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## [1225] 0 1 0 1 1 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 1 1 0 0 0 0 0 0 0 1 1 0 0 0
## [1259] 0 0 0 0 0 0 0 0 0 0 1 0 0 1 1 0 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 1 0
## [1293] 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 1 1 0 0 0 1
## [1327] 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0
## [1361] 0 0 0 1 0 0 1 1 0 0 0 0 0 1 0 1 0 1 1 0 0 0 1 0 0 0 0 0 0 1 0 1 0 1
## [1395] 0 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0
## [1429] 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0 1 0 0 0 1 1 0 0 0 0 0 0 0 1 1
## [1463] 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 1 1 0 1 0 0 0 1 0
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## [1565] 0 0 0 0 0 1 1 1 0 0 1 0 0 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 0
## [1599] 1 0 0 0 0 1 0 0 0 0 0 0 1 0 0 1 1 0 1 0 0 0 1 0 0 1 1 0 1 1 1 0 0 0
## [1633] 1 0 0 0 0 0 1 0 1 0 1 1 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0
## [1667] 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0
## [1701] 0 0 0 0 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 1 1 1 0 0 1 0 0 0 0 0 0 0 0 0
## [1735] 0 0 0 1 1 0 0 0 0 0 1 1 0 1 0 1 0 0 0 0 0 0 0 0 1 0 0 1 0 0 0 0 1
## [1769] 1 0 0 0 0 1 0 0 0 0 0 1 0 1 1 0 0 0 0 0 0 0 1 1 0 0 0 0 1 0 0 0 0 1
## [1803] 0 0 0 0 0 0 0 1 0 0 0 1 1 1 1 0 1 0 0 0 1 1 0 0 0 1 0 0 0 0 0 1 0 0
## [1837] 1 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 1 1 1 0 0 1 0 0 1 0 0 1 1 1 0 1 1 0
## [1871] 1 1 0 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 1 1 0 0 0 0 0 0 0 1 0 0 0
## [1905] 0 0 0 0 1 1 1 1 0 0 0 0 0 0 0 1 1 1 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0
## [1939] 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0 1 0 0 0 0
```

```
## [1973] 1 0 0 0 0 0 0 1 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 1 0 0
## [2007] 0 0 0 0 0 0 0 1 0 0 0 0 0 1 0 1 0 0 1 1 0 1 1 0 0 0 0 0 0 1 0 0 1 0
## [2041] 1 0 0 0 1 1 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 1 0 0 1 1
## [2075] 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 0 1 0 1 0 1 0 0 1 0 0 0 1 1
## [2109] 0 0 1 0 0 0 0 0 0 0 0 1 1 1 0 1 1 1 1 1 0 1 1 1 1 0 0 0 0 0 0 1 0 0
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## [2177] 1 1 0 0 0 0 0 0 1 0 0 0 1 0 0 1 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1
## [2211] 0 1 0 1 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1
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## [2381] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
## [2415] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
## [2449] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
## [2483] 0 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
## [2517] 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
## [2551] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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## [2653] 1 1 1 0 0 1 1 0 1 0 1 0 1 1 0 1 1 1 1 0 1 1 1 1 1 1 1 1 0 0 0 0 0 0
## [2687] 0 1 1 1 1 1 1 0 1 1 0 1 1 0 1 1 0 1 1 1 0 1 0 1 0 1 1 0 1 0 1 0 1 1
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## [3095] 1 1 0 0 0 1 1 0 0 0 1 0 1 0 0 0 0 1 1 1 0 1 1 0 1 0 1 1 1 1 0 1 1 1
## [3129] 1 0 1 0 1 0 0 0 1 0 0 0 1 1 0 0 1 0 1 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0
## [3163] 0 0 0 0 1 0 0 1 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## [3197] 0 1 0 1 1 0 1 0 0 0 0 1 0 0 0 0 0 0 0 1 0 1 1 0 1 0 0 0 0 1 0 0 0 0
```

```
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## [3299] 1 1 0 0 0 1 0 0 0 1 0 1 0 0 0 1 1 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 1 0
## [3333] 0 1 0 0 1 1 0 0 0 0 1 1 0 1 0 0 1 0 0 1 1 0 0 0 0 0 1 0 0 1 0 0 0 0
## [3367] 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 1 0 1 0 0 0 0 1 0 0 1 0 0 1 0
## [3401] 1 1 0 1 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 1 0 0 1 0 0 0 0 1 0
## [3435] 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 1 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0
## [3469] 0 0 1 1 0 0 0 0 0 0 0 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 1 0 0 1 1
## [3503] 0 1 1 0 1 0 0 0 1 0 0 1 1 1 0 1 0 0 0 1 0 0 0 0 1 1 1 1 1 1 0 1 1 1
## [3537] 0 1 0 0 1 0 0 1 1 0 1 1 1 1 0 0 1 1 1 1 0 0 0 1 0 1 0 0 0 1 0 0 0 0
## [3571] 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 0 1 0 0 1 1 0 0 1 1 0 0 1 0 0 1 1
## [3605] 1 1 0 0 0 0 1 1 1 0 1 1 0 1 1 0 0 1 0 0 0 0 0 1 1 0 0 1 1 0 0 0 1 0
## [3639] 0 1 0 1 1 1 0 0 0 0 0 1 0 0 0 1 0 0 0 1 0 1 0 0 1 0 1 0 1 1 0 0 0 1
## [3673] 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 1 0 1 1 1 0 1 0 1 0 0 0 0 1 0
## [3707] 1 0 0 0 1 1 0 0 0 1 0 1 0 0 0 0 1 0 0 1 1 0 1 0 0 0 0 1 0 0 0 0 0 0
## [3741] 0 1 1 0 1 1 1 1 1 0 0 1 0 1 0 1 1 1 1 0 1 0 0 0 1 0 0 0 0 0 1 0 0 0
## [3775] 0 1 1 1 0 0 1 0 0 0 1 0 1 0 0 0 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0 1 1 1
## [3809] 0 0 0 1 0 1 0 1 0 0 1 0 0 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0 1 0 1 1 0 0
## [3843] 0 0 1 1 0 0 1 1 1 0 0 1 1 0 1 0 0 0 1 0 0 0 0 0 0 1 1 1 1 1 0 0 0 1
## [3877] 1 0 0 0 0 0 0 0 0 0 1 0 1 1 1 0 0 1 1 0 0 1 0 1 0 0 1 1 0 1 0 1 0 1
## [3911] 0 1 0 1 0 0 1 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 1 0 1 0 1 1 0 1 0 0 1
## [3945] 1 0 0 0 0 0 0 1 1 0 1 1 1 0 1 0 0 0 0 0 0 0 1 1 1 1 0 0 0 1 0 1 1 0
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## [4013] 0 0 0 0 0 0 0 1 1 0 1 1 0 0 0 1 0 0 0 0 0 0 1 0 1 0 0 1 0 0 0 1 0 0
## [4047] 0 0 1 1 0 0 1 1 0 0 0 0 0 1 0 0 0 0 0 0 0 1 0 1 0 0 0 0 1 1 0 0 0 1 0
## [4081] 0 0 1 1 1 1 0 0 0 0 0 0 0 1 1 1 0 1 0 0 1 0 0 0 1 1 0 0 0 1 0 1 0 0
## [4115] 1 0 1 0 0 1 0 0 1 0 0 1 0 0 0 1 0 0 1 1 1 1 1 0 1 1 1 0 1 0 1 1 1 1
## [4149] 1 1 1 1 1 1 1 0 0 1 1 1 1 1 1 1 1 1 0 1 0 1 1 0 1 1 1 1 1 1 1 1 1 1
## [4183] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
## [4217] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 0 1 1 1 0
## [4251] 0 1 0 1 1 1 1 1 1 1 1 0 1 0 1 0 0 0 1 1 0 1 1 1 1 1 0 1 0 1 1 1 1 1
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## [4319] 0 1 0 0 1 0 0 0 1 0 1 1 1 1 1 0 1 1 1 0 1 0 1 1 1 1 0 0 0 1 0 0 1 0
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## [4387] 0 0 0 0 1 1 0 1 1 1 0 0 1 0 1 0 0 0 1 1 1 0 0 0 1 1 0 1 0 0 1 0 1 1
## [4421] 1 0 1 1 0 1 1 1 1 1 0 1 0 0 0 0 0 1 0 1 1 1 0 0 1 1 1 1 1 0 1 0 0 0
## [4455] 1 1 1 1 1 1 0 1 0 0 1 0 0 1 1 0 1 1 0 0 0 0 0 1 0 0 0 1 1 0 1 1 1 1
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```
## [4489] 0 0 0 1 1 1 1 1 0 0 0 0 1 0 0 1 0 0 0 1 0 0 1 1 1 1 1 1 0 0 0 0 0 0
## [4523] 1 0 0 1 0 0 1 1 1 0 1 0 0 1 0 0 0 1 0 0 1 0 0 1 1 1 0 0 0 0 0 0 1
## [4557] 0 0 1 0 0 1 1 1 0 0 0 1 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0
## [4591] 1 0 1 1 0 0 0 1 0 1 0 1 1 0 1 1 0 0 0 0 0 0 0 0 1 1 0 1 0 1 0 1 0 0
## [4625] 0 0 1 0 1 1 1 0 1 1 0 1 1 1 1 1 1 0 1 1 1 1 0 1 1 0 1 1 1 0 0 0 1
## [4659] 0 0 0 0 1 1 0 1 1 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 1 1 0 1 0 0 0 1 0
## [4693] 1 0 0 0 1 0 0 1 0 1 0 1 0 0 1 1 1 0 1 0 1 1 1 0 0 1 1 1 0 1 1 0 1 1
## [4727] 0 0 0 1 0 1 0 0 1 0 1 0 0 0 1 0 0 0 0 1 1 1 0 0 0 1 1 0 0 1 0 1 1 1
## [4761] 0 0 1 1 0 1 0 1 0 1 1 1 1 1 1 1 0 1 0 0 0 0 0 0 1 1 0 1 0 0 1 1 0 1 0 1
## [4795] 1 1 0 0 0 1 0 1 0 0 0 0 1 0 1 0 1 0 0 0 0 0 0 0 1 0 1 0 1 1 0 1 0 0 1
## [4829] 1 0 0 1 0 0 0 0 1 0 1 0 1 0 1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 0 0 0 0 1
## [4863] 0 0 0 0 0 0 1 0 0 0 0 1 0 1 1 1 0 0 1 0 1 1 1 1 0 0 0 1 0 0 0 0 1 0
## [4897] 1 0 1 0 0 1 0 0 1 1 1 1 0 0 1 0 0 0 0 0 0 0 0 0 0 1 0 0 1 1 1 1 0 0
## [4931] 0 1 0 0 0 0 0 1 1 0 1 0 1 0 0 0 1 0 1 0 1 0 0 1 1 0 0 0 1 1 1 0 0 0
## [4965] 0 0 0 0 1 0 1 0 0 0 0 1 0 0 0 0 0 1 0 1 1 1 1 0 1 0 0 0 0 0 0 1 0 1
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## [5101] 0 1 0 1 1 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 1 1 0 0 1 0 0 0 0 0 1 0 0
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## [5373] 0 1 1 1 1 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 1 1 1 0 0 1 0 0 1
## [5407] 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 0 1 0 1 0 0 0 1 1 0 1 0 0 0 0 0 0 0 0 1
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## [5509] 1 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 1 1 0 1 1 0 0 0 1 0 0 0 0 1 0 0 1 0 0 1
## [5543] 0 1 1 0 1 0 0 1 1 1 0 0 0 0 0 0 1 1 1 0 0 0 0 0 1 1 1 0 0 0 1 0 0 0
## [5577] 1 0 1 0 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 1 1 1 0 1 0 0 1 0 1 0
## [5611] 1 0 0 0 1 0 1 1 1 0 0 1 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0
## [5645] 0 1 0 0 0 0 0 0 0 1 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 1 0 0
## [5679] 0 0 1 1 0 0 1 0 1 1 0 1 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 1 0 0 1 1 0 0 0
## [5713] 0 0 1 1 1 0 1 0 0 0 0 0 0 1 0 0 1 0 1 0 0 0 0 1 0 1 0 0 0 0 0 1 0 0 0
```

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## [5747] 0 1 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 1 0 0 1 1 1
## [5781] 0 1 0 1 1 1 0 1 0 0 0 1 0 0 0 0 0 0 1 1 1 1 0 0 0 1 1 0 1 1 0 0 0 0
## [5815] 0 1 0 0 0 1 0 0 1 0 0 1 0 1 0 0 0 1 0 0 0 0 0 1 1 0 1 0 1 0 0 0 0 1
## [5849] 0 1 0 1 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 1 0 0 1 0 1 1
## [5883] 0 1 0 1 0 0 0 0 1 0 0 0 0 0 0 1 0 0 0 1 0 0 1 1 0 0 0 0 0 0 0 1 0 1
## [5917] 0 1 0 1 0 1 1 1 1 0 0 0 1 0 0 0 1 0 0 1 0 0 1 0 0 0 0 0 1 0 1 0 0 1
## [5951] 0 0 1 0 0 0 0 0 0 0 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 1 1 1 0 0 0 0 1 0
## [5985] 0 0 0 0 1 1 1 0 1 0 0 0 0 0 0 1 1 0 1 0 1 1 0 0 0 1 0 1 1 0 0 0 0 1
## [6019] 0 0 0 0 0 0 0 1 0 0 1 1 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0
## [6053] 0 0 0 0 0 0 1 0 0 0 0 1 0 0 1 0 0 0 0 0 0 1 0 0 0 0 0 0 1 1 0 1 1 0
## [6087] 0 0 1 0 0 0 1 1 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 1 1 0 0 0 1
## [6121] 0 1 0 0 0 0 0 0 0 0 1 0 0 1 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 1 0 1 0 1
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## [6189] 0 1 0 0 0 1 0 0 0 0 1 0 0 0 1 1 1 0 0 1 0 1 0 0 0 1 0 0 0 0 1 1 0 1
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## [20809] 0 0 1 0 0 1 0 0 1 1 0 0 0 0 0 0 0 0 0 1 0 0 1 1 0 0 1 1 1 0 0 0 1 0 0 0
```

```
## [20843] 1 0 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 1 1 0 0 1 1 1 0 1 0 1 0 1 0 0 0 1
## [20877] 0 1 0 1 0 1 0 0 0 0 0 0 0 0 1 1 0 1 0 0 0 1 0 0 1 1 0 0 1 1 0 0 0 0
## [20911] 0 0 1 1 0 1 1 0 0 0 0 1 1 0 0 0 0 0 1 0 0 0 1 0 1 0 1 1 0 0 0 1 1 1
## [20945] 0 1 0 0 1 1 0 0 0 0 0 0 0 0 1 0 0 1 1 1 0 0 0 0 0 1 0 1 0 1 0 0 1 0
## [20979] 1 1 1 0 0 0 1 1 1 1 0 1 0 0 1 0 0 0 0 0 0 1 1 0 0 0 1 1 1 1 0 1 0 0
## [21013] 0 0 1 1 0 0 0 0 1 1 0 0 1 1 0 0 0 0 1 0 1 1 1 0 0 0 1 0 0 0 0 0 0 0
## [21047] 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 1 1 0 1 0 0 1 0 0 0 0 0 1 0 0
## [21081] 1 1 0 0 0 0 0 1 0 1 0 1 0 1 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 1 0
## [21115] 0 0 1 1 1 0 0 1 1 0 0 0 0 0 1 1 0 1 1 1 1 0 0 0 0 1 0 0 0 1 1 0 0 0
## [21149] 0 1 0 1 0 1 0 1 0 1 0 1 0 0 0 1 0 0 0 0 1 0 1 1 0 0 0 0 0 0 1 1 0 0
## [21183] 0 0 0 1 0 0 0 0 1 0 1 1 1 0 1 0 1 1 0 1 1 0 0 0 1 0 1 1 0 1 0 0 0 1
## [21217] 1 0 1 1 1 0 1 0 1 0 1 0 0 1 0 1 0 1 0 0 1 1 0 0 0 0 0 0 0 0 0 1 1 0
## [21251] 0 1 0 1 0 1 0 1 1 0 0 0 0 1 0 0 0 0 0 1 0 0 1 0 0 0 0 0 1 0 0 1 0 0
## [21285] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 0 1 0 0 0 0 0 1 0 0 0 0 1 1 0 0 0
## [21319] 1 0 0 0 1 1 0 0 0 0 0 1 0 1 0 0 0 0 1 1 0 1 0 0 0 1 1 0 0 1 1 0 1 0
## [21353] 0 0 0 0 0 0 1 0 0 0 0 1 0 1 0 0 1 0 0 0 0 1 1 0 0 0 0 1 0 0 0 0 1 1
## [21387] 1 0 0 0 0 0 1 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 1 0 0 1 0 0 1 0 0
## [21421] 0 1 1 1 0 0 0 1 0 0 0 1 1 0 0 0 1 1 0 0 0 0 0 0 1 1 0 0 0 0 0 1 1 0
## [21455] 1 0 0 1 0 0 1 0 0 0 0 0 0 0 1 0 0 1 0 0 0 0 1 0 0 1 0 0 0 0 1 1 0 1
## [21489] 1 0 1 0 1 0 1 0 0 0 0 0 1 1 1 0 1 1 0 1 0 1 1 1 0 0 0 1 0 1 0 1 1 1
## [21523] 1 0 0 0 0 0 1 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 0 1 1 0 1 1 1 1
## [21557] 0 0 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1
## [21591] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 1 1 0 1 1 1 1 1 1
## [21625] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1
## [21659] 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1
## [21693] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
## [21727] 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1
## [21761] 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1
## [21795] 1 1 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1
## [21829] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1 0 0
## [21863] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1
## [21897] 1 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
## [21931] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1
## [21965] 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
## [21999] 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0
## [22033] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1
## [22067] 1 1 1 1 1 1 1 1 0 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
```

```
## [22101] 1 1 1 1 0 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 0 1
## [22135] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
## [22169] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1
## [22203] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
## [22237] 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1
## [22271] 0 1 0 1 0 0 0 1 0 1 0 0 1 1 1 1 0 1 1 1 1 1 1 1 1 0 1 1 0 1 0 0 1 0
## [22305] 0 1 0 1 0 1 0 0 1 1 0 1 0 0 1 0 1 1 1 1 0 1 0 0 1 0 1 0 0 0 1 1 1 0
## [22339] 1 1 1 0 1 0 1 0 0 0 0 0 1 1 0 1 0 0 0 1 0 0 1 0 1 0 0 1 1 0 0 1 1 1
## [22373] 1 1 0 1 1 0 0 0 0 1 0 0 1 0 1 1 0 1 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0
## [22407] 0 0 1 0 1 0 1 1 0 0 0 1 1 1 1 1 1 0 0 1 1 0 1 1 1 1 1 1 1 0 1 0 0 1
## [22441] 0 1 1 1 0 0 0 1 1 0 1 1 1 1 1 1 1 0 1 1 0 1 0 0 1 1 1 1 1 0 1 0 0 1 1
## [22475] 0 0 1 1 1 1 1 1 1 1 0 1 1 0 1 1 1 0 0 0 1 1 0 1 0 0 1 0 1 1 1 1 1 1
## [22509] 0 0 0 0 1 1 0 1 0 1 1 1 1 1 1 0 0 1 0 0 0 0 0 1 1 1 0 0 1 1 1 1 1 0
## [22543] 0 0 1 0 1 0 0 1 0 1 0 1 0 1 1 1 1 0 1 1 1 1 1 0 1 0 0 0 1 0 0 1 0 1 0
## [22577] 0 1 1 1 1 0 0 1 0 1 1 1 1 1 1 1 1 0 0 1 1 0 1 0 1 0 1 1 0 1 1 1 1 0 0
## [22611] 0 0 0 1 1 1 0 0 1 0 0 1 1 1 1 1 1 1 0 0 1 0 0 1 1 0 0 0 0 0 0 1 0 1
## [22645] 1 0 0 1 1 1 1 0 0 1 1 0 1 0 0 0 0 0 1 0 0 0 0 1 0 1 1 0 1 1 1 1 0 1
## [22679] 0 0 1 1 0 1 1 0 1 0 1 0 1 1 1 0 1 1 0 1 0 1 1 1 1 1 0 0 0 1 1 1 1 1
## [22713] 1 1 1 1 0 0 0 1 1 1 0 0 0 0 1 0 0 1 0 1 0 1 1 0 0 0 0 0 1 0 1 1 0 1
## [22747] 0 0 1 1 1 0 1 1 0 0 0 0 0 1 0 0 1 0 1 1 0 1 1 0 1 1 0 0 0 0 1 0 1 0
## [22781] 0 0 0 1 0 0 0 0 1 1 1 1 1 0 1 1 1 1 1 0 0 1 0 0 0 0 0 1 1 1 0 0 1 0
## [22815] 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 1 0 1 1 1
## [22849] 0 1 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0
## [22883] 1 0 0 1 0 1 0 0 1 0 1 0 0 0 0 1 1 1 1 1 1 0 0 0 0 0 1 1 1 1 1 0 1 0
## [22917] 1 0 1 1 1 0 1 1 1 1 0 1 1 1 1 1 1 0 0 1 1 1 0 1 1 1 1 0 1 1 0 1 1 1
## [22951] 0 1 1 0 0 1 1 1 1 1 1 0 0 1 0 1 0 1 1 1 0 1 1 1 0 1 0 0 0 1 0 1 1 1
## [22985] 1 1 1 1 1 1 0 0 1 0 1 1 1 0 0 0 0 0 1 1 1 0 1 0 1 1 0 0 1 0 1 0 1 1
## [23019] 1 0 0 1 1 0 1 1 1 1 0 1 1 1 1 1 1 1 1 0 1 0 0 0 0 0 1 1 0 0 1 0 1 1
## [23053] 0 1 1 0 1 0 1 0 0 1 1 1 1 1 1 0 1 1 1 0 0 1 0 0 1 1 1 1 0 0 1 1 1 1
## [23087] 0 0 0 1 0 1 0 1 1 0 1 0 1 1 1 0 0 1 1 0 1 1 0 0 1 0 1 0 1 0 1 1 0 1
## [23121] 0 1 1 0 0 1 0 1 0 1 0 1 1 0 1 0 1 0 0 1 0 1 1 0 0 1 0 0 0 1 1 0 1 0
## [23155] 0 1 1 1 0 1 0 0 1 1 1 0 0 0 1 1 0 0 1 0 1 0 1 1 1 1 0 0 0 1 1 1 1 1
## [23189] 1 0 0 1 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 1 1 0 0 1 1 1 0 0 1 0 0 1 0 1
## [23223] 0
##
## $Ntotal
## [1] 23223
```

```
y<-myData$y
(Ntotal<-length(y))
```

```
## [1] 23223
```

Simple binomial breaks down.

Let's examine then the impact of gender.

```
unique(myData$sex)
```

```
## [1] 1.Male 2.Female
## Levels: 1.Male 2.Female
```

```
#string

y = as.numeric(myData$y)
s = as.numeric(myData$sex) # ensures consecutive integer levels
# Do some checking that data make sense:

if ( any( y!=0 & y!=1 ) ) { stop("All y values must be 0 or 1.") }
Ntotal = length(y)
Nsubj = length(unique(s))

# Specify the data in a list, for later shipment to JAGS:
dataList = list(
  y = y ,
  s = s ,
  Ntotal = Ntotal ,
  Nsubj = Nsubj
)

# THE MODEL.
```

```

modelString = "
data {
  int<lower=1> Nsubj ;
  int<lower=1> Ntotal ;
  int<lower=0,upper=1> y[Ntotal] ;
  int<lower=1> s[Ntotal] ; // notice Ntotal not Nsubj
}
parameters {
  real<lower=0,upper=1> theta[Nsubj] ; // individual prob correct
  real<lower=0,upper=1> omega ;          // group mode
  real<lower=0> kappaMinusTwo ;          // group concentration minus two
}
transformed parameters {
  real<lower=0> kappa ;
  kappa = kappaMinusTwo + 2 ;
}
model {
  omega ~ beta( 1 , 1 ) ;
  kappaMinusTwo ~ gamma( 0.01 , 0.01 ) ; // mean=1 , sd=10 (generic vague)
  // kappaMinusTwo ~ gamma( 1.105125 , 0.1051249 ) ; # mode=1 , sd=10
  theta ~ beta( omega*(kappa-2)+1 , (1-omega)*(kappa-2)+1 ) ; // vectorized
  for ( i in 1:Ntotal ) {
    y[i] ~ bernoulli( theta[s[i]] ) ;
  }
}
" # close quote for modelString

```

Initialize.

```

# INITIALIZE THE CHAINS.
# Initial values of MCMC chains based on data:
initsList = function() {
  thetaInit = rep(0,Nsubj)
  for ( sIdx in 1:Nsubj ) { # for each subject
    includeRows = ( s == sIdx ) # identify rows of this subject
    yThisSubj = y[includeRows] # extract data of this subject
    resampledY = sample( yThisSubj , replace=TRUE ) # resample
  }
}

```

```

    thetaInit[sIdx] = sum(resampledY)/length(resampledY)
  }
  thetaInit = 0.001+0.998*thetaInit # keep away from 0,1
  meanThetaInit = mean( thetaInit )
  kappaInit = 100 # lazy, start high and let burn-in find better value
  return( list( theta=thetaInit , omega=meanThetaInit ,
               kappaMinusTwo=kappaInit-2 ) )
}

# RUN THE CHAINS
parameters = c( "theta","omega","kappa") # The parameters to be monitored
burnInSteps = 500          # Number of steps to burn-in the chains
nChains = 4                # nChains should be 2 or more for diagnostics
numSavedSteps=50000
thinSteps=1

# Translate to C++ and compile to DSO:
stanDso <- stan_model( model_code=modelString )

```

```

## In file included from D:/R-3.4.4/library/BH/include/boost/config.hpp:39:0,
##          from D:/R-3.4.4/library/BH/include/boost/math/tools/config.hpp:13,
##          from D:/R-3.4.4/library/StanHeaders/include/stan/math/rev/core/var.hpp:7,
##          from D:/R-3.4.4/library/StanHeaders/include/stan/math/rev/core/gevv_vvv_vari.hpp:5,
##          from D:/R-3.4.4/library/StanHeaders/include/stan/math/rev/core.hpp:12,
##          from D:/R-3.4.4/library/StanHeaders/include/stan/math/rev/mat.hpp:4,
##          from D:/R-3.4.4/library/StanHeaders/include/stan/math.hpp:4,
##          from D:/R-3.4.4/library/StanHeaders/include/src/stan/model/model_header.hpp:4,
##          from file21fc10726b4.cpp:8:
## D:/R-3.4.4/library/BH/include/boost/config/compiler/gcc.hpp:186:0: warning: "BOOST_NO_CXX11_RVALUE_REFERENCES"
## redefined
## # define BOOST_NO_CXX11_RVALUE_REFERENCES
## ^
## <command-line>:0:0: note: this is the location of the previous definition
## cclplus.exe: warning: unrecognized command line option "-Wno-ignored-attributes"

```

Now run.

```
# Get MC sample of posterior:
startTime = proc.time()
stanFit <- sampling( object=stanDso ,
                    data = dataList ,
                    #pars = parameters , # optional
                    chains = nChains ,
                    iter = ( ceiling(numSavedSteps/nChains)*thinSteps
                          +burnInSteps ) ,
                    warmup = burnInSteps ,
                    thin = thinSteps ,
                    init = initsList ) # optional
```

```
##
## SAMPLING FOR MODEL '0abcd1c6e22c697f2c611d2f31f359c0' NOW (CHAIN 1).
##
## Gradient evaluation took 0.002 seconds
## 1000 transitions using 10 leapfrog steps per transition would take 20 seconds.
## Adjust your expectations accordingly!
##
##
## Iteration:      1 / 13000 [ 0%] (Warmup)
## Iteration:    501 / 13000 [ 3%] (Sampling)
## Iteration:   1800 / 13000 [13%] (Sampling)
## Iteration:   3100 / 13000 [23%] (Sampling)
## Iteration:   4400 / 13000 [33%] (Sampling)
## Iteration:   5700 / 13000 [43%] (Sampling)
## Iteration:   7000 / 13000 [53%] (Sampling)
## Iteration:   8300 / 13000 [63%] (Sampling)
## Iteration:   9600 / 13000 [73%] (Sampling)
## Iteration:  10900 / 13000 [83%] (Sampling)
## Iteration:  12200 / 13000 [93%] (Sampling)
## Iteration:  13000 / 13000 [100%] (Sampling)
##
## Elapsed Time: 69.207 seconds (Warm-up)
##              244.761 seconds (Sampling)
##              313.968 seconds (Total)
```



```
##
##
## SAMPLING FOR MODEL '0abcd1c6e22c697f2c611d2f31f359c0' NOW (CHAIN 2).
##
## Gradient evaluation took 0.002 seconds
## 1000 transitions using 10 leapfrog steps per transition would take 20 seconds.
## Adjust your expectations accordingly!
##
##
## Iteration:      1 / 13000 [  0%] (Warmup)
## Iteration:    501 / 13000 [  3%] (Sampling)
## Iteration:   1800 / 13000 [ 13%] (Sampling)
## Iteration:   3100 / 13000 [ 23%] (Sampling)
## Iteration:   4400 / 13000 [ 33%] (Sampling)
## Iteration:   5700 / 13000 [ 43%] (Sampling)
## Iteration:   7000 / 13000 [ 53%] (Sampling)
## Iteration:   8300 / 13000 [ 63%] (Sampling)
## Iteration:   9600 / 13000 [ 73%] (Sampling)
## Iteration:  10900 / 13000 [ 83%] (Sampling)
## Iteration:  12200 / 13000 [ 93%] (Sampling)
## Iteration:  13000 / 13000 [100%] (Sampling)
##
## Elapsed Time: 24.916 seconds (Warm-up)
##                123.932 seconds (Sampling)
##                148.848 seconds (Total)
##
##
## SAMPLING FOR MODEL '0abcd1c6e22c697f2c611d2f31f359c0' NOW (CHAIN 3).
##
## Gradient evaluation took 0.002 seconds
## 1000 transitions using 10 leapfrog steps per transition would take 20 seconds.
## Adjust your expectations accordingly!
##
##
## Iteration:      1 / 13000 [  0%] (Warmup)
## Iteration:    501 / 13000 [  3%] (Sampling)
## Iteration:   1800 / 13000 [ 13%] (Sampling)
```

```
## Iteration: 3100 / 13000 [ 23%] (Sampling)
## Iteration: 4400 / 13000 [ 33%] (Sampling)
## Iteration: 5700 / 13000 [ 43%] (Sampling)
## Iteration: 7000 / 13000 [ 53%] (Sampling)
## Iteration: 8300 / 13000 [ 63%] (Sampling)
## Iteration: 9600 / 13000 [ 73%] (Sampling)
## Iteration: 10900 / 13000 [ 83%] (Sampling)
## Iteration: 12200 / 13000 [ 93%] (Sampling)
## Iteration: 13000 / 13000 [100%] (Sampling)
##
## Elapsed Time: 55.728 seconds (Warm-up)
##                289.801 seconds (Sampling)
##                345.529 seconds (Total)
##
##
## SAMPLING FOR MODEL '0abcd1c6e22c697f2c611d2f31f359c0' NOW (CHAIN 4).
##
## Gradient evaluation took 0.001 seconds
## 1000 transitions using 10 leapfrog steps per transition would take 10 seconds.
## Adjust your expectations accordingly!
##
##
## Iteration:      1 / 13000 [  0%] (Warmup)
## Iteration:    501 / 13000 [  3%] (Sampling)
## Iteration:   1800 / 13000 [ 13%] (Sampling)
## Iteration:   3100 / 13000 [ 23%] (Sampling)
## Iteration:   4400 / 13000 [ 33%] (Sampling)
## Iteration:   5700 / 13000 [ 43%] (Sampling)
## Iteration:   7000 / 13000 [ 53%] (Sampling)
## Iteration:   8300 / 13000 [ 63%] (Sampling)
## Iteration:   9600 / 13000 [ 73%] (Sampling)
## Iteration:  10900 / 13000 [ 83%] (Sampling)
## Iteration:  12200 / 13000 [ 93%] (Sampling)
## Iteration:  13000 / 13000 [100%] (Sampling)
##
## Elapsed Time: 26.96 seconds (Warm-up)
```

```
##          90.119 seconds (Sampling)
##          117.079 seconds (Total)
```

```
## Warning: There were 35351 divergent transitions after warmup. Increasing adapt_delta above 0.8 may help. See
## http://mc-stan.org/misc/warnings.html#divergent-transitions-after-warmup
```

```
## Warning: Examine the pairs() plot to diagnose sampling problems
```

```
stopTime = proc.time()
duration = stopTime - startTime
show(duration)
```

```
##      user  system elapsed
##  920.88    0.05   925.83
```

Convergence.

```
show(stanFit)
```

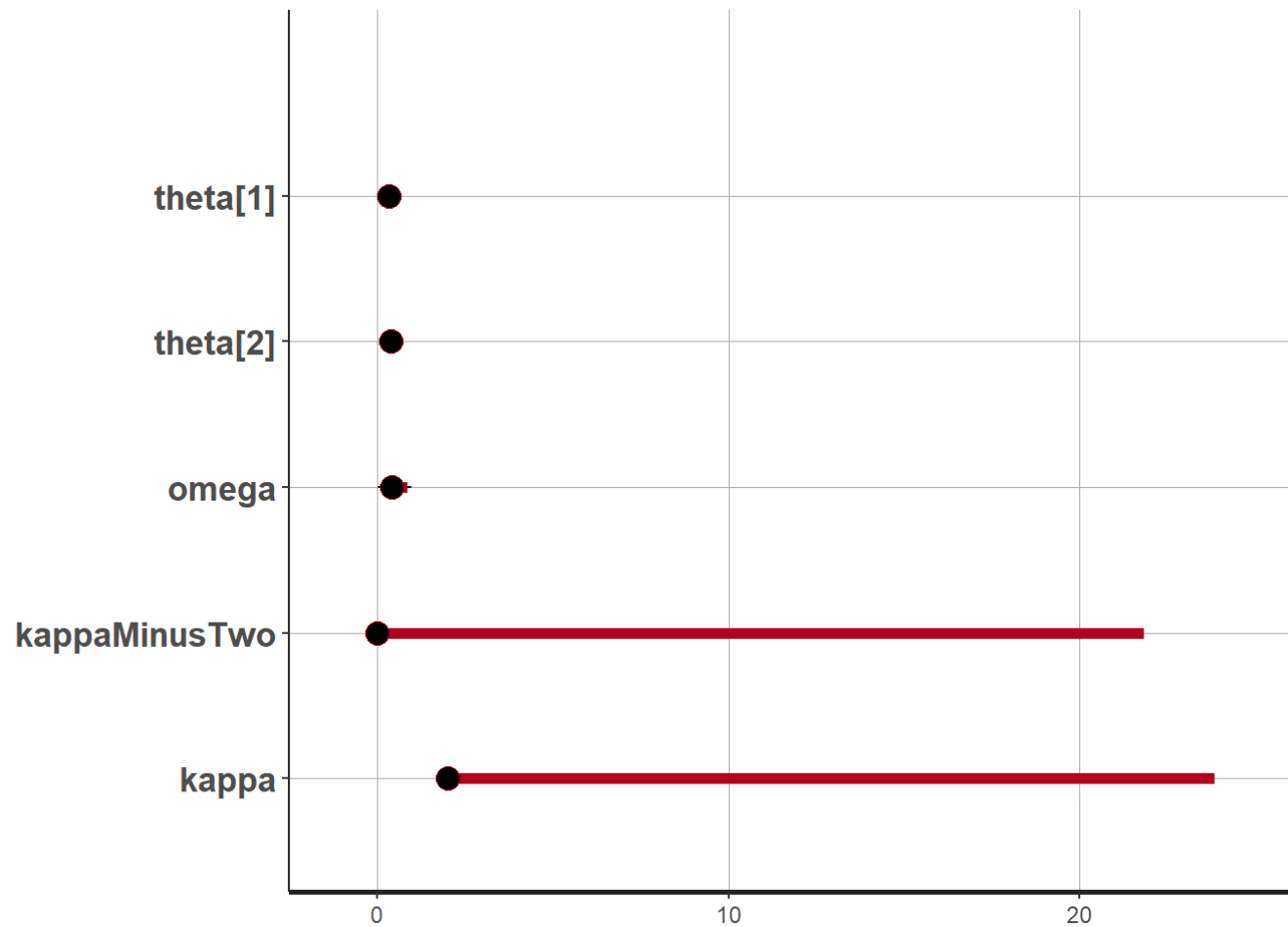
```
## Inference for Stan model: 0abcd1c6e22c697f2c611d2f31f359c0.
## 4 chains, each with iter=13000; warmup=500; thin=1;
## post-warmup draws per chain=12500, total post-warmup draws=50000.
##
##              mean se_mean   sd      2.5%      25%      50%
## theta[1]      0.34    0.00  0.00      0.33      0.34      0.34
## theta[2]      0.38    0.00  0.00      0.38      0.38      0.38
## omega         0.47    0.02  0.27      0.03      0.28      0.42
## kappaMinusTwo 3.96    1.97 12.74      0.00      0.00      0.00
## kappa         5.96    1.97 12.74      2.00      2.00      2.00
## lp__        -15245.97  0.40  2.02 -15250.26 -15247.13 -15245.91
##              75%      97.5% n_eff Rhat
## theta[1]      0.34      0.35   222 1.02
## theta[2]      0.38      0.39    85 1.04
```

```
## omega          0.70      0.97   192 1.02
## kappaMinusTwo  0.00      21.84    42 1.10
## kappa          2.00      23.84    42 1.10
## lp__          -15244.86 -15242.60   26 1.18
##
## Samples were drawn using NUTS(diag_e) at Sat Apr 28 13:24:55 2018.
## For each parameter, n_eff is a crude measure of effective sample size,
## and Rhat is the potential scale reduction factor on split chains (at
## convergence, Rhat=1).
```

```
plot(stanFit)
```

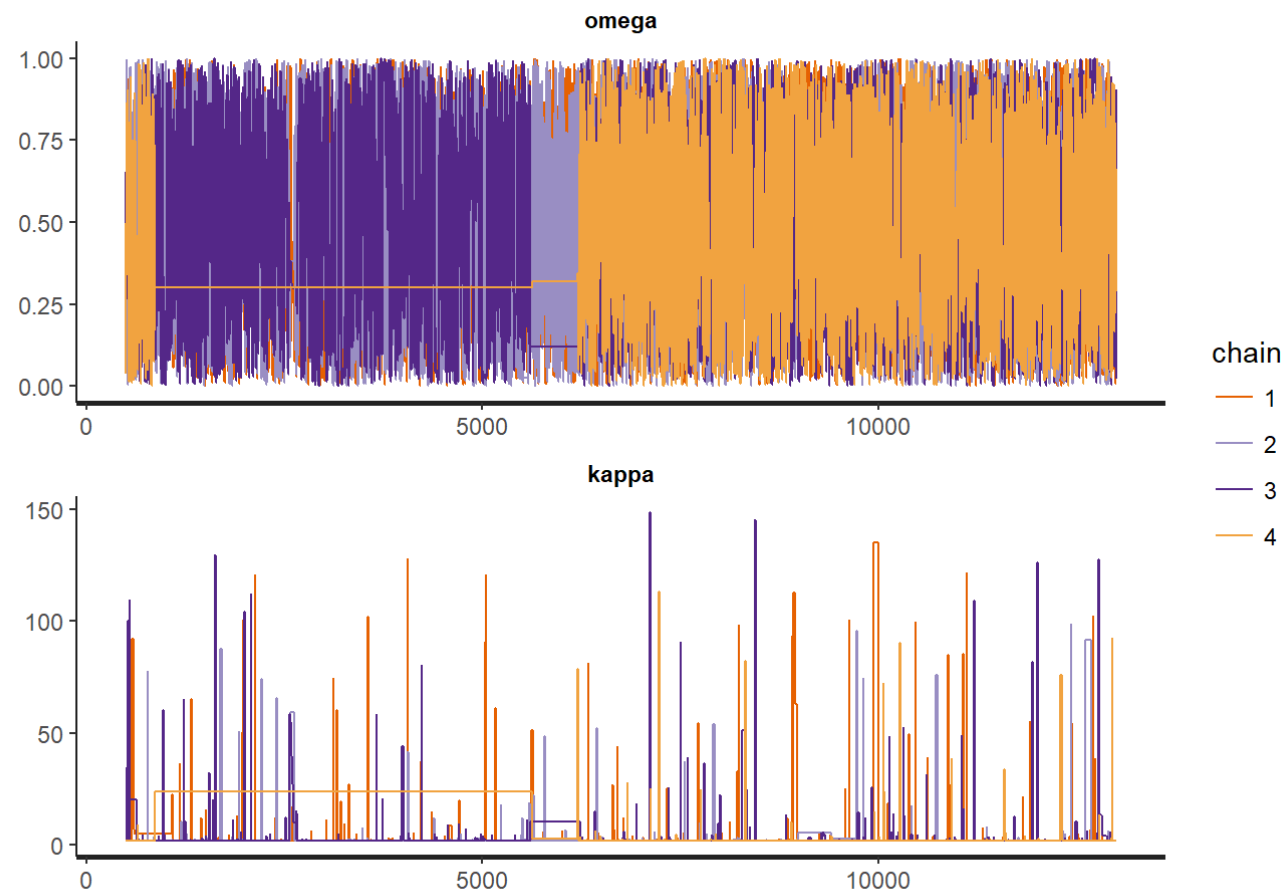
```
## ci_level: 0.8 (80% intervals)
```

```
## outer_level: 0.95 (95% intervals)
```



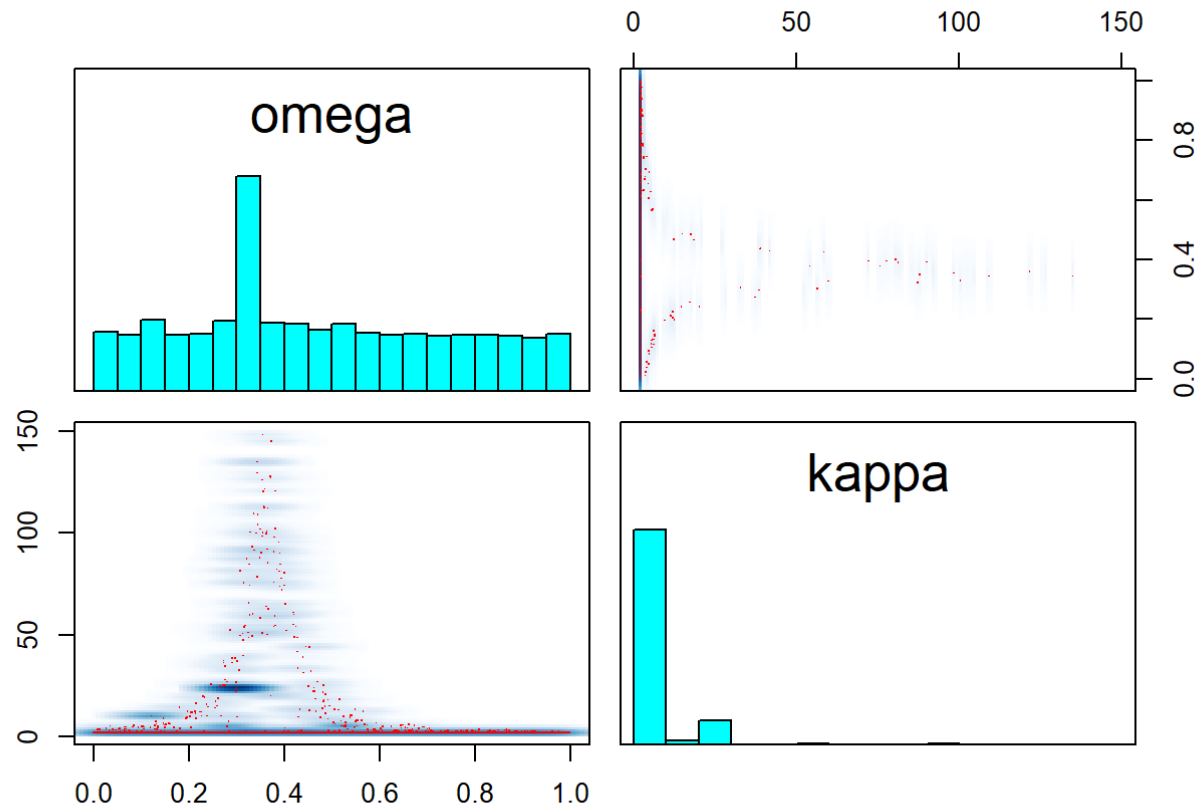
We can see that the theta values are very well split, with nearly 0 sd in the samples. The same can not be said for the omega and kappa values.

```
rstan::traceplot(stanFit, pars=c("omega", "kappa"), ncol=1, inc_warmup=F)
```



```
pairs(stanFit, pars=c("omega", "kappa"))
```

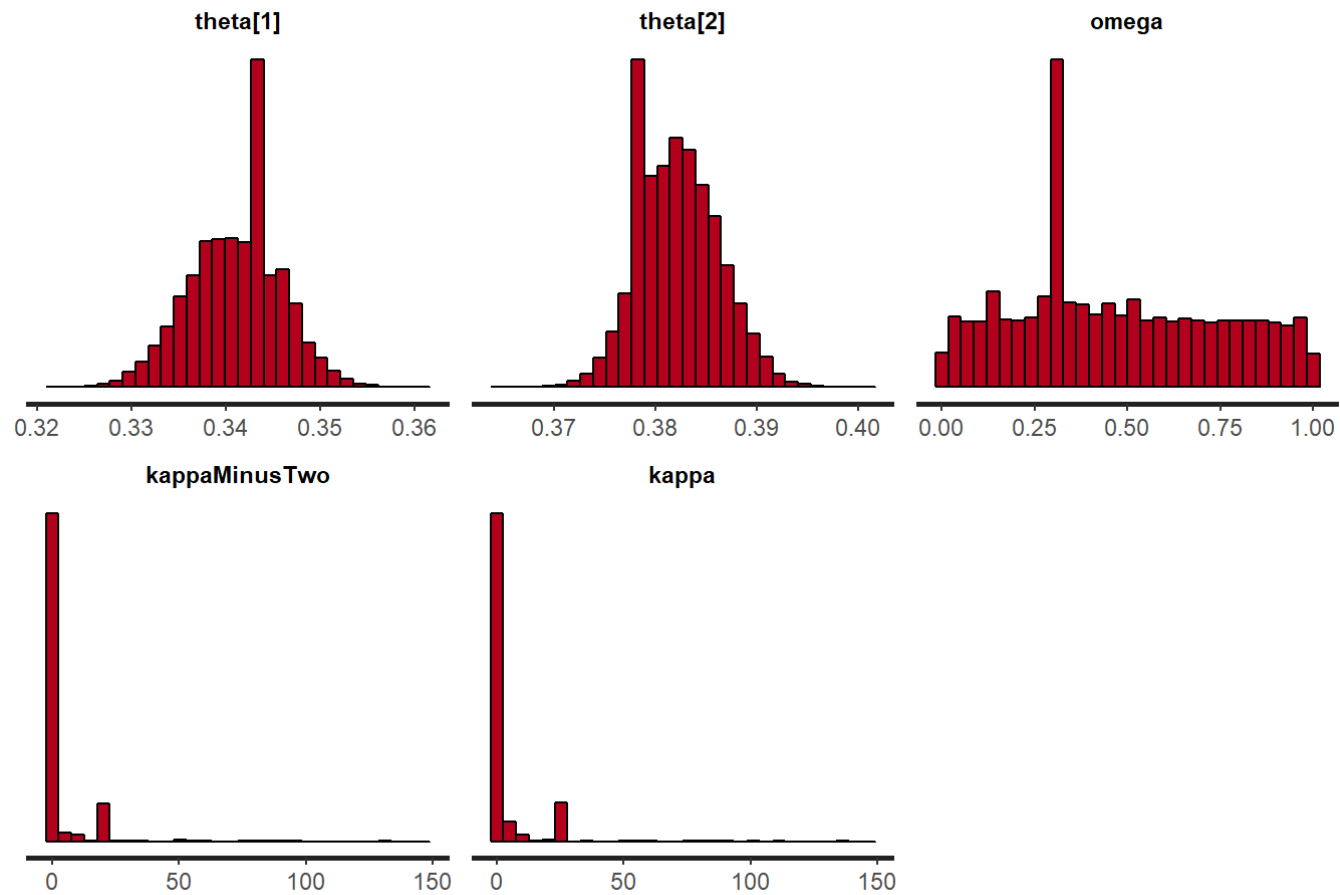
```
## Warning in KernSmooth::bkde2D(x, bandwidth = bandwidth, gridsize = nbin, :  
## Binning grid too coarse for current (small) bandwidth: consider increasing  
## 'gridsize'
```



We can see that the oomega anmd kappa values are not centered well for omega.

```
stan_hist(stanFit)
```

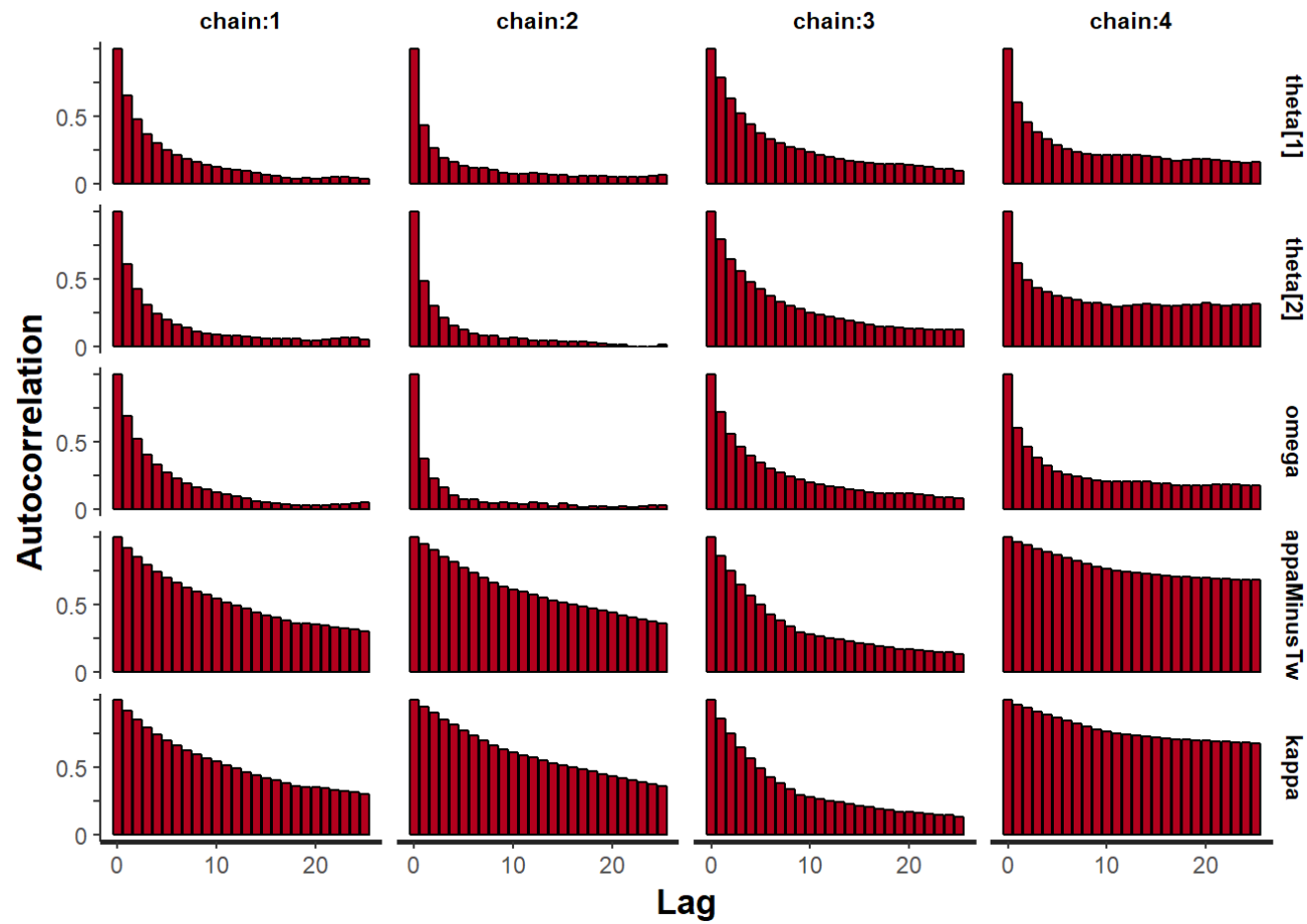
```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



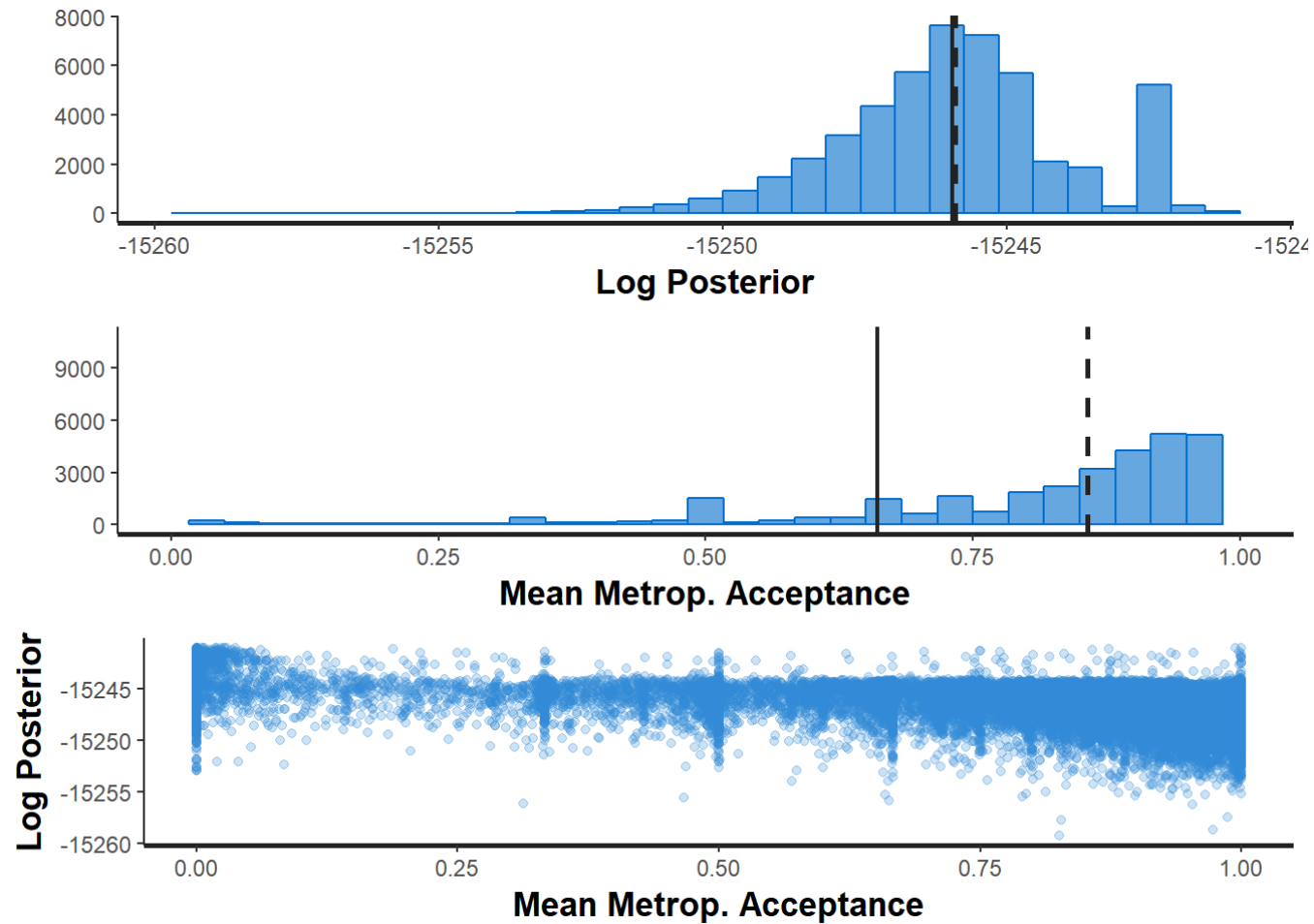
Different visualization, but theta value histograms look like a strong estimate with low sd.

Autocorrelation.

```
stan_ac(stanFit, separate_chains = T)
```

```
stan_diag(stanFit, information = "sample", chain=0)
```



MCMC trajecvtories

```
OmegaKappa<-cbind(Omega=rstan::extract(stanFit,pars=c("omega","kappa"))$'omega',
                  Kappa=rstan::extract(stanFit,pars=c("omega","kappa"))$'kappa')
```

```
head(OmegaKappa)
```

```
##           Omega Kappa
## [1,] 0.9191226      2
```

```
## [2,] 0.7746665      2
## [3,] 0.4953840      2
## [4,] 0.8822153      2
## [5,] 0.7295080      2
## [6,] 0.8588787      2
```

```
Thetas<-rstan::extract(stanFit,pars=names(stanFit))
Thetas<-matrix(unlist(Thetas), ncol = 6, byrow = F)
colnames(Thetas)<-names(stanFit)
Thetas<-Thetas[, -(3:6)]
head(Thetas)
```

```
##      theta[1]  theta[2]
## [1,] 0.3448699 0.3819357
## [2,] 0.3405153 0.3867133
## [3,] 0.3391786 0.3809804
## [4,] 0.3401334 0.3774189
## [5,] 0.3507526 0.3791103
## [6,] 0.3358661 0.3844596
```

HDIS

```
library(HDIInterval)
```

```
hdi(as.vector(Thetas))
```

```
##      lower      upper
## 0.3330421 0.3891706
## attr(,"credMass")
## [1] 0.95
```

```
apply(Thetas,2,function(z) hdi(z))
```

```
##      theta[1]  theta[2]  
## lower 0.3311273 0.3751786  
## upper 0.3500341 0.3903191
```