# MCMC Diagnostics - IFLS data

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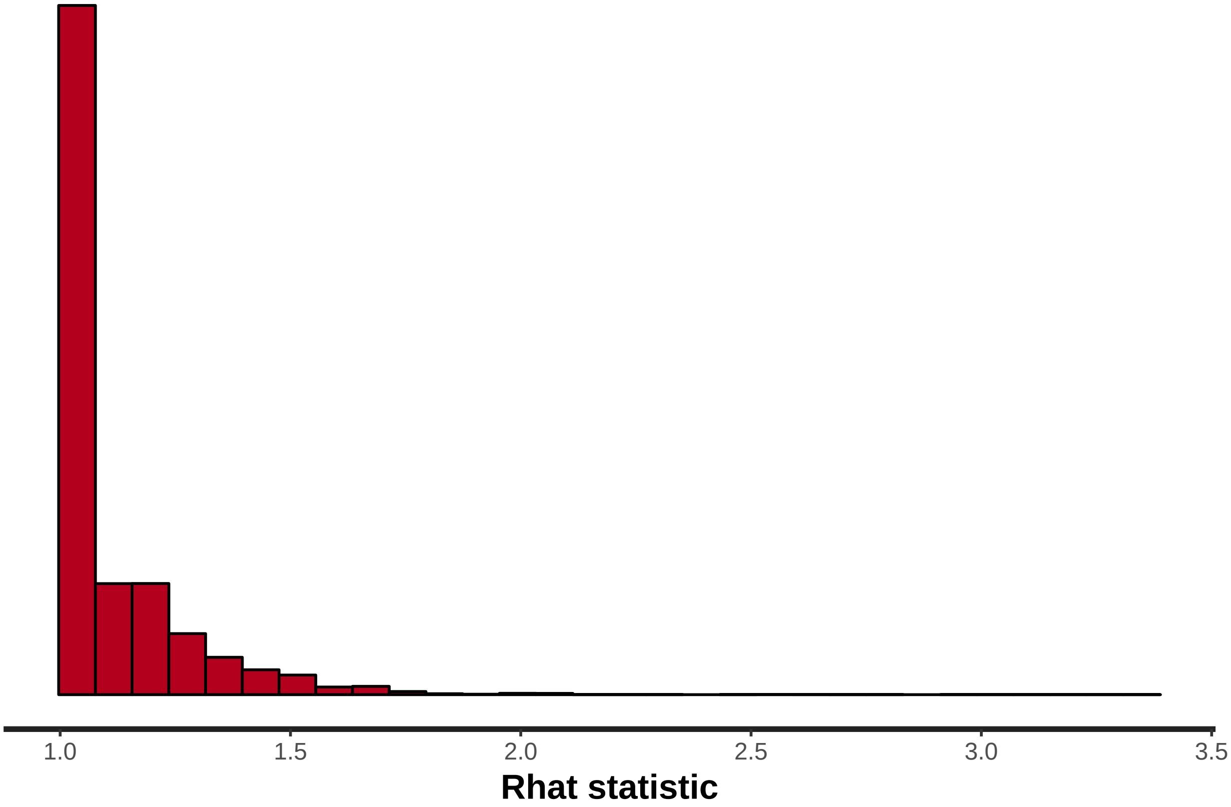
```
K <- 7
Ti <- 3
N <- 1973
```

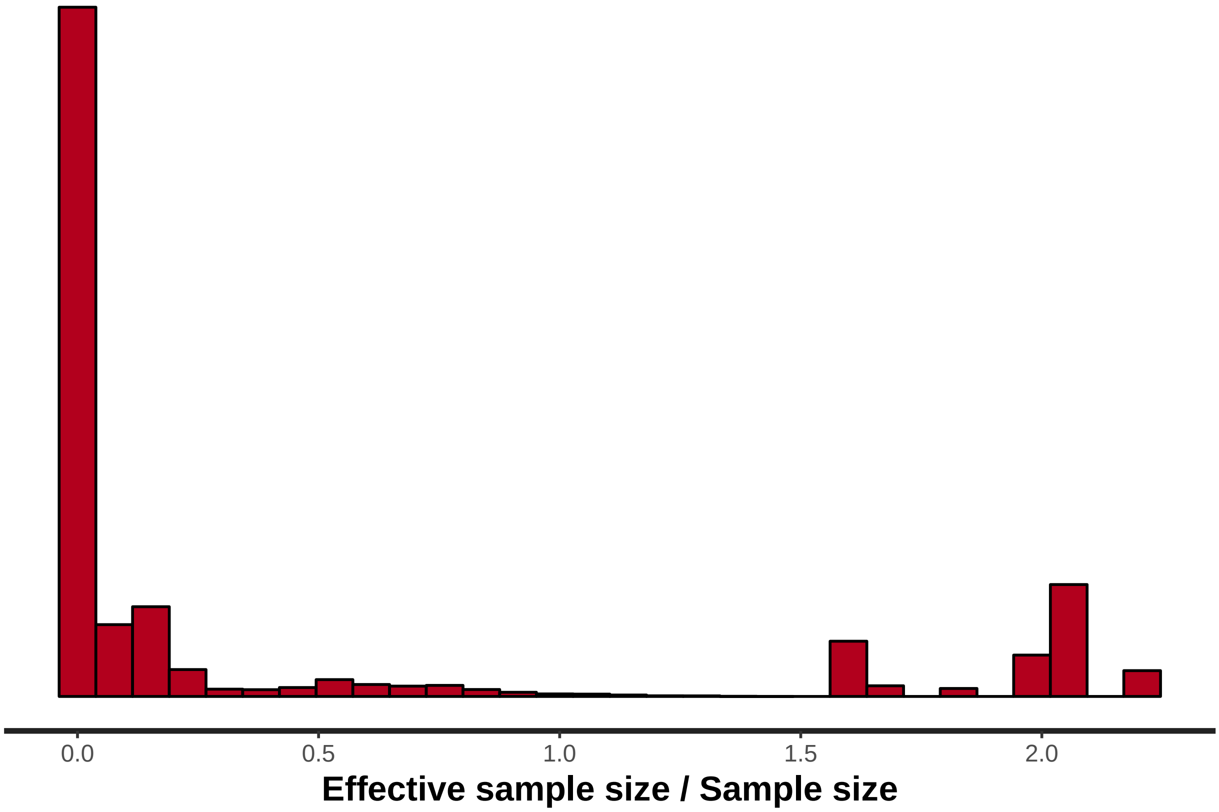
### General MCMC diagnostic plots

Overall model diagnostics from rstan package.

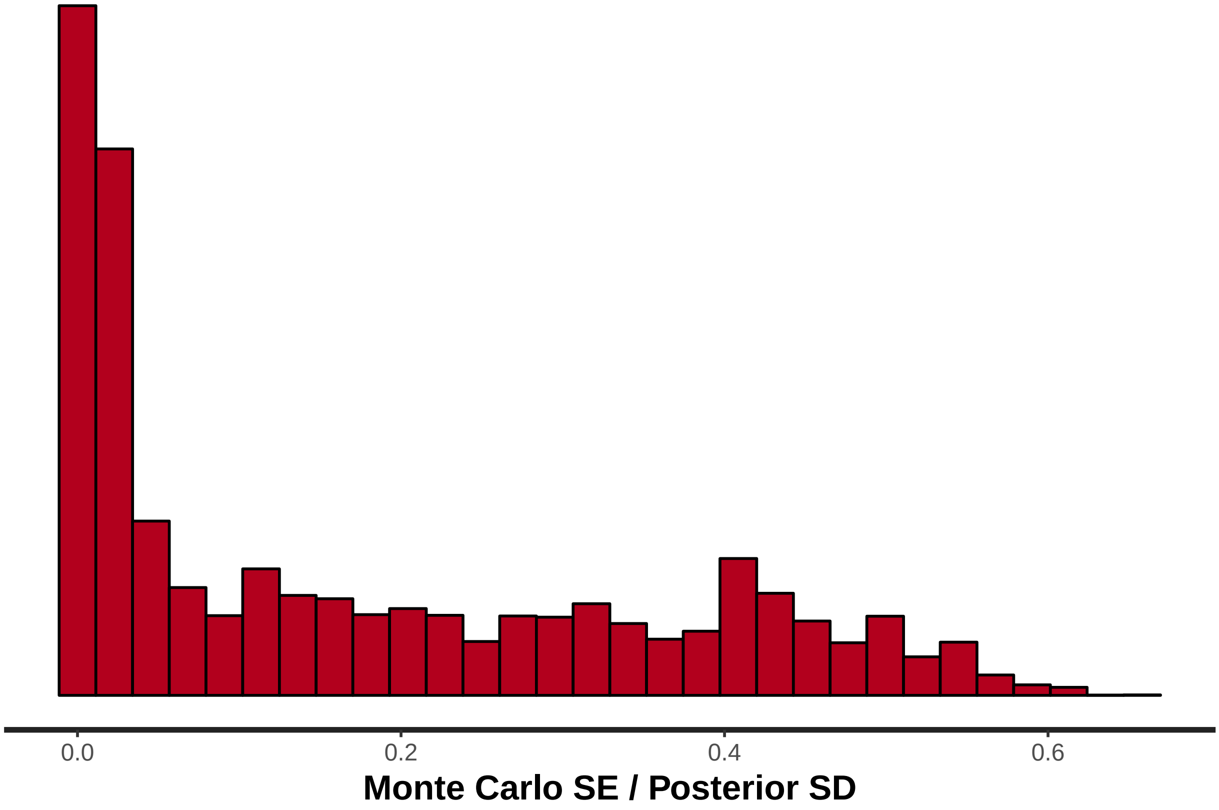
```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



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



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

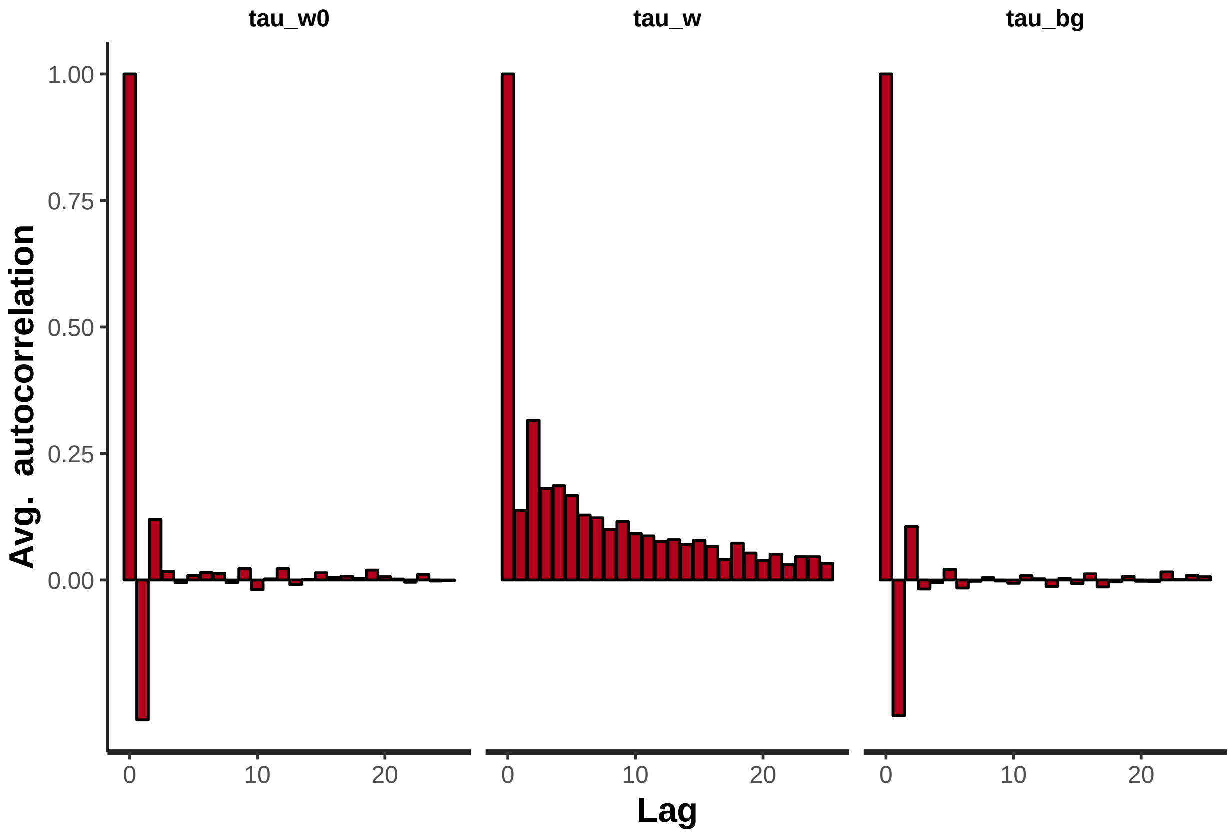


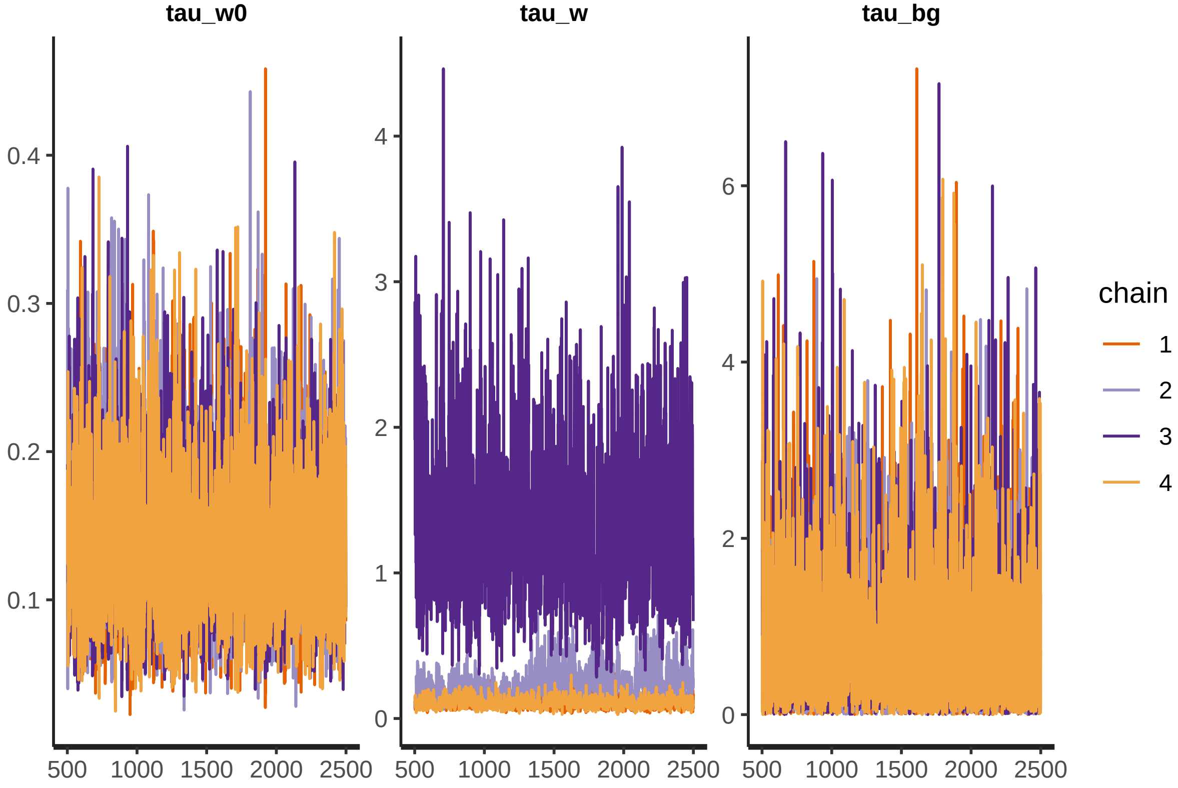
### Individual Parameter Diagnostics

Individual parameter plots. Autocorrelation and trace plots for individual parameters, and histograms of posterior medians for group parameters.

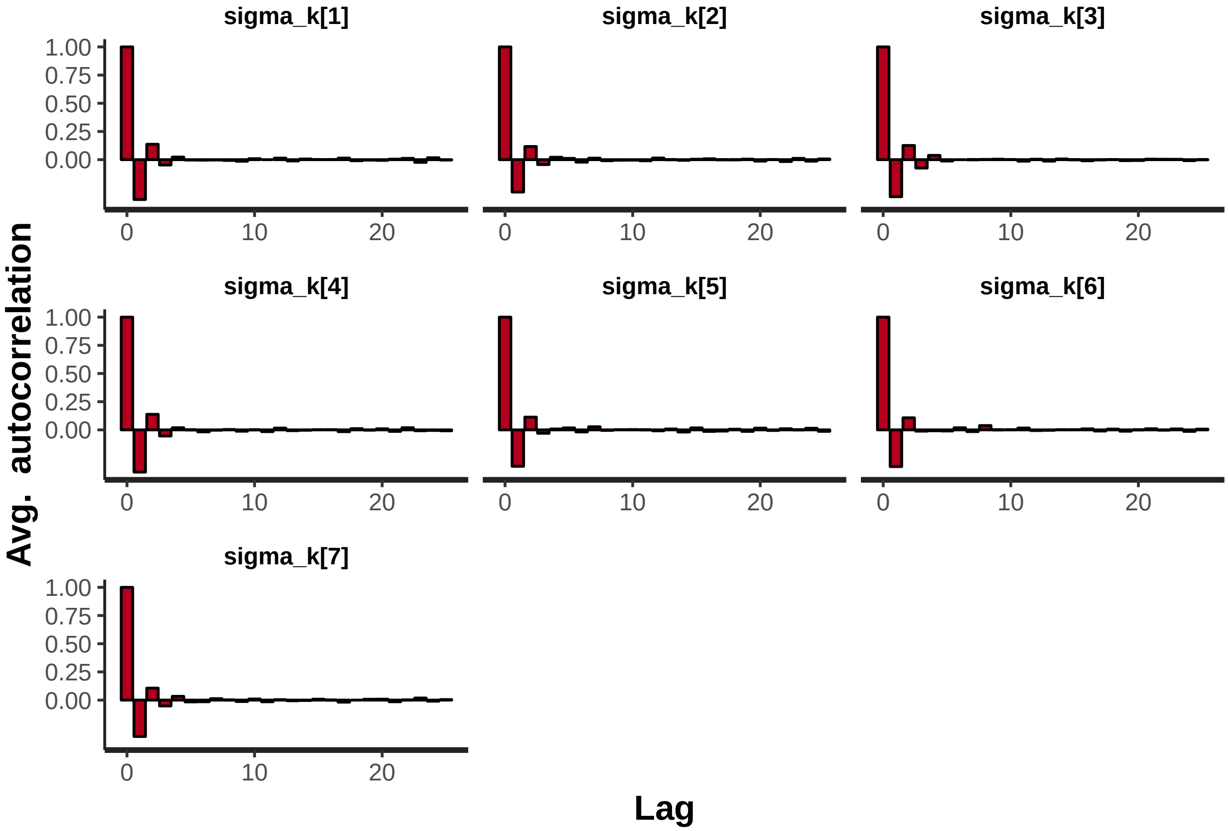
```r
get_single_plots <- function(fit, param) {
  print(fit_summ[param,c(1,2,3,5,6,7,9,10)])
  print(stan_ac(fit, pars = param))
  print(rstan::traceplot(fit, pars = param))
}
get_aggreg_plots <- function(fit, param, trim = F, trim_amount) {
  ind <- grep(paste0("^",param), rownames(as.data.frame(summary(fit)$summary)))
  medians <- data.frame(avg = as.data.frame(summary(fit)$summary)$`50%`[ind])
  title <- paste0("Posterior Medians of ",param)
  print(ggplot(medians, aes(x = avg)) + geom_histogram(bins = 30) + ggtitle(title) +
    xlab("Medians") + ylab("Count"))
  print("       ")
  if (trim == T) {
    lim <- quantile(abs(medians$avg), probs = trim_amount)
    meds_trim <- medians %>% filter(abs(medians$avg) < lim)
    print(ggplot(meds_trim, aes(x = avg)) + geom_histogram(bins = 60) +
            ggtitle(paste0(title, " Without Extreme ",100*(1-trim_amount),"%")))
  }
  means <- data.frame(avg = as.data.frame(summary(fit)$summary)$`mean`[ind])
  title <- paste0("Posterior Means of ",param)
  print(ggplot(means, aes(x = avg)) + geom_histogram(bins = 30) + ggtitle(title) +
    xlab("Means") + ylab("Count"))
  print("      ")
  sds <- data.frame(avg = as.data.frame(summary(fit)$summary)$`sd`[ind])
  title <- paste0("Posterior Standard Deviations of ",param)
  print(ggplot(sds, aes(x = avg)) + geom_histogram(bins = 30) + ggtitle(title) +
    xlab("Standard Deviations") + ylab("Count"))
}
plot_fit <- function(fit) {
  get_single_plots(fit, tau_params)
  get_single_plots(fit, sigma_params)
  get_single_plots(fit, beta)
  get_aggreg_plots(fit, "w")
  get_aggreg_plots(fit, "z")
  get_aggreg_plots(fit, "p")
}
plot_fit(fit)
```

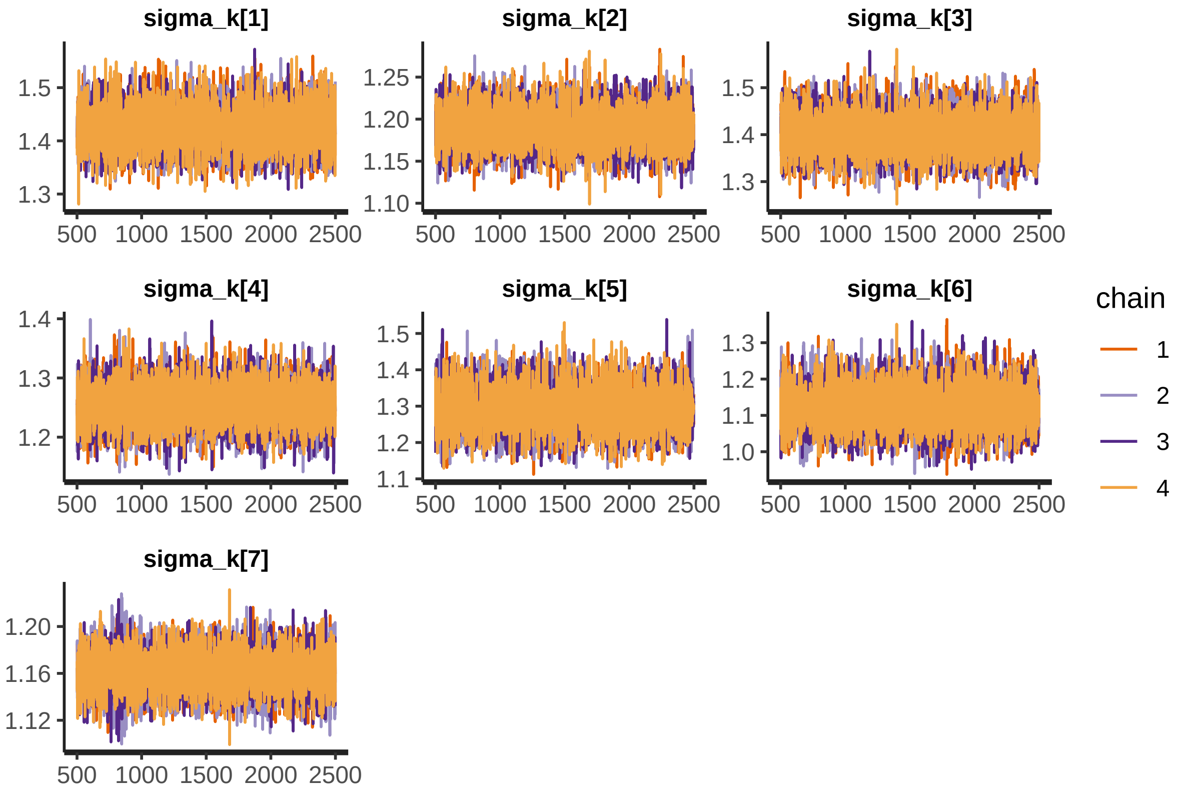
```
##             mean      se_mean         sd       25%       50%       75%
## tau_w0 0.1390138 0.0006479034 0.05231012 0.1012255 0.1318972 0.1699737
## tau_w  0.4448292 0.3694202784 0.58210534 0.1044706 0.1553905 0.4968722
## tau_bg 0.7605704 0.0073072787 0.78016386 0.2109199 0.5122428 1.0522921
##               n_eff     Rhat
## tau_w0  6518.547182 1.005343
## tau_w      2.482914 2.224697
## tau_bg 11398.830909 1.001408
```



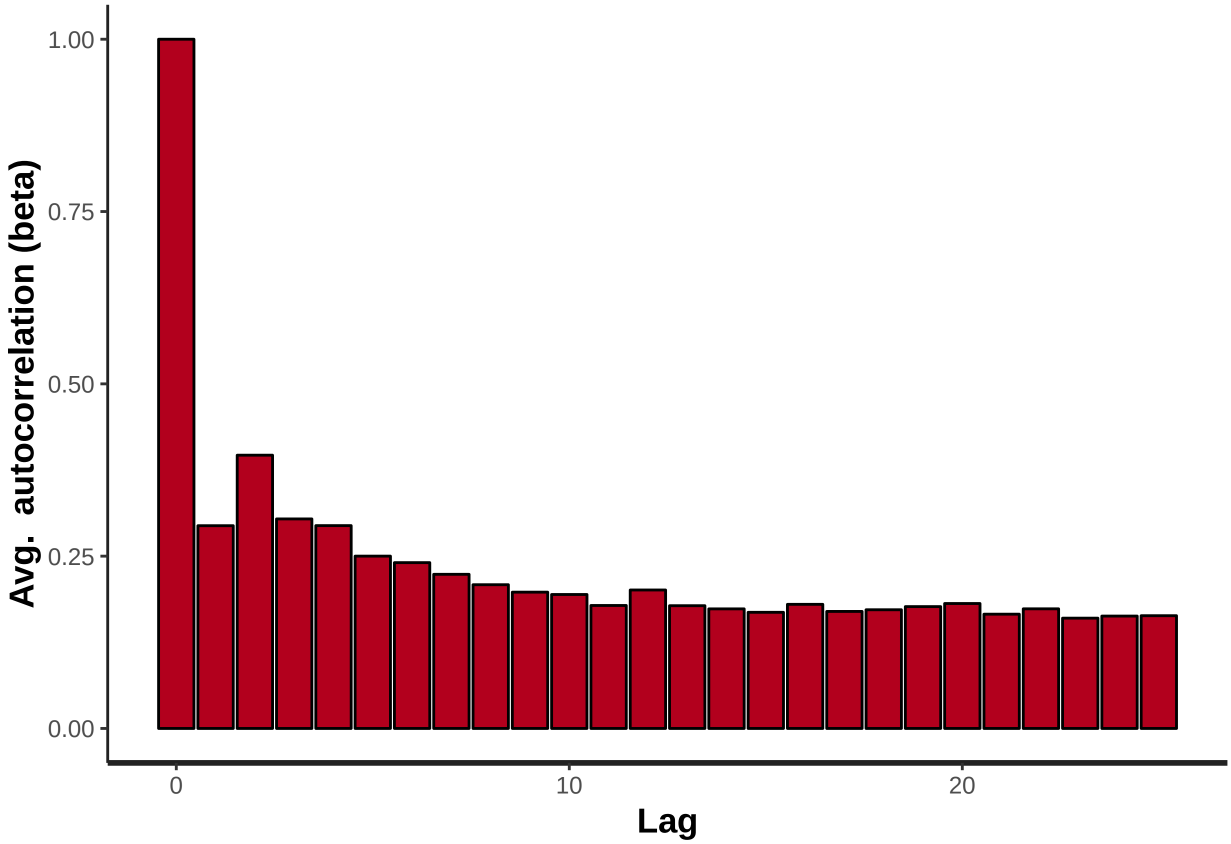


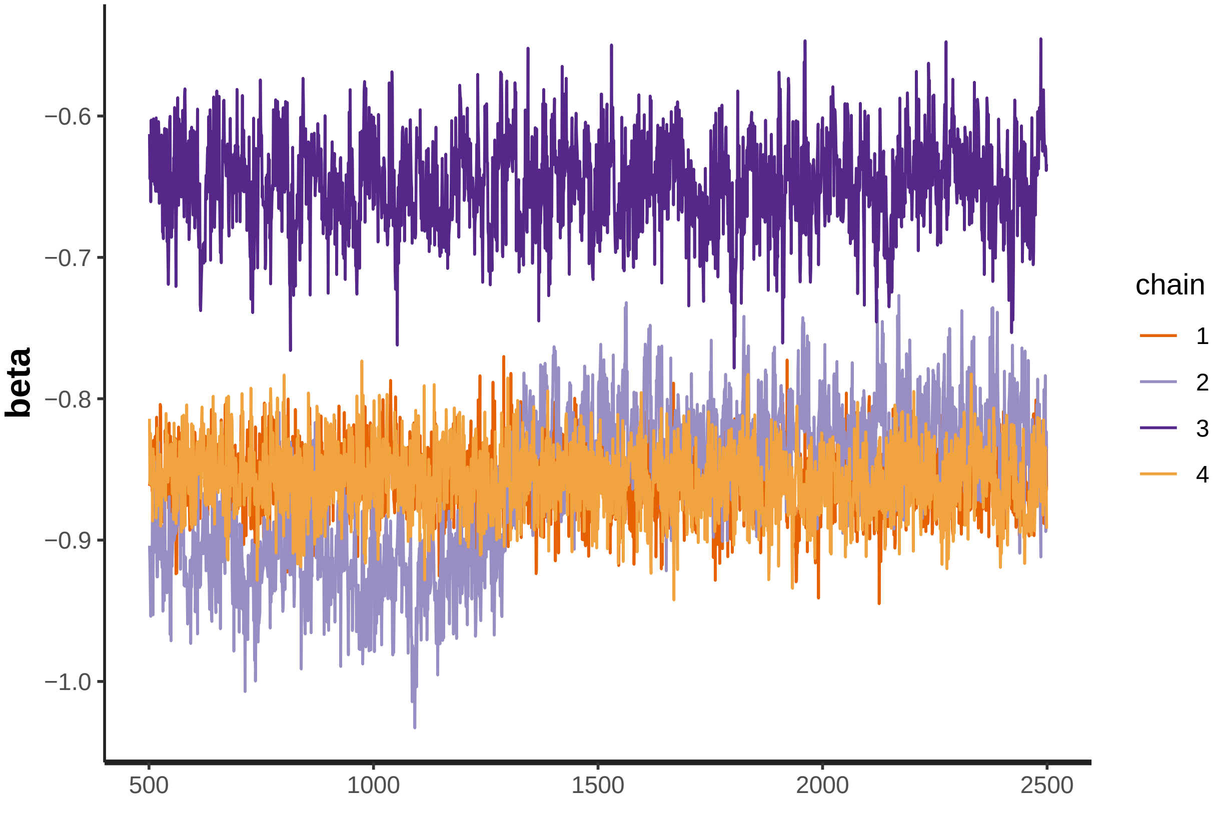
```
##                  mean      se_mean         sd      25%      50%      75%
## sigma_k[1] 1.425080 0.0003094062 0.03884780 1.398685 1.424097 1.450973
## sigma_k[2] 1.190492 0.0002095338 0.02354564 1.174238 1.189974 1.206327
## sigma_k[3] 1.401941 0.0003360389 0.04277218 1.372117 1.401219 1.430627
## sigma_k[4] 1.253010 0.0002641521 0.03511055 1.228698 1.252290 1.276468
## sigma_k[5] 1.291186 0.0004957669 0.05800786 1.250469 1.288869 1.329125
## sigma_k[6] 1.119547 0.0004801738 0.05855528 1.078537 1.116743 1.157900
## sigma_k[7] 1.161285 0.0001326352 0.01696841 1.149982 1.161268 1.172267
##                n_eff      Rhat
## sigma_k[1] 15764.30 0.9998556
## sigma_k[2] 12627.37 0.9996325
## sigma_k[3] 16201.07 0.9997829
## sigma_k[4] 17667.18 0.9997530
## sigma_k[5] 13690.48 0.9997018
## sigma_k[6] 14870.83 0.9996076
## sigma_k[7] 16366.84 0.9997508
```

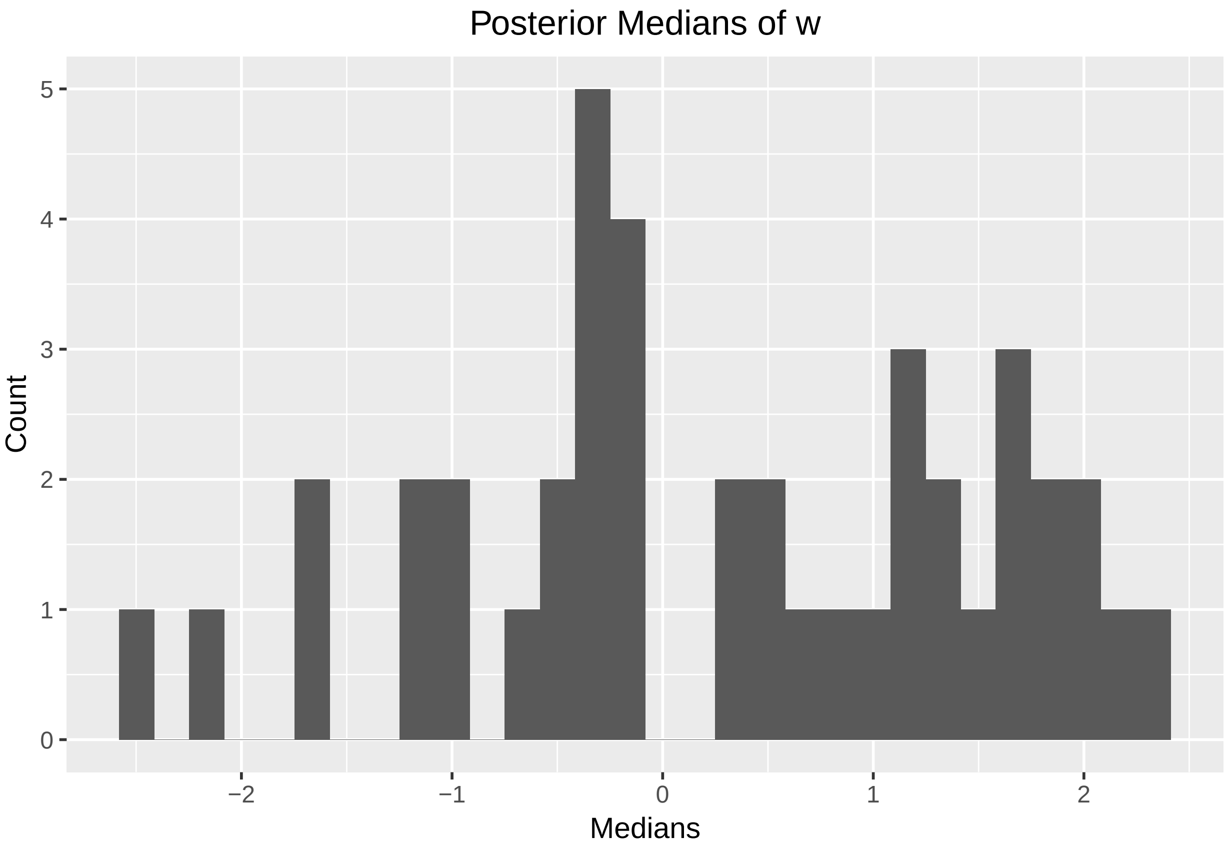




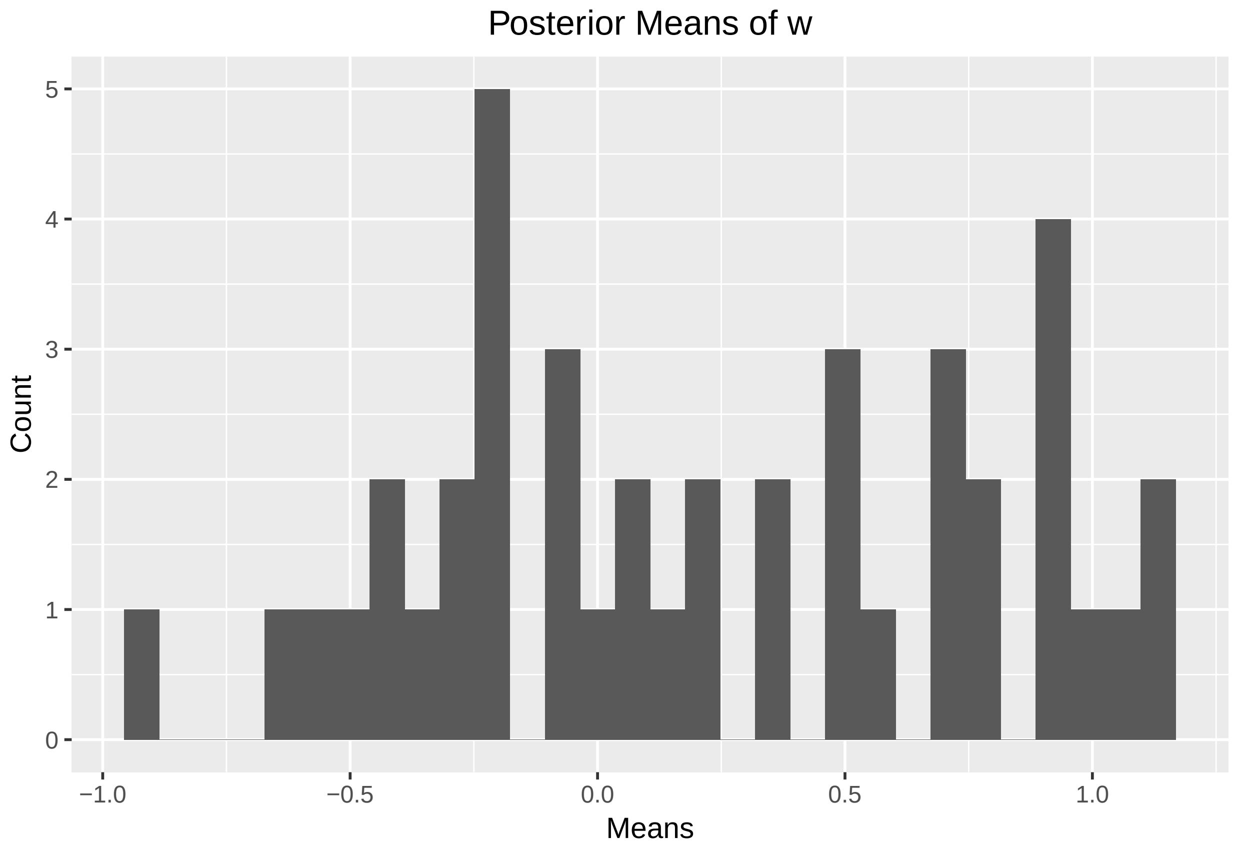
```
##              mean    se_mean        sd        25%        50%        75%
## beta -0.8057743 0.06470605 0.097895 -0.8708312 -0.8421404 -0.7415692
##         n_eff     Rhat
## beta 2.288923 3.311956
```


1.00
0.75
0.50
0.25
0.00
Avg. autocorrelation (beta)
0
10
20
Lag

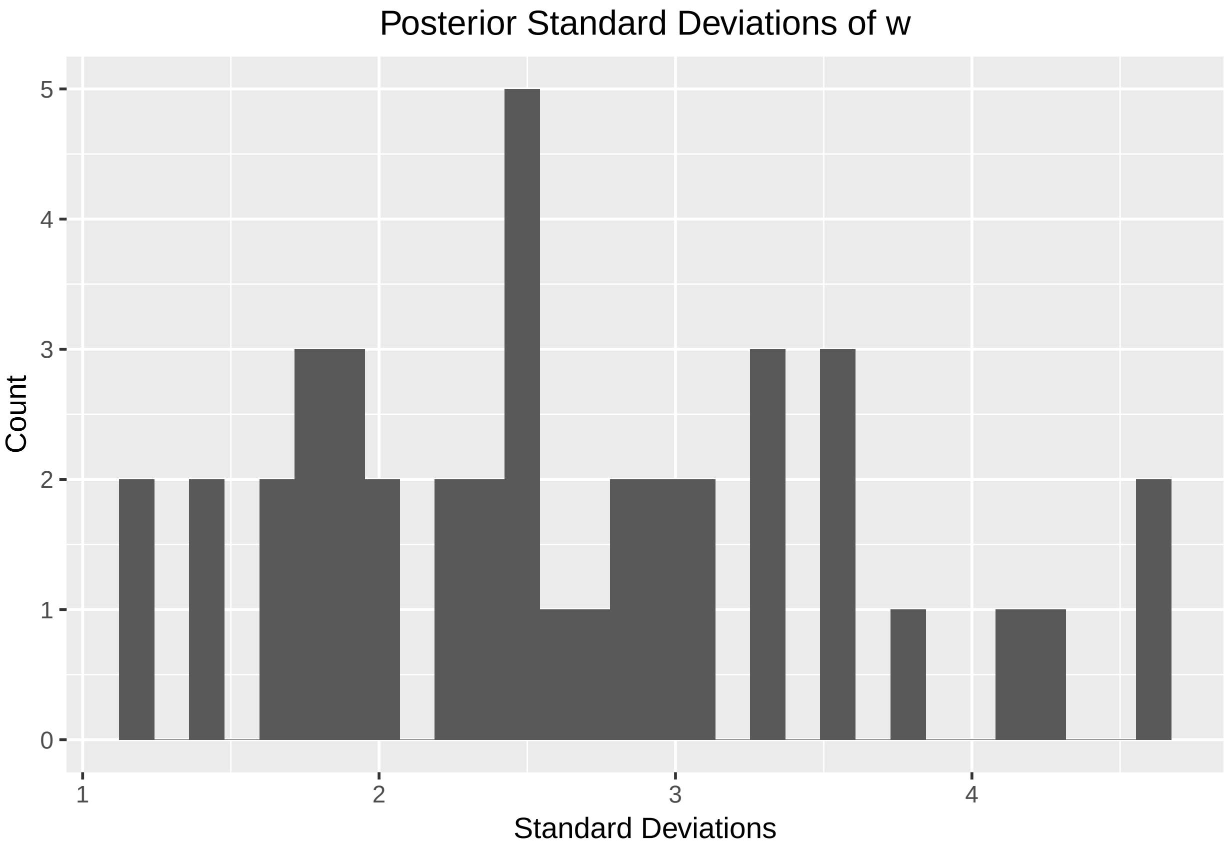

−0.6
−0.7
−0.8
−0.9
−1.0
beta
500
1000
1500
2000
2500
chain
1
2
3
4

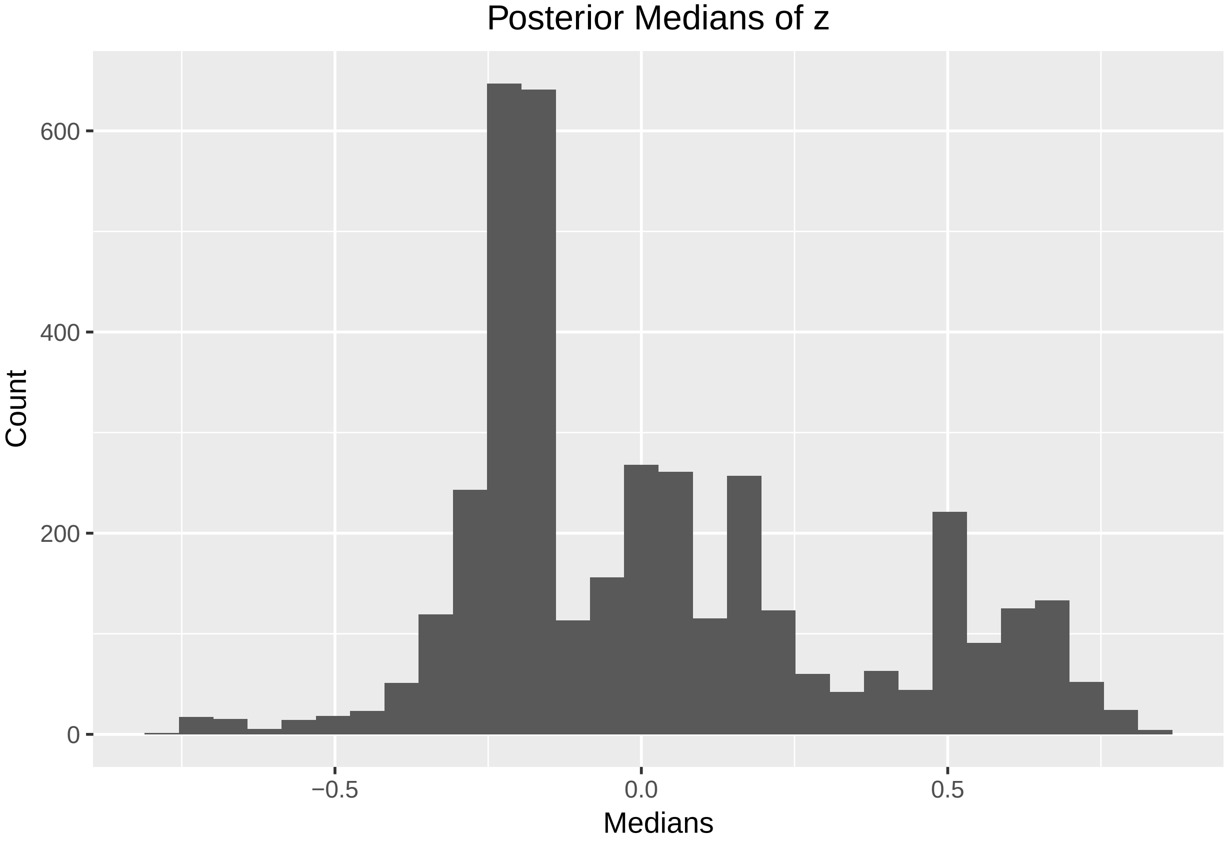


```
## [1] "       "
```

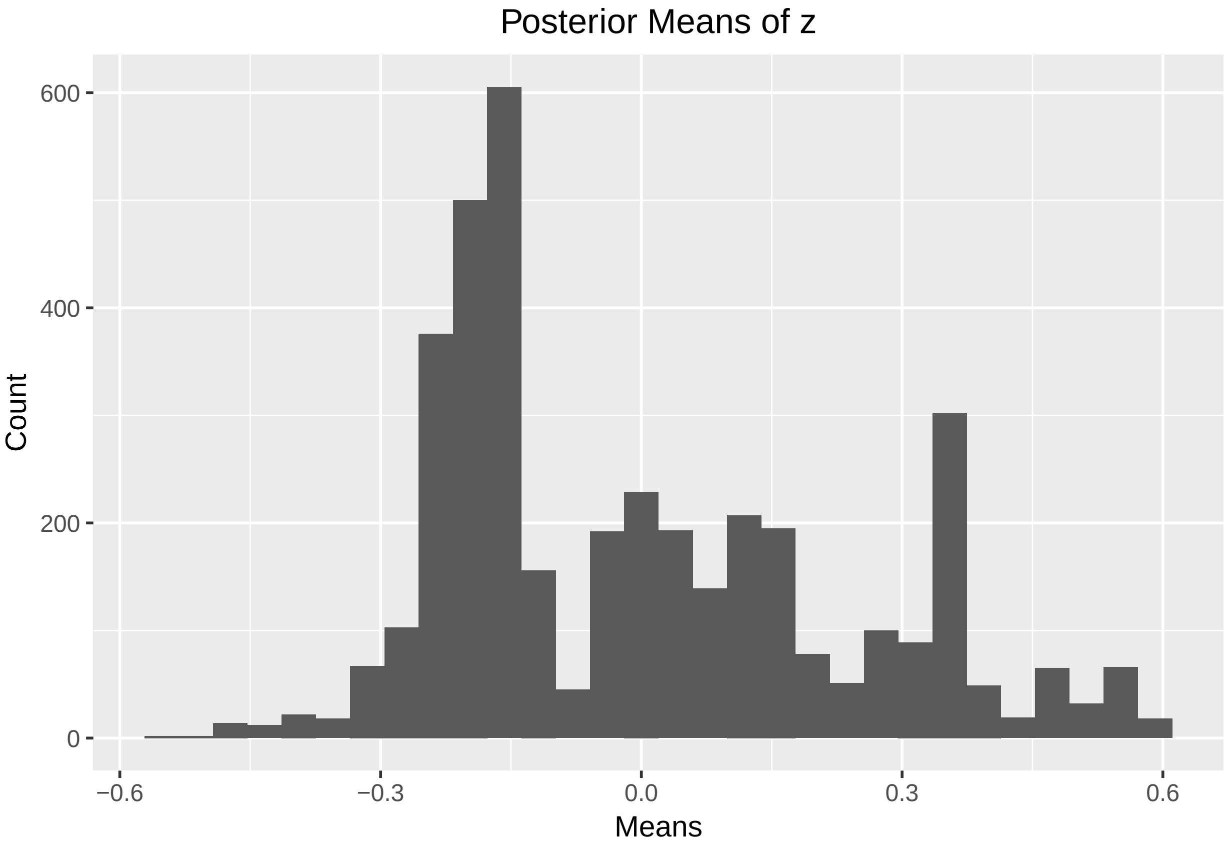


```
## [1] "      "
```

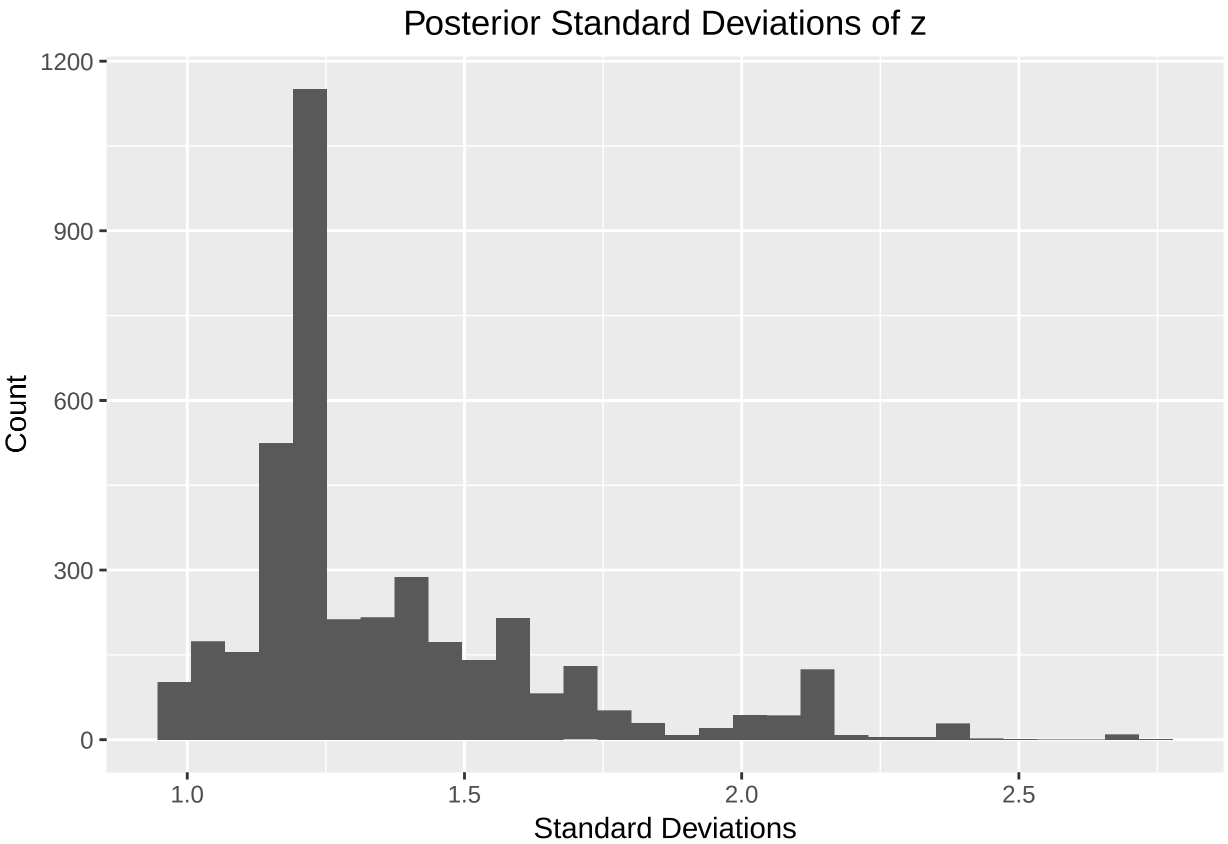

Posterior Standard Deviations of w
Count
5
4
3
2
1
0
1
2
3
4
Standard Deviations


Posterior Medians of z
Count
600
400
200
0
−0.5
0.0
0.5
Medians

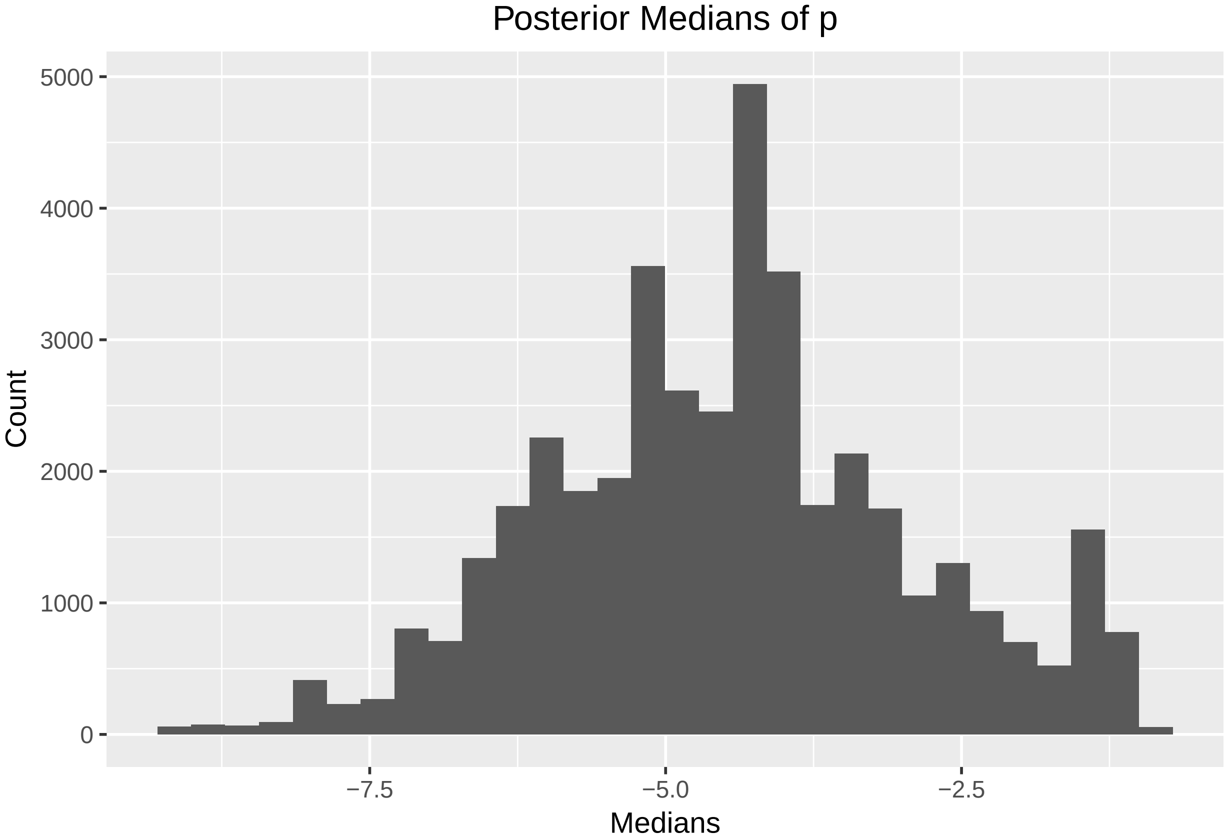
```
## [1] "       "
```



```
## [1] "      "
```

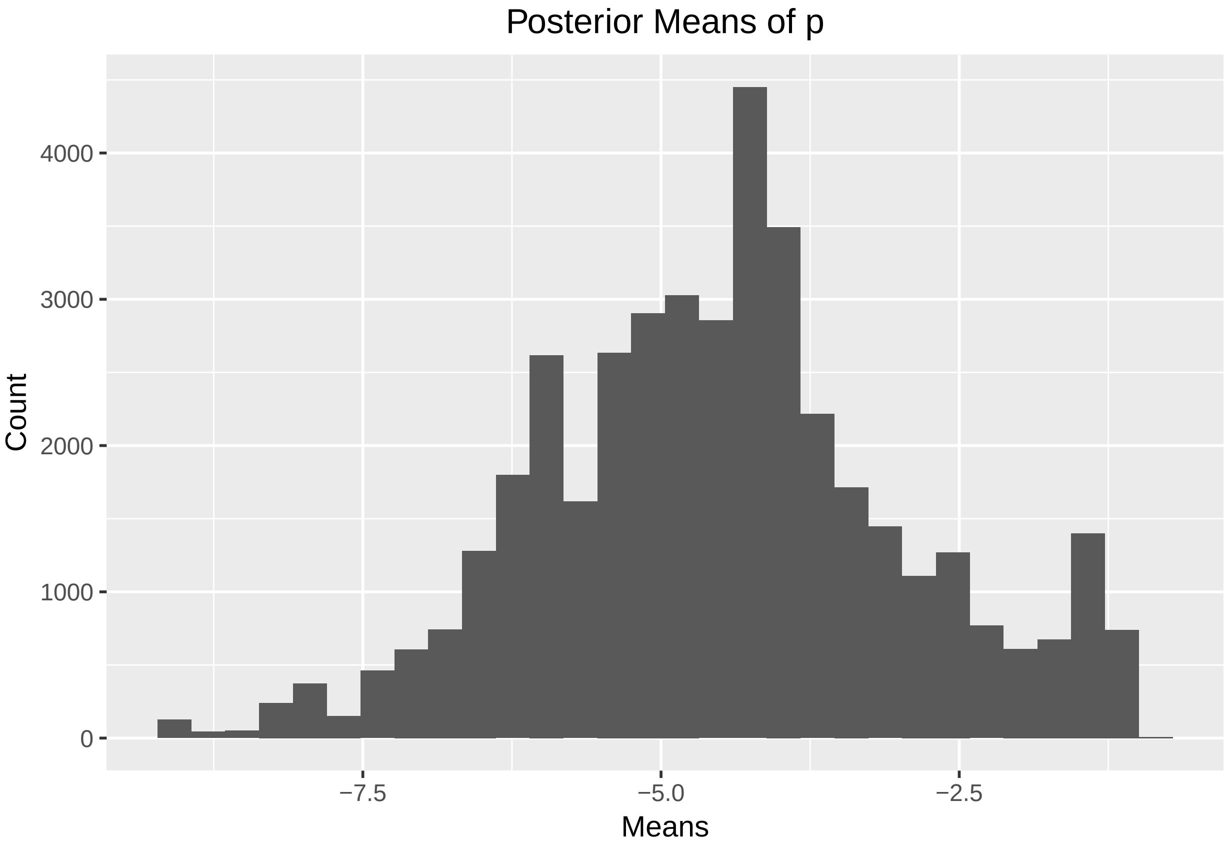


Posterior Standard Deviations of z

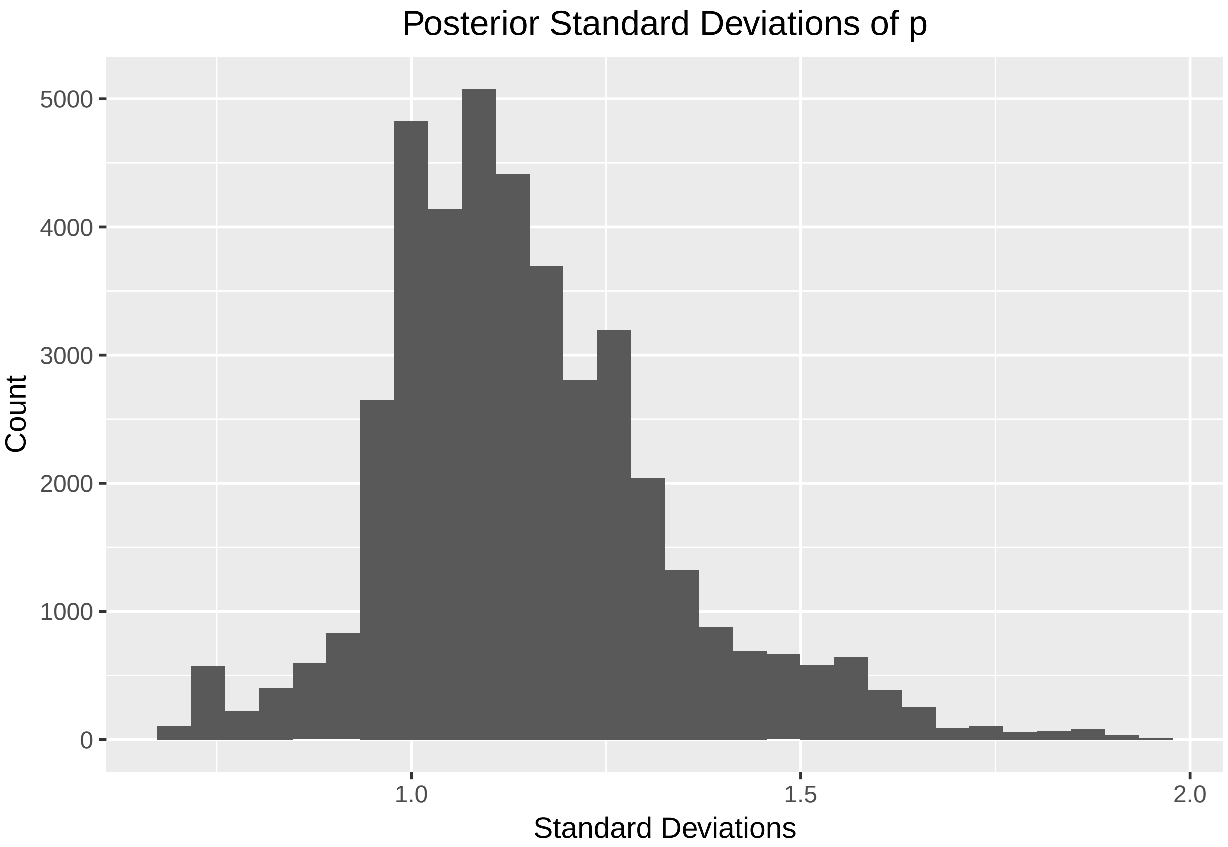


Posterior Medians of p

```
## [1] "        "
```


Posterior Means of p
Count
4000
3000
2000
1000
0
−7.5
−5.0
−2.5
Means

```
## [1] "       "
```


Posterior Standard Deviations of p
Count
5000
4000
3000
2000
1000
0
1.0
1.5
2.0
Standard Deviations