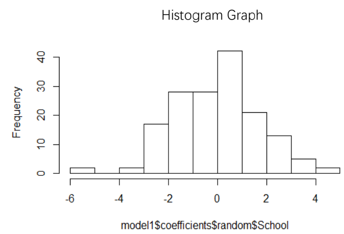
QUESTION 1

We analyzed the data set MathAchieve from the MEMSS package. The main problem was to find the factors that affect mathematics achievement scores. In general, treated school as a random effect or fixed effect depended on the problem. If we wanted to generalize results to other comparable schools, we treated School as a random effect. If we wanted to apply them to other students within the same school, it should be taken as a fixed effect.



Parameter estimates

	MLE	Std.Error	DF	t-value	p-value
(Intercept)	12.88	0.19	7022	66.59	0
MinorityYes	-2.96	0.21	7022	-14.39	0
SexMale	1.23	0.16	7022	7.56	0
SES	2.09	0.11	7022	19.77	0
σ	1.92	NA	NA	NA	NA
τ	5.99	NA	NA	NA	NA

The data looked like a bell curve, the normality assumptions holds. We carried out an analysis that treats school as a random effect. For the mix effect model, we had random intercept and fixed slope. (Note: we took restricted maximum likelihood (**REML**) approach.)

$$Y_{ij} | U_{ij} \sim N\left(\mu_{ij}, \tau^2\right) \qquad \mu_{ij} = X_{ij}\beta + U_i \quad U_i \sim N(0, \sigma^2)$$

$$Y_{ij}\ is\ the\ Math\ achievement\ for\ the\ i_{th}\ individual\ in\ j_{th}\ school$$

$$X_{ij}\beta\ is\ the\ effect\ of\ fix\ effect, contains\ Minority\text{、}Sex\text{、}\ SES$$

$$U_i\ is\ individual\ i's\ radom\ effect\ of\ school$$

$$\tau^2\ is\ the\ randomness\ associated\ with\ each\ observation$$

From the parameter estimates graph, the between school variability $\sigma^2 = 1.92^2 = 3.64$ was smaller than within school variability $\tau^2 = 5.99^2 = 35.81$. Both variabilities were unbiased since we used restricted maximum likelihood approach. The total variance is $\sigma^2 + \tau^2 = 35.81 + 3.64 = 39.45$. The proportion of variance explained by school was $\frac{\sigma^2}{\sigma^2+\tau^2} = \frac{3.64}{3.64+35.81} = 0.0922$. That is, approximately 9.22% of the variance in the data is due to variance between schools. Therefore, spending varies more within schools than between them.

Minority, Sex and SES were fixed effects variables. The coefficient had predicted value at -2.96, 1.23 and 2.09 separately. Noticed that only MinorityYes in fixed effect had negative impact on Math scores. All of them were statistically significant because their credible intervals did not contain 0 and their p-value <0.05.

```
                 lower      est.     upper
(Intercept) 12.5054283 12.884717 13.264005
MinorityYes -3.3648147 -2.961472 -2.558129
SexMale      0.9108366  1.229794  1.548752
SES          1.8822087  2.089424  2.296639
```

Credible interval of β in fixed effects

QUESTION 2

Introduction

We used R to analyze the Treatment Episode Data Set -Discharges (TEDS-D) data in detail. The data was available from http://www.icpsr.umich.edu/icpsrweb/ICPSR/studies/35074. We analyzed the parameters that could affect drug treatment effectiveness. For the first question, we researched what kind of drugs that affect more on completing the drug treatment. And for the second question, we researched the effectiveness of treatment programs in different states.

Methods

For analysis, we used a **Generalized Linear Mixed Model (GLMM)** which combined a generalized linear model with normal random effects on the linear predictor scale.

$$Y_{ijk} \sim Bernoulli(\lambda_i) \quad logit(\lambda_i) = X_{ijk}\beta + U_i + V_i$$

$$U_i \sim N(0, \sigma^2_{STFIPS}) \quad V_i \sim N(0, \sigma^2_{TOWN})$$

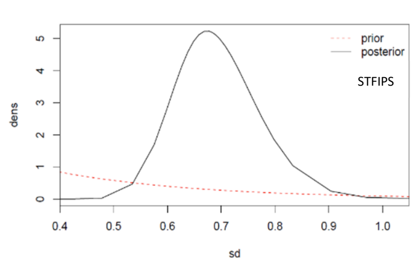
$$\mathrm{Y_{ijk}}\ is\ 0/1\ value\ for\ the\ i_{th}\ individual\ in\ j_{th}\ STFIPS\ (US\ State) and\ k_{th}\ Town$$

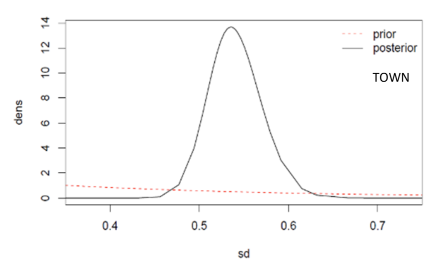
$$X_{ijk}\beta\ is\ the\ effect\ of\ fix\ effect, contains\ SUB1、GENDER\ 、\ raceEthnicity\ 、AGE、\ homeless$$

$$U_i\ is\ individual\ i's\ radom\ effect\ of\ STFIPS$$

$$\mathrm{V_i}\ is\ \ individual\ i's\ radom\ effect\ of\ Town$$

Because we used Bayesian here, we need a prior for all unknown quantities. We already modeled U and V as Gaussian. Since we don't know σ^2_{STFIPS} and σ^2_{TOWN}, we chose **penalized complexity prior** (PC Prior) which put an exponential prior on the standard σ^2_{STFIPS} and σ^2_{TOWN}.





After testing, we set a penalized complexity prior for STFIPS and Town by $P(\sigma > a) = b$. Param=c (0.8, 0.05) indicated that $P(\sigma_{STFIPS} > 0.8) = 0.05$ and $P(\sigma_{TOWN} > 0.8) = 0.08$. For interpretation, there was a 5% chance that between subject variability $\sigma_{STFIPS} > 0.8$ and $\sigma_{Town} > 0.8$.

Results

```
##                    mean         sd    q0.025      q0.5    q0.975      mode
## SD for STFIPS 0.6935176 0.07825824 0.5565746 0.6872606 0.8633300 0.6734471
## SD for TOWN   0.5404324 0.02933449 0.4865681 0.5389609 0.6016381 0.5354730
```

Posterior of the standard deviation

The posterior mean random effect standard deviation for STFIPS was about 0.69 and a 95% credible interval was $(0.556, 0.863)$. The posterior mean random effect standard deviation for Town was about 0.54 and 95% credible interval was $(0.487, 0.601)$.

Table 1: Posterior means and quantiles for model parameters.

	0.5quant	0.025quant	0.975quant
(Intercept)			
(Intercept)	0.716	0.575	0.891
SUB1			
ALCOHOL	1.609	1.574	1.645
HEROIN	0.872	0.849	0.896
OTHER OPIATES AND SYNTHET	0.901	0.874	0.929
METHAMPHETAMINE	0.955	0.917	0.994
COCAINE/CRACK	0.855	0.814	0.898

The model contains a fixed effect for SUB1, gender, age, race-ethnicity, homeless. We took the exponential to the summary table and checked how the exponential coefficients change the Odds. When we held gender, age, race, and homeless unchanged, the Alcohol in SUB1 had the most significant effect on the odds, with a coefficient at 1.609 — followed by Marijuana with a coefficient at 1. In other words, individuals addicted to alcohol and Marijuana were more likely to cure compared to other drugs. Furthermore, the individuals addicted to the "hard drug" like Heroin, Opiates, Methamphetamine, and Cocaine had less chance to complete the drug treatment since those substances had small effects (less than 1) on the Odds.

ID	mean	0.025q	0.975q	ID	mean	0.025q	0.975q
ALABAMA	0.2	-0.3	0.8	MONTANA	-0.2	-1.0	0.7
ALASKA	0.0	-0.9	0.8	NEBRASKA	0.8	0.4	1.2
ARIZONA	0.0	-1.3	1.3	NEVADA	-0.1	-0.8	0.6
ARKANSAS	-0.1	-0.7	0.5	NEW HAMPSHIRE	0.2	-0.3	0.7
CALIFORNIA	-0.3	-0.6	0.0	NEW JERSEY	0.5	0.2	0.8
COLORADO	0.5	0.1	1.0	NEW MEXICO	-1.2	-1.9	-0.5
CONNECTICUT	0.1	-0.4	0.7	NEW YORK	-0.3	-0.6	0.0
DELAWARE	1.0	0.7	1.3	NORTH CAROLINA	-0.8	-1.2	-0.5
WASHINGTON DC	-0.3	-0.6	0.1	NORTH DAKOTA	-0.3	-1.0	0.4
FLORIDA	1.0	0.7	1.4	OHIO	-0.2	-0.6	0.1
GEORGIA	-0.2	-0.8	0.4	OKLAHOMA	0.6	0.0	1.1
HAWAII	0.2	-0.6	1.1	OREGON	0.1	-0.3	0.5
IDAHO	-0.2	-1.0	0.7	PENNSYLVANIA	0.0	-1.3	1.3
ILLINOIS	-0.5	-0.8	-0.2	RHODE ISLAND	-0.2	-0.6	0.3
INDIANA	-0.1	-0.9	0.8	SOUTH CAROLINA	0.4	0.0	0.7
IOWA	0.4	0.1	0.7	SOUTH DAKOTA	0.5	-0.3	1.3
KANSAS	-0.2	-0.6	0.1	TENNESSEE	0.3	-0.2	0.7
KENTUCKY	-0.2	-0.5	0.2	TEXAS	0.6	0.3	0.9
LOUISIANA	-0.6	-1.0	-0.1	UTAH	0.1	-0.5	0.7
MAINE	0.1	-0.7	1.0	VERMONT	-0.2	-1.1	0.6
MARYLAND	0.5	0.2	0.8	VIRGINIA	-2.9	-3.3	-2.5
MASSACHUSETTS	0.8	0.4	1.2	WASHINGTON	-0.1	-0.5	0.3
MICHIGAN	-0.4	-0.7	0.0	WEST VIRGINIA	0.0	-1.3	1.3
MINNESOTA	0.4	0.0	0.9	WISCONSIN	0.0	-1.3	1.3
MISSISSIPPI	0.0	-1.3	1.3	WYOMING	0.0	-1.3	1.3
MISSOURI	-0.4	-0.7	-0.1	PUERTO RICO	0.6	-0.1	1.3

The Treat program in different states

The research indicated that several states had negative effects on the Odds. Virginia and North Carolina had the lowest completion rate at -2.9 and -0.8 separately. The states with negative completion rates had highly problematic treatment programs. Inversely, the states with positive completion rates had particularly useful programs for the young person. Noticed that Nebraska and Massachusetts's program were the most effective with rates at 0.8. Furthermore, the states with 0 mean had no significant effect on program. Thus, the effectiveness of the treatment program was differ based on the different states of America.

Conclusions

When we fit a Generalized Linear Mixed Model (GLMM) for the Treatment Episode Data set – Discharges, we mainly researched how different substances that affected the treatment and effectiveness of treatment programs in different states. The results supported two hypotheses that "hard drugs" (Heroin, Opiates, Methamphetamine, Cocaine) being more difficult to treat than alcohol (or Marijuana). Also, some US states like Nebraska had excellent performance on treatment programs, and some states like Virginia were highly problematic on programs.

Appendix Q1

LIANGJIAYI WANG

16/10/2019

```r
library(knitr)
library(nlme)
library(rmarkdown)
library(Pmisc)
library(kableExtra)
library(Hmisc)
```

```
## Loading required package: lattice

## Loading required package: survival

## Loading required package: Formula

## Loading required package: ggplot2

##
## Attaching package: 'Hmisc'

## The following objects are masked from 'package:base':
##
##     format.pval, units
```

```r
install.packages("data.table", repos="https://Rdatatable.gitlab.io/data.table")
```

```
## Installing package into 'F:/Documents/R/win-library/3.6'
## (as 'lib' is unspecified)

## package 'data.table' successfully unpacked and MD5 sums checked

## Warning: cannot remove prior installation of package 'data.table'

## Warning in file.copy(savedcopy, lib, recursive = TRUE): problem copying F:
## \Documents\R\win-library\3.6\00LOCK\data.table\libs\x64\datatable.dll to F:
## \Documents\R\win-library\3.6\data.table\libs\x64\datatable.dll: Permission
## denied

## Warning: restored 'data.table'

##
## The downloaded binary packages are in
##  C:\Users\shenh\AppData\Local\Temp\RtmpKGSe0R\downloaded_packages
```

```r
data("MathAchieve", package = "MEMSS")
head(MathAchieve)
```

```
##   School Minority    Sex    SES MathAch MEANSES
## 1   1224       No Female -1.528   5.876  -0.428
## 2   1224       No Female -0.588  19.708  -0.428
## 3   1224       No   Male -0.528  20.349  -0.428
## 4   1224       No   Male -0.668   8.781  -0.428
## 5   1224       No   Male -0.158  17.898  -0.428
## 6   1224       No   Male  0.022   4.583  -0.428
```

```r
model1<- lme(MathAch ~ Minority + Sex + SES , random = ~1 | School, data=MathAchieve)
summary(model1)
```

```
## Linear mixed-effects model fit by REML
##  Data: MathAchieve
##        AIC      BIC    logLik
##   46406.38 46447.66 -23197.19
##
## Random effects:
##  Formula: ~1 | School
##         (Intercept) Residual
## StdDev:    1.916676 5.992412
##
## Fixed effects: MathAch ~ Minority + Sex + SES
##                 Value Std.Error   DF   t-value p-value
## (Intercept) 12.884717 0.1934846 7022  66.59299       0
## MinorityYes -2.961472 0.2057554 7022 -14.39316       0
## SexMale      1.229794 0.1627085 7022   7.55827       0
## SES          2.089424 0.1057058 7022  19.76641       0
##  Correlation:
##             (Intr) MnrtyY SexMal
## MinorityYes -0.286
## SexMale     -0.398 -0.014
## SES         -0.031  0.195 -0.058
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -3.24268681 -0.72159709  0.03417673  0.76196041  2.86310743
##
## Number of Observations: 7185
## Number of Groups: 160
```

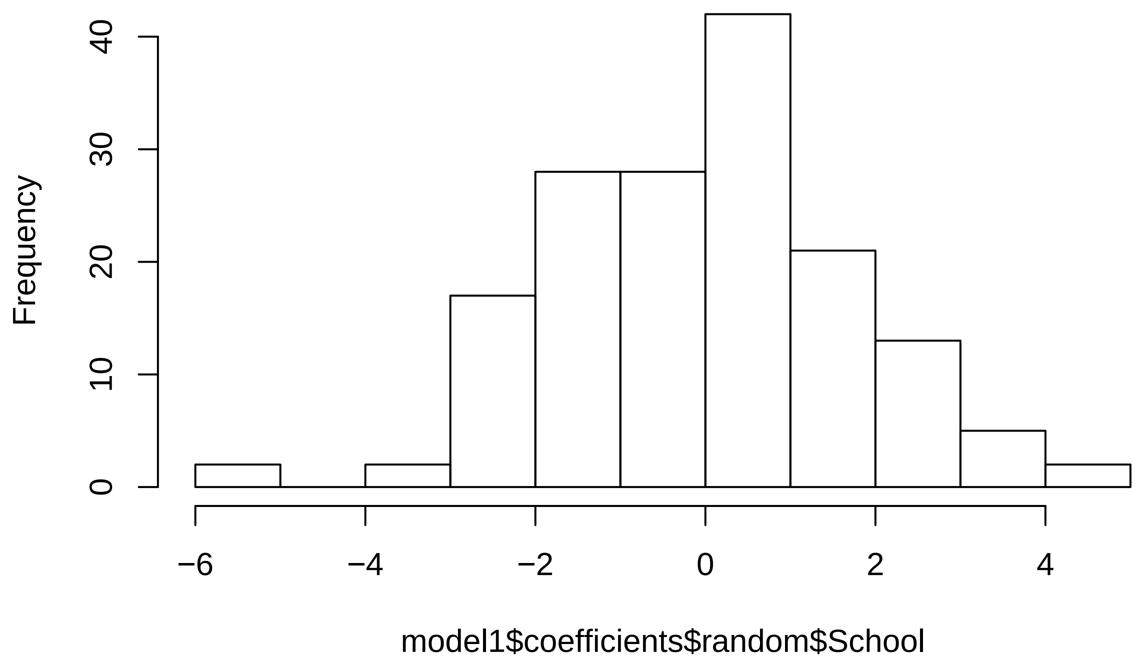
```r
knitr::kable(Pmisc::lmeTable(model1),digits = 2,escape= FALSE,
             format="latex")
```

	MLE	Std.Error	DF	t-value	p-value
(Intercept)	12.88	0.19	7022	66.59	0
MinorityYes	-2.96	0.21	7022	-14.39	0
SexMale	1.23	0.16	7022	7.56	0
SES	2.09	0.11	7022	19.77	0
σ	1.92	NA	NA	NA	NA
τ	5.99	NA	NA	NA	NA

```r
intervals(model1)$fixed
```

```
##                  lower      est.     upper
## (Intercept) 12.5054283 12.884717 13.264005
## MinorityYes -3.3648147 -2.961472 -2.558129
## SexMale      0.9108366  1.229794  1.548752
## SES          1.8822087  2.089424  2.296639
## attr(,"label")
## [1] "Fixed effects:"
```

```r
hist(model1$coefficients$random$School,main="")
```



Q2

LIANGJIAYI WANG

14/10/2019

```
library(Pmisc)
library(kableExtra)
library(data.table)
library(Hmisc)
```

```
## Loading required package: lattice

## Loading required package: survival

## Loading required package: Formula

## Loading required package: ggplot2

##
## Attaching package: 'Hmisc'

## The following objects are masked from 'package:base':
##
##     format.pval, units
```

```
download.file("http://pbrown.ca/teaching/appliedstats/data/drugs.rds",
              "drugs.rds")
xSub = readRDS("drugs.rds")
table(xSub$SUB1)
```

```
##
##           (4) MARIJUANA/HASHISH                         (2) ALCOHOL
##                          188406                               97013
##                      (5) HEROIN (7) OTHER OPIATES AND SYNTHETICS
##                           58511                               45609
##            (10) METHAMPHETAMINE                   (3) COCAINE/CRACK
##                           21606                               11333
```

```
table(xSub$STFIPS)[1:5]
```

```
##
##    (1) ALABAMA     (2) ALASKA    (4) ARIZONA   (5) ARKANSAS (6) CALIFORNIA
##            616           1360           4479           1508          48065
```

```
table(xSub$TOWN)[1:2]
```

```
##
## ABILENE, TX   AKRON, OH
##          42        1078
```

```
forInla = na.omit(xSub)
forInla$y = as.numeric(forInla$completed)

library("INLA")
```

```
## Loading required package: Matrix

## Loading required package: sp
```

```
## Loading required package: parallel

## This is INLA_19.09.03 built 2019-09-03 09:03:02 UTC.
## See www.r-inla.org/contact-us for how to get help.
```

```
ires = inla(y ~ SUB1 + GENDER + raceEthnicity +AGE+ homeless +f(STFIPS, hyper=list(prec=list(
  prior='pc.prec', param=c(0.8, 0.05)))) +
    f(TOWN,hyper=list(prec=list(prior='pc.prec', param=c(0.8, 0.05)))),
  data=forInla, family='binomial',
  control.inla = list(strategy='gaussian', int.strategy='eb'))

summary(ires)
```

```
##
## Call:
##    c("inla(formula = y ~ SUB1 + GENDER + raceEthnicity + AGE +
##    homeless + ", " f(STFIPS, hyper = list(prec = list(prior =
##    \"pc.prec\", param = c(0.8, ", " 0.05)))) + f(TOWN, hyper =
##    list(prec = list(prior = \"pc.prec\", ", " param = c(0.8,
##    0.05)))), family = \"binomial\", data = forInla, ", " control.inla
##    = list(strategy = \"gaussian\", int.strategy = \"eb\"))" )
## Time used:
##     Pre = 1.6, Running = 158, Post = 0.131, Total = 160
## Fixed effects:
##                                                               mean    sd
## (Intercept)                                                 -0.334 0.111
## SUB1(2) ALCOHOL                                              0.476 0.011
## SUB1(5) HEROIN                                              -0.137 0.014
## SUB1(7) OTHER OPIATES AND SYNTHETICS                        -0.105 0.016
## SUB1(10) METHAMPHETAMINE                                    -0.046 0.021
## SUB1(3) COCAINE/CRACK                                       -0.156 0.025
## GENDER(2) FEMALE                                            -0.113 0.009
## raceEthnicityHispanic                                       -0.184 0.012
## raceEthnicityBLACK OR AFRICAN AMERICAN                      -0.383 0.012
## raceEthnicityAMERICAN INDIAN (OTHER THAN ALASKA NATIVE) -0.317 0.036
## raceEthnicityOTHER SINGLE RACE                              -0.144 0.033
## raceEthnicityTWO OR MORE RACES                              -0.157 0.038
## raceEthnicityASIAN                                           0.124 0.044
## raceEthnicityNATIVE HAWAIIAN OR OTHER PACIFIC ISLANDER  -0.169 0.062
## raceEthnicityASIAN OR PACIFIC ISLANDER                       0.374 0.087
## raceEthnicityALASKA NATIVE (ALEUT, ESKIMO, INDIAN)          -0.168 0.155
## AGE18-20                                                    -0.067 0.010
## AGE15-17                                                    -0.077 0.012
## AGE12-14                                                    -0.028 0.021
## homelessTRUE                                                 0.005 0.016
##                                                             0.025quant
## (Intercept)                                                     -0.553
## SUB1(2) ALCOHOL                                                  0.454
## SUB1(5) HEROIN                                                  -0.164
## SUB1(7) OTHER OPIATES AND SYNTHETICS                            -0.135
## SUB1(10) METHAMPHETAMINE                                        -0.087
## SUB1(3) COCAINE/CRACK                                           -0.206
## GENDER(2) FEMALE                                                -0.130
## raceEthnicityHispanic                                           -0.208
## raceEthnicityBLACK OR AFRICAN AMERICAN                          -0.407
```

```
## raceEthnicityAMERICAN INDIAN (OTHER THAN ALASKA NATIVE)     -0.387
## raceEthnicityOTHER SINGLE RACE                              -0.208
## raceEthnicityTWO OR MORE RACES                              -0.231
## raceEthnicityASIAN                                           0.037
## raceEthnicityNATIVE HAWAIIAN OR OTHER PACIFIC ISLANDER      -0.290
## raceEthnicityASIAN OR PACIFIC ISLANDER                       0.204
## raceEthnicityALASKA NATIVE (ALEUT, ESKIMO, INDIAN)          -0.472
## AGE18-20                                                    -0.087
## AGE15-17                                                    -0.100
## AGE12-14                                                    -0.068
## homelessTRUE                                                -0.027
##                                                         0.5quant
## (Intercept)                                               -0.334
## SUB1(2) ALCOHOL                                            0.476
## SUB1(5) HEROIN                                            -0.137
## SUB1(7) OTHER OPIATES AND SYNTHETICS                      -0.105
## SUB1(10) METHAMPHETAMINE                                  -0.046
## SUB1(3) COCAINE/CRACK                                     -0.156
## GENDER(2) FEMALE                                          -0.113
## raceEthnicityHispanic                                     -0.184
## raceEthnicityBLACK OR AFRICAN AMERICAN                    -0.383
## raceEthnicityAMERICAN INDIAN (OTHER THAN ALASKA NATIVE)   -0.317
## raceEthnicityOTHER SINGLE RACE                            -0.144
## raceEthnicityTWO OR MORE RACES                            -0.157
## raceEthnicityASIAN                                         0.124
## raceEthnicityNATIVE HAWAIIAN OR OTHER PACIFIC ISLANDER    -0.169
## raceEthnicityASIAN OR PACIFIC ISLANDER                     0.374
## raceEthnicityALASKA NATIVE (ALEUT, ESKIMO, INDIAN)        -0.168
## AGE18-20                                                  -0.067
## AGE15-17                                                  -0.077
## AGE12-14                                                  -0.028
## homelessTRUE                                               0.005
##                                                         0.975quant   mode
## (Intercept)                                                 -0.115 -0.334
## SUB1(2) ALCOHOL                                              0.498  0.476
## SUB1(5) HEROIN                                              -0.110 -0.137
## SUB1(7) OTHER OPIATES AND SYNTHETICS                        -0.074 -0.105
## SUB1(10) METHAMPHETAMINE                                    -0.006 -0.046
## SUB1(3) COCAINE/CRACK                                       -0.107 -0.156
## GENDER(2) FEMALE                                            -0.096 -0.113
## raceEthnicityHispanic                                       -0.161 -0.184
## raceEthnicityBLACK OR AFRICAN AMERICAN                      -0.358 -0.383
## raceEthnicityAMERICAN INDIAN (OTHER THAN ALASKA NATIVE)     -0.247 -0.317
## raceEthnicityOTHER SINGLE RACE                              -0.081 -0.144
## raceEthnicityTWO OR MORE RACES                              -0.082 -0.157
## raceEthnicityASIAN                                           0.211  0.124
## raceEthnicityNATIVE HAWAIIAN OR OTHER PACIFIC ISLANDER      -0.048 -0.169
## raceEthnicityASIAN OR PACIFIC ISLANDER                       0.544  0.374
## raceEthnicityALASKA NATIVE (ALEUT, ESKIMO, INDIAN)           0.136 -0.168
## AGE18-20                                                    -0.048 -0.067
## AGE15-17                                                    -0.054 -0.077
## AGE12-14                                                     0.012 -0.028
## homelessTRUE                                                 0.036  0.005
##                                                         kld
```

```
## (Intercept)                                                0
## SUB1(2) ALCOHOL                                            0
## SUB1(5) HEROIN                                             0
## SUB1(7) OTHER OPIATES AND SYNTHETICS                       0
## SUB1(10) METHAMPHETAMINE                                   0
## SUB1(3) COCAINE/CRACK                                      0
## GENDER(2) FEMALE                                           0
## raceEthnicityHispanic                                      0
## raceEthnicityBLACK OR AFRICAN AMERICAN                     0
## raceEthnicityAMERICAN INDIAN (OTHER THAN ALASKA NATIVE)    0
## raceEthnicityOTHER SINGLE RACE                             0
## raceEthnicityTWO OR MORE RACES                             0
## raceEthnicityASIAN                                         0
## raceEthnicityNATIVE HAWAIIAN OR OTHER PACIFIC ISLANDER     0
## raceEthnicityASIAN OR PACIFIC ISLANDER                     0
## raceEthnicityALASKA NATIVE (ALEUT, ESKIMO, INDIAN)         0
## AGE18-20                                                   0
## AGE15-17                                                   0
## AGE12-14                                                   0
## homelessTRUE                                               0
##
## Random effects:
##   Name     Model
##     STFIPS IID model
##    TOWN IID model
##
## Model hyperparameters:
##                      mean    sd 0.025quant 0.5quant 0.975quant mode
## Precision for STFIPS 2.16 0.486       1.33     2.12       3.24 2.04
## Precision for TOWN   3.45 0.375       2.76     3.44       4.23 3.43
##
## Expected number of effective parameters(stdev): 270.07(0.00)
## Number of equivalent replicates : 1087.75
##
## Marginal log-Likelihood:  -185644.93
```

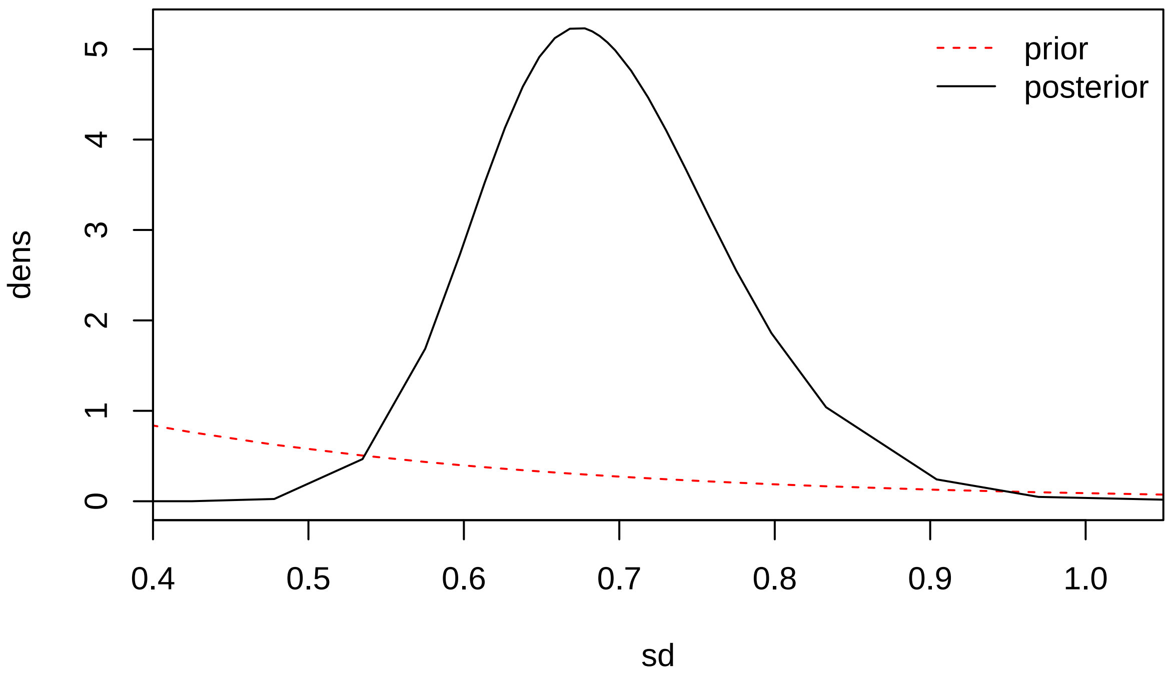
```
knitr::kable(ires$summary.hyperpar, digits=2)
```

	mean	sd	0.025quant	0.5quant	0.975quant	mode
Precision for STFIPS	2.16	0.49	1.34	2.12	3.24	2.04
Precision for TOWN	3.45	0.38	2.76	3.44	4.23	3.43

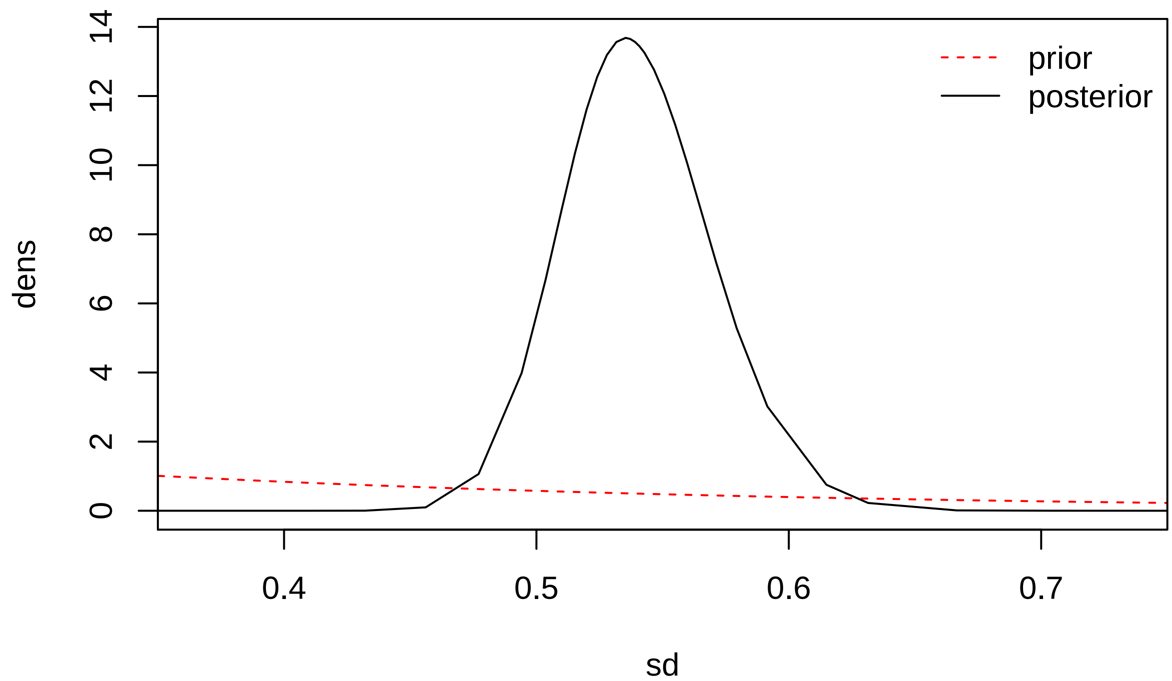
```
library(brinla)
bri.hyperpar.summary(ires)
```

```
##                     mean         sd    q0.025      q0.5    q0.975      mode
## SD for STFIPS 0.6935176 0.07825824 0.5565746 0.6872606 0.8633300 0.6734471
## SD for TOWN   0.5404324 0.02933449 0.4865681 0.5389609 0.6016381 0.5354730
```

```
sdState = Pmisc::priorPostSd(ires)
do.call(matplot, sdState$STFIPS$matplot)
do.call(legend, sdState$legend)
```




```
sdState2 = Pmisc::priorPostSd(ires)
do.call(matplot, sdState2$TOWN$matplot)
do.call(legend, sdState2$legend)
```




```
toPrint = as.data.frame(rbind(exp(ires$summary.fixed[,
                                  c(4, 3, 5)]), sdState$summary[, c(4, 3, 5)]))
sss = "^(raceEthnicity|SUB1|GENDER|homeless|SD)(.[[:digit:]]+.[[:space:]]+| for )?"
toPrint = cbind(variable = gsub(paste0(sss, ".*"),
                                "\\1", rownames(toPrint)), category = substr(gsub(sss,
                                                                                  "", rownames(toPrint)
Pmisc::mdTable(toPrint, digits = 3, mdToTex = TRUE,
               guessGroup = TRUE, caption = "Posterior means and quantiles for model parameters.")
```

```
ires$summary.random$STFIPS$ID = gsub("[[:punct:]]|[[:digit:]]",
                                     "", ires$summary.random$STFIPS$ID)
ires$summary.random$STFIPS$ID = gsub("DISTRICT OF COLUMBIA",
                                     "WASHINGTON DC", ires$summary.random$STFIPS$ID)
toprint = cbind(ires$summary.random$STFIPS[1:26, c(1,
                                                   2, 4, 6)], ires$summary.random$STFIPS[-(1:26),
                                                                                          c(1, 2, 4, 6)]
colnames(toprint) = gsub("uant", "", colnames(toprint))
knitr::kable(toprint, digits = 1,format="latex")
```

Table 1: Posterior means and quantiles for model parameters.

	0.5quant	0.025quant	0.975quant
(Intercept)			
(Intercept)	0.716	0.575	0.891
SUB1			
ALCOHOL	1.609	1.574	1.645
HEROIN	0.872	0.849	0.896
OTHER OPIATES AND SYNTHET	0.901	0.874	0.929
METHAMPHETAMINE	0.955	0.917	0.994
COCAINE/CRACK	0.855	0.814	0.898
GENDER			
FEMALE	0.893	0.878	0.909
raceEthnicity			
Hispanic	0.832	0.812	0.851
BLACK OR AFRICAN AMERICAN	0.682	0.666	0.699
AMERICAN INDIAN (OTHER TH	0.728	0.679	0.781
OTHER SINGLE RACE	0.865	0.812	0.923
TWO OR MORE RACES	0.855	0.794	0.921
ASIAN	1.132	1.038	1.235
NATIVE HAWAIIAN OR OTHER	0.845	0.748	0.953
ASIAN OR PACIFIC ISLANDER	1.454	1.227	1.723
ALASKA NATIVE (ALEUT, ESK	0.845	0.624	1.145
AGE18-20			
AGE18-20	0.935	0.916	0.953
AGE15-17			
AGE15-17	0.926	0.905	0.947
AGE12-14			
AGE12-14	0.972	0.934	1.012
homeless			
TRUE	1.005	0.973	1.037
SD			
STFIPS	0.687	0.556	0.865
TOWN	0.539	0.486	0.602

ID	mean	0.025q	0.975q	ID	mean	0.025q	0.975q
ALABAMA	0.2	-0.3	0.8	MONTANA	-0.2	-1.0	0.7
ALASKA	0.0	-0.9	0.8	NEBRASKA	0.8	0.4	1.2
ARIZONA	0.0	-1.3	1.3	NEVADA	-0.1	-0.8	0.6
ARKANSAS	-0.1	-0.7	0.5	NEW HAMPSHIRE	0.2	-0.3	0.7
CALIFORNIA	-0.3	-0.6	0.0	NEW JERSEY	0.5	0.2	0.8
COLORADO	0.5	0.1	1.0	NEW MEXICO	-1.2	-1.9	-0.5
CONNECTICUT	0.1	-0.4	0.7	NEW YORK	-0.3	-0.6	0.0
DELAWARE	1.0	0.7	1.3	NORTH CAROLINA	-0.8	-1.2	-0.5
WASHINGTON DC	-0.3	-0.6	0.1	NORTH DAKOTA	-0.3	-1.0	0.4
FLORIDA	1.0	0.7	1.4	OHIO	-0.2	-0.6	0.1
GEORGIA	-0.2	-0.8	0.4	OKLAHOMA	0.6	0.0	1.1
HAWAII	0.2	-0.6	1.1	OREGON	0.1	-0.3	0.5
IDAHO	-0.2	-1.0	0.7	PENNSYLVANIA	0.0	-1.3	1.3
ILLINOIS	-0.5	-0.8	-0.2	RHODE ISLAND	-0.2	-0.6	0.3
INDIANA	-0.1	-0.9	0.8	SOUTH CAROLINA	0.4	0.0	0.7
IOWA	0.4	0.1	0.7	SOUTH DAKOTA	0.5	-0.3	1.3
KANSAS	-0.2	-0.6	0.1	TENNESSEE	0.3	-0.2	0.7
KENTUCKY	-0.2	-0.5	0.2	TEXAS	0.6	0.3	0.9
LOUISIANA	-0.6	-1.0	-0.1	UTAH	0.1	-0.5	0.7
MAINE	0.1	-0.7	1.0	VERMONT	-0.2	-1.1	0.6
MARYLAND	0.5	0.2	0.8	VIRGINIA	-2.9	-3.3	-2.5
MASSACHUSETTS	0.8	0.4	1.2	WASHINGTON	-0.1	-0.5	0.3
MICHIGAN	-0.4	-0.7	0.0	WEST VIRGINIA	0.0	-1.3	1.3
MINNESOTA	0.4	0.0	0.9	WISCONSIN	0.0	-1.3	1.3
MISSISSIPPI	0.0	-1.3	1.3	WYOMING	0.0	-1.3	1.3
MISSOURI	-0.4	-0.7	-0.1	PUERTO RICO	0.6	-0.1	1.3