

Stanpractice

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2/18/2021

Prepping the data

Because stan gets mad if I give it the raw hospital ID, I create a new index

```
# Generate hospital index
hosp <- read.csv("hosp_full.csv", header=TRUE)
hosp_table <- data.frame(id = unique(hosp$id), hosp_index = c(1:length(unique(hosp$id))))
hosp <- inner_join(hosp, hosp_table) %>%
  filter(category!="Overall")
```

```
## Joining, by = "id"
```

Create stan data list and run the stan file

Stan doesn't like factors, so create a model matrix and DO NOT FORGET TO DROP LEVELS, because rstan will not do that for you. Consider scaling X

```
# Missing values cause trouble
apply(hosp, 2,function(x) sum(is.na(x)))
```

```
##           hospital           id           category
##           0           0           0
##      procedures      deaths      mort_rate
##           0           0           0
## mort_rate_overall      EMR      total_procedures
##           0           0           0
##      overall_deaths      cat1      cat2
##           0           0           0
##           cat3      cat4      cat5
##           0           0           0
## Overall_procedures      prop_5      prop_4
##           0           0           0
##           prop_45      teaching      trauma_level
##           0           0           5
##           helipad      ped_trauma      ped_trauma_level
##           19           0           10
##           nbeds      npediatricbeds      nbassinets
##           0           119           64
##           rural      nicu      nicu_level
##           0           0           10
## top50_ped_anyspecialty      top50_ped_cardio      rank_ped_cardio
```

```
##              0              0              178
##      top50_ped_pulm      rank_ped_pulm      hosp_index
##              0              202              0

# Set up data and select model matrix, selecting desired vars

y = hosp$deaths
n = hosp$procedures
X = model.matrix(deaths ~ -1 + category + prop_45 + nbeds + top50_ped_cardio +
                 top50_ped_pulm , data=hosp)
g = hosp$hosp_index

N = nrow(hosp)
M = length(unique(hosp$id))
K = ncol(X)

stan_data = list(N=N, M = M, K = K, n=n, y = y, x = X, g = g)

start_time <- Sys.time()
fit1 <- stan("JK_stanmodel0.stan", data = stan_data, chains = 2, iter = 1000)

##
## SAMPLING FOR MODEL 'JK_stanmodel0' NOW (CHAIN 1).
## Chain 1: Rejecting initial value:
## Chain 1:   Log probability evaluates to log(0), i.e. negative infinity.
## Chain 1:   Stan can't start sampling from this initial value.
## Chain 1: Rejecting initial value:
## Chain 1:   Log probability evaluates to log(0), i.e. negative infinity.
## Chain 1:   Stan can't start sampling from this initial value.
## Chain 1:
## Chain 1: Gradient evaluation took 0 seconds
## Chain 1: 1000 transitions using 10 leapfrog steps per transition would take 0 seconds.
## Chain 1: Adjust your expectations accordingly!
## Chain 1:
## Chain 1:
## Chain 1: Iteration:   1 / 1000 [ 0%]   (Warmup)
## Chain 1: Iteration: 100 / 1000 [ 10%]  (Warmup)
## Chain 1: Iteration: 200 / 1000 [ 20%]  (Warmup)
## Chain 1: Iteration: 300 / 1000 [ 30%]  (Warmup)
## Chain 1: Iteration: 400 / 1000 [ 40%]  (Warmup)
## Chain 1: Iteration: 500 / 1000 [ 50%]  (Warmup)
## Chain 1: Iteration: 501 / 1000 [ 50%]  (Sampling)
## Chain 1: Iteration: 600 / 1000 [ 60%]  (Sampling)
## Chain 1: Iteration: 700 / 1000 [ 70%]  (Sampling)
## Chain 1: Iteration: 800 / 1000 [ 80%]  (Sampling)
## Chain 1: Iteration: 900 / 1000 [ 90%]  (Sampling)
## Chain 1: Iteration: 1000 / 1000 [100%] (Sampling)
## Chain 1:
## Chain 1: Elapsed Time: 69.84 seconds (Warm-up)
## Chain 1:                46.298 seconds (Sampling)
## Chain 1:                116.138 seconds (Total)
## Chain 1:
##
## SAMPLING FOR MODEL 'JK_stanmodel0' NOW (CHAIN 2).
## Chain 2:
```

```
## Chain 2: Gradient evaluation took 0 seconds
## Chain 2: 1000 transitions using 10 leapfrog steps per transition would take 0 seconds.
## Chain 2: Adjust your expectations accordingly!
## Chain 2:
## Chain 2:
## Chain 2: Iteration: 1 / 1000 [ 0%] (Warmup)
## Chain 2: Iteration: 100 / 1000 [ 10%] (Warmup)
## Chain 2: Iteration: 200 / 1000 [ 20%] (Warmup)
## Chain 2: Iteration: 300 / 1000 [ 30%] (Warmup)
## Chain 2: Iteration: 400 / 1000 [ 40%] (Warmup)
## Chain 2: Iteration: 500 / 1000 [ 50%] (Warmup)
## Chain 2: Iteration: 501 / 1000 [ 50%] (Sampling)
## Chain 2: Iteration: 600 / 1000 [ 60%] (Sampling)
## Chain 2: Iteration: 700 / 1000 [ 70%] (Sampling)
## Chain 2: Iteration: 800 / 1000 [ 80%] (Sampling)
## Chain 2: Iteration: 900 / 1000 [ 90%] (Sampling)
## Chain 2: Iteration: 1000 / 1000 [100%] (Sampling)
## Chain 2:
## Chain 2: Elapsed Time: 62.262 seconds (Warm-up)
## Chain 2: 50.123 seconds (Sampling)
## Chain 2: 112.385 seconds (Total)
## Chain 2:

## Warning: Bulk Effective Samples Size (ESS) is too low, indicating posterior means and medians may be
## Running the chains for more iterations may help. See
## http://mc-stan.org/misc/warnings.html#bulk-ess

## Warning: Tail Effective Samples Size (ESS) is too low, indicating posterior variances and tail quant
## Running the chains for more iterations may help. See
## http://mc-stan.org/misc/warnings.html#tail-ess
```

```
end_time <- Sys.time()
```

```
end_time - start_time
```

```
## Time difference of 4.98798 mins
```

BEWARE THE DUMMY VARIABLE TRAP!

```
# Look at fixed effect coefficients
fixed_effects <- summary(fit1, pars=c("beta"),
  probs = c(0.025, 0.975), digits_summary=3)$summary

row.names(fixed_effects) <- c( colnames(X)) # fix coefficient names
fixed_effects
```

```
##               mean      se_mean      sd      2.5%
## categoryCategory 1 -5.393560e+00 1.350418e-02 0.2366726050 -5.8806971861
## categoryCategory 2 -3.947514e+00 1.325806e-02 0.2245354449 -4.3824631248
## categoryCategory 3 -3.494444e+00 1.372436e-02 0.2280809426 -3.9419251129
## categoryCategory 4 -2.426348e+00 1.361798e-02 0.2238985023 -2.8771354977
## categoryCategory 5 -1.558651e+00 1.372911e-02 0.2288664745 -2.0079661966
## prop_45            -7.533002e-01 5.567273e-02 0.9405076051 -2.6090244046
## nbeds              7.842856e-05 6.417233e-06 0.0001961288 -0.0003053565
## top50_ped_cardio   -1.425634e-01 4.607986e-03 0.1037346314 -0.3486236534
## top50_ped_pulm     -9.120718e-02 4.174446e-03 0.0925726878 -0.2607214403
##               97.5%      n_eff      Rhat
```

```
## categoryCategory 1 -4.9336074249 307.1566 1.0044417
## categoryCategory 2 -3.5168022438 286.8205 1.0074931
## categoryCategory 3 -3.0610833778 276.1810 1.0066187
## categoryCategory 4 -2.0079366827 270.3193 1.0089051
## categoryCategory 5 -1.0924491071 277.8944 1.0070871
## prop_45 1.1028390002 285.3905 1.0069740
## nbeds 0.0004771021 934.0863 0.9985730
## top50_ped_cardio 0.0650987810 506.7868 1.0001151
## top50_ped_pulm 0.0935422261 491.7768 0.9989912
```

```
# Look at hospital random effects
random_effects <- summary(fit1, pars=c("a"),
  probs = c(0.025, 0.975), digits_summary=3)$summary
row.names(random_effects) <- unique(hosp$hospital) # this should be right, double check
random_effects
```

	mean
## Advocate Children's Hospital	-0.3434145357
## Akron Children's Hospital	-0.0741700128
## Albany Medical Center	-0.1847141032
## Alfred I. duPont Hospital for Children	-0.0098103955
## American Family Children's Hospital-University of Wisconsin Hospitals and Clinics	-0.1640254685
## Ann & Robert H. Lurie Children's Hospital of Chicago	-0.2230724574
## Arkansas Children's Hospital	0.2236776350
## Arnold Palmer Medical Center	-0.1088973172
## Boston Children's Hospital	0.0643649573
## C.S. Mott Children's Hospital - University of Michigan	0.2231400422
## Children's Health Medical Center Dallas	-0.1762621202
## Children's Healthcare of Atlanta	0.3777182429
## Children's Hospital & Medical Center	0.3151815361
## Children's Hospital Colorado	0.0416012501
## Children's Hospital New Orleans	0.2271678225
## Children's Hospital of Illinois	-0.1223825797
## Children's Hospital of Los Angeles	0.0799982798
## Children's Hospital of Michigan	0.1609643619
## Children's Hospital of Philadelphia	0.2318244621
## Children's Hospital of Pittsburgh	-0.1464707061
## Children's Hospital of the King's Daughters	0.2107225778
## Children's Hospital of Wisconsin	-0.0378710660
## Children's Hospitals and Clinics of Minnesota	0.2009104270
## Children's Memorial Hermann Hospital	-0.0906518916
## Children's Mercy Kansas City	-0.1145679422
## CHOC Children's Hospital	-0.2014886321
## Cincinnati Children's Hospital Medical Center	0.2892552481
## Cleveland Clinic	-0.1916128758
## CMC-Levine Children's Hospital	-0.0153762818
## Cohen Children's Medical Center of New York	0.0968460026
## Connecticut Children's Medical Center	-0.2663683324
## Cook Children's Medical Center	-0.1871096867
## Dell Children's Medical Center	0.1034313020
## Doernbecher Children's Hospital/Oregon Health & Science University	-0.0612754881
## Duke University Hospital	0.3310404509
## Florida Hospital for Children	0.1232605319
## Geisinger Medical Center	-0.1843850304
## Helen DeVos Children's Hospital	-0.3329954407

## Inova Children's Hospital	0.3063309422
## Jackson Memorial Hospital	0.0834675463
## Joe DiMaggio Children's Hospital	0.1716571217
## Johns Hopkins All Children's Hospital	0.1035777301
## Le Bonheur Children's Hospital	-0.0348925186
## Loma Linda University Medical Center and Children's Hospital	0.2302059056
## Maine Medical Center	0.1508002922
## Mayo Clinic Hospital - Rochester	-0.0416243998
## Mercy Medical Center	-0.2156825813
## Mount Sinai Hospital	0.2190711919
## MUSC Children's Hospital	-0.2503007403
## Nationwide Children's Hospital	0.3222056933
## Nemours Children's Hospital	-0.0849417965
## New York Presbyterian / Morgan Stanley Children's Hospital	0.0004751681
## Nicklaus Children's Hospital	0.3296988724
## Norton Children's Hospital	0.2307822226
## Ochsner Health System	0.0362915544
## Penn State Children's Hospital	-0.3518043456
## Phoenix Children's Hospital	-0.4635252055
## Primary Children's Hospital	0.0770878472
## Providence Sacred Heart Medical Center and Children's Hospital	-0.2303754421
## Rady Children's Hospital San Diego	0.0242208846
## Rainbow Babies & Children's Hospital	-0.0442741561
## Randall Children's Hospital at Legacy Emanuel	-0.1493232013
## Riley Hospital for Children at Indiana University Health	-0.0553572017
## Seattle Children's Hospital	-0.0549509864
## SSM Health Cardinal Glennon Children's Hospital	0.0090473954
## St. Christopher's Hospital for Children	0.2815616309
## St. Joseph's Children's Hospital BayCare Health System	0.0296817754
## St. Louis Children's Hospital	-0.0360236224
## Sutter Medical Center, Sacramento: Women's and Children's Center	0.0259011283
## Texas Children's Hospital	-0.4136237023
## The Children's Hospital of Alabama	0.1808415923
## The Johns Hopkins Hospital	-0.0393019297
## UC Davis Medical Center	0.1545675428
## UCLA Mattel Children's Hospital	0.0091756955
## UCSF Benioff Children's Hospital	-0.2654466949
## UF Health Shands Children's Hospital	-0.4974761514
## University Hospital	0.0035911899
## University of Kentucky Healthcare	-0.0343533403
## University of Maryland Children's Hospital	-0.2613736043
## University of Minnesota Masonic Children's Hospital	0.1768319708
## University of Virginia Children's Hospital	0.1475875758
## Yale-New Haven Children's Hospital	-0.0565062322
##	se_mean
## Advocate Children's Hospital	0.005646135
## Akron Children's Hospital	0.006180401
## Albany Medical Center	0.006359190
## Alfred I. duPont Hospital for Children	0.005809671
## American Family Children's Hospital-University of Wisconsin Hospitals and Clinics	0.006383120
## Ann & Robert H. Lurie Children's Hospital of Chicago	0.005267047
## Arkansas Children's Hospital	0.005110711
## Arnold Palmer Medical Center	0.006390988
## Boston Children's Hospital	0.003117889

## C.S. Mott Children's Hospital - University of Michigan	0.004389154
## Children's Health Medical Center Dallas	0.005087984
## Children's Healthcare of Atlanta	0.004281068
## Children's Hospital & Medical Center	0.004532281
## Children's Hospital Colorado	0.004035219
## Children's Hospital New Orleans	0.004737070
## Children's Hospital of Illinois	0.005757334
## Children's Hospital of Los Angeles	0.005550841
## Children's Hospital of Michigan	0.004625667
## Children's Hospital of Philadelphia	0.003315772
## Children's Hospital of Pittsburgh	0.004622016
## Children's Hospital of the King's Daughters	0.006605155
## Children's Hospital of Wisconsin	0.004723270
## Children's Hospitals and Clinics of Minnesota	0.004550180
## Children's Memorial Hermann Hospital	0.004712724
## Children's Mercy Kansas City	0.004368030
## CHOC Children's Hospital	0.006229234
## Cincinnati Children's Hospital Medical Center	0.004374823
## Cleveland Clinic	0.005011076
## CMC-Levine Children's Hospital	0.004518178
## Cohen Children's Medical Center of New York	0.006568972
## Connecticut Children's Medical Center	0.007178660
## Cook Children's Medical Center	0.004463964
## Dell Children's Medical Center	0.006014111
## Doernbecher Children's Hospital/Oregon Health & Science University	0.004804553
## Duke University Hospital	0.005496295
## Florida Hospital for Children	0.005142047
## Geisinger Medical Center	0.007176137
## Helen DeVos Children's Hospital	0.007030943
## Inova Children's Hospital	0.006039373
## Jackson Memorial Hospital	0.006171880
## Joe DiMaggio Children's Hospital	0.004769655
## Johns Hopkins All Children's Hospital	0.004654144
## Le Bonheur Children's Hospital	0.004102993
## Loma Linda University Medical Center and Children's Hospital	0.005076966
## Maine Medical Center	0.006247835
## Mayo Clinic Hospital - Rochester	0.005090032
## Mercy Medical Center	0.005357041
## Mount Sinai Hospital	0.005207209
## MUSC Children's Hospital	0.005029818
## Nationwide Children's Hospital	0.004023462
## Nemours Children's Hospital	0.006515102
## New York Presbyterian / Morgan Stanley Children's Hospital	0.003729869
## Nicklaus Children's Hospital	0.004208999
## Norton Children's Hospital	0.004603043
## Ochsner Health System	0.005196454
## Penn State Children's Hospital	0.006884554
## Phoenix Children's Hospital	0.005943265
## Primary Children's Hospital	0.005262867
## Providence Sacred Heart Medical Center and Children's Hospital	0.005448403
## Rady Children's Hospital San Diego	0.003706734
## Rainbow Babies & Children's Hospital	0.005322414
## Randall Children's Hospital at Legacy Emanuel	0.006137108
## Riley Hospital for Children at Indiana University Health	0.003980684

## Seattle Children's Hospital	0.005304931
## SSM Health Cardinal Glennon Children's Hospital	0.005004556
## St. Christopher's Hospital for Children	0.005902204
## St. Joseph's Children's Hospital BayCare Health System	0.003991097
## St. Louis Children's Hospital	0.005199946
## Sutter Medical Center, Sacramento: Women's and Children's Center	0.005146210
## Texas Children's Hospital	0.005426070
## The Children's Hospital of Alabama	0.004378664
## The Johns Hopkins Hospital	0.004662448
## UC Davis Medical Center	0.006126318
## UCLA Mattel Children's Hospital	0.005129629
## UCSF Benioff Children's Hospital	0.003971345
## UF Health Shands Children's Hospital	0.007448827
## University Hospital	0.004872617
## University of Kentucky Healthcare	0.005934125
## University of Maryland Children's Hospital	0.006300418
## University of Minnesota Masonic Children's Hospital	0.004982239
## University of Virginia Children's Hospital	0.005542981
## Yale-New Haven Children's Hospital	0.007282976
##	sd
## Advocate Children's Hospital	0.1717572
## Akron Children's Hospital	0.2254336
## Albany Medical Center	0.2309881
## Alfred I. duPont Hospital for Children	0.1894137
## American Family Children's Hospital-University of Wisconsin Hospitals and Clinics	0.2272267
## Ann & Robert H. Lurie Children's Hospital of Chicago	0.1790228
## Arkansas Children's Hospital	0.1574185
## Arnold Palmer Medical Center	0.2081945
## Boston Children's Hospital	0.1015968
## C.S. Mott Children's Hospital - University of Michigan	0.1293546
## Children's Health Medical Center Dallas	0.1612986
## Children's Healthcare of Atlanta	0.1226389
## Children's Hospital & Medical Center	0.1708090
## Children's Hospital Colorado	0.1478734
## Children's Hospital New Orleans	0.1721893
## Children's Hospital of Illinois	0.2113016
## Children's Hospital of Los Angeles	0.1316740
## Children's Hospital of Michigan	0.1707340
## Children's Hospital of Philadelphia	0.1177476
## Children's Hospital of Pittsburgh	0.1731250
## Children's Hospital of the King's Daughters	0.2456056
## Children's Hospital of Wisconsin	0.1499322
## Children's Hospitals and Clinics of Minnesota	0.1634902
## Children's Memorial Hermann Hospital	0.1836225
## Children's Mercy Kansas City	0.1514351
## CHOC Children's Hospital	0.1994893
## Cincinnati Children's Hospital Medical Center	0.1455722
## Cleveland Clinic	0.1935711
## CMC-Levine Children's Hospital	0.1664451
## Cohen Children's Medical Center of New York	0.2193014
## Connecticut Children's Medical Center	0.2590908
## Cook Children's Medical Center	0.1585393
## Dell Children's Medical Center	0.2112872
## Doernbecher Children's Hospital/Oregon Health & Science University	0.1823939

## Duke University Hospital	0.1885746
## Florida Hospital for Children	0.1998462
## Geisinger Medical Center	0.2741093
## Helen DeVos Children's Hospital	0.2037939
## Inova Children's Hospital	0.1866049
## Jackson Memorial Hospital	0.2359226
## Joe DiMaggio Children's Hospital	0.1874641
## Johns Hopkins All Children's Hospital	0.1712035
## Le Bonheur Children's Hospital	0.1782147
## Loma Linda University Medical Center and Children's Hospital	0.1750402
## Maine Medical Center	0.2242556
## Mayo Clinic Hospital - Rochester	0.1576931
## Mercy Medical Center	0.2153004
## Mount Sinai Hospital	0.2065226
## MUSC Children's Hospital	0.1726523
## Nationwide Children's Hospital	0.1305352
## Nemours Children's Hospital	0.2539852
## New York Presbyterian / Morgan Stanley Children's Hospital	0.1343683
## Nicklaus Children's Hospital	0.1601959
## Norton Children's Hospital	0.1609238
## Ochsner Health System	0.2197598
## Penn State Children's Hospital	0.2177090
## Phoenix Children's Hospital	0.1745130
## Primary Children's Hospital	0.1517621
## Providence Sacred Heart Medical Center and Children's Hospital	0.1979015
## Rady Children's Hospital San Diego	0.1499261
## Rainbow Babies & Children's Hospital	0.2489210
## Randall Children's Hospital at Legacy Emanuel	0.2150047
## Riley Hospital for Children at Indiana University Health	0.1586236
## Seattle Children's Hospital	0.1571263
## SSM Health Cardinal Glennon Children's Hospital	0.1785196
## St. Christopher's Hospital for Children	0.2354750
## St. Joseph's Children's Hospital BayCare Health System	0.2186014
## St. Louis Children's Hospital	0.1688067
## Sutter Medical Center, Sacramento: Women's and Children's Center	0.2085238
## Texas Children's Hospital	0.1663550
## The Children's Hospital of Alabama	0.1564800
## The Johns Hopkins Hospital	0.2019571
## UC Davis Medical Center	0.2139738
## UCLA Mattel Children's Hospital	0.1948709
## UCSF Benioff Children's Hospital	0.1711250
## UF Health Shands Children's Hospital	0.2208049
## University Hospital	0.1997866
## University of Kentucky Healthcare	0.2871460
## University of Maryland Children's Hospital	0.2211918
## University of Minnesota Masonic Children's Hospital	0.2028110
## University of Virginia Children's Hospital	0.1841175
## Yale-New Haven Children's Hospital	0.2596509
##	2.5%
## Advocate Children's Hospital	-0.715599148
## Akron Children's Hospital	-0.522255577
## Albany Medical Center	-0.646289528
## Alfred I. duPont Hospital for Children	-0.387545282
## American Family Children's Hospital-University of Wisconsin Hospitals and Clinics	-0.643281957

## Ann & Robert H. Lurie Children's Hospital of Chicago	-0.580624681
## Arkansas Children's Hospital	-0.065569268
## Arnold Palmer Medical Center	-0.529473921
## Boston Children's Hospital	-0.144869543
## C.S. Mott Children's Hospital - University of Michigan	-0.037262433
## Children's Health Medical Center Dallas	-0.502129902
## Children's Healthcare of Atlanta	0.137273250
## Children's Hospital & Medical Center	-0.027631913
## Children's Hospital Colorado	-0.256376874
## Children's Hospital New Orleans	-0.113992500
## Children's Hospital of Illinois	-0.542503925
## Children's Hospital of Los Angeles	-0.180062255
## Children's Hospital of Michigan	-0.165767918
## Children's Hospital of Philadelphia	-0.021184542
## Children's Hospital of Pittsburgh	-0.497066241
## Children's Hospital of the King's Daughters	-0.265146474
## Children's Hospital of Wisconsin	-0.332954168
## Children's Hospitals and Clinics of Minnesota	-0.119427676
## Children's Memorial Hermann Hospital	-0.451898450
## Children's Mercy Kansas City	-0.405962329
## CHOC Children's Hospital	-0.613645837
## Cincinnati Children's Hospital Medical Center	0.002948105
## Cleveland Clinic	-0.581801076
## CMC-Levine Children's Hospital	-0.358192903
## Cohen Children's Medical Center of New York	-0.318233172
## Connecticut Children's Medical Center	-0.793599143
## Cook Children's Medical Center	-0.492811630
## Dell Children's Medical Center	-0.314168993
## Doernbecher Children's Hospital/Oregon Health & Science University	-0.434710734
## Duke University Hospital	-0.034363784
## Florida Hospital for Children	-0.272131686
## Geisinger Medical Center	-0.764820761
## Helen DeVos Children's Hospital	-0.746597175
## Inova Children's Hospital	-0.043871206
## Jackson Memorial Hospital	-0.377198715
## Joe DiMaggio Children's Hospital	-0.174496022
## Johns Hopkins All Children's Hospital	-0.227762575
## Le Bonheur Children's Hospital	-0.397244236
## Loma Linda University Medical Center and Children's Hospital	-0.086685464
## Maine Medical Center	-0.303167308
## Mayo Clinic Hospital - Rochester	-0.363115573
## Mercy Medical Center	-0.640279544
## Mount Sinai Hospital	-0.185900001
## MUSC Children's Hospital	-0.591039425
## Nationwide Children's Hospital	0.066317272
## Nemours Children's Hospital	-0.573304592
## New York Presbyterian / Morgan Stanley Children's Hospital	-0.270126640
## Nicklaus Children's Hospital	0.033769619
## Norton Children's Hospital	-0.091630157
## Ochsner Health System	-0.398672003
## Penn State Children's Hospital	-0.778334052
## Phoenix Children's Hospital	-0.791241771
## Primary Children's Hospital	-0.222828100
## Providence Sacred Heart Medical Center and Children's Hospital	-0.631055995

## Rady Children's Hospital San Diego	-0.289503360
## Rainbow Babies & Children's Hospital	-0.526651931
## Randall Children's Hospital at Legacy Emanuel	-0.591372477
## Riley Hospital for Children at Indiana University Health	-0.359049658
## Seattle Children's Hospital	-0.377698537
## SSM Health Cardinal Glennon Children's Hospital	-0.355190997
## St. Christopher's Hospital for Children	-0.173485837
## St. Joseph's Children's Hospital BayCare Health System	-0.402632945
## St. Louis Children's Hospital	-0.397432877
## Sutter Medical Center, Sacramento: Women's and Children's Center	-0.390137899
## Texas Children's Hospital	-0.737974074
## The Children's Hospital of Alabama	-0.118373644
## The Johns Hopkins Hospital	-0.431784276
## UC Davis Medical Center	-0.276480208
## UCLA Mattel Children's Hospital	-0.368342689
## UCSF Benioff Children's Hospital	-0.608804609
## UF Health Shands Children's Hospital	-0.930285163
## University Hospital	-0.385762789
## University of Kentucky Healthcare	-0.599420739
## University of Maryland Children's Hospital	-0.709285862
## University of Minnesota Masonic Children's Hospital	-0.239200454
## University of Virginia Children's Hospital	-0.194128403
## Yale-New Haven Children's Hospital	-0.642014543
##	97.5%
## Advocate Children's Hospital	-0.01018759
## Akron Children's Hospital	0.35043157
## Albany Medical Center	0.22765001
## Alfred I. duPont Hospital for Children	0.36132952
## American Family Children's Hospital-University of Wisconsin Hospitals and Clinics	0.27793226
## Ann & Robert H. Lurie Children's Hospital of Chicago	0.11242453
## Arkansas Children's Hospital	0.51580389
## Arnold Palmer Medical Center	0.28221765
## Boston Children's Hospital	0.25880312
## C.S. Mott Children's Hospital - University of Michigan	0.46253070
## Children's Health Medical Center Dallas	0.13307120
## Children's Healthcare of Atlanta	0.60234851
## Children's Hospital & Medical Center	0.62739994
## Children's Hospital Colorado	0.32867456
## Children's Hospital New Orleans	0.56971982
## Children's Hospital of Illinois	0.28620819
## Children's Hospital of Los Angeles	0.34332719
## Children's Hospital of Michigan	0.49897747
## Children's Hospital of Philadelphia	0.44485213
## Children's Hospital of Pittsburgh	0.16478104
## Children's Hospital of the King's Daughters	0.70989579
## Children's Hospital of Wisconsin	0.24854657
## Children's Hospitals and Clinics of Minnesota	0.50655682
## Children's Memorial Hermann Hospital	0.26505935
## Children's Mercy Kansas City	0.17604843
## CHOC Children's Hospital	0.17359639
## Cincinnati Children's Hospital Medical Center	0.54824680
## Cleveland Clinic	0.16538915
## CMC-Levine Children's Hospital	0.29824379
## Cohen Children's Medical Center of New York	0.55871517

## Connecticut Children's Medical Center	0.20479831
## Cook Children's Medical Center	0.09581460
## Dell Children's Medical Center	0.49726965
## Doernbecher Children's Hospital/Oregon Health & Science University	0.27800997
## Duke University Hospital	0.67916756
## Florida Hospital for Children	0.51183695
## Geisinger Medical Center	0.31260361
## Helen DeVos Children's Hospital	0.04247037
## Inova Children's Hospital	0.67197247
## Jackson Memorial Hospital	0.54045916
## Joe DiMaggio Children's Hospital	0.55487756
## Johns Hopkins All Children's Hospital	0.44283846
## Le Bonheur Children's Hospital	0.30917513
## Loma Linda University Medical Center and Children's Hospital	0.58848071
## Maine Medical Center	0.59738367
## Mayo Clinic Hospital - Rochester	0.25111577
## Mercy Medical Center	0.20074401
## Mount Sinai Hospital	0.65107025
## MUSC Children's Hospital	0.08331247
## Nationwide Children's Hospital	0.57274290
## Nemours Children's Hospital	0.41362102
## New York Presbyterian / Morgan Stanley Children's Hospital	0.25118481
## Nicklaus Children's Hospital	0.62910419
## Norton Children's Hospital	0.54240623
## Ochsner Health System	0.45493687
## Penn State Children's Hospital	0.03418665
## Phoenix Children's Hospital	-0.10725515
## Primary Children's Hospital	0.36679673
## Providence Sacred Heart Medical Center and Children's Hospital	0.15900411
## Rady Children's Hospital San Diego	0.31570409
## Rainbow Babies & Children's Hospital	0.44707166
## Randall Children's Hospital at Legacy Emanuel	0.24989360
## Riley Hospital for Children at Indiana University Health	0.24013193
## Seattle Children's Hospital	0.23812851
## SSM Health Cardinal Glennon Children's Hospital	0.35025563
## St. Christopher's Hospital for Children	0.72713403
## St. Joseph's Children's Hospital BayCare Health System	0.45090820
## St. Louis Children's Hospital	0.29280373
## Sutter Medical Center, Sacramento: Women's and Children's Center	0.40766627
## Texas Children's Hospital	-0.11937198
## The Children's Hospital of Alabama	0.47519531
## The Johns Hopkins Hospital	0.36741397
## UC Davis Medical Center	0.56476400
## UCLA Mattel Children's Hospital	0.39413680
## UCSF Benioff Children's Hospital	0.05049805
## UF Health Shands Children's Hospital	-0.09278011
## University Hospital	0.38829931
## University of Kentucky Healthcare	0.54404873
## University of Maryland Children's Hospital	0.16512548
## University of Minnesota Masonic Children's Hospital	0.55683471
## University of Virginia Children's Hospital	0.52078224
## Yale-New Haven Children's Hospital	0.41864664
##	n_eff
## Advocate Children's Hospital	925.3954

## Akron Children's Hospital	1330.4665
## Albany Medical Center	1319.3974
## Alfred I. duPont Hospital for Children	1062.9669
## American Family Children's Hospital-University of Wisconsin Hospitals and Clinics	1267.2222
## Ann & Robert H. Lurie Children's Hospital of Chicago	1155.2661
## Arkansas Children's Hospital	948.7437
## Arnold Palmer Medical Center	1061.2127
## Boston Children's Hospital	1061.7915
## C.S. Mott Children's Hospital - University of Michigan	868.5642
## Children's Health Medical Center Dallas	1005.0079
## Children's Healthcare of Atlanta	820.6391
## Children's Hospital & Medical Center	1420.3246
## Children's Hospital Colorado	1342.9070
## Children's Hospital New Orleans	1321.2727
## Children's Hospital of Illinois	1346.9852
## Children's Hospital of Los Angeles	562.7074
## Children's Hospital of Michigan	1362.3575
## Children's Hospital of Philadelphia	1261.0576
## Children's Hospital of Pittsburgh	1402.9966
## Children's Hospital of the King's Daughters	1382.6439
## Children's Hospital of Wisconsin	1007.6379
## Children's Hospitals and Clinics of Minnesota	1290.9999
## Children's Memorial Hermann Hospital	1518.1261
## Children's Mercy Kansas City	1201.9380
## CHOC Children's Hospital	1025.5811
## Cincinnati Children's Hospital Medical Center	1107.2251
## Cleveland Clinic	1492.1722
## CMC-Levine Children's Hospital	1357.1111
## Cohen Children's Medical Center of New York	1114.5203
## Connecticut Children's Medical Center	1302.6181
## Cook Children's Medical Center	1261.3406
## Dell Children's Medical Center	1234.2516
## Doernbecher Children's Hospital/Oregon Health & Science University	1441.1678
## Duke University Hospital	1177.1351
## Florida Hospital for Children	1510.4963
## Geisinger Medical Center	1459.0363
## Helen DeVos Children's Hospital	840.1467
## Inova Children's Hospital	954.6897
## Jackson Memorial Hospital	1461.1814
## Joe DiMaggio Children's Hospital	1544.7647
## Johns Hopkins All Children's Hospital	1353.1494
## Le Bonheur Children's Hospital	1886.6257
## Loma Linda University Medical Center and Children's Hospital	1188.6851
## Maine Medical Center	1288.3312
## Mayo Clinic Hospital - Rochester	959.8079
## Mercy Medical Center	1615.2507
## Mount Sinai Hospital	1572.9873
## MUSC Children's Hospital	1178.2581
## Nationwide Children's Hospital	1052.5802
## Nemours Children's Hospital	1519.7576
## New York Presbyterian / Morgan Stanley Children's Hospital	1297.7967
## Nicklaus Children's Hospital	1448.5889
## Norton Children's Hospital	1222.2229
## Ochsner Health System	1788.4722

## Penn State Children's Hospital	1000.0029
## Phoenix Children's Hospital	862.1944
## Primary Children's Hospital	831.5380
## Providence Sacred Heart Medical Center and Children's Hospital	1319.3487
## Rady Children's Hospital San Diego	1635.9559
## Rainbow Babies & Children's Hospital	2187.2864
## Randall Children's Hospital at Legacy Emanuel	1227.3502
## Riley Hospital for Children at Indiana University Health	1587.8891
## Seattle Children's Hospital	877.2797
## SSM Health Cardinal Glennon Children's Hospital	1272.4506
## St. Christopher's Hospital for Children	1591.7002
## St. Joseph's Children's Hospital BayCare Health System	3000.0000
## St. Louis Children's Hospital	1053.8571
## Sutter Medical Center, Sacramento: Women's and Children's Center	1641.8598
## Texas Children's Hospital	939.9420
## The Children's Hospital of Alabama	1277.1284
## The Johns Hopkins Hospital	1876.2470
## UC Davis Medical Center	1219.8938
## UCLA Mattel Children's Hospital	1443.1857
## UCSF Benioff Children's Hospital	1856.7421
## UF Health Shands Children's Hospital	878.7022
## University Hospital	1681.1567
## University of Kentucky Healthcare	2341.4897
## University of Maryland Children's Hospital	1232.5353
## University of Minnesota Masonic Children's Hospital	1657.0430
## University of Virginia Children's Hospital	1103.3244
## Yale-New Haven Children's Hospital	1271.0479
##	Rhat
## Advocate Children's Hospital	0.9994041
## Akron Children's Hospital	0.9993723
## Albany Medical Center	0.9982997
## Alfred I. duPont Hospital for Children	1.0007079
## American Family Children's Hospital-University of Wisconsin Hospitals and Clinics	0.9983739
## Ann & Robert H. Lurie Children's Hospital of Chicago	1.0016770
## Arkansas Children's Hospital	1.0017216
## Arnold Palmer Medical Center	0.9985050
## Boston Children's Hospital	0.9989187
## C.S. Mott Children's Hospital - University of Michigan	1.0002783
## Children's Health Medical Center Dallas	0.9983932
## Children's Healthcare of Atlanta	0.9999502
## Children's Hospital & Medical Center	0.9986133
## Children's Hospital Colorado	0.9986566
## Children's Hospital New Orleans	0.9983887
## Children's Hospital of Illinois	0.9999707
## Children's Hospital of Los Angeles	1.0005506
## Children's Hospital of Michigan	1.0001996
## Children's Hospital of Philadelphia	0.9986781
## Children's Hospital of Pittsburgh	1.0014302
## Children's Hospital of the King's Daughters	0.9993719
## Children's Hospital of Wisconsin	0.9983144
## Children's Hospitals and Clinics of Minnesota	0.9985666
## Children's Memorial Hermann Hospital	1.0004935
## Children's Mercy Kansas City	1.0002687
## CHOC Children's Hospital	1.0022974

## Cincinnati Children's Hospital Medical Center	0.9985030
## Cleveland Clinic	0.9990556
## CMC-Levine Children's Hospital	0.9982366
## Cohen Children's Medical Center of New York	1.0034487
## Connecticut Children's Medical Center	0.9993693
## Cook Children's Medical Center	1.0009295
## Dell Children's Medical Center	1.0003589
## Doernbecher Children's Hospital/Oregon Health & Science University	0.9995798
## Duke University Hospital	0.9999720
## Florida Hospital for Children	0.9980603
## Geisinger Medical Center	0.9994663
## Helen DeVos Children's Hospital	0.9999292
## Inova Children's Hospital	1.0002256
## Jackson Memorial Hospital	0.9995127
## Joe DiMaggio Children's Hospital	0.9985455
## Johns Hopkins All Children's Hospital	0.9981550
## Le Bonheur Children's Hospital	1.0003608
## Loma Linda University Medical Center and Children's Hospital	0.9989221
## Maine Medical Center	1.0003095
## Mayo Clinic Hospital - Rochester	0.9989301
## Mercy Medical Center	0.9996901
## Mount Sinai Hospital	0.9997620
## MUSC Children's Hospital	0.9994153
## Nationwide Children's Hospital	0.9988498
## Nemours Children's Hospital	0.9994537
## New York Presbyterian / Morgan Stanley Children's Hospital	1.0012765
## Nicklaus Children's Hospital	1.0015059
## Norton Children's Hospital	0.9990214
## Ochsner Health System	0.9997759
## Penn State Children's Hospital	0.9999862
## Phoenix Children's Hospital	0.9998569
## Primary Children's Hospital	0.9993150
## Providence Sacred Heart Medical Center and Children's Hospital	0.9987789
## Rady Children's Hospital San Diego	0.9983835
## Rainbow Babies & Children's Hospital	0.9985790
## Randall Children's Hospital at Legacy Emanuel	0.9982078
## Riley Hospital for Children at Indiana University Health	0.9988529
## Seattle Children's Hospital	0.9999326
## SSM Health Cardinal Glennon Children's Hospital	1.0000509
## St. Christopher's Hospital for Children	0.9990222
## St. Joseph's Children's Hospital BayCare Health System	0.9984107
## St. Louis Children's Hospital	0.9986422
## Sutter Medical Center, Sacramento: Women's and Children's Center	0.9999492
## Texas Children's Hospital	1.0022571
## The Children's Hospital of Alabama	0.9991403
## The Johns Hopkins Hospital	0.9983901
## UC Davis Medical Center	0.9998442
## UCLA Mattel Children's Hospital	0.9990472
## UCSF Benioff Children's Hospital	1.0001306
## UF Health Shands Children's Hospital	1.0019969
## University Hospital	0.9985519
## University of Kentucky Healthcare	0.9985166
## University of Maryland Children's Hospital	0.9990045
## University of Minnesota Masonic Children's Hospital	0.9989305

```
## University of Virginia Children's Hospital  
## Yale-New Haven Children's Hospital
```

0.9985592

1.0001320

```
traceplot(fit1 ,pars = c("beta[1]","beta[2]","beta[3]","beta[4]"),  
  ncol=1,nrow=6,inc_warmup=F)
```

