Stratified Analysis

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Contents

```
library(here)
```

```
## Warning in readLines(f, n): line 1 appears to contain an embedded nul
```

```
## Warning in readLines(f, n): incomplete final line found on '/Volumes/
## ALVINDRIVE2/flood-risk-health-effects/._flood-risk-health-effects.Rproj'
```

```
## here() starts at /Volumes/ALVINDRIVE2/flood-risk-health-effects
```

```
library(coda)
library(CARBayes)
```

```
## Loading required package: MASS
```

```
## Loading required package: Rcpp
```

```
## Registered S3 method overwritten by 'GGally':
##   method from
##   +.gg   ggplot2
```

```
library(ggplot2)
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --
```

```
## v tibble  3.1.6     v dplyr   1.0.7
## v tidyr   1.1.4     v stringr 1.4.0
## v readr   2.1.1     v forcats 0.5.1
## v purrr   0.3.4
```

```
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## x dplyr::select() masks MASS::select()
```

```
fhs_model_df <- readRDS(here("intermediary_data/fhs_model_df_all_census_tract_pc.rds"))
```

Effect Size Analysis

Recall that regression coefficient estimates $\hat{\beta}$ can be standardized in the following manner:

$$\hat{\beta}^* = \frac{SD(X)}{SD(Y)}\hat{\beta},$$

where $SD(X)$ is the standard deviation of the covariate that $\hat{\beta}$ corresponds to, and $SD(Y)$ is the standard deviation of the response variable, i.e., one of the health outcomes.

In the present analysis, the covariates have been scaled by their standard deviations, but the response variable has not been scaled. Denote the regression coefficient estimates of this analysis as $\hat{b}$, such that

$$\hat{\beta}^* = \frac{\hat{b}}{SD(Y)}$$

Acock (2014, p. 272) suggests the following effect size heuristic for standardized beta coefficients $\hat{\beta}^*$:

1. Weak: $|\hat{\beta}^*| < 0.2$
2. Moderate: $0.2 < |\hat{\beta}^*| < 0.5$

3. Strong: $|\hat{\beta}^*| > 0.5$

Citation: Acock, A. C. (2014). A Gentle Introduction to Stata (4th ed.). Texas: Stata Press.

Translating the heuristic for our estimates $\hat{b}$, we have that

1. Weak: $|\hat{b}| < 0.2 \times SD(Y)$
2. Moderate: $0.2 < |\hat{b}| < 0.5 \times SD(Y)$
3. Strong: $|\hat{b}| > 0.5 \times SD(Y)$

In the following ggplots, I include the positive/negative cut-off for the "Weak" effect size as dashed red lines.

```
# standard deviations for the health outcome variables

(sd_CHD <- sd(fhs_model_df$Data_Value_CHD, na.rm = T))
```

```
## [1] 2.207308
```

```
(sd_BPHIGH <- sd(fhs_model_df$Data_Value_BPHIGH, na.rm = T))
```

```
## [1] 7.295828
```

```
(sd_CASTHMA <- sd(fhs_model_df$Data_Value_CASTHMA, na.rm = T))
```

```
## [1] 1.575484
```

```
(sd_MHLTH <- sd(fhs_model_df$Data_Value_MHLTH, na.rm = T))
```

```
## [1] 3.408159
```

CHD Stratified Analysis

CAR model results, Coronary Heart Disease Stratified on Poverty

Inference is based on 3 markov chains, each of which has been run for 110000 samples, the first 10000 of which has been removed for burn-in. The remaining 100000 samples are thinned by 2, resulting in 150000 samples for inference across the 3 Markov chains.

```
load(here("modeling_files/stratified_analysis/model_stratif_poverty.RData"))
```

Beta samples

```
beta_samples <- mcmc.list(chain1$samples$beta, chain2$samples$beta,
                          chain3$samples$beta)
```

```
effectiveSize(beta_samples)
```

```
##       var1       var2       var3       var4       var5       var6       var7
## 68234.5424 36356.9101 36778.6933 50946.3591 80150.2031 67822.1599 87865.9815
##       var8       var9      var10      var11      var12      var13      var14
## 41964.3988 60618.7756 50073.0483 60334.8196 75007.3816 89902.3839 35045.8948
##      var15      var16      var17      var18      var19      var20      var21
## 63117.7510 62661.4556 69927.4805 73680.7421 32256.2277 88511.0820 57595.3884
##      var22      var23      var24      var25      var26      var27      var28
## 10851.9152  6001.4567   317.1082  4437.2354  2004.1565  2899.3999   995.0713
##      var29      var30      var31      var32      var33      var34      var35
##   164.5188   722.6596  1183.8573 29119.6798 78352.9703 36653.1752 36139.4806
```

```
##      var36      var37      var38      var39      var40      var41      var42
## 50634.0701 77078.3877 70894.4321 76688.9918 56324.0408 50255.7950 49933.1315
##      var43      var44      var45      var46      var47      var48      var49
## 60491.6497 61218.1427 80163.9440 28505.6155 41269.4077 54162.6266 35387.8972
##      var50      var51      var52      var53      var54      var55      var56
## 63127.3506 36669.3947 79892.3252 47047.7399  8712.7153  7042.4165   335.2226
##      var57      var58      var59      var60      var61      var62      var63
##  4082.7807  2170.2260  2715.5098  1038.0427   163.2142   745.0809  1222.9936
##      var64
## 27981.7396
```

Examining sigma2, nu2, rho

```
sigma2_samples <- mcmc.list(chain1$samples$sigma2, chain2$samples$sigma2,
                            chain3$samples$sigma2)

nu2_samples <- mcmc.list(chain1$samples$nu2, chain2$samples$nu2,
                         chain3$samples$nu2)
```

```
effectiveSize(sigma2_samples)
```

```
##     var1
## 6807.264
```

```
effectiveSize(nu2_samples)
```

```
##     var1
## 9359.226
```

Examining a sample of the 3108 phi parameters

```
phi_samples <- mcmc.list(chain1$samples$phi, chain2$samples$phi, chain3$samples$phi)
```

```
set.seed(1157, kind = "Mersenne-Twister", normal.kind = "Inversion", sample.kind = "Rejection")

phi_subset_idx <- sample(1:ncol(phi_samples[[1]]), size = 10)

phi_samples_subset <- phi_samples[, phi_subset_idx]
```

```
effectiveSize(phi_samples_subset)
```

```
##      var1      var2      var3      var4      var5      var6      var7      var8
## 37139.629  4544.964  6814.498 20112.476 93352.202 39125.311 33513.256 40471.322
##      var9     var10
## 70414.953  4815.674
```

Inference

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```r
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                                50%     2.5%    97.5%
## strat0                     6.43015  6.41643  6.44387
## strat0:flood_risk_pc1     -0.01188 -0.02410  0.00042
## strat0:flood_risk_pc2      0.01155 -0.00035  0.02350
## strat0:flood_risk_pc3     -0.00119 -0.01072  0.00837
## strat0:flood_risk_pc4     -0.00696 -0.01549  0.00153
## strat0:flood_risk_pc5      0.00965  0.00096  0.01828
## strat0:EP_UNEMP            0.04977  0.03459  0.06484
## strat0:EP_PCI             -0.04939 -0.06330 -0.03546
## strat0:EP_NOHSDP           0.23419  0.20652  0.26172
## strat0:EP_AGE65            1.23085  1.21726  1.24439
## strat0:EP_AGE17            0.15967  0.14412  0.17517
## strat0:EP_DISABL           0.22490  0.20815  0.24175
## strat0:EP_SNGPNT           0.01432 -0.00135  0.02996
## strat0:EP_MINRTY          -0.17386 -0.19638 -0.15152
## strat0:EP_LIMENG          -0.02991 -0.05522 -0.00479
## strat0:EP_MUNIT           -0.05969 -0.07259 -0.04675
## strat0:EP_MOBILE           0.07831  0.06529  0.09133
## strat0:EP_CROWD            0.01423 -0.00632  0.03480
## strat0:EP_NOVEH            0.08921  0.06704  0.11136
## strat0:EP_GROUPQ          -0.09385 -0.10677 -0.08079
## strat0:EP_UNINSUR          0.13535  0.11834  0.15229
## strat0:co                 -0.11682 -0.15582 -0.07736
## strat0:no2                 0.01065 -0.04115  0.06181
## strat0:o3                 -0.14154 -0.21424 -0.07171
## strat0:pm10               -0.19892 -0.23246 -0.16640
## strat0:pm25                0.43580  0.38849  0.48542
## strat0:so2                 0.05602  0.02265  0.09008
## strat0:summer_tmmx         0.13325  0.08379  0.18664
## strat0:winter_tmmx        -0.32090 -0.48330 -0.19356
## strat0:summer_rmax         0.00287 -0.06516  0.07089
## strat0:winter_rmax         0.05328  0.00396  0.10327
## strat0:Data_Value_CSMOKING 0.70846  0.67930  0.73735
## strat1                     6.74724  6.73538  6.75898
## strat1:flood_risk_pc1     -0.00804 -0.01992  0.00387
## strat1:flood_risk_pc2      0.01057 -0.00045  0.02167
## strat1:flood_risk_pc3     -0.00928 -0.01869  0.00007
## strat1:flood_risk_pc4      0.00301 -0.00523  0.01125
## strat1:flood_risk_pc5     -0.00935 -0.01839 -0.00029
## strat1:EP_UNEMP            0.05273  0.04381  0.06166
## strat1:EP_PCI             -0.08125 -0.10574 -0.05676
## strat1:EP_NOHSDP           0.14309  0.12589  0.16024
## strat1:EP_AGE65            1.63391  1.61976  1.64814
## strat1:EP_AGE17            0.30134  0.28738  0.31548
## strat1:EP_DISABL           0.22384  0.21196  0.23575
## strat1:EP_SNGPNT          -0.05770 -0.06893 -0.04642
## strat1:EP_MINRTY           0.01397 -0.00378  0.03174
## strat1:EP_LIMENG          -0.04185 -0.05694 -0.02672
## strat1:EP_MUNIT           -0.00650 -0.01767  0.00468
## strat1:EP_MOBILE           0.05106  0.04145  0.06071
## strat1:EP_CROWD           -0.02343 -0.03516 -0.01170
## strat1:EP_NOVEH            0.20037  0.18577  0.21505
```

```
## strat1:EP_GROUPQ           -0.05302 -0.06160 -0.04446
## strat1:EP_UNINSUR           0.08836  0.07637  0.10022
## strat1:co                  -0.14902 -0.19131 -0.10701
## strat1:no2                 -0.02988 -0.08160  0.02114
## strat1:o3                  -0.15330 -0.22623 -0.08329
## strat1:pm10                -0.14935 -0.18423 -0.11588
## strat1:pm25                 0.44998  0.40284  0.49980
## strat1:so2                  0.01854 -0.01379  0.05156
## strat1:summer_tmmx          0.04619 -0.00401  0.09957
## strat1:winter_tmmx         -0.16545 -0.32808 -0.03828
## strat1:summer_rmax         -0.07350 -0.14250 -0.00573
## strat1:winter_rmax          0.04015 -0.00878  0.09025
## strat1:Data_Value_CSMOKING  1.03706  1.01664  1.05763
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/CHD_poverty
```

List of significant beta coefficients:

```
colnames(beta_samples_matrix)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                    "strat0:flood_risk_pc5"
##  [3] "strat0:EP_UNEMP"           "strat0:EP_PCI"
##  [5] "strat0:EP_NOHSDP"          "strat0:EP_AGE65"
##  [7] "strat0:EP_AGE17"           "strat0:EP_DISABL"
##  [9] "strat0:EP_MINRTY"          "strat0:EP_LIMENG"
## [11] "strat0:EP_MUNIT"           "strat0:EP_MOBILE"
## [13] "strat0:EP_NOVEH"           "strat0:EP_GROUPQ"
## [15] "strat0:EP_UNINSUR"         "strat0:co"
## [17] "strat0:o3"                 "strat0:pm10"
## [19] "strat0:pm25"               "strat0:so2"
## [21] "strat0:summer_tmmx"        "strat0:winter_tmmx"
## [23] "strat0:winter_rmax"        "strat0:Data_Value_CSMOKING"
## [25] "strat1"                    "strat1:flood_risk_pc5"
## [27] "strat1:EP_UNEMP"           "strat1:EP_PCI"
## [29] "strat1:EP_NOHSDP"          "strat1:EP_AGE65"
## [31] "strat1:EP_AGE17"           "strat1:EP_DISABL"
## [33] "strat1:EP_SNGPNT"          "strat1:EP_LIMENG"
## [35] "strat1:EP_MOBILE"          "strat1:EP_CROWD"
## [37] "strat1:EP_NOVEH"           "strat1:EP_GROUPQ"
## [39] "strat1:EP_UNINSUR"         "strat1:co"
## [41] "strat1:o3"                 "strat1:pm10"
## [43] "strat1:pm25"               "strat1:winter_tmmx"
## [45] "strat1:summer_rmax"        "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

```
# first, process the beta_inference matrix in a form ggplot can understand

beta_inference_df <- as.data.frame(beta_inference)

beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))

beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
```

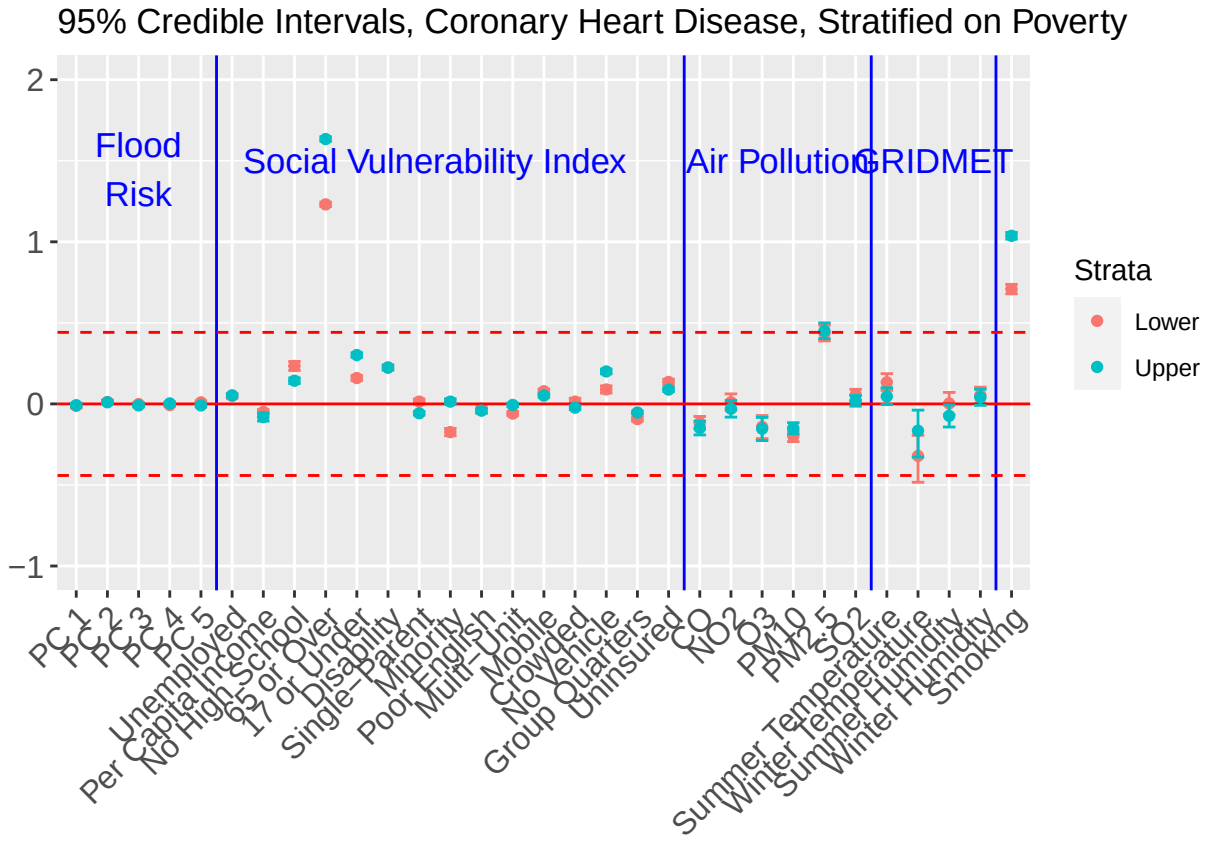
```
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)

beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))

beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-1, 2)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 20.5, 26.5, 30.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 1.45, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 12.5, y = 1.5, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 23.5, y = 1.5, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 28.5, y = 1.5, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Unemployed", "Per Capita Income", "No High School",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent", "Minority", "Poor English",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hu
                              "Smoking")) + ggtitle("95% Credible Intervals, Coronary Heart Disease, St
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_CHD, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_CHD, col = "red", linetype = "dashed")

p
```

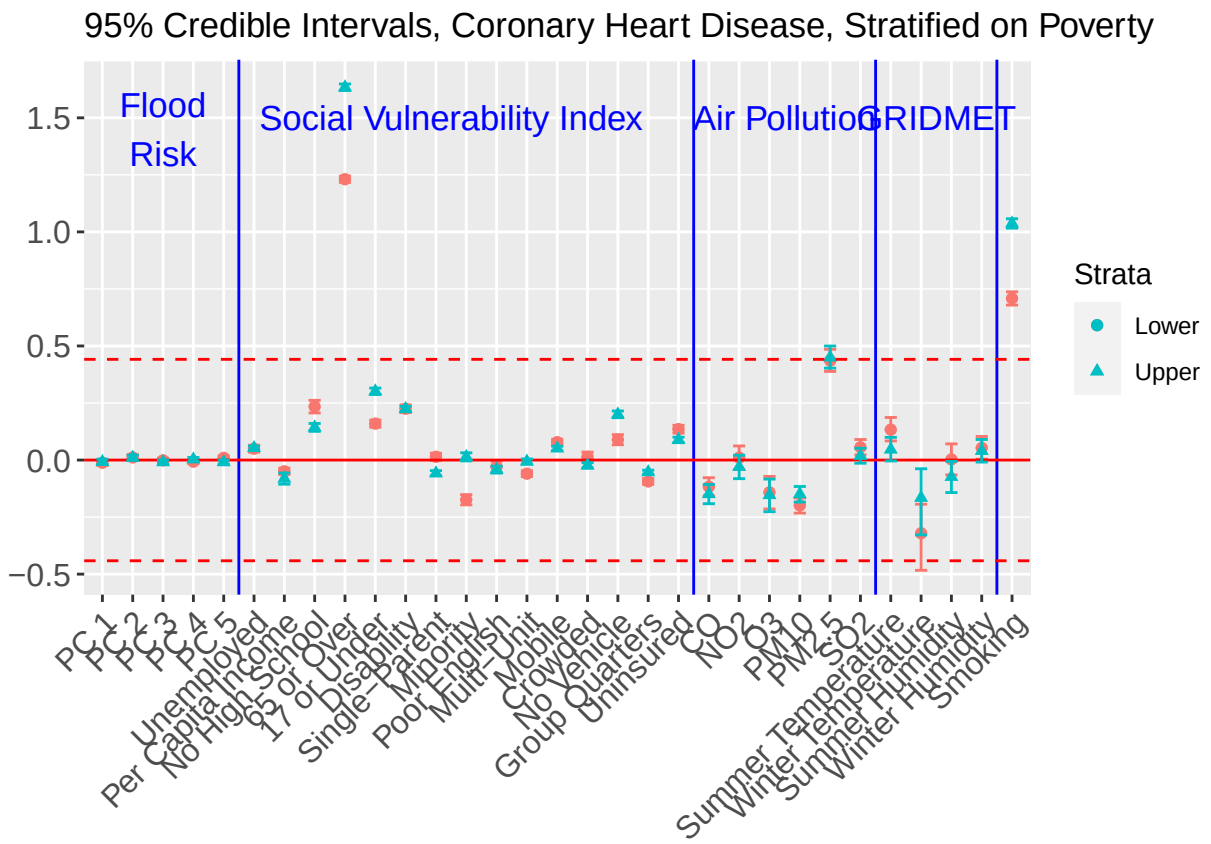



```
ggsave(here("figures/final_figures/stratified_analysis/CHD_CI_poverty.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

Below is my best attempt to use both color and shape to indicate the strata. The only problem is the legend.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat, shape = st
  geom_point() +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 20.5, 26.5, 30.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 1.45, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 12.5, y = 1.5, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 23.5, y = 1.5, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 28.5, y = 1.5, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Unemployed", "Per Capita Income", "No High School",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent", "Minority", "Poor English",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
```

```
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hu
                              "Smoking")) + ggtitle("95% Credible Intervals, Coronary Heart Disease, St
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_shape_manual(name = "Strata",
                     values = c(19, 17),
                     drop = FALSE) +
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_CHD, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_CHD, col = "red", linetype = "dashed")

p
```



CAR model results, Coronary Heart Disease Stratified on RPL_THEME1

```
load(here("modeling_files/stratified_analysis/model_stratif_rpl1.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                                50%     2.5%    97.5%
## strat0                     6.45380  6.43844  6.46922
## strat0:flood_risk_pc1     -0.01863 -0.03113 -0.00624
## strat0:flood_risk_pc2      0.00613 -0.00590  0.01822
## strat0:flood_risk_pc3     -0.00322 -0.01287  0.00643
## strat0:flood_risk_pc4     -0.00882 -0.01743 -0.00015
## strat0:flood_risk_pc5      0.00464 -0.00407  0.01323
## strat0:EP_AGE65            1.25720  1.24416  1.27020
## strat0:EP_AGE17            0.19423  0.17927  0.20925
## strat0:EP_DISABL           0.23027  0.21416  0.24639
## strat0:EP_SNGPNT           0.00341 -0.01257  0.01945
## strat0:EP_MINRTY          -0.13130 -0.15404 -0.10845
## strat0:EP_LIMENG           0.05561  0.02896  0.08220
## strat0:EP_MUNIT           -0.05139 -0.06357 -0.03922
## strat0:EP_MOBILE           0.08374  0.06905  0.09843
## strat0:EP_CROWD            0.03814  0.01431  0.06175
## strat0:EP_NOVEH            0.10980  0.08833  0.13118
## strat0:EP_GROUPQ          -0.05579 -0.06645 -0.04519
## strat0:EP_UNINSUR          0.15798  0.13989  0.17608
## strat0:co                 -0.10410 -0.14461 -0.06368
## strat0:no2                 0.00662 -0.04653  0.05977
## strat0:o3                 -0.17707 -0.24981 -0.10360
## strat0:pm10               -0.22233 -0.25631 -0.18814
## strat0:pm25                0.48796  0.43836  0.53740
## strat0:so2                 0.05779  0.02332  0.09156
## strat0:summer_tmmx         0.12288  0.07140  0.17407
## strat0:winter_tmmx        -0.31889 -0.44531 -0.18334
## strat0:summer_rmax        -0.00018 -0.06803  0.06832
## strat0:winter_rmax         0.05717  0.00627  0.10750
## strat0:Data_Value_CSMOKING 0.89868  0.87407  0.92364
## strat1                     6.68575  6.67434  6.69720
## strat1:flood_risk_pc1     -0.00679 -0.01886  0.00525
## strat1:flood_risk_pc2      0.01708  0.00584  0.02829
## strat1:flood_risk_pc3     -0.00814 -0.01782  0.00154
## strat1:flood_risk_pc4     -0.00194 -0.01028  0.00643
## strat1:flood_risk_pc5     -0.00331 -0.01249  0.00590
## strat1:EP_AGE65            1.70400  1.68911  1.71897
## strat1:EP_AGE17            0.28849  0.27420  0.30285
## strat1:EP_DISABL           0.24411  0.23206  0.25620
## strat1:EP_SNGPNT          -0.02575 -0.03681 -0.01471
## strat1:EP_MINRTY           0.06697  0.04994  0.08394
## strat1:EP_LIMENG           0.02107  0.00814  0.03397
## strat1:EP_MUNIT           -0.01385 -0.02564 -0.00203
## strat1:EP_MOBILE           0.05549  0.04609  0.06485
## strat1:EP_CROWD            0.00273 -0.00870  0.01421
## strat1:EP_NOVEH            0.21106  0.19620  0.22593
## strat1:EP_GROUPQ          -0.02987 -0.03869 -0.02103
## strat1:EP_UNINSUR          0.11249  0.10078  0.12417
## strat1:co                 -0.15559 -0.19796 -0.11350
## strat1:no2                -0.02250 -0.07522  0.02959
## strat1:o3                 -0.17648 -0.24900 -0.10308
## strat1:pm10               -0.14081 -0.17599 -0.10563
## strat1:pm25                0.49652  0.44691  0.54573
## strat1:so2                 0.02737 -0.00555  0.05965
```

```
## strat1:summer_tmmx          0.02694 -0.02574  0.07931
## strat1:winter_tmmx         -0.16019 -0.28637 -0.02482
## strat1:summer_rmax         -0.08138 -0.14907 -0.01208
## strat1:winter_rmax          0.06018  0.00935  0.11045
## strat1:Data_Value_CSMOKING  1.19445  1.17643  1.21239
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/CHD_rpl1.R
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                     "strat0:flood_risk_pc1"
##  [3] "strat0:flood_risk_pc4"      "strat0:EP_AGE65"
##  [5] "strat0:EP_AGE17"            "strat0:EP_DISABL"
##  [7] "strat0:EP_MINRTY"           "strat0:EP_LIMENG"
##  [9] "strat0:EP_MUNIT"            "strat0:EP_MOBILE"
## [11] "strat0:EP_CROWD"            "strat0:EP_NOVEH"
## [13] "strat0:EP_GROUPQ"           "strat0:EP_UNINSUR"
## [15] "strat0:co"                  "strat0:o3"
## [17] "strat0:pm10"                "strat0:pm25"
## [19] "strat0:so2"                 "strat0:summer_tmmx"
## [21] "strat0:winter_tmmx"         "strat0:winter_rmax"
## [23] "strat0:Data_Value_CSMOKING" "strat1"
## [25] "strat1:flood_risk_pc2"      "strat1:EP_AGE65"
## [27] "strat1:EP_AGE17"            "strat1:EP_DISABL"
## [29] "strat1:EP_SNGPNT"           "strat1:EP_MINRTY"
## [31] "strat1:EP_LIMENG"           "strat1:EP_MUNIT"
## [33] "strat1:EP_MOBILE"           "strat1:EP_NOVEH"
## [35] "strat1:EP_GROUPQ"           "strat1:EP_UNINSUR"
## [37] "strat1:co"                  "strat1:o3"
## [39] "strat1:pm10"                "strat1:pm25"
## [41] "strat1:winter_tmmx"         "strat1:summer_rmax"
## [43] "strat1:winter_rmax"         "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

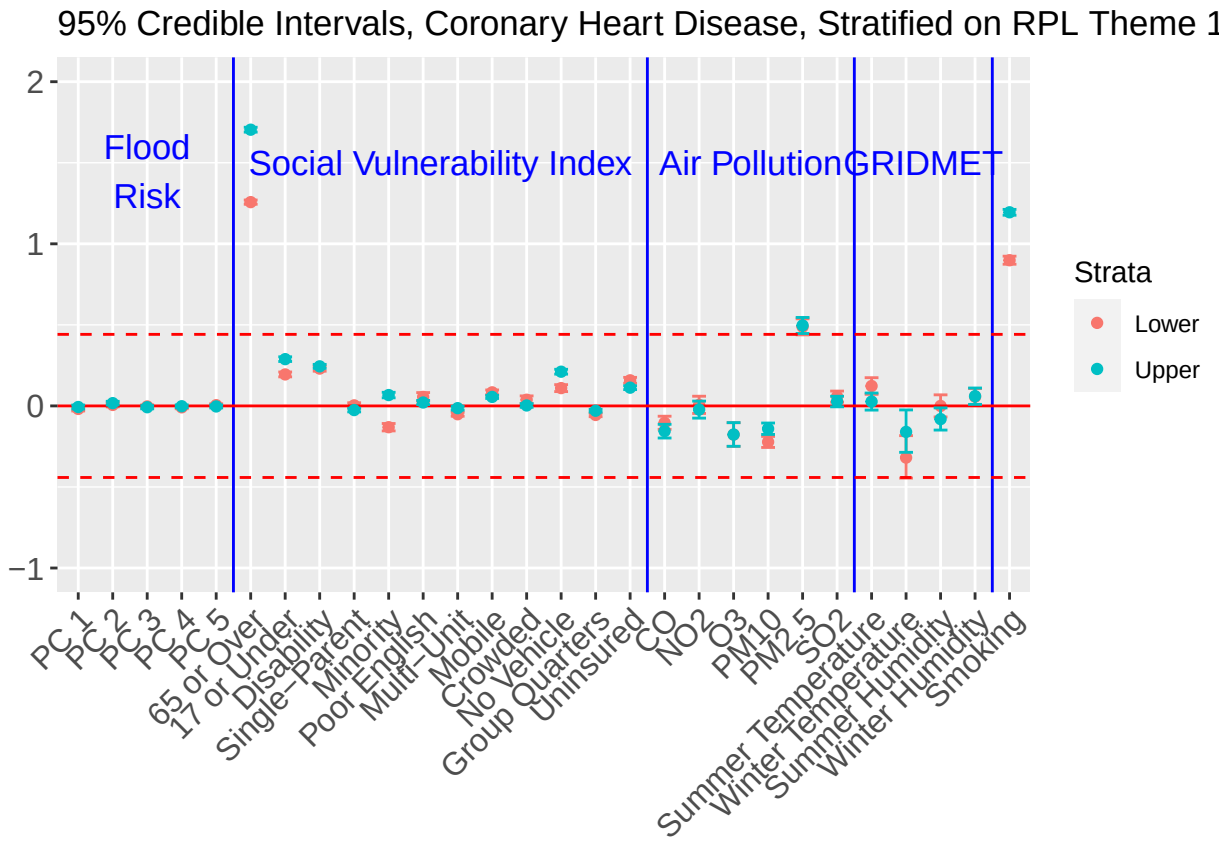
```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-1, 2)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 17.5, 23.5, 27.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 1.45, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 11.5, y = 1.5, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 20.5, y = 1.5, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 25.5, y = 1.5, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent", "Minority", "Poor English",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hum
                              "Smoking")) + ggtitle("95% Credible Intervals, Coronary Heart Disease, Str
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_CHD, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_CHD, col = "red", linetype = "dashed")
p
```




```
ggsave(here("figures/final_figures/stratified_analysis/CHD_CI_rpl1.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

CAR model results, Coronary Heart Disease Stratified on RPL_THEME2

```
load(here("modeling_files/stratified_analysis/model_stratif_rpl2.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                                50%     2.5%    97.5%
## strat0                     6.30362  6.28935  6.31795
## strat0:flood_risk_pc1     -0.04670 -0.06533 -0.02814
## strat0:flood_risk_pc2      0.04857  0.03056  0.06673
## strat0:flood_risk_pc3      0.00889 -0.00563  0.02339
## strat0:flood_risk_pc4     -0.01970 -0.03193 -0.00752
## strat0:flood_risk_pc5      0.00935 -0.00313  0.02172
## strat0:EP_POV              0.17558  0.15115  0.19987
## strat0:EP_UNEMP            0.14060  0.12145  0.15962
## strat0:EP_PCI              0.05966  0.03965  0.07990
## strat0:EP_NOHSDP           0.84891  0.81646  0.88188
## strat0:EP_MINRTY          -0.69708 -0.72769 -0.66668
```

```
## strat0:EP_LIMENG           -0.02529 -0.05308  0.00245
## strat0:EP_MUNIT            -0.07858 -0.09427 -0.06287
## strat0:EP_MOBILE            0.26818  0.24836  0.28799
## strat0:EP_CROWD            -0.25310 -0.27412 -0.23198
## strat0:EP_NOVEH             0.50564  0.47925  0.53184
## strat0:EP_GROUPQ           -0.29196 -0.30243 -0.28157
## strat0:EP_UNINSUR          -0.06960 -0.09105 -0.04806
## strat0:co                  -0.25086 -0.31421 -0.18763
## strat0:no2                 -0.00192 -0.08934  0.08356
## strat0:o3                   0.03725 -0.09935  0.17359
## strat0:pm10                -0.51735 -0.57596 -0.45855
## strat0:pm25                 0.52446  0.43967  0.60912
## strat0:so2                 -0.05967 -0.11855 -0.00197
## strat0:summer_tmmx         -0.00257 -0.09890  0.09035
## strat0:winter_tmmx         -0.26954 -0.50080  0.00062
## strat0:summer_rmax         -0.00031 -0.12620  0.12415
## strat0:winter_rmax          0.01987 -0.07330  0.11384
## strat0:Data_Value_CSMOKING -0.04664 -0.08384 -0.00923
## strat1                      7.02321  7.00835  7.03822
## strat1:flood_risk_pc1      -0.00739 -0.02668  0.01187
## strat1:flood_risk_pc2       0.05355  0.03530  0.07192
## strat1:flood_risk_pc3      -0.02088 -0.03643 -0.00538
## strat1:flood_risk_pc4      -0.00205 -0.01585  0.01175
## strat1:flood_risk_pc5       0.01961  0.00448  0.03474
## strat1:EP_POV               0.65131  0.62501  0.67750
## strat1:EP_UNEMP             0.07006  0.05512  0.08501
## strat1:EP_PCI              -0.04036 -0.07819 -0.00228
## strat1:EP_NOHSDP            0.60867  0.57951  0.63773
## strat1:EP_MINRTY           -0.54675 -0.57528 -0.51845
## strat1:EP_LIMENG           -0.17480 -0.20220 -0.14759
## strat1:EP_MUNIT             0.07301  0.05077  0.09511
## strat1:EP_MOBILE            0.20224  0.18760  0.21681
## strat1:EP_CROWD            -0.23732 -0.25786 -0.21662
## strat1:EP_NOVEH             0.54547  0.51908  0.57191
## strat1:EP_GROUPQ            0.12779  0.09953  0.15624
## strat1:EP_UNINSUR          -0.04955 -0.06947 -0.02954
## strat1:co                  -0.30408 -0.37570 -0.23293
## strat1:no2                 -0.20986 -0.30160 -0.12021
## strat1:o3                   0.06972 -0.06667  0.20598
## strat1:pm10                -0.45542 -0.51381 -0.39747
## strat1:pm25                 0.60031  0.51631  0.68384
## strat1:so2                 -0.03708 -0.09435  0.01999
## strat1:summer_tmmx          0.01420 -0.08305  0.10792
## strat1:winter_tmmx         -0.30295 -0.53571 -0.03361
## strat1:summer_rmax          0.02434 -0.10161  0.14916
## strat1:winter_rmax          0.03331 -0.05959  0.12658
## strat1:Data_Value_CSMOKING -0.21477 -0.25115 -0.17865
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/CHD_rpl2.RD
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                    "strat0:flood_risk_pc1"
```

```
##  [3] "strat0:flood_risk_pc2"      "strat0:flood_risk_pc4"
##  [5] "strat0:EP_POV"              "strat0:EP_UNEMP"
##  [7] "strat0:EP_PCI"              "strat0:EP_NOHSDP"
##  [9] "strat0:EP_MINRTY"           "strat0:EP_MUNIT"
## [11] "strat0:EP_MOBILE"           "strat0:EP_CROWD"
## [13] "strat0:EP_NOVEH"            "strat0:EP_GROUPQ"
## [15] "strat0:EP_UNINSUR"          "strat0:co"
## [17] "strat0:pm10"                "strat0:pm25"
## [19] "strat0:so2"                 "strat0:Data_Value_CSMOKING"
## [21] "strat1"                     "strat1:flood_risk_pc2"
## [23] "strat1:flood_risk_pc3"      "strat1:flood_risk_pc5"
## [25] "strat1:EP_POV"              "strat1:EP_UNEMP"
## [27] "strat1:EP_PCI"              "strat1:EP_NOHSDP"
## [29] "strat1:EP_MINRTY"           "strat1:EP_LIMENG"
## [31] "strat1:EP_MUNIT"            "strat1:EP_MOBILE"
## [33] "strat1:EP_CROWD"            "strat1:EP_NOVEH"
## [35] "strat1:EP_GROUPQ"           "strat1:EP_UNINSUR"
## [37] "strat1:co"                  "strat1:no2"
## [39] "strat1:pm10"                "strat1:pm25"
## [41] "strat1:winter_tmmx"         "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

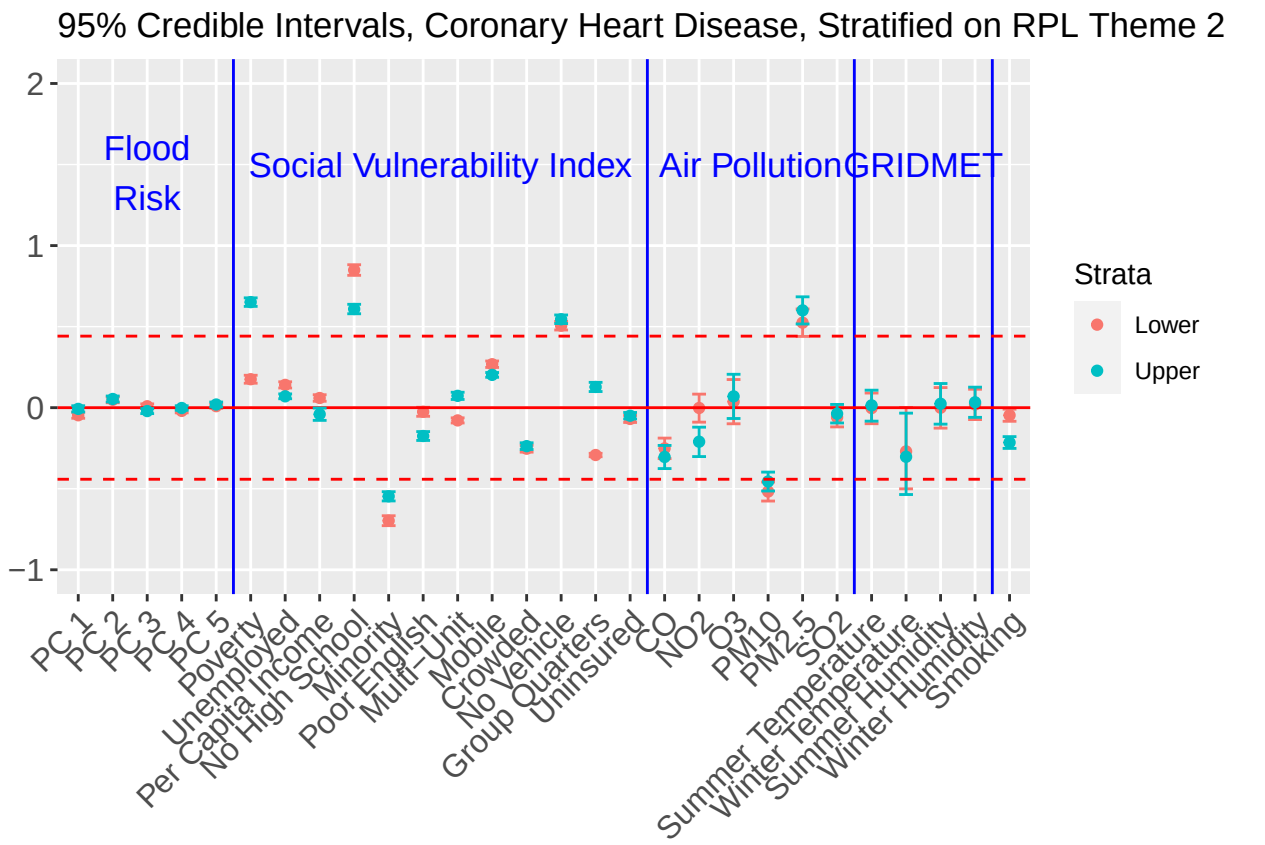
Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-1, 2)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 17.5, 23.5, 27.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 1.45, label = "Flood\nRisk",
```

```
          col = "blue", size = 4.5) +
  annotate(geom = "text", x = 11.5, y = 1.5, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 20.5, y = 1.5, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 25.5, y = 1.5, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Poverty", "Unemployed", "Per Capita Income", "No High School",
                              "Minority", "Poor English",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hu
                              "Smoking")) + ggtitle("95% Credible Intervals, Coronary Heart Disease, St
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_CHD, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_CHD, col = "red", linetype = "dashed")

p
```




```
ggsave(here("figures/final_figures/stratified_analysis/CHD_CI_rpl2.pdf"),
       plot = p, device = "pdf",
```

```
       width = 8, height = 6, units = "in")
```

CAR model results, Coronary Heart Disease Stratified on RPL_THEME3

Inference is based on 3 markov chains, each of which has been run for 110000 samples, the first 10000 of which has been removed for burn-in. The remaining 100000 samples are thinned by 2, resulting in 150000 samples for inference across the 3 Markov chains.

```
load(here("modeling_files/stratified_analysis/model_stratif_rpl3.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                                50%     2.5%    97.5%
## strat0                     6.76368  6.74633  6.78100
## strat0:flood_risk_pc1     -0.02286 -0.03570 -0.01002
## strat0:flood_risk_pc2      0.00487 -0.00733  0.01704
## strat0:flood_risk_pc3     -0.01789 -0.02790 -0.00795
## strat0:flood_risk_pc4     -0.01120 -0.02123 -0.00113
## strat0:flood_risk_pc5      0.01422  0.00394  0.02464
## strat0:EP_POV              0.31133  0.29359  0.32901
## strat0:EP_UNEMP            0.03742  0.02531  0.04945
## strat0:EP_PCI             -0.02884 -0.04299 -0.01475
## strat0:EP_NOHSDP           0.27364  0.24708  0.30017
## strat0:EP_AGE65            1.30320  1.29050  1.31586
## strat0:EP_AGE17            0.29621  0.28138  0.31094
## strat0:EP_DISABL           0.26674  0.25265  0.28082
## strat0:EP_SNGPNT          -0.01703 -0.03145 -0.00260
## strat0:EP_MUNIT           -0.05665 -0.07236 -0.04098
## strat0:EP_MOBILE           0.06432  0.05327  0.07543
## strat0:EP_CROWD           -0.00725 -0.03156  0.01686
## strat0:EP_NOVEH            0.13591  0.11512  0.15675
## strat0:EP_GROUPQ          -0.12837 -0.13855 -0.11831
## strat0:EP_UNINSUR          0.10750  0.09100  0.12393
## strat0:co                 -0.11763 -0.15895 -0.07609
## strat0:no2                -0.05594 -0.11066 -0.00118
## strat0:o3                 -0.15568 -0.22675 -0.07499
## strat0:pm10               -0.14745 -0.18174 -0.11336
## strat0:pm25                0.38729  0.33628  0.43730
## strat0:so2                 0.03923  0.00444  0.07382
## strat0:summer_tmmx         0.07925  0.02698  0.13080
## strat0:winter_tmmx        -0.28467 -0.41590 -0.15917
## strat0:summer_rmax        -0.01866 -0.08852  0.04774
## strat0:winter_rmax         0.07162  0.01932  0.12317
## strat0:Data_Value_CSMOKING 0.69031  0.66264  0.71785
## strat1                     6.70270  6.69167  6.71379
## strat1:flood_risk_pc1     -0.01071 -0.02290  0.00152
## strat1:flood_risk_pc2      0.01521  0.00386  0.02652
## strat1:flood_risk_pc3      0.00130 -0.00826  0.01084
## strat1:flood_risk_pc4     -0.00141 -0.00891  0.00599
## strat1:flood_risk_pc5     -0.00833 -0.01633 -0.00027
```

```
## strat1:EP_POV               0.32609  0.31094  0.34130
## strat1:EP_UNEMP             0.02953  0.01974  0.03935
## strat1:EP_PCI              -0.03719 -0.05413 -0.02023
## strat1:EP_NOHSDP            0.12991  0.11492  0.14493
## strat1:EP_AGE65             1.55204  1.53748  1.56673
## strat1:EP_AGE17             0.24300  0.22901  0.25709
## strat1:EP_DISABL            0.24636  0.23307  0.25960
## strat1:EP_SNGPNT           -0.06429 -0.07555 -0.05303
## strat1:EP_MUNIT            -0.06165 -0.07203 -0.05126
## strat1:EP_MOBILE            0.09251  0.08196  0.10309
## strat1:EP_CROWD            -0.02683 -0.03830 -0.01534
## strat1:EP_NOVEH             0.09332  0.07774  0.10891
## strat1:EP_GROUPQ           -0.06692 -0.07648 -0.05734
## strat1:EP_UNINSUR           0.08781  0.07564  0.09999
## strat1:co                  -0.11864 -0.16218 -0.07553
## strat1:no2                 -0.05537 -0.10848 -0.00257
## strat1:o3                  -0.15690 -0.22825 -0.07547
## strat1:pm10                -0.16979 -0.20605 -0.13317
## strat1:pm25                 0.44143  0.38996  0.49191
## strat1:so2                  0.02648 -0.01064  0.06287
## strat1:summer_tmmx          0.04731 -0.00608  0.10006
## strat1:winter_tmmx         -0.21172 -0.34311 -0.08687
## strat1:summer_rmax         -0.07724 -0.14746 -0.01054
## strat1:winter_rmax          0.03934 -0.01340  0.09143
## strat1:Data_Value_CSMOKING  0.84724  0.82384  0.87063
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/CHD_rpl3.R
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                    "strat0:flood_risk_pc1"
##  [3] "strat0:flood_risk_pc3"     "strat0:flood_risk_pc4"
##  [5] "strat0:flood_risk_pc5"     "strat0:EP_POV"
##  [7] "strat0:EP_UNEMP"           "strat0:EP_PCI"
##  [9] "strat0:EP_NOHSDP"          "strat0:EP_AGE65"
## [11] "strat0:EP_AGE17"           "strat0:EP_DISABL"
## [13] "strat0:EP_SNGPNT"          "strat0:EP_MUNIT"
## [15] "strat0:EP_MOBILE"          "strat0:EP_NOVEH"
## [17] "strat0:EP_GROUPQ"          "strat0:EP_UNINSUR"
## [19] "strat0:co"                 "strat0:no2"
## [21] "strat0:o3"                 "strat0:pm10"
## [23] "strat0:pm25"               "strat0:so2"
## [25] "strat0:summer_tmmx"        "strat0:winter_tmmx"
## [27] "strat0:winter_rmax"        "strat0:Data_Value_CSMOKING"
## [29] "strat1"                    "strat1:flood_risk_pc2"
## [31] "strat1:flood_risk_pc5"     "strat1:EP_POV"
## [33] "strat1:EP_UNEMP"           "strat1:EP_PCI"
## [35] "strat1:EP_NOHSDP"          "strat1:EP_AGE65"
## [37] "strat1:EP_AGE17"           "strat1:EP_DISABL"
## [39] "strat1:EP_SNGPNT"          "strat1:EP_MUNIT"
## [41] "strat1:EP_MOBILE"          "strat1:EP_CROWD"
## [43] "strat1:EP_NOVEH"           "strat1:EP_GROUPQ"
## [45] "strat1:EP_UNINSUR"         "strat1:co"
```

```
## [47] "strat1:no2"                 "strat1:o3"
## [49] "strat1:pm10"                "strat1:pm25"
## [51] "strat1:winter_tmmx"         "strat1:summer_rmax"
## [53] "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

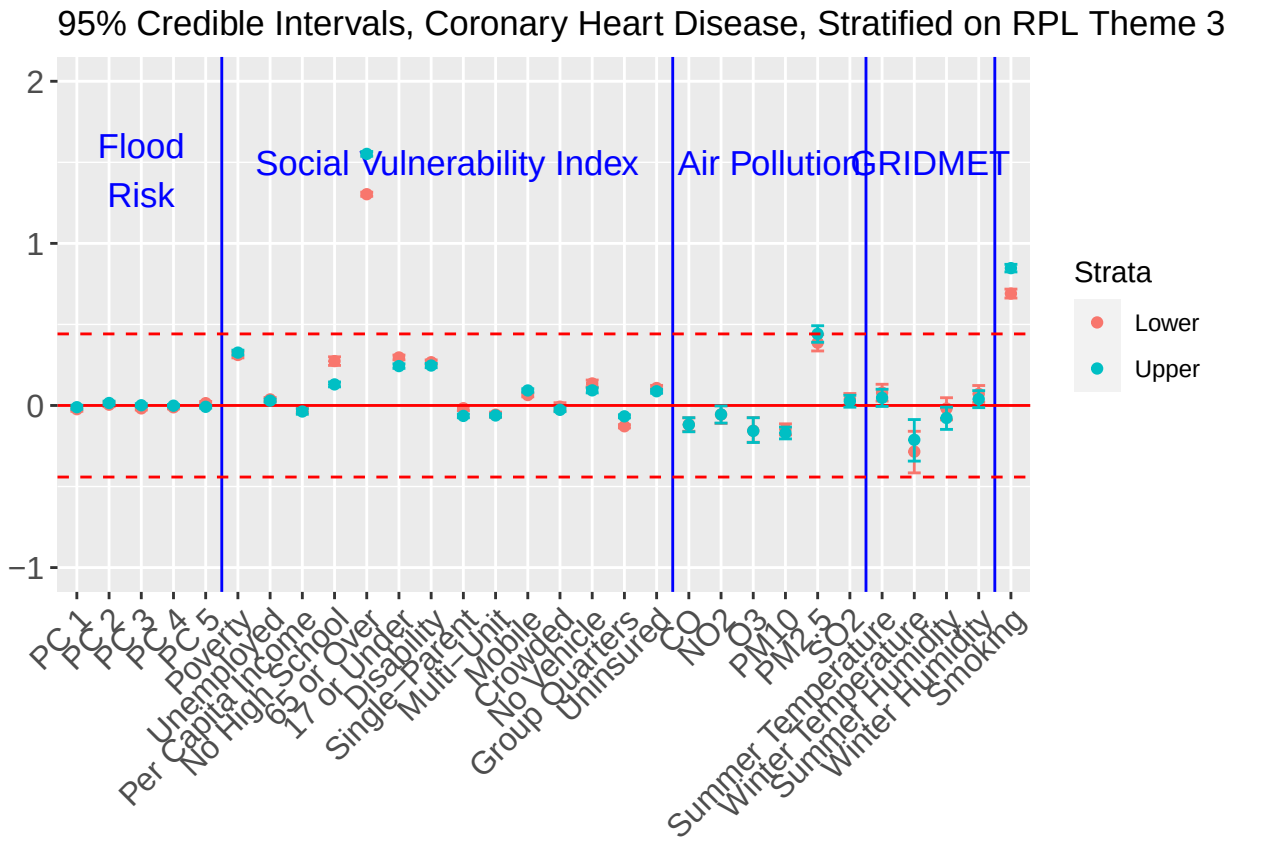
Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-1, 2)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 19.5, 25.5, 29.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 1.45, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 12.5, y = 1.5, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 22.5, y = 1.5, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 27.5, y = 1.5, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Poverty", "Unemployed", "Per Capita Income", "No High School",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hu
                              "Smoking")) + ggtitle("95% Credible Intervals, Coronary Heart Disease, St
```

```
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_CHD, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_CHD, col = "red", linetype = "dashed")

p
```




```
ggsave(here("figures/final_figures/stratified_analysis/CHD_CI_rpl3.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

CAR model results, Coronary Heart Disease Stratified on RPL_THEME4

Inference is based on 3 markov chains, each of which has been run for 110000 samples, the first 10000 of which has been removed for burn-in. The remaining 100000 samples are thinned by 2, resulting in 150000 samples for inference across the 3 Markov chains.

```
load(here("modeling_files/stratified_analysis/model_stratif_rpl4.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                                50%     2.5%    97.5%
## strat0                     6.63756  6.62885  6.64618
## strat0:flood_risk_pc1     -0.01734 -0.02936 -0.00533
## strat0:flood_risk_pc2     -0.00419 -0.01591  0.00754
## strat0:flood_risk_pc3     -0.01052 -0.01996 -0.00107
## strat0:flood_risk_pc4     -0.00709 -0.01587  0.00176
## strat0:flood_risk_pc5      0.00623 -0.00314  0.01564
## strat0:EP_POV              0.35396  0.33556  0.37248
## strat0:EP_UNEMP            0.02849  0.01679  0.04025
## strat0:EP_PCI              0.00119 -0.01263  0.01505
## strat0:EP_NOHSDP           0.25514  0.23308  0.27748
## strat0:EP_AGE65            1.31750  1.30524  1.32972
## strat0:EP_AGE17            0.28548  0.27298  0.29794
## strat0:EP_DISABL           0.24542  0.23122  0.25960
## strat0:EP_SNGPNT          -0.05507 -0.06856 -0.04147
## strat0:EP_MINRTY          -0.11454 -0.13357 -0.09549
## strat0:EP_LIMENG          -0.10933 -0.13211 -0.08666
## strat0:EP_UNINSUR          0.14968  0.13453  0.16487
## strat0:co                 -0.13752 -0.18084 -0.09447
## strat0:no2                -0.01961 -0.07353  0.03417
## strat0:o3                 -0.18411 -0.25445 -0.11063
## strat0:pm10               -0.18376 -0.21745 -0.15027
## strat0:pm25                0.39252  0.34464  0.44135
## strat0:so2                 0.04537  0.01123  0.07893
## strat0:summer_tmmx         0.11524  0.06181  0.16654
## strat0:winter_tmmx        -0.27489 -0.40105 -0.12420
## strat0:summer_rmax        -0.02991 -0.09386  0.03711
## strat0:winter_rmax         0.06157  0.00982  0.11067
## strat0:Data_Value_CSMOKING 0.76798  0.74223  0.79389
## strat1                     6.69215  6.68390  6.70045
## strat1:flood_risk_pc1     -0.00255 -0.01448  0.00929
## strat1:flood_risk_pc2      0.01305  0.00192  0.02413
## strat1:flood_risk_pc3     -0.00793 -0.01734  0.00147
## strat1:flood_risk_pc4     -0.00115 -0.00913  0.00689
## strat1:flood_risk_pc5     -0.00505 -0.01349  0.00341
## strat1:EP_POV              0.27547  0.26197  0.28894
## strat1:EP_UNEMP            0.02954  0.01938  0.03966
## strat1:EP_PCI             -0.02066 -0.03803 -0.00322
## strat1:EP_NOHSDP           0.12799  0.11039  0.14557
## strat1:EP_AGE65            1.58111  1.56789  1.59437
## strat1:EP_AGE17            0.36864  0.35658  0.38068
## strat1:EP_DISABL           0.29334  0.28075  0.30595
## strat1:EP_SNGPNT          -0.08492 -0.09694 -0.07290
## strat1:EP_MINRTY          -0.00039 -0.01875  0.01796
## strat1:EP_LIMENG          -0.03893 -0.05406 -0.02377
## strat1:EP_UNINSUR          0.10886  0.09677  0.12098
## strat1:co                 -0.13772 -0.17604 -0.09950
## strat1:no2                -0.06922 -0.11931 -0.01939
## strat1:o3                 -0.20721 -0.27772 -0.13401
## strat1:pm10               -0.13618 -0.17095 -0.10200
## strat1:pm25                0.40016  0.35282  0.44843
## strat1:so2                 0.04973  0.01651  0.08259
```

```
## strat1:summer_tmmx          0.08046  0.02776  0.13048
## strat1:winter_tmmx         -0.20911 -0.33444 -0.05870
## strat1:summer_rmax         -0.06329 -0.12683  0.00369
## strat1:winter_rmax          0.05038 -0.00059  0.09917
## strat1:Data_Value_CSMOKING  0.92131  0.89879  0.94398
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/CHD_rpl4.R
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                    "strat0:flood_risk_pc1"
##  [3] "strat0:flood_risk_pc3"     "strat0:EP_POV"
##  [5] "strat0:EP_UNEMP"           "strat0:EP_NOHSDP"
##  [7] "strat0:EP_AGE65"           "strat0:EP_AGE17"
##  [9] "strat0:EP_DISABL"          "strat0:EP_SNGPNT"
## [11] "strat0:EP_MINRTY"          "strat0:EP_LIMENG"
## [13] "strat0:EP_UNINSUR"         "strat0:co"
## [15] "strat0:o3"                 "strat0:pm10"
## [17] "strat0:pm25"               "strat0:so2"
## [19] "strat0:summer_tmmx"        "strat0:winter_tmmx"
## [21] "strat0:winter_rmax"        "strat0:Data_Value_CSMOKING"
## [23] "strat1"                    "strat1:flood_risk_pc2"
## [25] "strat1:EP_POV"             "strat1:EP_UNEMP"
## [27] "strat1:EP_PCI"             "strat1:EP_NOHSDP"
## [29] "strat1:EP_AGE65"           "strat1:EP_AGE17"
## [31] "strat1:EP_DISABL"          "strat1:EP_SNGPNT"
## [33] "strat1:EP_LIMENG"          "strat1:EP_UNINSUR"
## [35] "strat1:co"                 "strat1:no2"
## [37] "strat1:o3"                 "strat1:pm10"
## [39] "strat1:pm25"               "strat1:so2"
## [41] "strat1:summer_tmmx"        "strat1:winter_tmmx"
## [43] "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

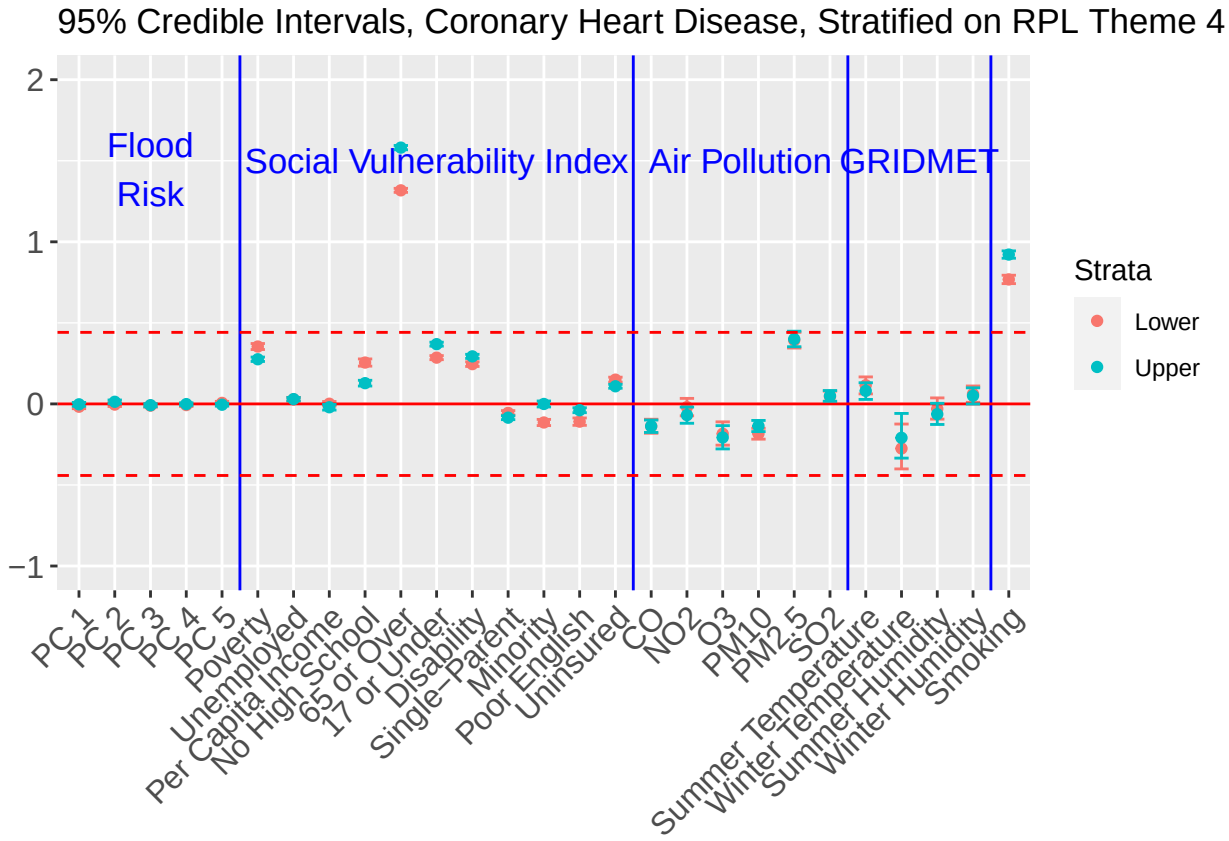
```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-1, 2)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 16.5, 22.5, 26.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 1.45, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 11, y = 1.5, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 19.5, y = 1.5, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 24.5, y = 1.5, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Poverty", "Unemployed", "Per Capita Income", "No High School",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent",
                              "Minority", "Poor English",
                              "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hum
                              "Smoking")) + ggtitle("95% Credible Intervals, Coronary Heart Disease, Str
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_CHD, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_CHD, col = "red", linetype = "dashed")

p
```




```
ggsave(here("figures/final_figures/stratified_analysis/CHD_CI_rpl4.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

CAR model results, Coronary Heart Disease Stratified on RPL_THEMES

Inference is based on 3 markov chains, each of which has been run for 110000 samples, the first 10000 of which has been removed for burn-in. The remaining 100000 samples are thinned by 2, resulting in 150000 samples for inference across the 3 Markov chains.

```
load(here("modeling_files/stratified_analysis/model_stratif_rpls.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                                50%     2.5%    97.5%
## strat0                     6.22942  6.20980  6.24888
## strat0:flood_risk_pc1     -0.05150 -0.07330 -0.02964
## strat0:flood_risk_pc2      0.08437  0.06277  0.10616
## strat0:flood_risk_pc3     -0.00013 -0.01721  0.01706
## strat0:flood_risk_pc4     -0.02722 -0.04278 -0.01168
## strat0:flood_risk_pc5      0.00861 -0.00718  0.02436
## strat0:EP_UNINSUR         -0.01060 -0.03904  0.01801
## strat0:co                 -0.30540 -0.38024 -0.23078
```

```
## strat0:no2                 -0.35681 -0.45306 -0.25791
## strat0:o3                  -0.40993 -0.57233 -0.26159
## strat0:pm10                -0.68930 -0.75704 -0.62223
## strat0:pm25                 0.80430  0.70770  0.90179
## strat0:so2                  0.03169 -0.03389  0.10022
## strat0:summer_tmmx          0.08295 -0.03005  0.20234
## strat0:winter_tmmx         -0.48075 -0.82517 -0.14383
## strat0:summer_rmax         -0.02092 -0.15872  0.12196
## strat0:winter_rmax          0.12833  0.02430  0.23121
## strat0:Data_Value_CSMOKING  0.36543  0.33348  0.39743
## strat1                      6.86184  6.84495  6.87864
## strat1:flood_risk_pc1      -0.04456 -0.06609 -0.02311
## strat1:flood_risk_pc2       0.04608  0.02567  0.06650
## strat1:flood_risk_pc3       0.00312 -0.01429  0.02026
## strat1:flood_risk_pc4      -0.01029 -0.02488  0.00415
## strat1:flood_risk_pc5      -0.00157 -0.01750  0.01437
## strat1:EP_UNINSUR          -0.13840 -0.15702 -0.11962
## strat1:co                  -0.49009 -0.56989 -0.41012
## strat1:no2                 -0.04782 -0.14579  0.05136
## strat1:o3                  -0.52018 -0.68290 -0.37046
## strat1:pm10                -0.62776 -0.69821 -0.55823
## strat1:pm25                 0.80908  0.71154  0.90626
## strat1:so2                  0.03672 -0.02803  0.10379
## strat1:summer_tmmx          0.00410 -0.10973  0.12446
## strat1:winter_tmmx         -0.27054 -0.61260  0.06424
## strat1:summer_rmax         -0.08160 -0.22012  0.06233
## strat1:winter_rmax          0.10486  0.00054  0.20762
## strat1:Data_Value_CSMOKING  0.86630  0.84256  0.89003
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/CHD_rpls.R
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                    "strat0:flood_risk_pc1"
##  [3] "strat0:flood_risk_pc2"     "strat0:flood_risk_pc4"
##  [5] "strat0:co"                 "strat0:no2"
##  [7] "strat0:o3"                 "strat0:pm10"
##  [9] "strat0:pm25"               "strat0:winter_tmmx"
## [11] "strat0:winter_rmax"        "strat0:Data_Value_CSMOKING"
## [13] "strat1"                    "strat1:flood_risk_pc1"
## [15] "strat1:flood_risk_pc2"     "strat1:EP_UNINSUR"
## [17] "strat1:co"                 "strat1:o3"
## [19] "strat1:pm10"               "strat1:pm25"
## [21] "strat1:winter_rmax"        "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
```

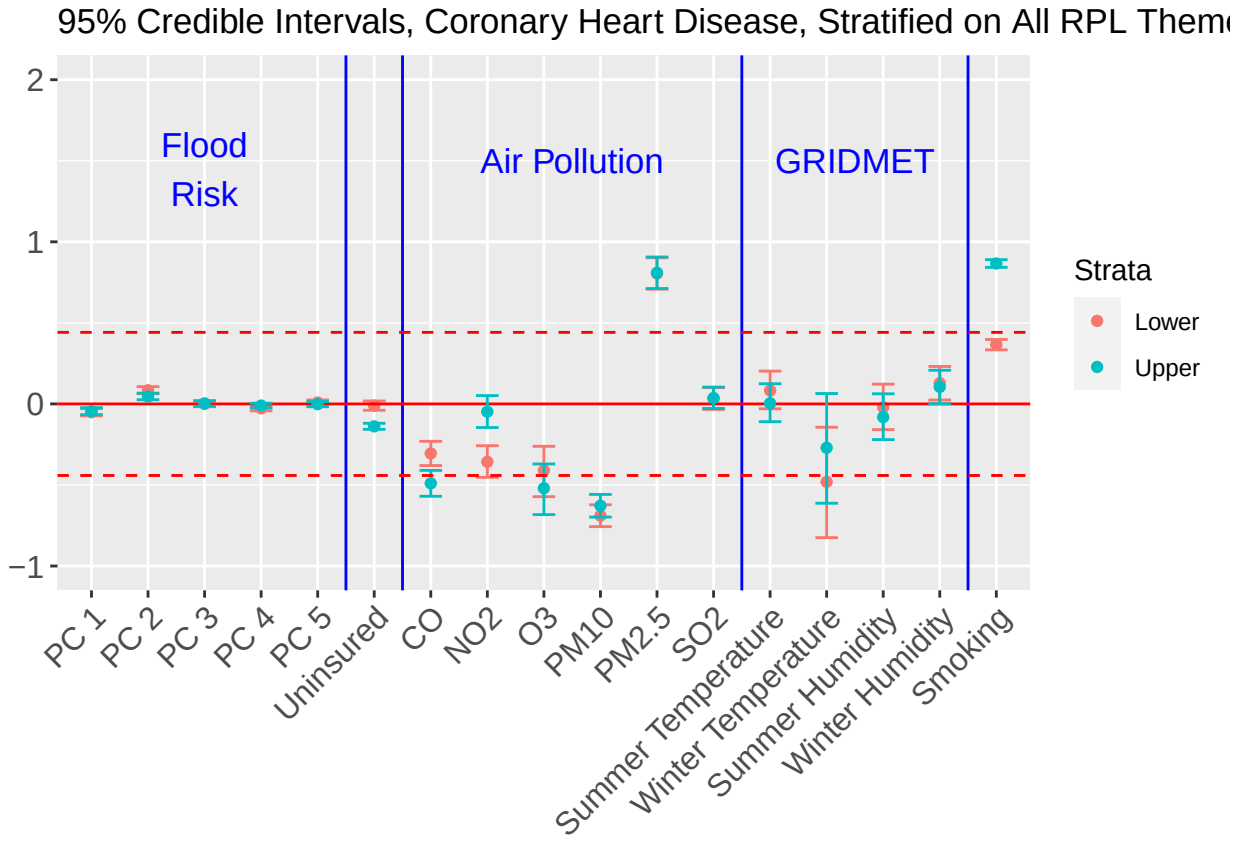
```
                              post_2.5 = `2.5%`,
                              post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-1, 2)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 6.5, 12.5, 16.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 1.45, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 9.5, y = 1.5, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 14.5, y = 1.5, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hu
                              "Smoking")) + ggtitle("95% Credible Intervals, Coronary Heart Disease, St
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_CHD, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_CHD, col = "red", linetype = "dashed")

p
```




```
ggsave(here("figures/final_figures/stratified_analysis/CHD_CI_rpls.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

BPHIGH Stratified Analysis

Repeating the stratified analysis in the last section, this time just doing the plots

Stratified on Poverty

```
load(here("modeling_files/stratified_analysis/model_stratif_poverty_BPHIGH.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                               50%     2.5%    97.5%
## strat0                    31.80871 31.76607 31.85117
## strat0:flood_risk_pc1     -0.03591 -0.07487  0.00342
## strat0:flood_risk_pc2     -0.03172 -0.07001  0.00680
## strat0:flood_risk_pc3     -0.03262 -0.06308 -0.00210
## strat0:flood_risk_pc4     -0.01151 -0.03837  0.01529
## strat0:flood_risk_pc5      0.01573 -0.01166  0.04303
```

```
## strat0:EP_UNEMP             0.10382  0.05656  0.15057
## strat0:EP_PCI               0.11042  0.06585  0.15518
## strat0:EP_NOHSDP            0.26377  0.17674  0.35016
## strat0:EP_AGE65             3.69043  3.64732  3.73345
## strat0:EP_AGE17             0.26837  0.21915  0.31748
## strat0:EP_DISABL            0.64679  0.59469  0.69944
## strat0:EP_SNGPNT            0.05379  0.00484  0.10265
## strat0:EP_MINRTY            1.79003  1.71733  1.86212
## strat0:EP_LIMENG           -0.84961 -0.92880 -0.77079
## strat0:EP_MUNIT            -0.70157 -0.74226 -0.66065
## strat0:EP_MOBILE            0.18622  0.14515  0.22695
## strat0:EP_CROWD            -0.01388 -0.07799  0.05041
## strat0:EP_NOVEH             0.24756  0.17690  0.31785
## strat0:EP_GROUPQ           -0.71962 -0.76051 -0.67851
## strat0:EP_UNINSUR           0.38136  0.32781  0.43452
## strat0:co                  -0.51529 -0.64455 -0.38513
## strat0:no2                 -0.60938 -0.78446 -0.43708
## strat0:o3                  -0.47146 -0.73369 -0.20997
## strat0:pm10                -0.51138 -0.62640 -0.39942
## strat0:pm25                 1.06420  0.90301  1.23530
## strat0:so2                  0.16106  0.04559  0.27880
## strat0:summer_tmmx          0.28738  0.10880  0.48100
## strat0:winter_tmmx         -0.91288 -1.50604 -0.44580
## strat0:summer_rmax         -0.15589 -0.40369  0.09495
## strat0:winter_rmax          0.24259  0.06259  0.42464
## strat0:Data_Value_CSMOKING  1.83475  1.74142  1.92689
## strat1                     32.31728 32.28099 32.35335
## strat1:flood_risk_pc1      -0.08504 -0.12323 -0.04703
## strat1:flood_risk_pc2      -0.01599 -0.05176  0.02002
## strat1:flood_risk_pc3      -0.06053 -0.09054 -0.03070
## strat1:flood_risk_pc4       0.02305 -0.00306  0.04907
## strat1:flood_risk_pc5       0.00090 -0.02744  0.02944
## strat1:EP_UNEMP             0.09294  0.06485  0.12118
## strat1:EP_PCI               0.43333  0.35579  0.51030
## strat1:EP_NOHSDP           -0.14106 -0.19582 -0.08659
## strat1:EP_AGE65             4.42935  4.38438  4.47463
## strat1:EP_AGE17             0.72167  0.67750  0.76639
## strat1:EP_DISABL            0.75859  0.72107  0.79636
## strat1:EP_SNGPNT           -0.10801 -0.14330 -0.07262
## strat1:EP_MINRTY            3.08860  3.03034  3.14700
## strat1:EP_LIMENG           -0.88075 -0.92917 -0.83210
## strat1:EP_MUNIT            -0.50317 -0.53865 -0.46758
## strat1:EP_MOBILE            0.11425  0.08369  0.14468
## strat1:EP_CROWD            -0.14399 -0.18107 -0.10684
## strat1:EP_NOVEH             0.57384  0.52723  0.62060
## strat1:EP_GROUPQ           -0.49433 -0.52126 -0.46738
## strat1:EP_UNINSUR           0.19698  0.15888  0.23455
## strat1:co                  -0.80828 -0.94976 -0.66705
## strat1:no2                 -0.55664 -0.73282 -0.38381
## strat1:o3                  -0.54812 -0.81033 -0.28565
## strat1:pm10                -0.46687 -0.58642 -0.35211
## strat1:pm25                 1.30205  1.14052  1.47320
## strat1:so2                 -0.02254 -0.13590  0.09285
## strat1:summer_tmmx          0.02235 -0.15906  0.21608
```

```
## strat1:winter_tmmx         -0.48365 -1.07709 -0.01721
## strat1:summer_rmax         -0.29043 -0.54049 -0.03963
## strat1:winter_rmax          0.13023 -0.04814  0.31267
## strat1:Data_Value_CSMOKING  2.74856  2.68281  2.81470
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/BPHIGH_pov
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                     "strat0:flood_risk_pc3"
##  [3] "strat0:EP_UNEMP"            "strat0:EP_PCI"
##  [5] "strat0:EP_NOHSDP"           "strat0:EP_AGE65"
##  [7] "strat0:EP_AGE17"            "strat0:EP_DISABL"
##  [9] "strat0:EP_SNGPNT"           "strat0:EP_MINRTY"
## [11] "strat0:EP_LIMENG"           "strat0:EP_MUNIT"
## [13] "strat0:EP_MOBILE"           "strat0:EP_NOVEH"
## [15] "strat0:EP_GROUPQ"           "strat0:EP_UNINSUR"
## [17] "strat0:co"                  "strat0:no2"
## [19] "strat0:o3"                  "strat0:pm10"
## [21] "strat0:pm25"                "strat0:so2"
## [23] "strat0:summer_tmmx"         "strat0:winter_tmmx"
## [25] "strat0:winter_rmax"         "strat0:Data_Value_CSMOKING"
## [27] "strat1"                     "strat1:flood_risk_pc1"
## [29] "strat1:flood_risk_pc3"      "strat1:EP_UNEMP"
## [31] "strat1:EP_PCI"              "strat1:EP_NOHSDP"
## [33] "strat1:EP_AGE65"            "strat1:EP_AGE17"
## [35] "strat1:EP_DISABL"           "strat1:EP_SNGPNT"
## [37] "strat1:EP_MINRTY"           "strat1:EP_LIMENG"
## [39] "strat1:EP_MUNIT"            "strat1:EP_MOBILE"
## [41] "strat1:EP_CROWD"            "strat1:EP_NOVEH"
## [43] "strat1:EP_GROUPQ"           "strat1:EP_UNINSUR"
## [45] "strat1:co"                  "strat1:no2"
## [47] "strat1:o3"                  "strat1:pm10"
## [49] "strat1:pm25"                "strat1:winter_tmmx"
## [51] "strat1:summer_rmax"         "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

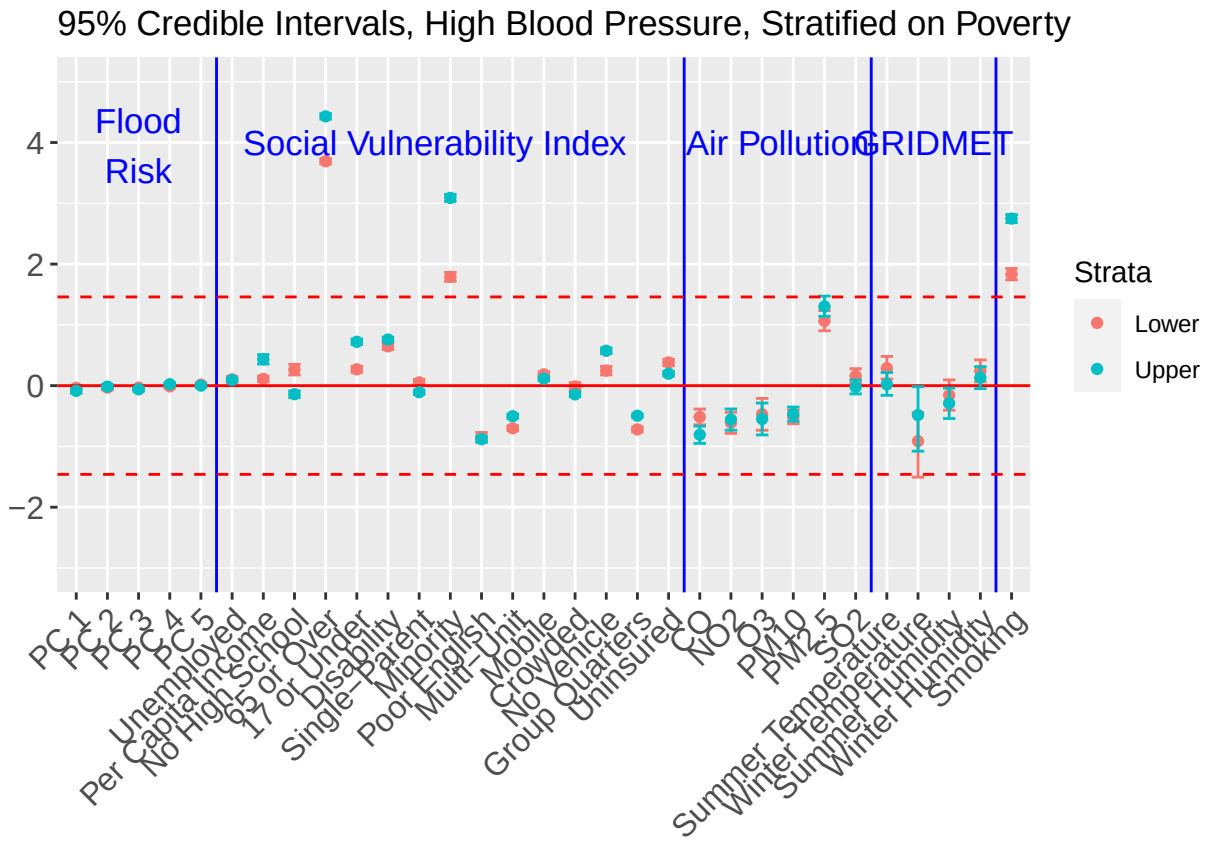
```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

Splitting up the beta coefficients for each strata

```r
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```r
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-3, 5)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 20.5, 26.5, 30.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 3.95, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 12.5, y = 4, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 23.5, y = 4, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 28.5, y = 4, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Unemployed", "Per Capita Income", "No High School",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent", "Minority", "Poor English",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hu
                              "Smoking")) + ggtitle("95% Credible Intervals, High Blood Pressure, Strati
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_BPHIGH, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_BPHIGH, col = "red", linetype = "dashed")

p
```




```
ggsave(here("figures/final_figures/stratified_analysis/BPHIGH_CI_poverty.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

Stratified on RPL_THEME1

```
load(here("modeling_files/stratified_analysis/model_stratif_rpl1_BPHIGH.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                                50%     2.5%    97.5%
## strat0                     31.74997 31.70239 31.79758
## strat0:flood_risk_pc1      -0.07208 -0.11177 -0.03243
## strat0:flood_risk_pc2      -0.04211 -0.08083 -0.00324
## strat0:flood_risk_pc3      -0.04063 -0.07131 -0.00987
## strat0:flood_risk_pc4      -0.00555 -0.03252  0.02157
## strat0:flood_risk_pc5       0.01098 -0.01644  0.03798
## strat0:EP_AGE65             3.78295  3.74186  3.82381
## strat0:EP_AGE17             0.47863  0.43175  0.52575
## strat0:EP_DISABL            0.63146  0.58124  0.68145
## strat0:EP_SNGPNT           -0.07405 -0.12366 -0.02440
## strat0:EP_MINRTY            1.67273  1.59998  1.74564
```

```
## strat0:EP_LIMENG           -0.67052 -0.75318 -0.58814
## strat0:EP_MUNIT            -0.64973 -0.68813 -0.61135
## strat0:EP_MOBILE            0.19310  0.14730  0.23882
## strat0:EP_CROWD            -0.07807 -0.15150 -0.00472
## strat0:EP_NOVEH             0.22217  0.15421  0.28973
## strat0:EP_GROUPQ           -0.59196 -0.62569 -0.55834
## strat0:EP_UNINSUR           0.41362  0.35739  0.47023
## strat0:co                  -0.48608 -0.61854 -0.35385
## strat0:no2                 -0.57822 -0.75712 -0.40053
## strat0:o3                  -0.52879 -0.79620 -0.26338
## strat0:pm10                -0.51996 -0.63536 -0.40326
## strat0:pm25                 1.03451  0.86527  1.20344
## strat0:so2                  0.14376  0.02553  0.25880
## strat0:summer_tmmx          0.27019  0.08353  0.45247
## strat0:winter_tmmx         -0.88126 -1.33898 -0.36499
## strat0:summer_rmax         -0.20568 -0.45121  0.03832
## strat0:winter_rmax          0.21393  0.03209  0.39563
## strat0:Data_Value_CSMOKING  2.05267  1.97417  2.13217
## strat1                     32.04878 32.01368 32.08413
## strat1:flood_risk_pc1      -0.07148 -0.10983 -0.03307
## strat1:flood_risk_pc2       0.01016 -0.02598  0.04633
## strat1:flood_risk_pc3      -0.05234 -0.08307 -0.02174
## strat1:flood_risk_pc4      -0.00508 -0.03130  0.02113
## strat1:flood_risk_pc5       0.01202 -0.01670  0.04086
## strat1:EP_AGE65             4.48995  4.44296  4.53712
## strat1:EP_AGE17             0.56020  0.51557  0.60524
## strat1:EP_DISABL            0.77314  0.73534  0.81107
## strat1:EP_SNGPNT           -0.01286 -0.04749  0.02167
## strat1:EP_MINRTY            3.06206  3.00632  3.11741
## strat1:EP_LIMENG           -1.01023 -1.05203 -0.96872
## strat1:EP_MUNIT            -0.42062 -0.45785 -0.38335
## strat1:EP_MOBILE            0.12104  0.09133  0.15058
## strat1:EP_CROWD            -0.11713 -0.15337 -0.08089
## strat1:EP_NOVEH             0.53851  0.49137  0.58553
## strat1:EP_GROUPQ           -0.57272 -0.60017 -0.54518
## strat1:EP_UNINSUR           0.21109  0.17421  0.24792
## strat1:co                  -0.81108 -0.95280 -0.67027
## strat1:no2                 -0.58184 -0.76062 -0.40588
## strat1:o3                  -0.57390 -0.84030 -0.30908
## strat1:pm10                -0.49781 -0.61796 -0.37816
## strat1:pm25                 1.30861  1.13915  1.47688
## strat1:so2                  0.04463 -0.06966  0.15661
## strat1:summer_tmmx          0.06549 -0.12520  0.25202
## strat1:winter_tmmx         -0.50906 -0.96759  0.00540
## strat1:summer_rmax         -0.29881 -0.54459 -0.05195
## strat1:winter_rmax          0.15811 -0.02392  0.34078
## strat1:Data_Value_CSMOKING  2.68284  2.62535  2.73998
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/BPHIGH_rpl
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                    "strat0:flood_risk_pc1"
```

```
##  [3] "strat0:flood_risk_pc2"      "strat0:flood_risk_pc3"
##  [5] "strat0:EP_AGE65"            "strat0:EP_AGE17"
##  [7] "strat0:EP_DISABL"           "strat0:EP_SNGPNT"
##  [9] "strat0:EP_MINRTY"           "strat0:EP_LIMENG"
## [11] "strat0:EP_MUNIT"            "strat0:EP_MOBILE"
## [13] "strat0:EP_CROWD"            "strat0:EP_NOVEH"
## [15] "strat0:EP_GROUPQ"           "strat0:EP_UNINSUR"
## [17] "strat0:co"                  "strat0:no2"
## [19] "strat0:o3"                  "strat0:pm10"
## [21] "strat0:pm25"                "strat0:so2"
## [23] "strat0:summer_tmmx"         "strat0:winter_tmmx"
## [25] "strat0:winter_rmax"         "strat0:Data_Value_CSMOKING"
## [27] "strat1"                     "strat1:flood_risk_pc1"
## [29] "strat1:flood_risk_pc3"      "strat1:EP_AGE65"
## [31] "strat1:EP_AGE17"            "strat1:EP_DISABL"
## [33] "strat1:EP_MINRTY"           "strat1:EP_LIMENG"
## [35] "strat1:EP_MUNIT"            "strat1:EP_MOBILE"
## [37] "strat1:EP_CROWD"            "strat1:EP_NOVEH"
## [39] "strat1:EP_GROUPQ"           "strat1:EP_UNINSUR"
## [41] "strat1:co"                  "strat1:no2"
## [43] "strat1:o3"                  "strat1:pm10"
## [45] "strat1:pm25"                "strat1:summer_rmax"
## [47] "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

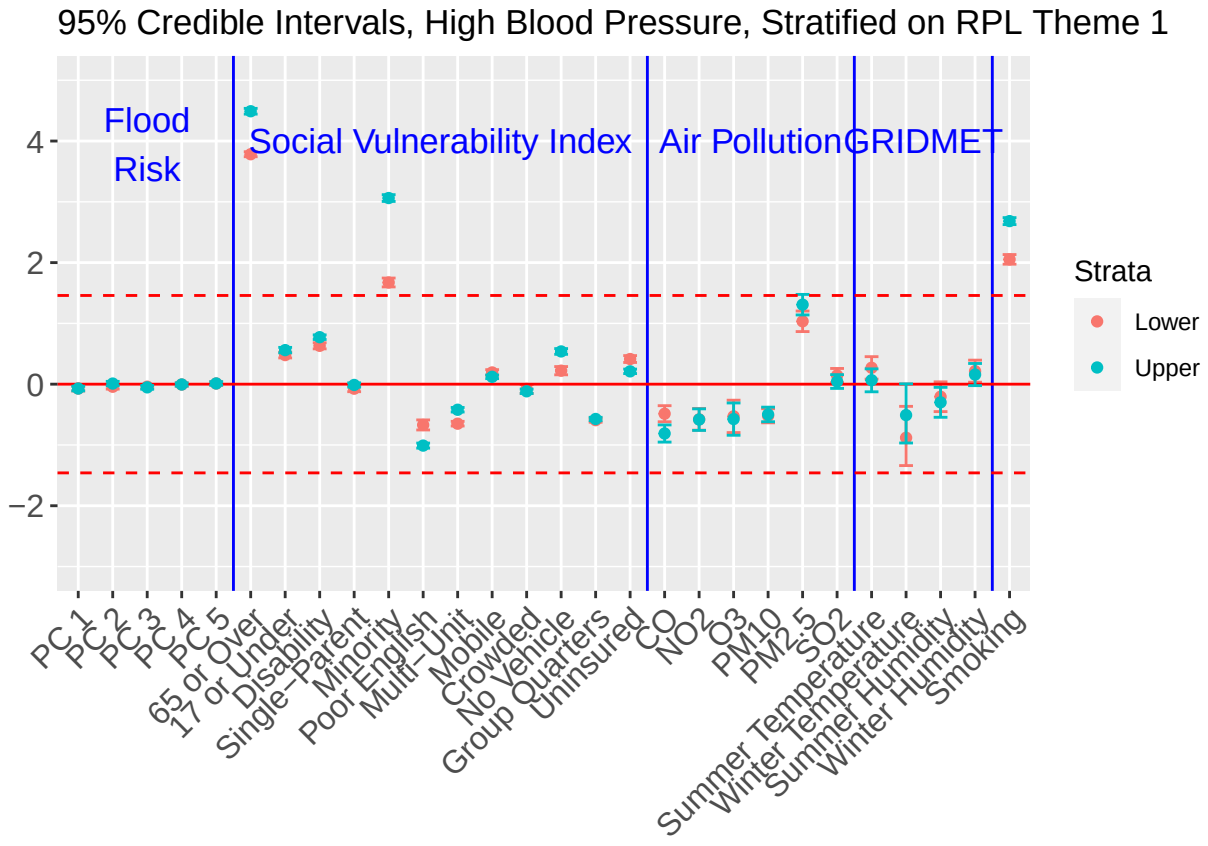
Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-3, 5)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
```

```
  geom_vline(xintercept = c(5.5, 17.5, 23.5, 27.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 3.95, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 11.5, y = 4, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 20.5, y = 4, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 25.5, y = 4, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent", "Minority", "Poor English",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hu
                              "Smoking")) + ggtitle("95% Credible Intervals, High Blood Pressure, Strati
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_BPHIGH, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_BPHIGH, col = "red", linetype = "dashed")
p
```



```
ggsave(here("figures/final_figures/stratified_analysis/BPHIGH_CI_rpl1.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

Stratified on RPL_THEME2

```
load(here("modeling_files/stratified_analysis/model_stratif_rpl2_BPHIGH.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                                50%     2.5%    97.5%
## strat0                     31.45525 31.41293 31.49764
## strat0:flood_risk_pc1      -0.12718 -0.18346 -0.07084
## strat0:flood_risk_pc2       0.10488  0.05015  0.16022
## strat0:flood_risk_pc3      -0.00010 -0.04416  0.04375
## strat0:flood_risk_pc4      -0.03831 -0.07505 -0.00149
## strat0:flood_risk_pc5       0.02954 -0.00812  0.06695
## strat0:EP_POV              -0.31643 -0.39081 -0.24282
## strat0:EP_UNEMP             0.47798  0.42028  0.53510
## strat0:EP_PCI               0.61211  0.55120  0.67342
## strat0:EP_NOHSDP            2.15771  2.05970  2.25775
## strat0:EP_MINRTY            0.16936  0.07605  0.26201
## strat0:EP_LIMENG           -0.74637 -0.83028 -0.66245
## strat0:EP_MUNIT            -0.58215 -0.62968 -0.53449
## strat0:EP_MOBILE            0.68601  0.62617  0.74563
## strat0:EP_CROWD            -0.75856 -0.82179 -0.69454
## strat0:EP_NOVEH             1.67992  1.59997  1.75925
## strat0:EP_GROUPQ           -1.13486 -1.16636 -1.10346
## strat0:EP_UNINSUR          -0.20649 -0.27127 -0.14153
## strat0:co                  -0.99477 -1.18877 -0.80129
## strat0:no2                 -0.36204 -0.63528 -0.09751
## strat0:o3                   0.02476 -0.40652  0.45377
## strat0:pm10                -1.52969 -1.71165 -1.34716
## strat0:pm25                 1.26105  0.99743  1.52442
## strat0:so2                 -0.17847 -0.36216  0.00156
## strat0:summer_tmmx         -0.16244 -0.47397  0.13158
## strat0:winter_tmmx         -0.70619 -1.42783  0.18185
## strat0:summer_rmax         -0.13586 -0.53755  0.25243
## strat0:winter_rmax          0.09389 -0.19982  0.39363
## strat0:Data_Value_CSMOKING  0.33810  0.22541  0.45173
## strat1                     33.45171 33.40759 33.49616
## strat1:flood_risk_pc1      -0.10218 -0.16088 -0.04376
## strat1:flood_risk_pc2       0.13443  0.07888  0.19018
## strat1:flood_risk_pc3      -0.07294 -0.12016 -0.02592
## strat1:flood_risk_pc4      -0.00950 -0.05112  0.03233
## strat1:flood_risk_pc5       0.08409  0.03833  0.12994
## strat1:EP_POV               1.09657  1.01721  1.17543
## strat1:EP_UNEMP             0.23556  0.19045  0.28048
## strat1:EP_PCI               0.17832  0.06443  0.29338
```

```
## strat1:EP_NOHSDP            1.08901  1.00111  1.17681
## strat1:EP_MINRTY            1.42013  1.33268  1.50677
## strat1:EP_LIMENG           -1.25805 -1.34105 -1.17566
## strat1:EP_MUNIT            -0.22355 -0.29101 -0.15697
## strat1:EP_MOBILE            0.51314  0.46887  0.55717
## strat1:EP_CROWD            -0.75234 -0.81468 -0.69004
## strat1:EP_NOVEH             1.77939  1.69945  1.85977
## strat1:EP_GROUPQ            0.05197 -0.03273  0.13753
## strat1:EP_UNINSUR          -0.24663 -0.30675 -0.18585
## strat1:co                  -1.17336 -1.39292 -0.95479
## strat1:no2                 -1.01712 -1.30336 -0.73876
## strat1:o3                   0.10920 -0.32145  0.53942
## strat1:pm10                -1.43551 -1.61767 -1.25563
## strat1:pm25                 1.73753  1.47547  1.99719
## strat1:so2                 -0.10198 -0.28111  0.07651
## strat1:summer_tmmx         -0.05611 -0.36809  0.24111
## strat1:winter_tmmx         -0.94009 -1.66947 -0.05295
## strat1:summer_rmax         -0.00819 -0.40911  0.38239
## strat1:winter_rmax          0.13643 -0.15713  0.43363
## strat1:Data_Value_CSMOKING -0.71321 -0.82358 -0.60333
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/BPHIGH_rpl
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                    "strat0:flood_risk_pc1"
##  [3] "strat0:flood_risk_pc2"     "strat0:flood_risk_pc4"
##  [5] "strat0:EP_POV"             "strat0:EP_UNEMP"
##  [7] "strat0:EP_PCI"             "strat0:EP_NOHSDP"
##  [9] "strat0:EP_MINRTY"          "strat0:EP_LIMENG"
## [11] "strat0:EP_MUNIT"           "strat0:EP_MOBILE"
## [13] "strat0:EP_CROWD"           "strat0:EP_NOVEH"
## [15] "strat0:EP_GROUPQ"          "strat0:EP_UNINSUR"
## [17] "strat0:co"                 "strat0:no2"
## [19] "strat0:pm10"               "strat0:pm25"
## [21] "strat0:Data_Value_CSMOKING" "strat1"
## [23] "strat1:flood_risk_pc1"     "strat1:flood_risk_pc2"
## [25] "strat1:flood_risk_pc3"     "strat1:flood_risk_pc5"
## [27] "strat1:EP_POV"             "strat1:EP_UNEMP"
## [29] "strat1:EP_PCI"             "strat1:EP_NOHSDP"
## [31] "strat1:EP_MINRTY"          "strat1:EP_LIMENG"
## [33] "strat1:EP_MUNIT"           "strat1:EP_MOBILE"
## [35] "strat1:EP_CROWD"           "strat1:EP_NOVEH"
## [37] "strat1:EP_UNINSUR"         "strat1:co"
## [39] "strat1:no2"                "strat1:pm10"
## [41] "strat1:pm25"               "strat1:winter_tmmx"
## [43] "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
```

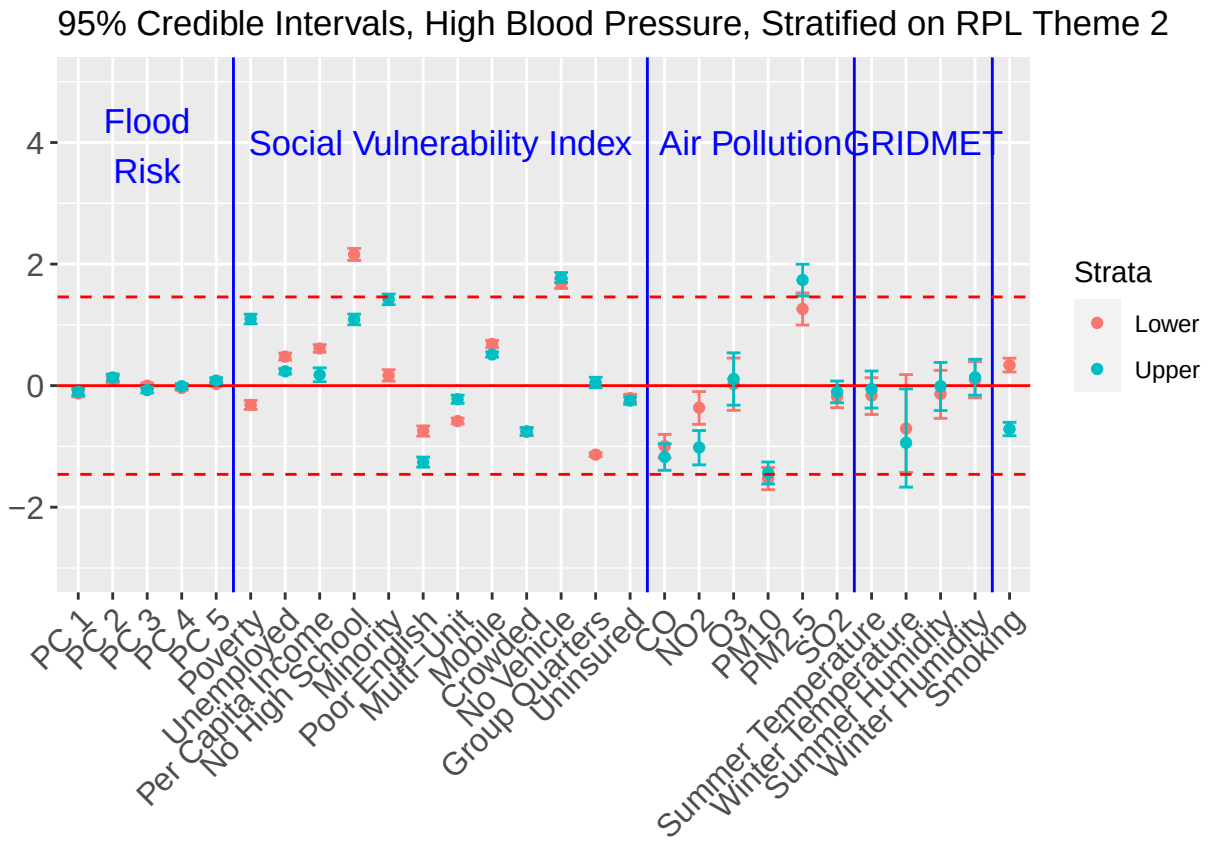
```
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-3, 5)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 17.5, 23.5, 27.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 3.95, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 11.5, y = 4, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 20.5, y = 4, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 25.5, y = 4, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Poverty", "Unemployed", "Per Capita Income", "No High School",
                              "Minority", "Poor English",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hu
                              "Smoking")) + ggtitle("95% Credible Intervals, High Blood Pressure, Strati
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_BPHIGH, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_BPHIGH, col = "red", linetype = "dashed")

p
```




```
ggsave(here("figures/final_figures/stratified_analysis/BPHIGH_CI_rpl2.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

Stratified on RPL_THEME3

Inference is based on 3 markov chains, each of which has been run for 110000 samples, the first 10000 of which has been removed for burn-in. The remaining 100000 samples are thinned by 2, resulting in 150000 samples for inference across the 3 Markov chains.

```
load(here("modeling_files/stratified_analysis/model_stratif_rpl3_BPHIGH.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                                50%     2.5%    97.5%
## strat0                     32.28474 32.22670 32.34255
## strat0:flood_risk_pc1      -0.07378 -0.11801 -0.02934
## strat0:flood_risk_pc2      -0.07068 -0.11326 -0.02815
## strat0:flood_risk_pc3      -0.05099 -0.08525 -0.01669
## strat0:flood_risk_pc4      -0.01749 -0.05142  0.01675
## strat0:flood_risk_pc5       0.04593  0.01078  0.08153
## strat0:EP_POV               0.18928  0.12868  0.24980
## strat0:EP_UNEMP             0.28519  0.24478  0.32545
```

```
## strat0:EP_PCI               0.02796 -0.02053  0.07610
## strat0:EP_NOHSDP            0.40055  0.31083  0.48988
## strat0:EP_AGE65             3.74031  3.69710  3.78359
## strat0:EP_AGE17             0.72564  0.67577  0.77539
## strat0:EP_DISABL            0.61942  0.57188  0.66671
## strat0:EP_SNGPNT            0.23568  0.18724  0.28415
## strat0:EP_MUNIT            -0.61607 -0.66897 -0.56313
## strat0:EP_MOBILE           -0.04739 -0.08501 -0.00995
## strat0:EP_CROWD            -0.09644 -0.17802 -0.01556
## strat0:EP_NOVEH             0.87848  0.80798  0.94939
## strat0:EP_GROUPQ           -0.75849 -0.79273 -0.72459
## strat0:EP_UNINSUR           0.22216  0.16708  0.27753
## strat0:co                  -0.67741 -0.82412 -0.53063
## strat0:no2                 -0.36440 -0.56547 -0.16394
## strat0:o3                  -0.12796 -0.42489  0.21823
## strat0:pm10                -0.46686 -0.59659 -0.33734
## strat0:pm25                 0.99644  0.80592  1.18294
## strat0:so2                  0.00751 -0.12629  0.14084
## strat0:summer_tmmx          0.14900 -0.05909  0.35426
## strat0:winter_tmmx         -0.37498 -0.92441  0.12709
## strat0:summer_rmax         -0.21430 -0.49648  0.04769
## strat0:winter_rmax          0.16748 -0.04145  0.37575
## strat0:Data_Value_CSMOKING  2.22277  2.12689  2.31753
## strat1                     32.50683 32.47023 32.54348
## strat1:flood_risk_pc1       0.01514 -0.02650  0.05677
## strat1:flood_risk_pc2       0.00430 -0.03536  0.04366
## strat1:flood_risk_pc3       0.00392 -0.02894  0.03672
## strat1:flood_risk_pc4       0.01430 -0.01097  0.03928
## strat1:flood_risk_pc5       0.00026 -0.02655  0.02734
## strat1:EP_POV               0.06749  0.01629  0.11895
## strat1:EP_UNEMP             0.32126  0.28844  0.35404
## strat1:EP_PCI              -0.19694 -0.25472 -0.13894
## strat1:EP_NOHSDP           -0.14629 -0.19784 -0.09465
## strat1:EP_AGE65             4.03198  3.98271  4.08163
## strat1:EP_AGE17             0.54658  0.49968  0.59380
## strat1:EP_DISABL            0.87794  0.83337  0.92225
## strat1:EP_SNGPNT            0.24077  0.20322  0.27834
## strat1:EP_MUNIT            -0.55358 -0.58899 -0.51809
## strat1:EP_MOBILE            0.06606  0.03049  0.10165
## strat1:EP_CROWD            -0.12232 -0.16125 -0.08337
## strat1:EP_NOVEH             0.65653  0.60313  0.70974
## strat1:EP_GROUPQ           -0.42595 -0.45848 -0.39388
## strat1:EP_UNINSUR           0.24422  0.20301  0.28527
## strat1:co                  -0.95238 -1.11255 -0.79435
## strat1:no2                  0.07135 -0.12732  0.26706
## strat1:o3                  -0.21387 -0.51418  0.13403
## strat1:pm10                -0.65618 -0.79169 -0.51931
## strat1:pm25                 1.31934  1.12739  1.50890
## strat1:so2                  0.11095 -0.03073  0.25034
## strat1:summer_tmmx          0.04288 -0.16975  0.25381
## strat1:winter_tmmx          0.07969 -0.47329  0.57865
## strat1:summer_rmax         -0.18200 -0.46597  0.08120
## strat1:winter_rmax         -0.13575 -0.34682  0.07569
## strat1:Data_Value_CSMOKING  2.67267  2.59171  2.75382
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/BPHIGH_rpl3
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                      "strat0:flood_risk_pc1"
##  [3] "strat0:flood_risk_pc2"       "strat0:flood_risk_pc3"
##  [5] "strat0:flood_risk_pc5"       "strat0:EP_POV"
##  [7] "strat0:EP_UNEMP"             "strat0:EP_NOHSDP"
##  [9] "strat0:EP_AGE65"             "strat0:EP_AGE17"
## [11] "strat0:EP_DISABL"            "strat0:EP_SNGPNT"
## [13] "strat0:EP_MUNIT"             "strat0:EP_MOBILE"
## [15] "strat0:EP_CROWD"             "strat0:EP_NOVEH"
## [17] "strat0:EP_GROUPQ"            "strat0:EP_UNINSUR"
## [19] "strat0:co"                   "strat0:no2"
## [21] "strat0:pm10"                 "strat0:pm25"
## [23] "strat0:Data_Value_CSMOKING" "strat1"
## [25] "strat1:EP_POV"               "strat1:EP_UNEMP"
## [27] "strat1:EP_PCI"               "strat1:EP_NOHSDP"
## [29] "strat1:EP_AGE65"             "strat1:EP_AGE17"
## [31] "strat1:EP_DISABL"            "strat1:EP_SNGPNT"
## [33] "strat1:EP_MUNIT"             "strat1:EP_MOBILE"
## [35] "strat1:EP_CROWD"             "strat1:EP_NOVEH"
## [37] "strat1:EP_GROUPQ"            "strat1:EP_UNINSUR"
## [39] "strat1:co"                   "strat1:pm10"
## [41] "strat1:pm25"                 "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

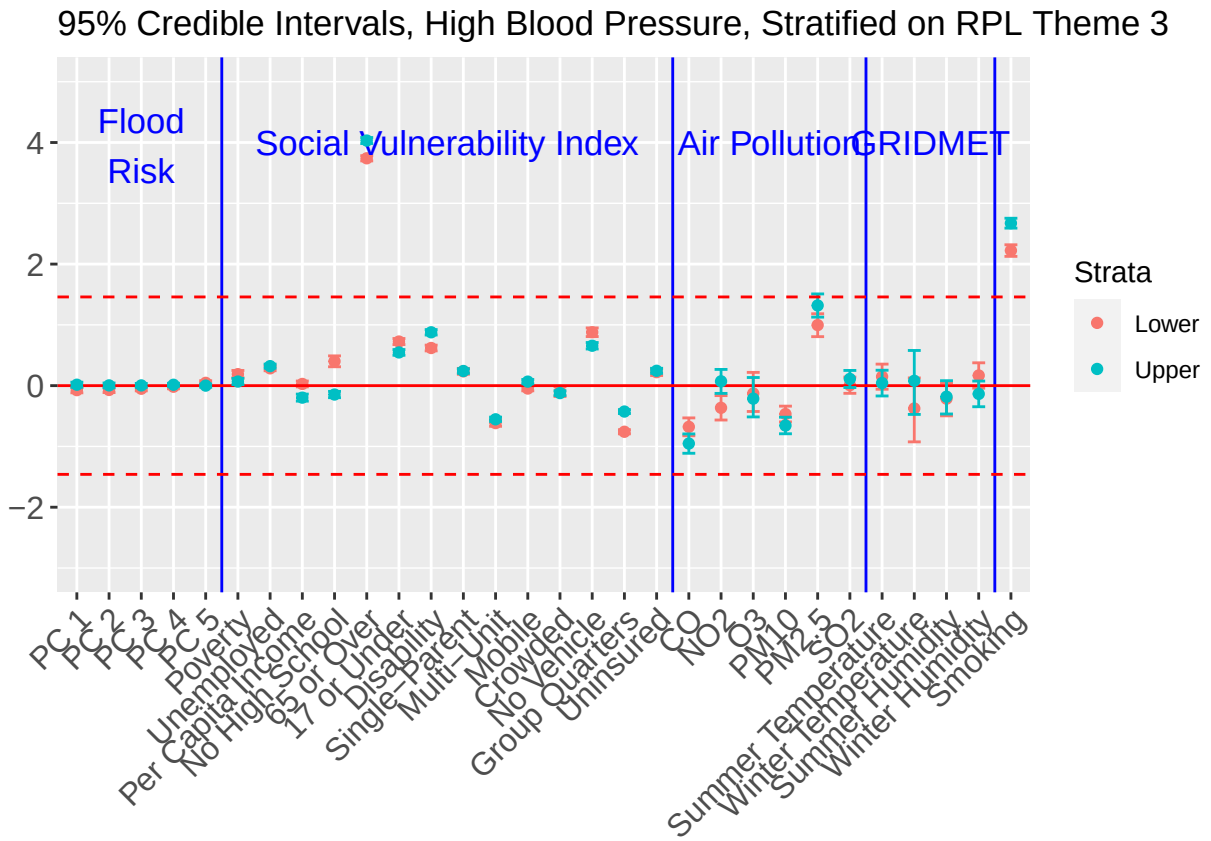
Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-3, 5)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
```

```
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 19.5, 25.5, 29.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 3.95, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 12.5, y = 4, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 22.5, y = 4, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 27.5, y = 4, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Poverty", "Unemployed", "Per Capita Income", "No High School",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hu
                              "Smoking")) + ggtitle("95% Credible Intervals, High Blood Pressure, Strat
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_BPHIGH, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_BPHIGH, col = "red", linetype = "dashed")

p
```




```
ggsave(here("figures/final_figures/stratified_analysis/BPHIGH_CI_rpl3.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

Stratified on RPL_THEME4

Inference is based on 3 markov chains, each of which has been run for 110000 samples, the first 10000 of which has been removed for burn-in. The remaining 100000 samples are thinned by 2, resulting in 150000 samples for inference across the 3 Markov chains.

```
load(here("modeling_files/stratified_analysis/model_stratif_rpl4_BPHIGH.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                              50%     2.5%    97.5%
## strat0                   32.34478 32.31767 32.37171
## strat0:flood_risk_pc1    -0.02548 -0.06503  0.01409
## strat0:flood_risk_pc2    -0.08714 -0.12599 -0.04791
## strat0:flood_risk_pc3    -0.03573 -0.06687 -0.00461
## strat0:flood_risk_pc4     0.00074 -0.02796  0.02952
## strat0:flood_risk_pc5     0.02096 -0.00960  0.05166
## strat0:EP_POV             0.02708 -0.03281  0.08734
## strat0:EP_UNEMP           0.13533  0.09740  0.17330
```

```
## strat0:EP_PCI               0.42518  0.37948  0.47073
## strat0:EP_NOHSDP            0.20962  0.13747  0.28187
## strat0:EP_AGE65             4.16922  4.12922  4.20956
## strat0:EP_AGE17             0.94541  0.90480  0.98622
## strat0:EP_DISABL            0.70272  0.65685  0.74849
## strat0:EP_SNGPNT           -0.08997 -0.13350 -0.04617
## strat0:EP_MINRTY            2.42121  2.35734  2.48512
## strat0:EP_LIMENG           -1.23035 -1.30422 -1.15668
## strat0:EP_UNINSUR           0.45529  0.40636  0.50440
## strat0:co                  -0.68864 -0.83661 -0.54127
## strat0:no2                 -0.83660 -1.02465 -0.64885
## strat0:o3                  -0.74520 -1.00900 -0.46838
## strat0:pm10                -0.66483 -0.78385 -0.54686
## strat0:pm25                 1.52841  1.35946  1.70009
## strat0:so2                  0.17627  0.05378  0.29606
## strat0:summer_tmmx          0.22592  0.02898  0.41754
## strat0:winter_tmmx         -1.10819 -1.59514 -0.54365
## strat0:summer_rmax         -0.30440 -0.54196 -0.05576
## strat0:winter_rmax          0.27892  0.08603  0.46173
## strat0:Data_Value_CSMOKING  2.55539  2.47067  2.64137
## strat1                     32.20255 32.17699 32.22820
## strat1:flood_risk_pc1      -0.03862 -0.07769  0.00034
## strat1:flood_risk_pc2      -0.00932 -0.04637  0.02763
## strat1:flood_risk_pc3      -0.03624 -0.06712 -0.00544
## strat1:flood_risk_pc4       0.00823 -0.01771  0.03429
## strat1:flood_risk_pc5      -0.00767 -0.03510  0.01987
## strat1:EP_POV              -0.20370 -0.24827 -0.15933
## strat1:EP_UNEMP             0.10896  0.07607  0.14162
## strat1:EP_PCI               0.35905  0.30175  0.41662
## strat1:EP_NOHSDP           -0.23897 -0.29662 -0.18124
## strat1:EP_AGE65             4.57794  4.53473  4.62111
## strat1:EP_AGE17             1.17457  1.13539  1.21386
## strat1:EP_DISABL            0.92098  0.88002  0.96208
## strat1:EP_SNGPNT           -0.12422 -0.16320 -0.08538
## strat1:EP_MINRTY            2.80775  2.74602  2.86931
## strat1:EP_LIMENG           -0.77069 -0.82093 -0.72062
## strat1:EP_UNINSUR           0.28821  0.24865  0.32771
## strat1:co                  -0.78204 -0.91339 -0.65120
## strat1:no2                 -0.81308 -0.98888 -0.63886
## strat1:o3                  -0.86144 -1.12502 -0.58533
## strat1:pm10                -0.62318 -0.74554 -0.50268
## strat1:pm25                 1.66427  1.49688  1.83511
## strat1:so2                  0.12015  0.00070  0.23747
## strat1:summer_tmmx          0.07456 -0.12081  0.26149
## strat1:winter_tmmx         -0.79995 -1.28248 -0.23843
## strat1:summer_rmax         -0.34991 -0.58498 -0.09976
## strat1:winter_rmax          0.15902 -0.03114  0.34090
## strat1:Data_Value_CSMOKING  3.01135  2.93642  3.08633
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/BPHIGH_rpl
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                    "strat0:flood_risk_pc2"
##  [3] "strat0:flood_risk_pc3"     "strat0:EP_UNEMP"
##  [5] "strat0:EP_PCI"             "strat0:EP_NOHSDP"
##  [7] "strat0:EP_AGE65"           "strat0:EP_AGE17"
##  [9] "strat0:EP_DISABL"          "strat0:EP_SNGPNT"
## [11] "strat0:EP_MINRTY"          "strat0:EP_LIMENG"
## [13] "strat0:EP_UNINSUR"         "strat0:co"
## [15] "strat0:no2"                "strat0:o3"
## [17] "strat0:pm10"               "strat0:pm25"
## [19] "strat0:so2"                "strat0:summer_tmmx"
## [21] "strat0:winter_tmmx"        "strat0:summer_rmax"
## [23] "strat0:winter_rmax"        "strat0:Data_Value_CSMOKING"
## [25] "strat1"                    "strat1:flood_risk_pc3"
## [27] "strat1:EP_POV"             "strat1:EP_UNEMP"
## [29] "strat1:EP_PCI"             "strat1:EP_NOHSDP"
## [31] "strat1:EP_AGE65"           "strat1:EP_AGE17"
## [33] "strat1:EP_DISABL"          "strat1:EP_SNGPNT"
## [35] "strat1:EP_MINRTY"          "strat1:EP_LIMENG"
## [37] "strat1:EP_UNINSUR"         "strat1:co"
## [39] "strat1:no2"                "strat1:o3"
## [41] "strat1:pm10"               "strat1:pm25"
## [43] "strat1:so2"                "strat1:winter_tmmx"
## [45] "strat1:summer_rmax"        "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

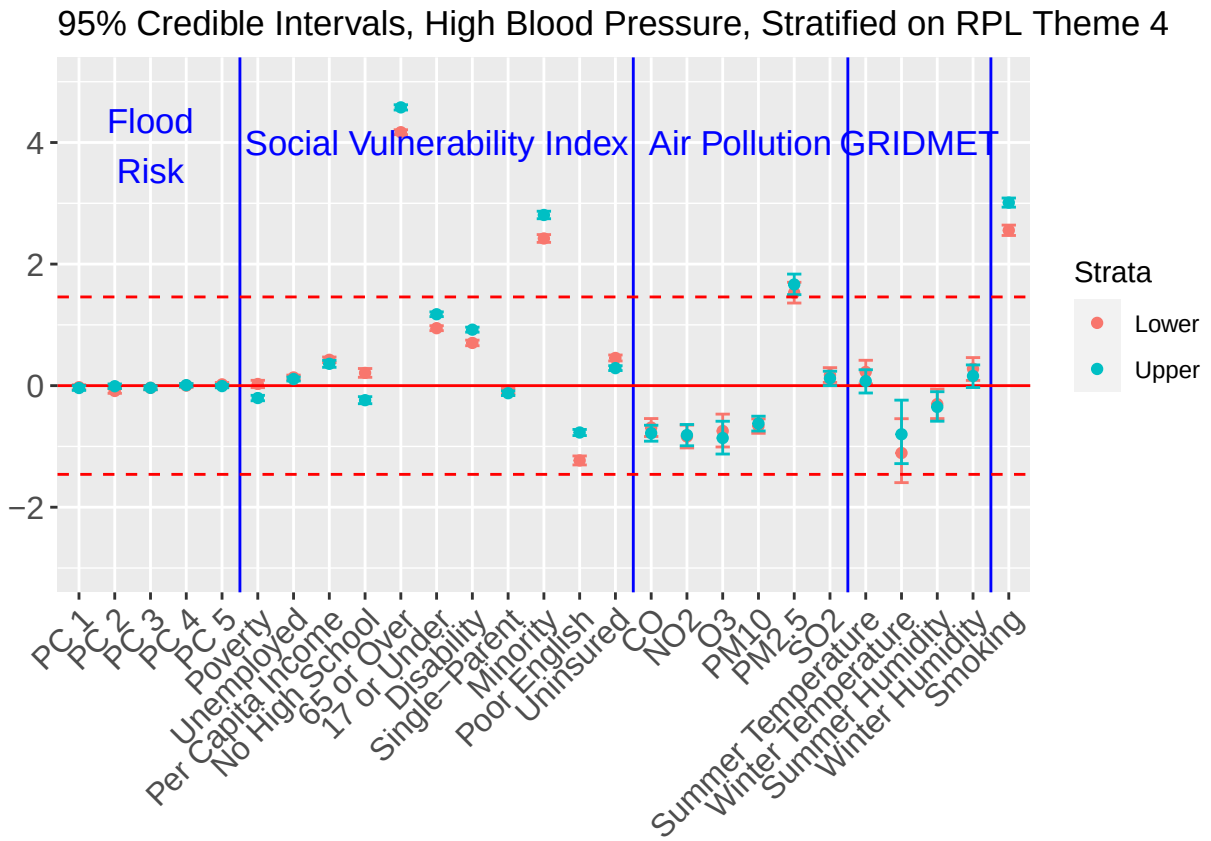
Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-3, 5)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
```

```
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 16.5, 22.5, 26.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 3.95, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 11, y = 4, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 19.5, y = 4, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 24.5, y = 4, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Poverty", "Unemployed", "Per Capita Income", "No High School",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent",
                              "Minority", "Poor English",
                              "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hu
                              "Smoking")) + ggtitle("95% Credible Intervals, High Blood Pressure, Strat
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_BPHIGH, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_BPHIGH, col = "red", linetype = "dashed")

p
```




```
ggsave(here("figures/final_figures/stratified_analysis/BPHIGH_CI_rpl4.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

Stratified on RPL_THEMES

Inference is based on 3 markov chains, each of which has been run for 110000 samples, the first 10000 of which has been removed for burn-in. The remaining 100000 samples are thinned by 2, resulting in 150000 samples for inference across the 3 Markov chains.

```
load(here("modeling_files/stratified_analysis/model_stratif_rpls_BPHIGH.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                                50%     2.5%    97.5%
## strat0                    31.01451 30.95665 31.07212
## strat0:flood_risk_pc1     -0.12989 -0.19603 -0.06401
## strat0:flood_risk_pc2      0.13839  0.07327  0.20453
## strat0:flood_risk_pc3      0.00669 -0.04461  0.05854
## strat0:flood_risk_pc4     -0.06391 -0.11066 -0.01732
## strat0:flood_risk_pc5      0.00593 -0.04159  0.05316
## strat0:EP_UNINSUR         -0.06651 -0.15147  0.01904
## strat0:co                 -1.39663 -1.62297 -1.17037
```

```
## strat0:no2                -1.91299 -2.20900 -1.60730
## strat0:o3                 -0.62227 -1.13809 -0.16696
## strat0:pm10               -1.90951 -2.12404 -1.69953
## strat0:pm25                2.87050  2.56620  3.17427
## strat0:so2                 0.05704 -0.15030  0.27084
## strat0:summer_tmmx         0.02746 -0.32980  0.42363
## strat0:winter_tmmx        -1.10775 -2.26436 -0.06549
## strat0:summer_rmax        -0.15491 -0.58848  0.29953
## strat0:winter_rmax         0.28536 -0.04097  0.60889
## strat0:Data_Value_CSMOKING  0.58811  0.49190  0.68484
## strat1                    32.81474 32.76521 32.86405
## strat1:flood_risk_pc1      0.04929 -0.01570  0.11375
## strat1:flood_risk_pc2      0.07868  0.01701  0.14065
## strat1:flood_risk_pc3      0.06164  0.00923  0.11334
## strat1:flood_risk_pc4     -0.00152 -0.04523  0.04203
## strat1:flood_risk_pc5      0.04279 -0.00503  0.09055
## strat1:EP_UNINSUR         -0.48701 -0.54317 -0.43018
## strat1:co                 -2.53364 -2.78038 -2.28639
## strat1:no2                 0.15007 -0.15401  0.45795
## strat1:o3                 -1.09729 -1.61567 -0.64089
## strat1:pm10               -2.24653 -2.46874 -2.02844
## strat1:pm25                3.23916  2.93134  3.53971
## strat1:so2                -0.03065 -0.23540  0.18134
## strat1:summer_tmmx        -0.00181 -0.36181  0.39446
## strat1:winter_tmmx        -0.31280 -1.47145  0.73425
## strat1:summer_rmax        -0.18681 -0.62381  0.26835
## strat1:winter_rmax         0.00967 -0.31642  0.33573
## strat1:Data_Value_CSMOKING  2.18814  2.11635  2.26003
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/BPHIGH_rpls
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                    "strat0:flood_risk_pc1"
##  [3] "strat0:flood_risk_pc2"     "strat0:flood_risk_pc4"
##  [5] "strat0:co"                 "strat0:no2"
##  [7] "strat0:o3"                 "strat0:pm10"
##  [9] "strat0:pm25"               "strat0:winter_tmmx"
## [11] "strat0:Data_Value_CSMOKING" "strat1"
## [13] "strat1:flood_risk_pc2"     "strat1:flood_risk_pc3"
## [15] "strat1:EP_UNINSUR"         "strat1:co"
## [17] "strat1:o3"                 "strat1:pm10"
## [19] "strat1:pm25"               "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
```

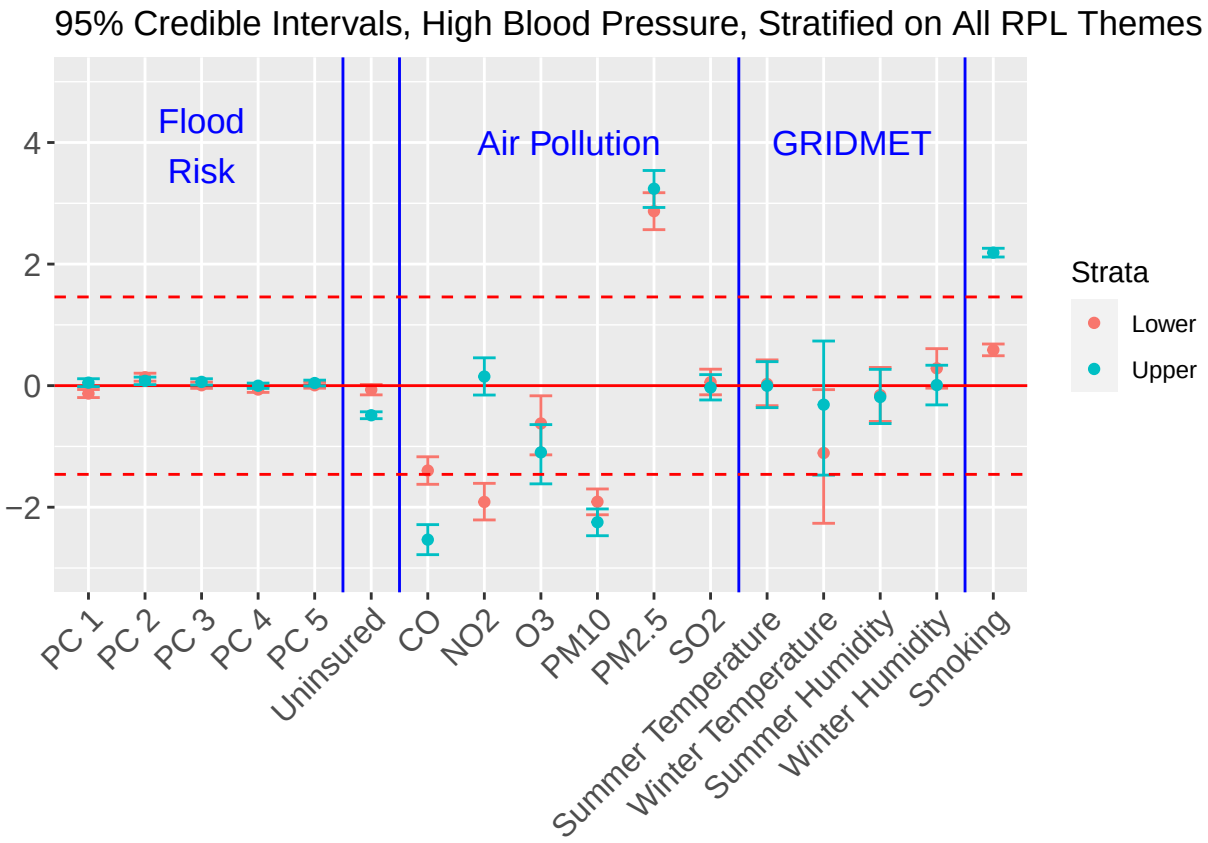
```
                              post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-3, 5)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 6.5, 12.5, 16.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 3.95, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 9.5, y = 4, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 14.5, y = 4, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hu
                              "Smoking")) + ggtitle("95% Credible Intervals, High Blood Pressure, Strati
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_BPHIGH, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_BPHIGH, col = "red", linetype = "dashed")

p
```




```
ggsave(here("figures/final_figures/stratified_analysis/BPHIGH_CI_rpls.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

CASTHMA Stratified Analysis

Repeating the stratified analysis in the last section, this time just doing the plots

Stratified on Poverty

```
load(here("modeling_files/stratified_analysis/model_stratif_poverty_CASTHMA.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                              50%     2.5%    97.5%
## strat0                   9.77571  9.76840  9.78301
## strat0:flood_risk_pc1    0.00429 -0.00260  0.01118
## strat0:flood_risk_pc2   -0.00628 -0.01305  0.00055
## strat0:flood_risk_pc3    0.00930  0.00396  0.01467
## strat0:flood_risk_pc4    0.00184 -0.00286  0.00650
## strat0:flood_risk_pc5   -0.00263 -0.00739  0.00217
```

```
## strat0:EP_UNEMP             0.06218  0.05401  0.07027
## strat0:EP_PCI              -0.02708 -0.03490 -0.01916
## strat0:EP_NOHSDP            0.07652  0.06146  0.09160
## strat0:EP_AGE65             0.07217  0.06469  0.07965
## strat0:EP_AGE17            -0.00755 -0.01614  0.00097
## strat0:EP_DISABL           -0.00637 -0.01540  0.00272
## strat0:EP_SNGPNT            0.04500  0.03654  0.05346
## strat0:EP_MINRTY            0.18576  0.17293  0.19843
## strat0:EP_LIMENG           -0.15496 -0.16869 -0.14135
## strat0:EP_MUNIT            -0.02440 -0.03155 -0.01729
## strat0:EP_MOBILE           -0.01325 -0.02035 -0.00617
## strat0:EP_CROWD            -0.02444 -0.03552 -0.01335
## strat0:EP_NOVEH             0.11708  0.10474  0.12933
## strat0:EP_GROUPQ           -0.04994 -0.05708 -0.04280
## strat0:EP_UNINSUR           0.01560  0.00632  0.02488
## strat0:co                  -0.05621 -0.07943 -0.03300
## strat0:no2                 -0.06121 -0.09335 -0.02972
## strat0:o3                  -0.01184 -0.06087  0.04059
## strat0:pm10                -0.16158 -0.18281 -0.14094
## strat0:pm25                 0.27419  0.24481  0.30570
## strat0:so2                  0.01034 -0.01131  0.03204
## strat0:summer_tmmx          0.03936  0.00591  0.07661
## strat0:winter_tmmx         -0.07030 -0.18635  0.01331
## strat0:summer_rmax          0.01343 -0.03443  0.06314
## strat0:winter_rmax         -0.05138 -0.08632 -0.01628
## strat0:Data_Value_CSMOKING  0.97571  0.95944  0.99193
## strat1                      9.87330  9.86710  9.87945
## strat1:flood_risk_pc1      -0.00902 -0.01576 -0.00235
## strat1:flood_risk_pc2       0.00491 -0.00143  0.01132
## strat1:flood_risk_pc3       0.00806  0.00279  0.01333
## strat1:flood_risk_pc4       0.00301 -0.00155  0.00755
## strat1:flood_risk_pc5       0.00193 -0.00300  0.00691
## strat1:EP_UNEMP             0.09313  0.08822  0.09807
## strat1:EP_PCI              -0.27247 -0.28604 -0.25901
## strat1:EP_NOHSDP            0.03376  0.02413  0.04332
## strat1:EP_AGE65             0.12034  0.11256  0.12818
## strat1:EP_AGE17            -0.00414 -0.01185  0.00371
## strat1:EP_DISABL           -0.09020 -0.09676 -0.08362
## strat1:EP_SNGPNT            0.05597  0.04984  0.06211
## strat1:EP_MINRTY            0.39284  0.38250  0.40323
## strat1:EP_LIMENG           -0.26990 -0.27847 -0.26132
## strat1:EP_MUNIT             0.03985  0.03364  0.04607
## strat1:EP_MOBILE           -0.02337 -0.02871 -0.01804
## strat1:EP_CROWD            -0.00652 -0.01301 -0.00004
## strat1:EP_NOVEH             0.19964  0.19147  0.20783
## strat1:EP_GROUPQ           -0.04254 -0.04722 -0.03785
## strat1:EP_UNINSUR          -0.05315 -0.05981 -0.04659
## strat1:co                  -0.03889 -0.06464 -0.01330
## strat1:no2                 -0.18077 -0.21351 -0.14918
## strat1:o3                   0.00441 -0.04465  0.05708
## strat1:pm10                -0.18558 -0.20760 -0.16440
## strat1:pm25                 0.31577  0.28624  0.34758
## strat1:so2                 -0.01856 -0.03991  0.00284
## strat1:summer_tmmx          0.00964 -0.02427  0.04717
```

```
## strat1:winter_tmmx          -0.07192 -0.18787  0.01155
## strat1:summer_rmax          -0.01692 -0.06496  0.03282
## strat1:winter_rmax          -0.06036 -0.09511 -0.02523
## strat1:Data_Value_CSMOKING   1.00036  0.98886  1.01195
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/CASTHMA_po
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                      "strat0:flood_risk_pc3"
##  [3] "strat0:EP_UNEMP"             "strat0:EP_PCI"
##  [5] "strat0:EP_NOHSDP"            "strat0:EP_AGE65"
##  [7] "strat0:EP_SNGPNT"            "strat0:EP_MINRTY"
##  [9] "strat0:EP_LIMENG"            "strat0:EP_MUNIT"
## [11] "strat0:EP_MOBILE"            "strat0:EP_CROWD"
## [13] "strat0:EP_NOVEH"             "strat0:EP_GROUPQ"
## [15] "strat0:EP_UNINSUR"           "strat0:co"
## [17] "strat0:no2"                  "strat0:pm10"
## [19] "strat0:pm25"                 "strat0:summer_tmmx"
## [21] "strat0:winter_rmax"          "strat0:Data_Value_CSMOKING"
## [23] "strat1"                      "strat1:flood_risk_pc1"
## [25] "strat1:flood_risk_pc3"       "strat1:EP_UNEMP"
## [27] "strat1:EP_PCI"               "strat1:EP_NOHSDP"
## [29] "strat1:EP_AGE65"             "strat1:EP_DISABL"
## [31] "strat1:EP_SNGPNT"            "strat1:EP_MINRTY"
## [33] "strat1:EP_LIMENG"            "strat1:EP_MUNIT"
## [35] "strat1:EP_MOBILE"            "strat1:EP_CROWD"
## [37] "strat1:EP_NOVEH"             "strat1:EP_GROUPQ"
## [39] "strat1:EP_UNINSUR"           "strat1:co"
## [41] "strat1:no2"                  "strat1:pm10"
## [43] "strat1:pm25"                 "strat1:winter_rmax"
## [45] "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

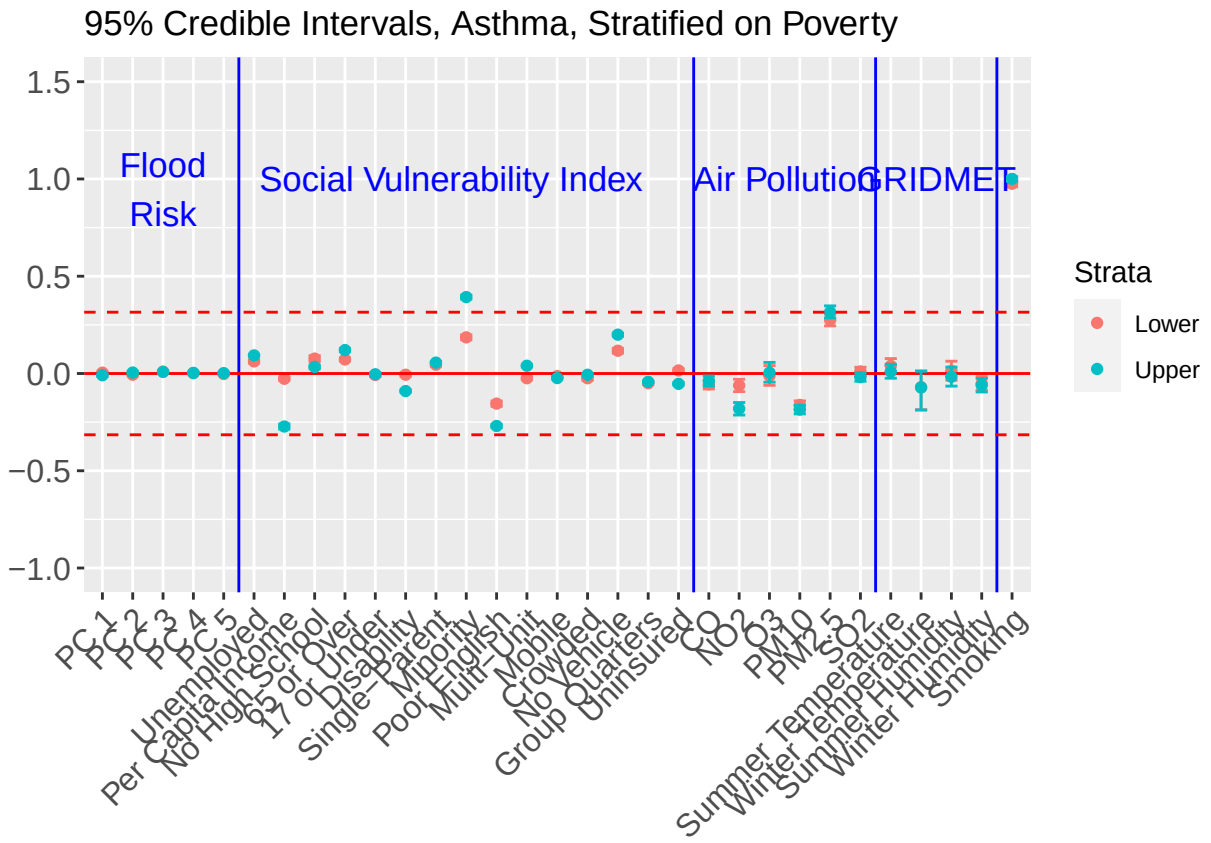
```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-1, 1.5)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 20.5, 26.5, 30.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 0.95, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 12.5, y = 1, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 23.5, y = 1, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 28.5, y = 1, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Unemployed", "Per Capita Income", "No High School",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent", "Minority", "Poor English",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hum
                              "Smoking")) + ggtitle("95% Credible Intervals, Asthma, Stratified on Pover
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_CASTHMA, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_CASTHMA, col = "red", linetype = "dashed")

p
```




```
ggsave(here("figures/final_figures/stratified_analysis/CASTHMA_CI_poverty.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

Stratified on RPL_THEME1

```
load(here("modeling_files/stratified_analysis/model_stratif_rpl1_CASTHMA.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                                50%     2.5%    97.5%
## strat0                     9.75153  9.74309  9.75988
## strat0:flood_risk_pc1      0.00190 -0.00525  0.00901
## strat0:flood_risk_pc2     -0.00541 -0.01243  0.00166
## strat0:flood_risk_pc3      0.01131  0.00576  0.01683
## strat0:flood_risk_pc4      0.00133 -0.00349  0.00615
## strat0:flood_risk_pc5     -0.00372 -0.00859  0.00110
## strat0:EP_AGE65            0.06843  0.06117  0.07570
## strat0:EP_AGE17           -0.01268 -0.02100 -0.00431
## strat0:EP_DISABL          -0.00973 -0.01863 -0.00088
## strat0:EP_SNGPNT           0.05297  0.04421  0.06173
## strat0:EP_MINRTY           0.17282  0.15974  0.18593
```

```
## strat0:EP_LIMENG           -0.12371 -0.13834 -0.10918
## strat0:EP_MUNIT            -0.02446 -0.03131 -0.01760
## strat0:EP_MOBILE           -0.00455 -0.01262  0.00357
## strat0:EP_CROWD            -0.01443 -0.02737 -0.00150
## strat0:EP_NOVEH             0.13289  0.12080  0.14496
## strat0:EP_GROUPQ           -0.03428 -0.04029 -0.02827
## strat0:EP_UNINSUR           0.02138  0.01142  0.03135
## strat0:co                  -0.05615 -0.08040 -0.03209
## strat0:no2                 -0.04295 -0.07684 -0.00978
## strat0:o3                  -0.01668 -0.06922  0.03487
## strat0:pm10                -0.17178 -0.19370 -0.14972
## strat0:pm25                 0.30466  0.27260  0.33667
## strat0:so2                  0.00890 -0.01341  0.03071
## strat0:summer_tmmx          0.04392  0.00674  0.07923
## strat0:winter_tmmx         -0.10288 -0.19067  0.00438
## strat0:summer_rmax          0.02078 -0.02784  0.06747
## strat0:winter_rmax         -0.04603 -0.08145 -0.01005
## strat0:Data_Value_CSMOKING  1.02419  1.01015  1.03846
## strat1                      9.92462  9.91847  9.93082
## strat1:flood_risk_pc1      -0.00378 -0.01070  0.00312
## strat1:flood_risk_pc2       0.00650 -0.00003  0.01306
## strat1:flood_risk_pc3       0.00656  0.00105  0.01204
## strat1:flood_risk_pc4       0.00539  0.00073  0.01005
## strat1:flood_risk_pc5       0.00192 -0.00320  0.00707
## strat1:EP_AGE65             0.13087  0.12255  0.13923
## strat1:EP_AGE17             0.00256 -0.00541  0.01056
## strat1:EP_DISABL           -0.07697 -0.08372 -0.07019
## strat1:EP_SNGPNT            0.06649  0.06035  0.07263
## strat1:EP_MINRTY            0.46574  0.45555  0.47586
## strat1:EP_LIMENG           -0.26169 -0.26929 -0.25418
## strat1:EP_MUNIT             0.04178  0.03510  0.04843
## strat1:EP_MOBILE           -0.01505 -0.02036 -0.00978
## strat1:EP_CROWD             0.00401 -0.00247  0.01049
## strat1:EP_NOVEH             0.22383  0.21533  0.23227
## strat1:EP_GROUPQ           -0.00286 -0.00775  0.00200
## strat1:EP_UNINSUR          -0.04239 -0.04899 -0.03581
## strat1:co                  -0.04477 -0.07112 -0.01870
## strat1:no2                 -0.17643 -0.21077 -0.14345
## strat1:o3                  -0.01220 -0.06462  0.03939
## strat1:pm10                -0.20257 -0.22532 -0.18010
## strat1:pm25                 0.37741  0.34508  0.40909
## strat1:so2                 -0.02936 -0.05112 -0.00802
## strat1:summer_tmmx          0.00916 -0.02868  0.04543
## strat1:winter_tmmx         -0.10165 -0.18994  0.00494
## strat1:summer_rmax         -0.04146 -0.09029  0.00558
## strat1:winter_rmax         -0.04709 -0.08265 -0.01102
## strat1:Data_Value_CSMOKING  1.13837  1.12806  1.14863
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/CASTHMA_rp
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                    "strat0:flood_risk_pc3"
```

```
##  [3] "strat0:EP_AGE65"            "strat0:EP_AGE17"
##  [5] "strat0:EP_DISABL"           "strat0:EP_SNGPNT"
##  [7] "strat0:EP_MINRTY"           "strat0:EP_LIMENG"
##  [9] "strat0:EP_MUNIT"            "strat0:EP_CROWD"
## [11] "strat0:EP_NOVEH"            "strat0:EP_GROUPQ"
## [13] "strat0:EP_UNINSUR"          "strat0:co"
## [15] "strat0:no2"                 "strat0:pm10"
## [17] "strat0:pm25"                "strat0:summer_tmmx"
## [19] "strat0:winter_rmax"         "strat0:Data_Value_CSMOKING"
## [21] "strat1"                     "strat1:flood_risk_pc3"
## [23] "strat1:flood_risk_pc4"      "strat1:EP_AGE65"
## [25] "strat1:EP_DISABL"           "strat1:EP_SNGPNT"
## [27] "strat1:EP_MINRTY"           "strat1:EP_LIMENG"
## [29] "strat1:EP_MUNIT"            "strat1:EP_MOBILE"
## [31] "strat1:EP_NOVEH"            "strat1:EP_UNINSUR"
## [33] "strat1:co"                  "strat1:no2"
## [35] "strat1:pm10"                "strat1:pm25"
## [37] "strat1:so2"                 "strat1:winter_rmax"
## [39] "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

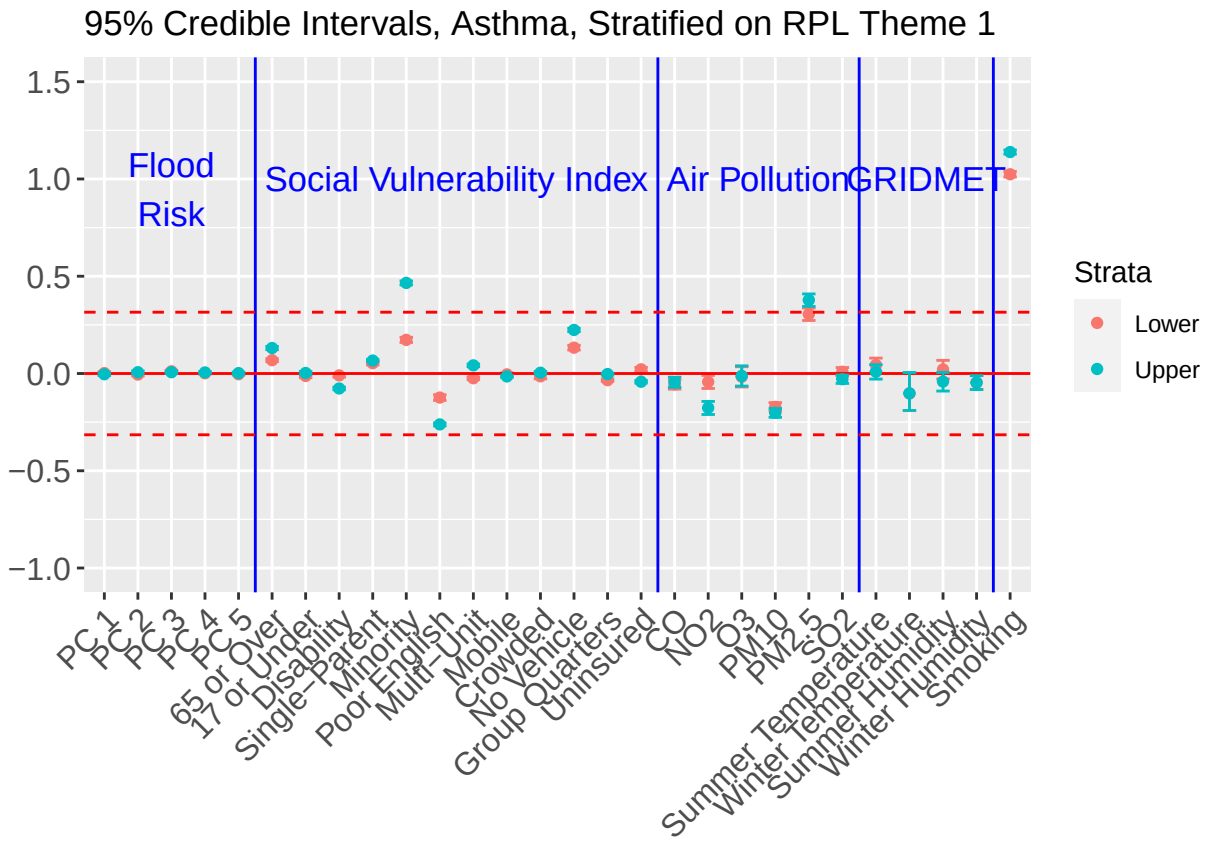
Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-1, 1.5)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 17.5, 23.5, 27.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 0.95, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
```

```
  annotate(geom = "text", x = 11.5, y = 1, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 20.5, y = 1, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 25.5, y = 1, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent", "Minority", "Poor English",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hu
                              "Smoking")) + ggtitle("95% Credible Intervals, Asthma, Stratified on RPL
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_CASTHMA, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_CASTHMA, col = "red", linetype = "dashed")
p
```




```
ggsave(here("figures/final_figures/stratified_analysis/CASTHMA_CI_rpl1.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

Stratified on RPL_THEME2

```
load(here("modeling_files/stratified_analysis/model_stratif_rpl2_CASTHMA.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                                50%     2.5%    97.5%
## strat0                     9.83257  9.82778  9.83736
## strat0:flood_risk_pc1      0.01216  0.00579  0.01854
## strat0:flood_risk_pc2     -0.00360 -0.00980  0.00265
## strat0:flood_risk_pc3      0.01494  0.00995  0.01991
## strat0:flood_risk_pc4      0.00213 -0.00203  0.00630
## strat0:flood_risk_pc5     -0.00289 -0.00716  0.00134
## strat0:EP_POV              0.35195  0.34355  0.36027
## strat0:EP_UNEMP            0.09397  0.08745  0.10044
## strat0:EP_PCI             -0.08317 -0.09006 -0.07623
## strat0:EP_NOHSDP           0.09996  0.08889  0.11126
## strat0:EP_MINRTY           0.13555  0.12501  0.14601
## strat0:EP_LIMENG          -0.19002 -0.19959 -0.18048
## strat0:EP_MUNIT           -0.02840 -0.03378 -0.02300
## strat0:EP_MOBILE          -0.02239 -0.02916 -0.01564
## strat0:EP_CROWD           -0.02121 -0.02837 -0.01397
## strat0:EP_NOVEH            0.10804  0.09900  0.11701
## strat0:EP_GROUPQ          -0.03267 -0.03623 -0.02912
## strat0:EP_UNINSUR         -0.00316 -0.01049  0.00421
## strat0:co                 -0.06186 -0.08378 -0.03998
## strat0:no2                -0.14100 -0.17181 -0.11107
## strat0:o3                  0.03155 -0.01696  0.07995
## strat0:pm10               -0.17401 -0.19457 -0.15340
## strat0:pm25                0.29421  0.26446  0.32395
## strat0:so2                -0.00820 -0.02895  0.01209
## strat0:summer_tmmx         0.05488  0.02045  0.08789
## strat0:winter_tmmx        -0.11266 -0.19355 -0.01417
## strat0:summer_rmax         0.03801 -0.00709  0.08177
## strat0:winter_rmax        -0.06334 -0.09647 -0.02965
## strat0:Data_Value_CSMOKING  0.66752  0.65475  0.68037
## strat1                     9.89579  9.89079  9.90083
## strat1:flood_risk_pc1     -0.01658 -0.02322 -0.00998
## strat1:flood_risk_pc2     -0.00106 -0.00734  0.00525
## strat1:flood_risk_pc3     -0.00103 -0.00637  0.00429
## strat1:flood_risk_pc4      0.00214 -0.00258  0.00687
## strat1:flood_risk_pc5      0.00519  0.00001  0.01038
## strat1:EP_POV              0.19769  0.18870  0.20662
## strat1:EP_UNEMP            0.04952  0.04442  0.05461
## strat1:EP_PCI              0.00868 -0.00422  0.02169
## strat1:EP_NOHSDP           0.08813  0.07818  0.09807
## strat1:EP_MINRTY           0.46133  0.45143  0.47114
## strat1:EP_LIMENG          -0.27939 -0.28879 -0.27002
## strat1:EP_MUNIT            0.01370  0.00606  0.02125
## strat1:EP_MOBILE          -0.01147 -0.01649 -0.00649
```

```
## strat1:EP_CROWD            -0.02383 -0.03088 -0.01678
## strat1:EP_NOVEH             0.17209  0.16305  0.18120
## strat1:EP_GROUPQ           -0.18128 -0.19088 -0.17159
## strat1:EP_UNINSUR          -0.04488 -0.05169 -0.03800
## strat1:co                  -0.09451 -0.11935 -0.06980
## strat1:no2                 -0.16847 -0.20072 -0.13701
## strat1:o3                   0.03158 -0.01692  0.08005
## strat1:pm10                -0.14402 -0.16456 -0.12372
## strat1:pm25                 0.28369  0.25408  0.31302
## strat1:so2                 -0.03194 -0.05217 -0.01183
## strat1:summer_tmmx          0.00158 -0.03300  0.03492
## strat1:winter_tmmx         -0.08912 -0.17079  0.00898
## strat1:summer_rmax         -0.02186 -0.06690  0.02214
## strat1:winter_rmax         -0.03986 -0.07293 -0.00646
## strat1:Data_Value_CSMOKING  0.92364  0.91115  0.93605
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/CASTHMA_rp
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                    "strat0:flood_risk_pc1"
##  [3] "strat0:flood_risk_pc3"     "strat0:EP_POV"
##  [5] "strat0:EP_UNEMP"           "strat0:EP_PCI"
##  [7] "strat0:EP_NOHSDP"          "strat0:EP_MINRTY"
##  [9] "strat0:EP_LIMENG"          "strat0:EP_MUNIT"
## [11] "strat0:EP_MOBILE"          "strat0:EP_CROWD"
## [13] "strat0:EP_NOVEH"           "strat0:EP_GROUPQ"
## [15] "strat0:co"                 "strat0:no2"
## [17] "strat0:pm10"               "strat0:pm25"
## [19] "strat0:summer_tmmx"        "strat0:winter_tmmx"
## [21] "strat0:winter_rmax"        "strat0:Data_Value_CSMOKING"
## [23] "strat1"                    "strat1:flood_risk_pc1"
## [25] "strat1:flood_risk_pc5"     "strat1:EP_POV"
## [27] "strat1:EP_UNEMP"           "strat1:EP_NOHSDP"
## [29] "strat1:EP_MINRTY"          "strat1:EP_LIMENG"
## [31] "strat1:EP_MUNIT"           "strat1:EP_MOBILE"
## [33] "strat1:EP_CROWD"           "strat1:EP_NOVEH"
## [35] "strat1:EP_GROUPQ"          "strat1:EP_UNINSUR"
## [37] "strat1:co"                 "strat1:no2"
## [39] "strat1:pm10"               "strat1:pm25"
## [41] "strat1:so2"                "strat1:winter_rmax"
## [43] "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)
```

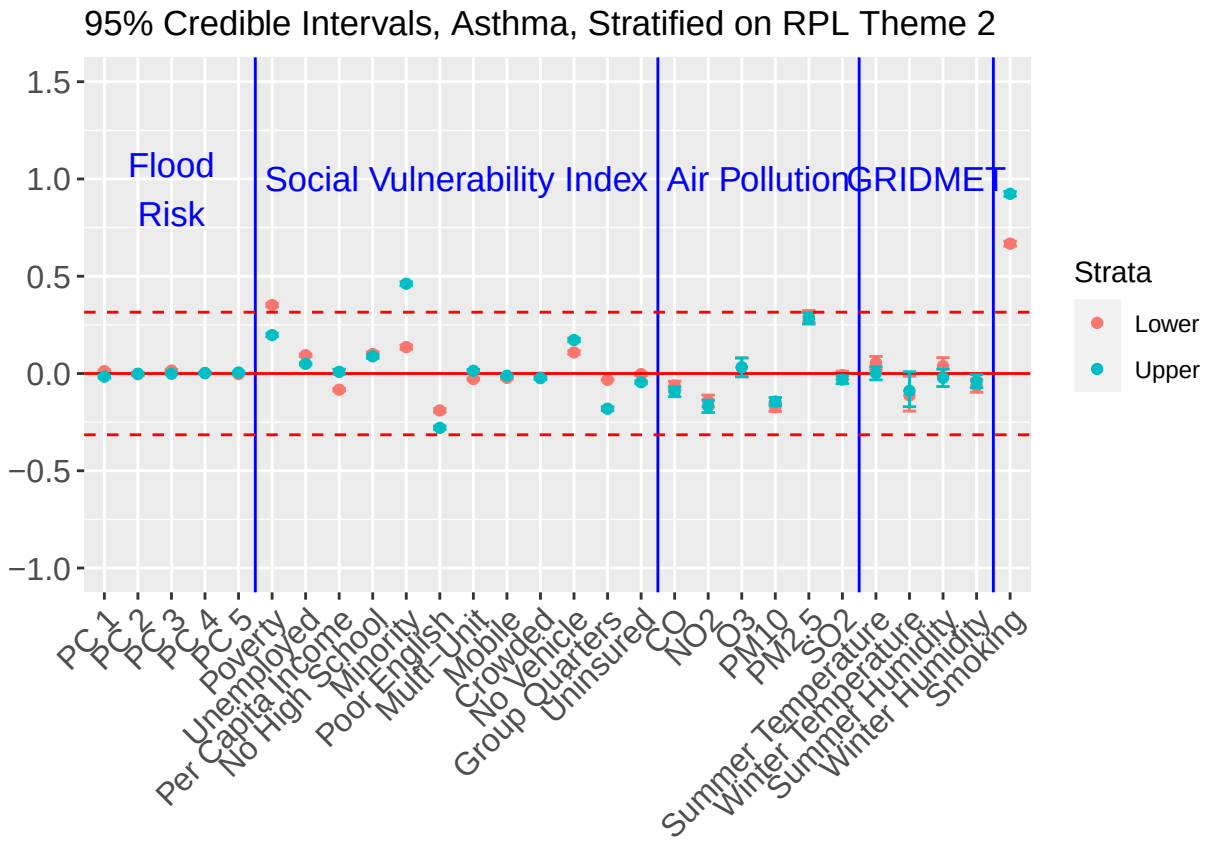
```
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-1, 1.5)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 17.5, 23.5, 27.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 0.95, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 11.5, y = 1, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 20.5, y = 1, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 25.5, y = 1, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Poverty", "Unemployed", "Per Capita Income", "No High School",
                              "Minority", "Poor English",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hu
                              "Smoking")) + ggtitle("95% Credible Intervals, Asthma, Stratified on RPL
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_CASTHMA, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_CASTHMA, col = "red", linetype = "dashed")

p
```




```
ggsave(here("figures/final_figures/stratified_analysis/CASTHMA_CI_rpl2.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

Stratified on RPL_THEME3

Inference is based on 3 markov chains, each of which has been run for 110000 samples, the first 10000 of which has been removed for burn-in. The remaining 100000 samples are thinned by 2, resulting in 150000 samples for inference across the 3 Markov chains.

```
load(here("modeling_files/stratified_analysis/model_stratif_rpl3_CASTHMA.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                                50%     2.5%    97.5%
## strat0                     9.99880  9.98925 10.00830
## strat0:flood_risk_pc1      0.00804  0.00072  0.01542
## strat0:flood_risk_pc2     -0.00302 -0.01010  0.00407
## strat0:flood_risk_pc3      0.01399  0.00828  0.01968
## strat0:flood_risk_pc4     -0.00011 -0.00577  0.00557
## strat0:flood_risk_pc5      0.00221 -0.00361  0.00811
## strat0:EP_POV              0.34683  0.33677  0.35679
## strat0:EP_UNEMP            0.08161  0.07493  0.08823
```

```
## strat0:EP_PCI              -0.08775 -0.09583 -0.07981
## strat0:EP_NOHSDP            0.15174  0.13689  0.16643
## strat0:EP_AGE65             0.04277  0.03565  0.04992
## strat0:EP_AGE17             0.00597 -0.00227  0.01419
## strat0:EP_DISABL           -0.04494 -0.05278 -0.03714
## strat0:EP_SNGPNT            0.06454  0.05654  0.07254
## strat0:EP_MUNIT            -0.03172 -0.04046 -0.02295
## strat0:EP_MOBILE           -0.02864 -0.03486 -0.02247
## strat0:EP_CROWD             0.01575  0.00228  0.02906
## strat0:EP_NOVEH             0.13549  0.12383  0.14716
## strat0:EP_GROUPQ            0.00895  0.00330  0.01456
## strat0:EP_UNINSUR          -0.01731 -0.02637 -0.00820
## strat0:co                  -0.10621 -0.13081 -0.08192
## strat0:no2                 -0.12860 -0.16259 -0.09494
## strat0:o3                   0.05013 -0.00253  0.11236
## strat0:pm10                -0.12230 -0.14432 -0.10020
## strat0:pm25                 0.26680  0.23463  0.29839
## strat0:so2                 -0.01014 -0.03312  0.01267
## strat0:summer_tmmx          0.02615 -0.00986  0.06082
## strat0:winter_tmmx         -0.01594 -0.10751  0.07156
## strat0:summer_rmax          0.02195 -0.02684  0.06650
## strat0:winter_rmax         -0.06214 -0.09806 -0.02620
## strat0:Data_Value_CSMOKING  0.73846  0.72263  0.75421
## strat1                      9.91879  9.91280  9.92478
## strat1:flood_risk_pc1      -0.00519 -0.01209  0.00167
## strat1:flood_risk_pc2      -0.00566 -0.01226  0.00088
## strat1:flood_risk_pc3       0.00566  0.00023  0.01108
## strat1:flood_risk_pc4       0.00640  0.00222  0.01051
## strat1:flood_risk_pc5       0.00005 -0.00436  0.00451
## strat1:EP_POV               0.21791  0.20939  0.22640
## strat1:EP_UNEMP             0.10423  0.09880  0.10961
## strat1:EP_PCI              -0.11830 -0.12786 -0.10873
## strat1:EP_NOHSDP           -0.03555 -0.04413 -0.02695
## strat1:EP_AGE65             0.09370  0.08558  0.10184
## strat1:EP_AGE17             0.00745 -0.00030  0.01527
## strat1:EP_DISABL           -0.04208 -0.04942 -0.03475
## strat1:EP_SNGPNT            0.08022  0.07402  0.08640
## strat1:EP_MUNIT            -0.01105 -0.01691 -0.00517
## strat1:EP_MOBILE           -0.02861 -0.03448 -0.02279
## strat1:EP_CROWD            -0.05010 -0.05651 -0.04366
## strat1:EP_NOVEH             0.16668  0.15787  0.17548
## strat1:EP_GROUPQ           -0.09129 -0.09664 -0.08602
## strat1:EP_UNINSUR          -0.06262 -0.06942 -0.05585
## strat1:co                  -0.11962 -0.14678 -0.09299
## strat1:no2                 -0.06301 -0.09678 -0.02997
## strat1:o3                   0.07369  0.02062  0.13639
## strat1:pm10                -0.19649 -0.21951 -0.17328
## strat1:pm25                 0.30810  0.27569  0.34031
## strat1:so2                 -0.05125 -0.07550 -0.02734
## strat1:summer_tmmx          0.01770 -0.01917  0.05341
## strat1:winter_tmmx          0.04960 -0.04257  0.13644
## strat1:summer_rmax         -0.00660 -0.05599  0.03819
## strat1:winter_rmax         -0.06590 -0.10216 -0.02936
## strat1:Data_Value_CSMOKING  1.01443  1.00108  1.02788
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/CASTHMA_rp
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                    "strat0:flood_risk_pc1"
##  [3] "strat0:flood_risk_pc3"     "strat0:EP_POV"
##  [5] "strat0:EP_UNEMP"           "strat0:EP_PCI"
##  [7] "strat0:EP_NOHSDP"          "strat0:EP_AGE65"
##  [9] "strat0:EP_DISABL"          "strat0:EP_SNGPNT"
## [11] "strat0:EP_MUNIT"           "strat0:EP_MOBILE"
## [13] "strat0:EP_CROWD"           "strat0:EP_NOVEH"
## [15] "strat0:EP_GROUPQ"          "strat0:EP_UNINSUR"
## [17] "strat0:co"                 "strat0:no2"
## [19] "strat0:pm10"               "strat0:pm25"
## [21] "strat0:winter_rmax"        "strat0:Data_Value_CSMOKING"
## [23] "strat1"                    "strat1:flood_risk_pc3"
## [25] "strat1:flood_risk_pc4"     "strat1:EP_POV"
## [27] "strat1:EP_UNEMP"           "strat1:EP_PCI"
## [29] "strat1:EP_NOHSDP"          "strat1:EP_AGE65"
## [31] "strat1:EP_DISABL"          "strat1:EP_SNGPNT"
## [33] "strat1:EP_MUNIT"           "strat1:EP_MOBILE"
## [35] "strat1:EP_CROWD"           "strat1:EP_NOVEH"
## [37] "strat1:EP_GROUPQ"          "strat1:EP_UNINSUR"
## [39] "strat1:co"                 "strat1:no2"
## [41] "strat1:o3"                 "strat1:pm10"
## [43] "strat1:pm25"               "strat1:so2"
## [45] "strat1:winter_rmax"        "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

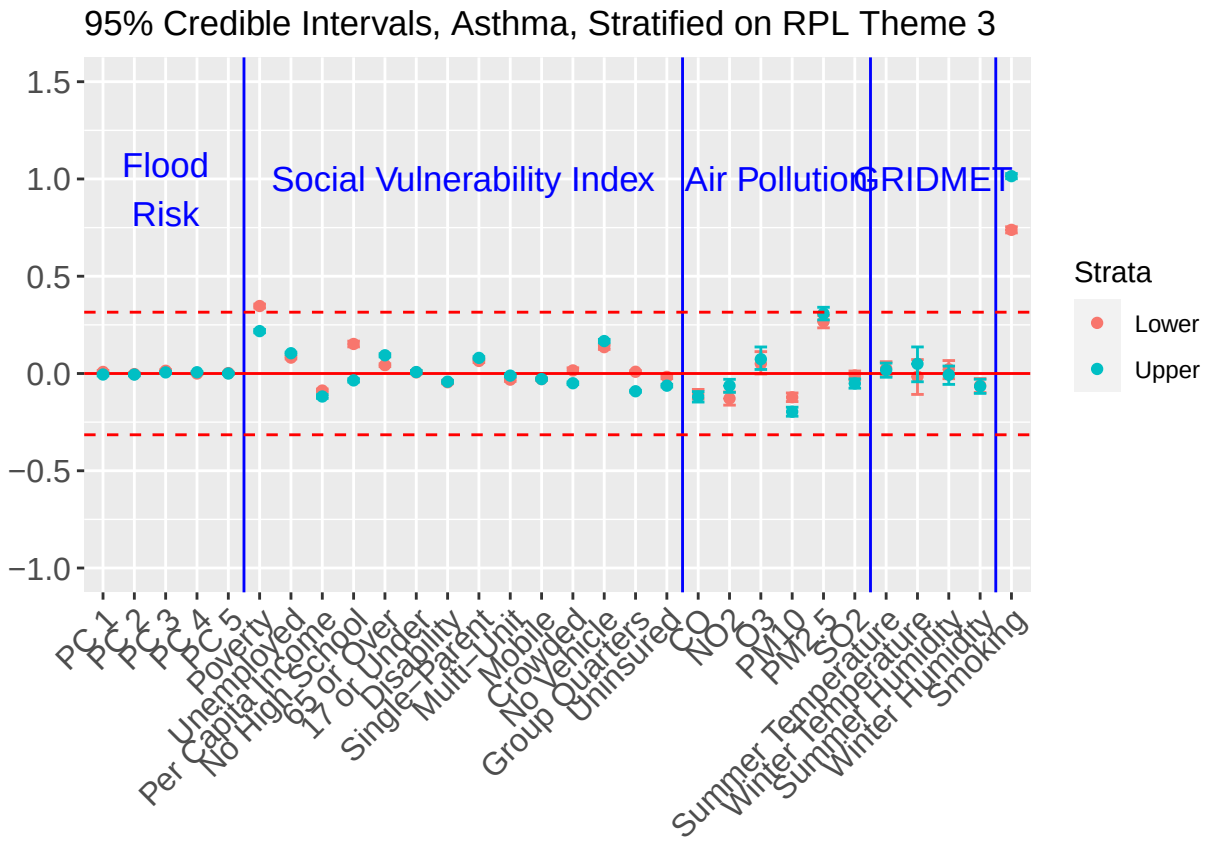
Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
```

```
  ylim(c(-1, 1.5)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 19.5, 25.5, 29.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 0.95, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 12.5, y = 1, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 22.5, y = 1, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 27.5, y = 1, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Poverty", "Unemployed", "Per Capita Income", "No High School",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hum
                              "Smoking")) + ggtitle("95% Credible Intervals, Asthma, Stratified on RPL T
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_CASTHMA, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_CASTHMA, col = "red", linetype = "dashed")

p
```




```
ggsave(here("figures/final_figures/stratified_analysis/CASTHMA_CI_rpl3.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

Stratified on RPL_THEME4

Inference is based on 3 markov chains, each of which has been run for 110000 samples, the first 10000 of which has been removed for burn-in. The remaining 100000 samples are thinned by 2, resulting in 150000 samples for inference across the 3 Markov chains.

```
load(here("modeling_files/stratified_analysis/model_stratif_rpl4_CASTHMA.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                                50%     2.5%    97.5%
## strat0                     9.88550  9.88114  9.88982
## strat0:flood_risk_pc1      0.00788  0.00122  0.01453
## strat0:flood_risk_pc2     -0.00497 -0.01152  0.00167
## strat0:flood_risk_pc3      0.00916  0.00394  0.01439
## strat0:flood_risk_pc4      0.00603  0.00123  0.01083
## strat0:flood_risk_pc5     -0.00318 -0.00827  0.00196
## strat0:EP_POV              0.25567  0.24570  0.26572
## strat0:EP_UNEMP            0.06554  0.05922  0.07184
```

```
## strat0:EP_PCI              -0.02589 -0.03360 -0.01825
## strat0:EP_NOHSDP            0.07147  0.05938  0.08358
## strat0:EP_AGE65             0.11589  0.10928  0.12258
## strat0:EP_AGE17             0.03884  0.03207  0.04565
## strat0:EP_DISABL           -0.01990 -0.02751 -0.01228
## strat0:EP_SNGPNT            0.02884  0.02163  0.03610
## strat0:EP_MINRTY            0.33417  0.32346  0.34487
## strat0:EP_LIMENG           -0.24653 -0.25888 -0.23422
## strat0:EP_UNINSUR          -0.01269 -0.02081 -0.00449
## strat0:co                  -0.06428 -0.08965 -0.03909
## strat0:no2                 -0.11788 -0.15048 -0.08509
## strat0:o3                  -0.06789 -0.11509 -0.01713
## strat0:pm10                -0.16190 -0.18269 -0.14131
## strat0:pm25                 0.30887  0.27940  0.33877
## strat0:so2                  0.00596 -0.01558  0.02703
## strat0:summer_tmmx          0.03683  0.00210  0.07155
## strat0:winter_tmmx         -0.12951 -0.21789 -0.03072
## strat0:summer_rmax          0.00143 -0.04068  0.04549
## strat0:winter_rmax         -0.05656 -0.09122 -0.02402
## strat0:Data_Value_CSMOKING  0.89188  0.87766  0.90625
## strat1                      9.88384  9.87977  9.88794
## strat1:flood_risk_pc1      -0.00553 -0.01207  0.00099
## strat1:flood_risk_pc2      -0.00258 -0.00886  0.00366
## strat1:flood_risk_pc3       0.00901  0.00385  0.01416
## strat1:flood_risk_pc4       0.00355 -0.00078  0.00788
## strat1:flood_risk_pc5       0.00017 -0.00440  0.00476
## strat1:EP_POV               0.31737  0.30991  0.32481
## strat1:EP_UNEMP             0.07537  0.06988  0.08079
## strat1:EP_PCI              -0.08706 -0.09664 -0.07742
## strat1:EP_NOHSDP            0.05047  0.04081  0.06015
## strat1:EP_AGE65             0.13795  0.13078  0.14508
## strat1:EP_AGE17             0.03899  0.03246  0.04554
## strat1:EP_DISABL           -0.04465 -0.05147 -0.03781
## strat1:EP_SNGPNT            0.04362  0.03714  0.05008
## strat1:EP_MINRTY            0.35976  0.34939  0.37012
## strat1:EP_LIMENG           -0.25849 -0.26696 -0.25008
## strat1:EP_UNINSUR          -0.02646 -0.03307 -0.01987
## strat1:co                  -0.03124 -0.05368 -0.00898
## strat1:no2                 -0.16010 -0.19075 -0.12969
## strat1:o3                  -0.06687 -0.11393 -0.01635
## strat1:pm10                -0.16411 -0.18541 -0.14317
## strat1:pm25                 0.32338  0.29416  0.35315
## strat1:so2                  0.00239 -0.01863  0.02308
## strat1:summer_tmmx          0.02332 -0.01137  0.05728
## strat1:winter_tmmx         -0.13017 -0.21830 -0.03152
## strat1:summer_rmax         -0.00766 -0.04943  0.03638
## strat1:winter_rmax         -0.06760 -0.10210 -0.03514
## strat1:Data_Value_CSMOKING  0.85818  0.84555  0.87082
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/CASTHMA_rp
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                    "strat0:flood_risk_pc1"
##  [3] "strat0:flood_risk_pc3"     "strat0:flood_risk_pc4"
##  [5] "strat0:EP_POV"             "strat0:EP_UNEMP"
##  [7] "strat0:EP_PCI"             "strat0:EP_NOHSDP"
##  [9] "strat0:EP_AGE65"           "strat0:EP_AGE17"
## [11] "strat0:EP_DISABL"          "strat0:EP_SNGPNT"
## [13] "strat0:EP_MINRTY"          "strat0:EP_LIMENG"
## [15] "strat0:EP_UNINSUR"         "strat0:co"
## [17] "strat0:no2"                "strat0:o3"
## [19] "strat0:pm10"               "strat0:pm25"
## [21] "strat0:summer_tmmx"        "strat0:winter_tmmx"
## [23] "strat0:winter_rmax"        "strat0:Data_Value_CSMOKING"
## [25] "strat1"                    "strat1:flood_risk_pc3"
## [27] "strat1:EP_POV"             "strat1:EP_UNEMP"
## [29] "strat1:EP_PCI"             "strat1:EP_NOHSDP"
## [31] "strat1:EP_AGE65"           "strat1:EP_AGE17"
## [33] "strat1:EP_DISABL"          "strat1:EP_SNGPNT"
## [35] "strat1:EP_MINRTY"          "strat1:EP_LIMENG"
## [37] "strat1:EP_UNINSUR"         "strat1:co"
## [39] "strat1:no2"                "strat1:o3"
## [41] "strat1:pm10"               "strat1:pm25"
## [43] "strat1:winter_tmmx"        "strat1:winter_rmax"
## [45] "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

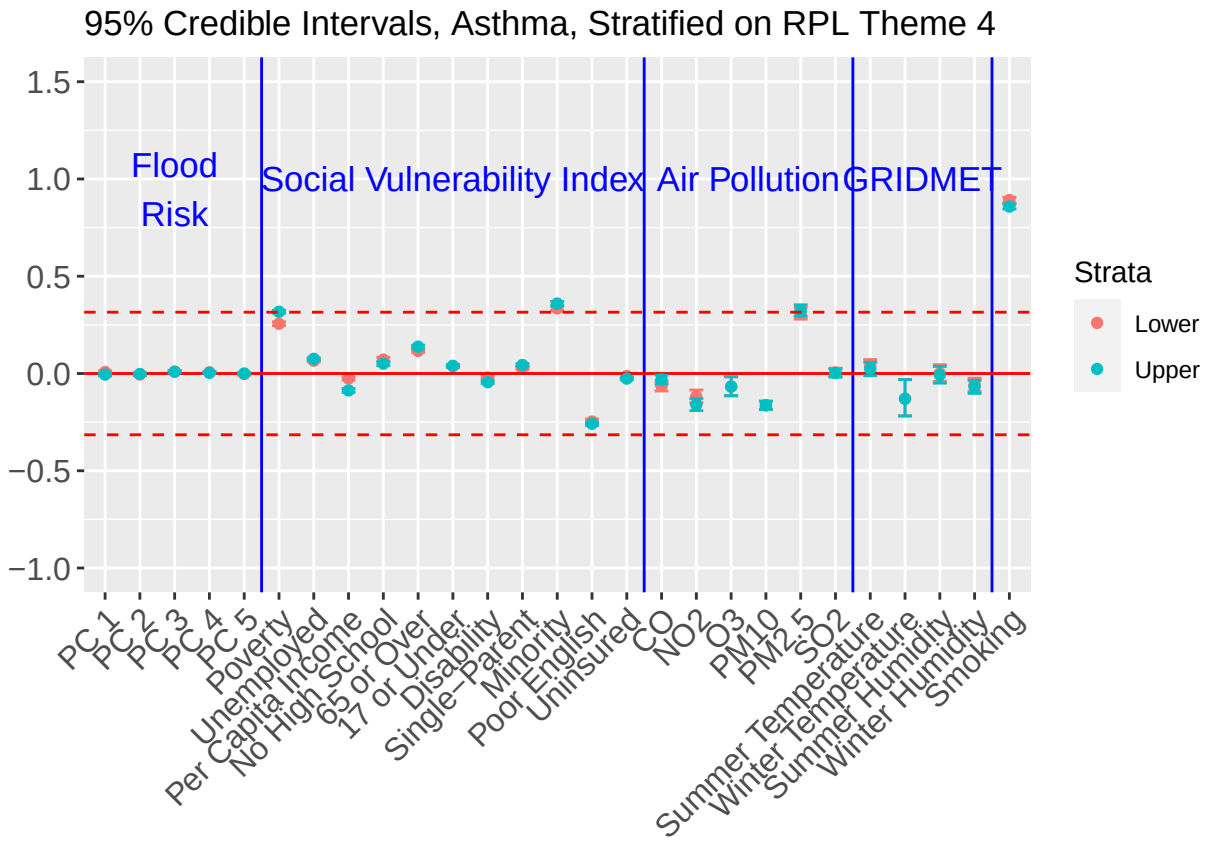
Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-1, 1.5)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
```

```
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 16.5, 22.5, 26.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 0.95, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 11, y = 1, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 19.5, y = 1, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 24.5, y = 1, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Poverty", "Unemployed", "Per Capita Income", "No High School",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent",
                              "Minority", "Poor English",
                              "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hu
                              "Smoking")) + ggtitle("95% Credible Intervals, Asthma, Stratified on RPL
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_CASTHMA, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_CASTHMA, col = "red", linetype = "dashed")

p
```




```
ggsave(here("figures/final_figures/stratified_analysis/CASTHMA_CI_rpl4.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

Stratified on RPL_THEMES

Inference is based on 3 markov chains, each of which has been run for 110000 samples, the first 10000 of which has been removed for burn-in. The remaining 100000 samples are thinned by 2, resulting in 150000 samples for inference across the 3 Markov chains.

```
load(here("modeling_files/stratified_analysis/model_stratif_rpls_CASTHMA.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                              50%     2.5%    97.5%
## strat0                   9.75621  9.74943  9.76297
## strat0:flood_risk_pc1   -0.00657 -0.01439  0.00120
## strat0:flood_risk_pc2   -0.00403 -0.01174  0.00383
## strat0:flood_risk_pc3    0.00792  0.00185  0.01410
## strat0:flood_risk_pc4    0.00286 -0.00267  0.00837
## strat0:flood_risk_pc5   -0.00882 -0.01444 -0.00321
## strat0:EP_UNINSUR       -0.02305 -0.03310 -0.01293
## strat0:co               -0.02414 -0.05093  0.00265
```

```
## strat0:no2                 -0.05539 -0.09060 -0.01885
## strat0:o3                  -0.02485 -0.08653  0.02890
## strat0:pm10                -0.19263 -0.21848 -0.16745
## strat0:pm25                 0.40863  0.37174  0.44473
## strat0:so2                  0.02386 -0.00101  0.04944
## strat0:summer_tmmx          0.02859 -0.01417  0.07686
## strat0:winter_tmmx         -0.14216 -0.28390 -0.01601
## strat0:summer_rmax          0.00229 -0.04962  0.05686
## strat0:winter_rmax         -0.06357 -0.10244 -0.02499
## strat0:Data_Value_CSMOKING  1.10569  1.09428  1.11711
## strat1                      9.94044  9.93463  9.94622
## strat1:flood_risk_pc1       0.02007  0.01237  0.02773
## strat1:flood_risk_pc2       0.00606 -0.00128  0.01342
## strat1:flood_risk_pc3       0.02554  0.01932  0.03166
## strat1:flood_risk_pc4       0.00363 -0.00154  0.00879
## strat1:flood_risk_pc5       0.00837  0.00274  0.01405
## strat1:EP_UNINSUR          -0.08758 -0.09424 -0.08087
## strat1:co                  -0.11886 -0.14841 -0.08939
## strat1:no2                  0.13086  0.09453  0.16785
## strat1:o3                  -0.06549 -0.12745 -0.01112
## strat1:pm10                -0.26962 -0.29636 -0.24331
## strat1:pm25                 0.46832  0.43110  0.50403
## strat1:so2                 -0.00010 -0.02470  0.02542
## strat1:summer_tmmx          0.01951 -0.02368  0.06772
## strat1:winter_tmmx         -0.06222 -0.20370  0.06437
## strat1:summer_rmax         -0.04954 -0.10189  0.00494
## strat1:winter_rmax         -0.10545 -0.14441 -0.06632
## strat1:Data_Value_CSMOKING  1.32013  1.31162  1.32861
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/CASTHMA_rp
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                    "strat0:flood_risk_pc3"
##  [3] "strat0:flood_risk_pc5"     "strat0:EP_UNINSUR"
##  [5] "strat0:no2"                "strat0:pm10"
##  [7] "strat0:pm25"               "strat0:winter_tmmx"
##  [9] "strat0:winter_rmax"        "strat0:Data_Value_CSMOKING"
## [11] "strat1"                    "strat1:flood_risk_pc1"
## [13] "strat1:flood_risk_pc3"     "strat1:flood_risk_pc5"
## [15] "strat1:EP_UNINSUR"         "strat1:co"
## [17] "strat1:no2"                "strat1:o3"
## [19] "strat1:pm10"               "strat1:pm25"
## [21] "strat1:winter_rmax"        "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
```

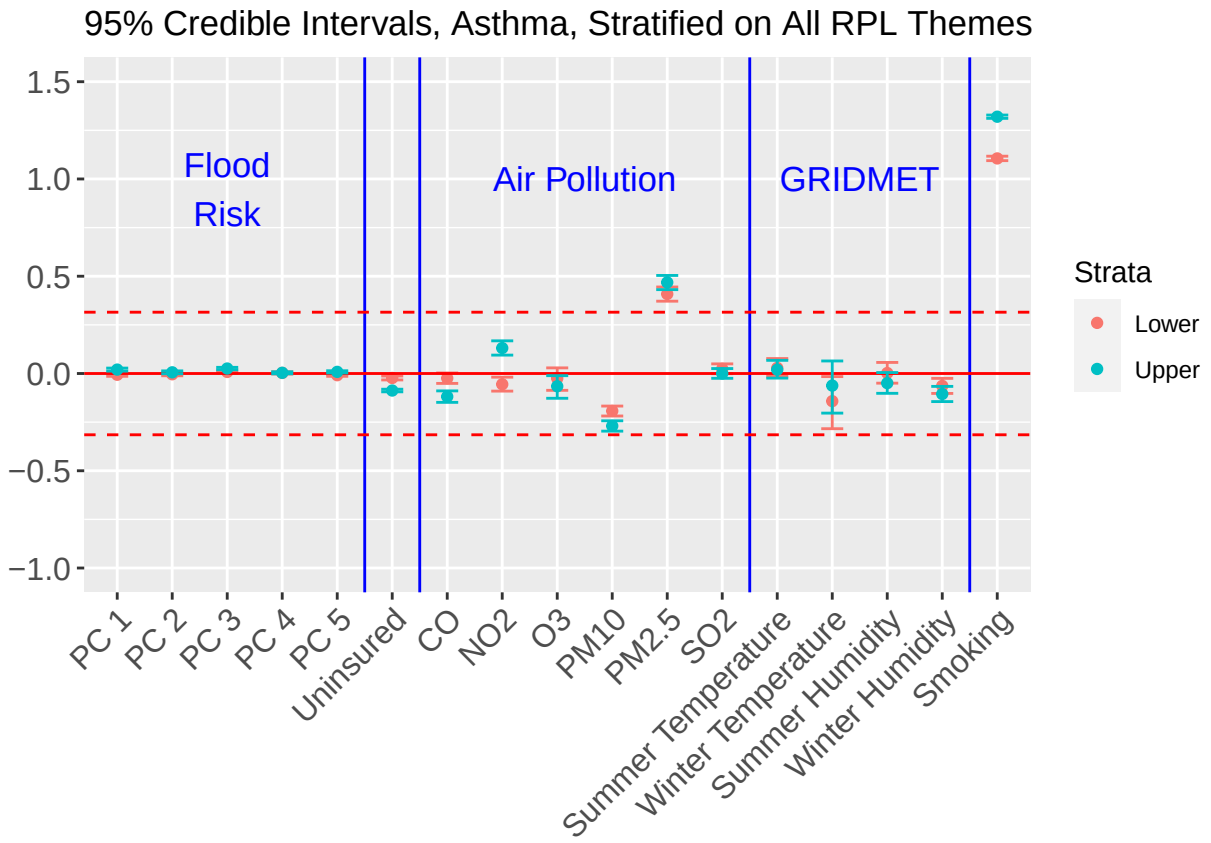
```
                              post_2.5 = `2.5%`,
                              post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-1, 1.5)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 6.5, 12.5, 16.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 0.95, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 9.5, y = 1, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 14.5, y = 1, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hu
                              "Smoking")) + ggtitle("95% Credible Intervals, Asthma, Stratified on All
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_CASTHMA, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_CASTHMA, col = "red", linetype = "dashed")

p
```




```
ggsave(here("figures/final_figures/stratified_analysis/CASTHMA_CI_rpls.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

MHLTH Stratified Analysis

Repeating the stratified analysis in the last section, this time just doing the plots

Stratified on Poverty

```
load(here("modeling_files/stratified_analysis/model_stratif_poverty_MHLTH.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                               50%     2.5%    97.5%
## strat0                    14.06011 14.04734 14.07288
## strat0:flood_risk_pc1     -0.01680 -0.02877 -0.00480
## strat0:flood_risk_pc2     -0.00592 -0.01769  0.00598
## strat0:flood_risk_pc3      0.00215 -0.00719  0.01149
## strat0:flood_risk_pc4      0.00195 -0.00623  0.01007
## strat0:flood_risk_pc5     -0.00413 -0.01243  0.00423
```

```
## strat0:EP_UNEMP             0.08953  0.07528  0.10368
## strat0:EP_PCI              -0.17027 -0.18392 -0.15647
## strat0:EP_NOHSDP            0.11607  0.08977  0.14234
## strat0:EP_AGE65            -0.22732 -0.24036 -0.21430
## strat0:EP_AGE17            -0.03214 -0.04711 -0.01729
## strat0:EP_DISABL           -0.03695 -0.05268 -0.02109
## strat0:EP_SNGPNT            0.07431  0.05955  0.08909
## strat0:EP_MINRTY           -0.07849 -0.10083 -0.05647
## strat0:EP_LIMENG            0.05970  0.03578  0.08345
## strat0:EP_MUNIT             0.08576  0.07332  0.09815
## strat0:EP_MOBILE           -0.02326 -0.03567 -0.01091
## strat0:EP_CROWD             0.07573  0.05641  0.09510
## strat0:EP_NOVEH             0.11870  0.09718  0.14009
## strat0:EP_GROUPQ            0.17621  0.16374  0.18862
## strat0:EP_UNINSUR           0.03998  0.02377  0.05613
## strat0:co                   0.09892  0.05861  0.13923
## strat0:no2                  0.14333  0.08770  0.19792
## strat0:o3                  -0.02195 -0.10671  0.06813
## strat0:pm10                -0.16181 -0.19863 -0.12611
## strat0:pm25                 0.30435  0.25344  0.35888
## strat0:so2                  0.04441  0.00708  0.08193
## strat0:summer_tmmx          0.05412 -0.00398  0.11821
## strat0:winter_tmmx         -0.00380 -0.20363  0.14585
## strat0:summer_rmax          0.03994 -0.04229  0.12515
## strat0:winter_rmax         -0.05100 -0.11082  0.00950
## strat0:Data_Value_CSMOKING  2.74508  2.71654  2.77339
## strat1                     14.21993 14.20909 14.23066
## strat1:flood_risk_pc1       0.00389 -0.00784  0.01552
## strat1:flood_risk_pc2       0.01530  0.00426  0.02643
## strat1:flood_risk_pc3       0.02289  0.01371  0.03204
## strat1:flood_risk_pc4      -0.00592 -0.01386  0.00200
## strat1:flood_risk_pc5       0.00212 -0.00648  0.01079
## strat1:EP_UNEMP             0.13905  0.13049  0.14766
## strat1:EP_PCI              -0.97738 -1.00118 -0.95377
## strat1:EP_NOHSDP            0.18960  0.17285  0.20625
## strat1:EP_AGE65            -0.40938 -0.42305 -0.39569
## strat1:EP_AGE17            -0.17886 -0.19237 -0.16516
## strat1:EP_DISABL           -0.24694 -0.25836 -0.23544
## strat1:EP_SNGPNT            0.14447  0.13379  0.15519
## strat1:EP_MINRTY           -0.22892 -0.24685 -0.21084
## strat1:EP_LIMENG           -0.03337 -0.04822 -0.01846
## strat1:EP_MUNIT             0.22047  0.20967  0.23131
## strat1:EP_MOBILE           -0.04185 -0.05117 -0.03257
## strat1:EP_CROWD             0.07330  0.06199  0.08461
## strat1:EP_NOVEH             0.25092  0.23668  0.26518
## strat1:EP_GROUPQ            0.15215  0.14399  0.16033
## strat1:EP_UNINSUR          -0.09036 -0.10194 -0.07891
## strat1:co                   0.10159  0.05701  0.14599
## strat1:no2                 -0.02745 -0.08400  0.02736
## strat1:o3                   0.02519 -0.05947  0.11579
## strat1:pm10                -0.21924 -0.25732 -0.18261
## strat1:pm25                 0.37089  0.31972  0.42596
## strat1:so2                  0.04638  0.00950  0.08346
## strat1:summer_tmmx          0.03640 -0.02248  0.10063
```

```
## strat1:winter_tmmx          0.12008 -0.08005  0.26918
## strat1:summer_rmax         -0.01066 -0.09345  0.07433
## strat1:winter_rmax         -0.02255 -0.08213  0.03790
## strat1:Data_Value_CSMOKING  2.51363  2.49348  2.53391
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/MHLTH_pove
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                      "strat0:flood_risk_pc1"
##  [3] "strat0:EP_UNEMP"             "strat0:EP_PCI"
##  [5] "strat0:EP_NOHSDP"            "strat0:EP_AGE65"
##  [7] "strat0:EP_AGE17"             "strat0:EP_DISABL"
##  [9] "strat0:EP_SNGPNT"            "strat0:EP_MINRTY"
## [11] "strat0:EP_LIMENG"            "strat0:EP_MUNIT"
## [13] "strat0:EP_MOBILE"            "strat0:EP_CROWD"
## [15] "strat0:EP_NOVEH"             "strat0:EP_GROUPQ"
## [17] "strat0:EP_UNINSUR"           "strat0:co"
## [19] "strat0:no2"                  "strat0:pm10"
## [21] "strat0:pm25"                 "strat0:so2"
## [23] "strat0:Data_Value_CSMOKING" "strat1"
## [25] "strat1:flood_risk_pc2"       "strat1:flood_risk_pc3"
## [27] "strat1:EP_UNEMP"             "strat1:EP_PCI"
## [29] "strat1:EP_NOHSDP"            "strat1:EP_AGE65"
## [31] "strat1:EP_AGE17"             "strat1:EP_DISABL"
## [33] "strat1:EP_SNGPNT"            "strat1:EP_MINRTY"
## [35] "strat1:EP_LIMENG"            "strat1:EP_MUNIT"
## [37] "strat1:EP_MOBILE"            "strat1:EP_CROWD"
## [39] "strat1:EP_NOVEH"             "strat1:EP_GROUPQ"
## [41] "strat1:EP_UNINSUR"           "strat1:co"
## [43] "strat1:pm10"                 "strat1:pm25"
## [45] "strat1:so2"                  "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

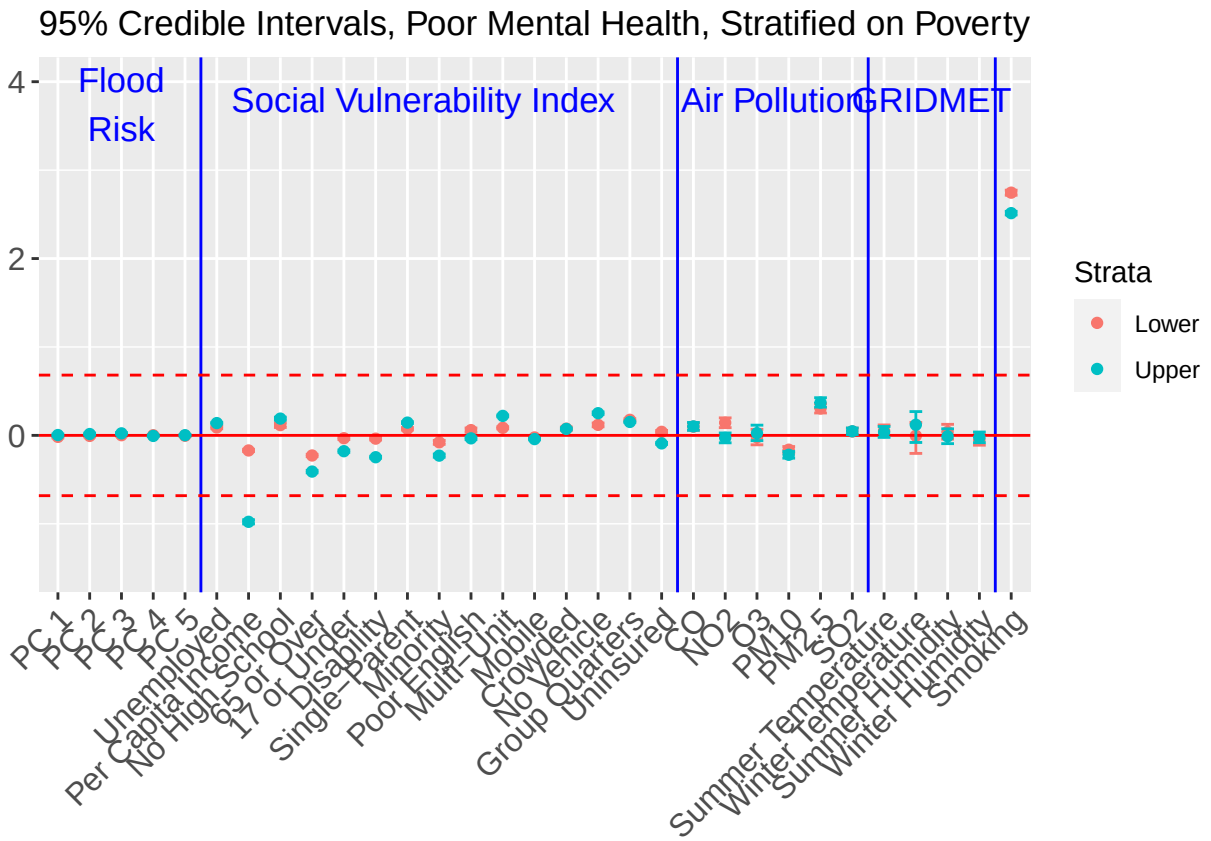
```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-1.5, 4)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 20.5, 26.5, 30.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 3.75, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 12.5, y = 3.8, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 23.5, y = 3.8, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 28.5, y = 3.8, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Unemployed", "Per Capita Income", "No High School",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent", "Minority", "Poor English",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hum
                              "Smoking")) + ggtitle("95% Credible Intervals, Poor Mental Health, Stratif
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_MHLTH, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_MHLTH, col = "red", linetype = "dashed")

p
```




```
ggsave(here("figures/final_figures/stratified_analysis/MHLTH_CI_poverty.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

Stratified on RPL_THEME1

```
load(here("modeling_files/stratified_analysis/model_stratif_rpl1_MHLTH.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                                50%     2.5%    97.5%
## strat0                    14.07655 14.06138 14.09155
## strat0:flood_risk_pc1     -0.00919 -0.02205  0.00362
## strat0:flood_risk_pc2     -0.00384 -0.01646  0.00891
## strat0:flood_risk_pc3      0.00904 -0.00094  0.01898
## strat0:flood_risk_pc4     -0.00119 -0.00985  0.00748
## strat0:flood_risk_pc5     -0.00778 -0.01652  0.00089
## strat0:EP_AGE65           -0.25793 -0.27100 -0.24486
## strat0:EP_AGE17           -0.09469 -0.10966 -0.07962
## strat0:EP_DISABL          -0.03573 -0.05169 -0.01982
## strat0:EP_SNGPNT           0.10721  0.09146  0.12296
## strat0:EP_MINRTY          -0.03140 -0.05493 -0.00779
```

```
## strat0:EP_LIMENG            0.05541  0.02918  0.08149
## strat0:EP_MUNIT             0.08780  0.07550  0.10014
## strat0:EP_MOBILE           -0.00439 -0.01889  0.01022
## strat0:EP_CROWD             0.09500  0.07174  0.11823
## strat0:EP_NOVEH             0.19098  0.16927  0.21270
## strat0:EP_GROUPQ            0.21311  0.20231  0.22389
## strat0:EP_UNINSUR           0.05382  0.03594  0.07176
## strat0:co                   0.09701  0.05335  0.14040
## strat0:no2                  0.18407  0.12288  0.24395
## strat0:o3                  -0.05207 -0.14730  0.04099
## strat0:pm10                -0.18972 -0.22934 -0.14987
## strat0:pm25                 0.41809  0.36020  0.47589
## strat0:so2                  0.03026 -0.01003  0.06955
## strat0:summer_tmmx          0.06509 -0.00412  0.12947
## strat0:winter_tmmx         -0.09728 -0.25818  0.10461
## strat0:summer_rmax          0.05665 -0.03164  0.14134
## strat0:winter_rmax         -0.02001 -0.08403  0.04511
## strat0:Data_Value_CSMOKING  2.90293  2.87759  2.92867
## strat1                     14.45254 14.44149 14.46368
## strat1:flood_risk_pc1       0.01420  0.00178  0.02661
## strat1:flood_risk_pc2       0.01269  0.00094  0.02450
## strat1:flood_risk_pc3       0.01887  0.00894  0.02873
## strat1:flood_risk_pc4       0.00772 -0.00068  0.01609
## strat1:flood_risk_pc5       0.00110 -0.00810  0.01036
## strat1:EP_AGE65            -0.41456 -0.42953 -0.39945
## strat1:EP_AGE17            -0.11717 -0.13150 -0.10277
## strat1:EP_DISABL           -0.21049 -0.22262 -0.19828
## strat1:EP_SNGPNT            0.15421  0.14315  0.16522
## strat1:EP_MINRTY           -0.04156 -0.05982 -0.02338
## strat1:EP_LIMENG            0.06967  0.05605  0.08309
## strat1:EP_MUNIT             0.19111  0.17908  0.20307
## strat1:EP_MOBILE           -0.01763 -0.02718 -0.00815
## strat1:EP_CROWD             0.11268  0.10101  0.12433
## strat1:EP_NOVEH             0.31867  0.30341  0.33383
## strat1:EP_GROUPQ            0.27662  0.26784  0.28539
## strat1:EP_UNINSUR          -0.06457 -0.07645 -0.05273
## strat1:co                   0.10242  0.05494  0.14945
## strat1:no2                 -0.00442 -0.06632  0.05520
## strat1:o3                  -0.02516 -0.12022  0.06785
## strat1:pm10                -0.24604 -0.28714 -0.20552
## strat1:pm25                 0.53906  0.48068  0.59623
## strat1:so2                  0.00190 -0.03737  0.04048
## strat1:summer_tmmx          0.04375 -0.02640  0.10976
## strat1:winter_tmmx          0.05536 -0.10604  0.25671
## strat1:summer_rmax         -0.06808 -0.15679  0.01723
## strat1:winter_rmax          0.02971 -0.03454  0.09509
## strat1:Data_Value_CSMOKING  2.92122  2.90268  2.93970
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/MHLTH_rpl1
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                    "strat0:EP_AGE65"
```

```
##  [3] "strat0:EP_AGE17"            "strat0:EP_DISABL"
##  [5] "strat0:EP_SNGPNT"           "strat0:EP_MINRTY"
##  [7] "strat0:EP_LIMENG"           "strat0:EP_MUNIT"
##  [9] "strat0:EP_CROWD"            "strat0:EP_NOVEH"
## [11] "strat0:EP_GROUPQ"           "strat0:EP_UNINSUR"
## [13] "strat0:co"                  "strat0:no2"
## [15] "strat0:pm10"                "strat0:pm25"
## [17] "strat0:Data_Value_CSMOKING" "strat1"
## [19] "strat1:flood_risk_pc1"      "strat1:flood_risk_pc2"
## [21] "strat1:flood_risk_pc3"      "strat1:EP_AGE65"
## [23] "strat1:EP_AGE17"            "strat1:EP_DISABL"
## [25] "strat1:EP_SNGPNT"           "strat1:EP_MINRTY"
## [27] "strat1:EP_LIMENG"           "strat1:EP_MUNIT"
## [29] "strat1:EP_MOBILE"           "strat1:EP_CROWD"
## [31] "strat1:EP_NOVEH"            "strat1:EP_GROUPQ"
## [33] "strat1:EP_UNINSUR"          "strat1:co"
## [35] "strat1:pm10"                "strat1:pm25"
## [37] "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

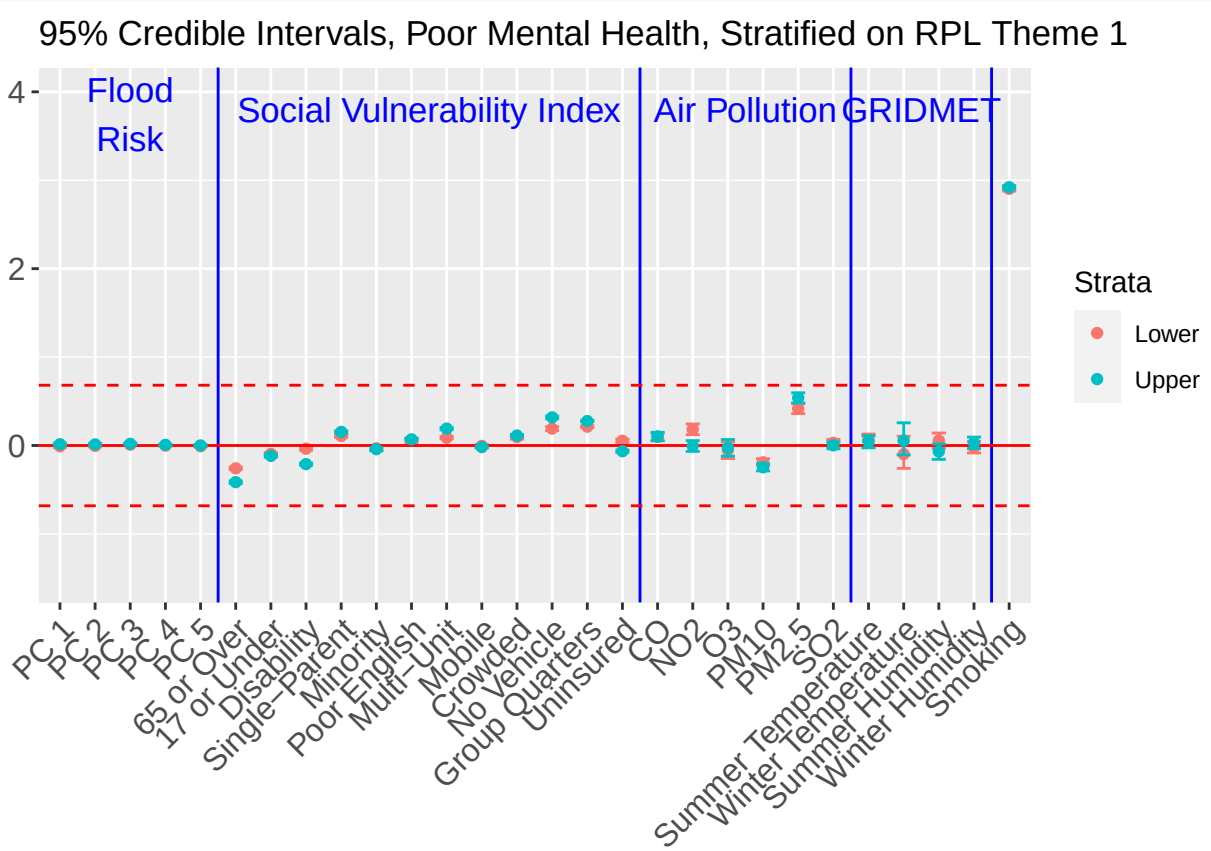
Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-1.5, 4)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 17.5, 23.5, 27.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 3.75, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 11.5, y = 3.8, label = "Social Vulnerability Index",
```

```
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 20.5, y = 3.8, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 25.5, y = 3.8, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent", "Minority", "Poor English",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hu
                              "Smoking")) + ggtitle("95% Credible Intervals, Poor Mental Health, Strati
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_MHLTH, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_MHLTH, col = "red", linetype = "dashed")
p
```




```
ggsave(here("figures/final_figures/stratified_analysis/MHLTH_CI_rpl1.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

Stratified on RPL_THEME2

```
load(here("modeling_files/stratified_analysis/model_stratif_rpl2_MHLTH.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                                50%     2.5%    97.5%
## strat0                     14.30660 14.29818 14.31510
## strat0:flood_risk_pc1       0.01445  0.00339  0.02550
## strat0:flood_risk_pc2      -0.01521 -0.02593 -0.00439
## strat0:flood_risk_pc3       0.01567  0.00704  0.02430
## strat0:flood_risk_pc4       0.00448 -0.00279  0.01172
## strat0:flood_risk_pc5      -0.00655 -0.01397  0.00082
## strat0:EP_POV               1.06863  1.05381  1.08338
## strat0:EP_UNEMP             0.08689  0.07554  0.09818
## strat0:EP_PCI              -0.35927 -0.37119 -0.34723
## strat0:EP_NOHSDP           -0.00143 -0.02069  0.01814
## strat0:EP_MINRTY           -0.08695 -0.10524 -0.06879
## strat0:EP_LIMENG            0.01364 -0.00289  0.03019
## strat0:EP_MUNIT             0.05464  0.04527  0.06400
## strat0:EP_MOBILE           -0.08814 -0.09991 -0.07637
## strat0:EP_CROWD             0.13236  0.11987  0.14494
## strat0:EP_NOVEH            -0.09631 -0.11200 -0.08074
## strat0:EP_GROUPQ            0.25128  0.24506  0.25747
## strat0:EP_UNINSUR           0.05380  0.04103  0.06662
## strat0:co                   0.12624  0.08841  0.16397
## strat0:no2                 -0.07471 -0.12718 -0.02358
## strat0:o3                  -0.01109 -0.09323  0.07077
## strat0:pm10                -0.05103 -0.08608 -0.01580
## strat0:pm25                 0.30769  0.25698  0.35833
## strat0:so2                  0.05878  0.02347  0.09339
## strat0:summer_tmmx          0.13503  0.07695  0.19091
## strat0:winter_tmmx         -0.05637 -0.19524  0.10797
## strat0:summer_rmax          0.08274  0.00688  0.15743
## strat0:winter_rmax         -0.03878 -0.09473  0.01782
## strat0:Data_Value_CSMOKING  2.13376  2.11149  2.15618
## strat1                     14.12196 14.11317 14.13083
## strat1:flood_risk_pc1      -0.00421 -0.01568  0.00725
## strat1:flood_risk_pc2      -0.01531 -0.02619 -0.00438
## strat1:flood_risk_pc3       0.00323 -0.00603  0.01246
## strat1:flood_risk_pc4       0.00117 -0.00703  0.00939
## strat1:flood_risk_pc5      -0.00358 -0.01259  0.00542
## strat1:EP_POV               0.44628  0.43061  0.46188
## strat1:EP_UNEMP             0.02539  0.01649  0.03426
## strat1:EP_PCI              -0.29833 -0.32083 -0.27568
## strat1:EP_NOHSDP            0.17836  0.16097  0.19566
## strat1:EP_MINRTY            0.11601  0.09899  0.13288
## strat1:EP_LIMENG            0.00390 -0.01241  0.02008
## strat1:EP_MUNIT             0.10373  0.09049  0.11686
## strat1:EP_MOBILE           -0.05927 -0.06797 -0.05060
```

```
## strat1:EP_CROWD             0.09820  0.08596  0.11052
## strat1:EP_NOVEH            -0.00134 -0.01704  0.01439
## strat1:EP_GROUPQ           -0.11593 -0.13275 -0.09906
## strat1:EP_UNINSUR           0.01265  0.00080  0.02457
## strat1:co                   0.04337  0.00057  0.08587
## strat1:no2                  0.05024 -0.00478  0.10391
## strat1:o3                  -0.01287 -0.09484  0.06897
## strat1:pm10                -0.02983 -0.06477  0.00484
## strat1:pm25                 0.24513  0.19487  0.29518
## strat1:so2                  0.01708 -0.01728  0.05128
## strat1:summer_tmmx          0.03901 -0.01967  0.09531
## strat1:winter_tmmx          0.10362 -0.03633  0.26721
## strat1:summer_rmax         -0.03106 -0.10688  0.04393
## strat1:winter_rmax          0.00386 -0.05200  0.06000
## strat1:Data_Value_CSMOKING  2.64638  2.62462  2.66793
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/MHLTH_rpl2
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                    "strat0:flood_risk_pc1"
##  [3] "strat0:flood_risk_pc2"     "strat0:flood_risk_pc3"
##  [5] "strat0:EP_POV"             "strat0:EP_UNEMP"
##  [7] "strat0:EP_PCI"             "strat0:EP_MINRTY"
##  [9] "strat0:EP_MUNIT"           "strat0:EP_MOBILE"
## [11] "strat0:EP_CROWD"           "strat0:EP_NOVEH"
## [13] "strat0:EP_GROUPQ"          "strat0:EP_UNINSUR"
## [15] "strat0:co"                 "strat0:no2"
## [17] "strat0:pm10"               "strat0:pm25"
## [19] "strat0:so2"                "strat0:summer_tmmx"
## [21] "strat0:summer_rmax"        "strat0:Data_Value_CSMOKING"
## [23] "strat1"                    "strat1:flood_risk_pc2"
## [25] "strat1:EP_POV"             "strat1:EP_UNEMP"
## [27] "strat1:EP_PCI"             "strat1:EP_NOHSDP"
## [29] "strat1:EP_MINRTY"          "strat1:EP_MUNIT"
## [31] "strat1:EP_MOBILE"          "strat1:EP_CROWD"
## [33] "strat1:EP_GROUPQ"          "strat1:EP_UNINSUR"
## [35] "strat1:co"                 "strat1:pm25"
## [37] "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
```

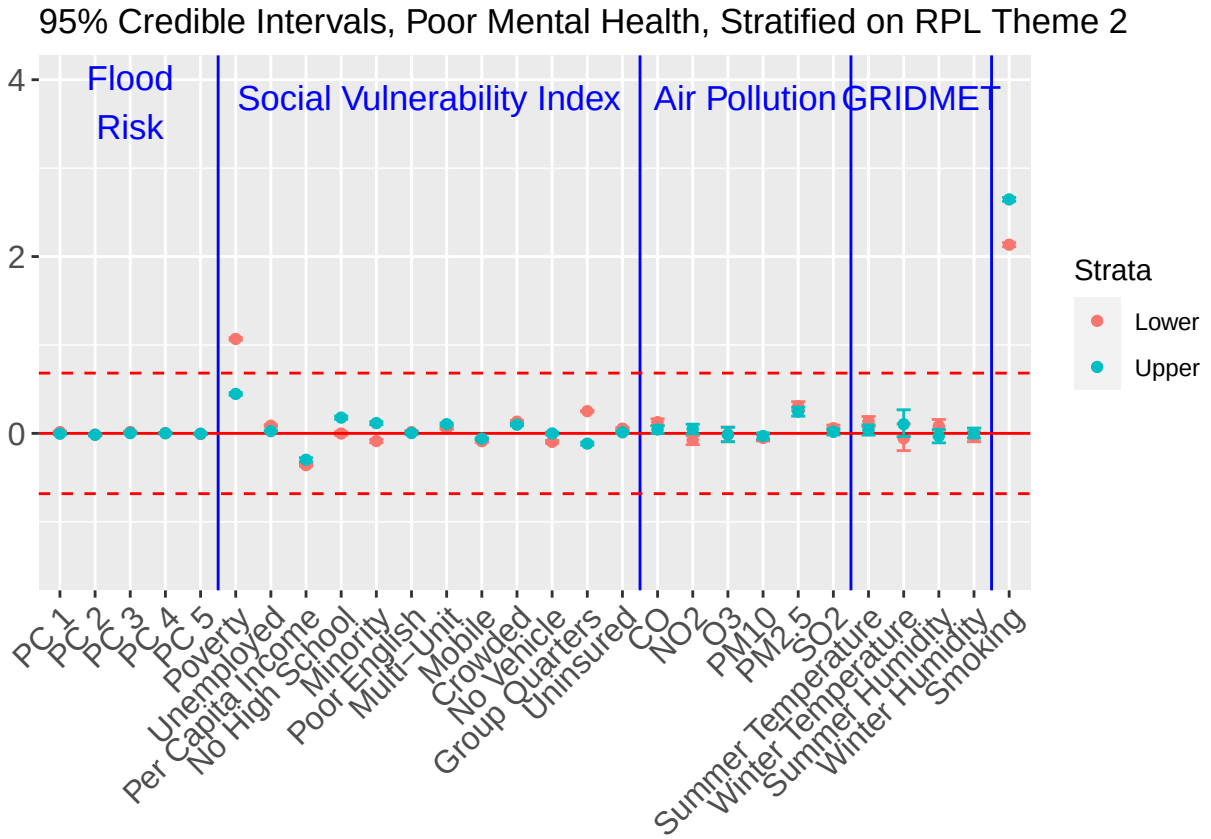
```
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                      rep("Upper", (nrow(beta_inference_df)/2))))
```

Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-1.5, 4)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 17.5, 23.5, 27.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 3.75, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 11.5, y = 3.8, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 20.5, y = 3.8, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 25.5, y = 3.8, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Poverty", "Unemployed", "Per Capita Income", "No High School",
                              "Minority", "Poor English",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hu
                              "Smoking")) + ggtitle("95% Credible Intervals, Poor Mental Health, Strati
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_MHLTH, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_MHLTH, col = "red", linetype = "dashed")

p
```




```
ggsave(here("figures/final_figures/stratified_analysis/MHLTH_CI_rpl2.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

Stratified on RPL_THEME3

Inference is based on 3 markov chains, each of which has been run for 110000 samples, the first 10000 of which has been removed for burn-in. The remaining 100000 samples are thinned by 2, resulting in 150000 samples for inference across the 3 Markov chains.

```
load(here("modeling_files/stratified_analysis/model_stratif_rpl3_MHLTH.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                                50%     2.5%    97.5%
## strat0                    14.28892 14.27391 14.30387
## strat0:flood_risk_pc1      0.00663 -0.00476  0.01805
## strat0:flood_risk_pc2      0.00430 -0.00662  0.01522
## strat0:flood_risk_pc3      0.01694  0.00811  0.02576
## strat0:flood_risk_pc4      0.00000 -0.00873  0.00883
## strat0:flood_risk_pc5      0.00067 -0.00838  0.00982
## strat0:EP_POV              0.89256  0.87678  0.90830
## strat0:EP_UNEMP            0.05208  0.04164  0.06248
```

```
## strat0:EP_PCI              -0.27383 -0.28632 -0.26140
## strat0:EP_NOHSDP            0.17851  0.15533  0.20154
## strat0:EP_AGE65            -0.34296 -0.35405 -0.33183
## strat0:EP_AGE17            -0.14715 -0.16006 -0.13437
## strat0:EP_DISABL           -0.14049 -0.15273 -0.12828
## strat0:EP_SNGPNT            0.02256  0.01006  0.03506
## strat0:EP_MUNIT             0.08855  0.07490  0.10220
## strat0:EP_MOBILE            0.01199  0.00230  0.02161
## strat0:EP_CROWD             0.07478  0.05370  0.09566
## strat0:EP_NOVEH             0.02396  0.00577  0.04223
## strat0:EP_GROUPQ            0.29625  0.28740  0.30499
## strat0:EP_UNINSUR          -0.03624 -0.05050 -0.02194
## strat0:co                   0.01937 -0.01819  0.05705
## strat0:no2                 -0.13323 -0.18446 -0.08207
## strat0:o3                   0.01692 -0.05726  0.10313
## strat0:pm10                -0.09174 -0.12468 -0.05883
## strat0:pm25                 0.32518  0.27671  0.37272
## strat0:so2                  0.01786 -0.01609  0.05162
## strat0:summer_tmmx          0.06669  0.01420  0.11861
## strat0:winter_tmmx          0.02531 -0.11313  0.15203
## strat0:summer_rmax          0.05483 -0.01627  0.12126
## strat0:winter_rmax         -0.04443 -0.09720  0.00803
## strat0:Data_Value_CSMOKING  2.14241  2.11770  2.16690
## strat1                     14.19663 14.18717 14.20612
## strat1:flood_risk_pc1      -0.00971 -0.02044  0.00102
## strat1:flood_risk_pc2      -0.00771 -0.01791  0.00240
## strat1:flood_risk_pc3       0.00236 -0.00608  0.01080
## strat1:flood_risk_pc4       0.00157 -0.00495  0.00799
## strat1:flood_risk_pc5       0.00042 -0.00650  0.00741
## strat1:EP_POV               0.71279  0.69947  0.72617
## strat1:EP_UNEMP             0.06574  0.05727  0.07421
## strat1:EP_PCI              -0.36353 -0.37842 -0.34859
## strat1:EP_NOHSDP            0.21781  0.20453  0.23110
## strat1:EP_AGE65            -0.32932 -0.34200 -0.31658
## strat1:EP_AGE17            -0.08934 -0.10146 -0.07713
## strat1:EP_DISABL           -0.17419 -0.18568 -0.16274
## strat1:EP_SNGPNT            0.07467  0.06496  0.08438
## strat1:EP_MUNIT             0.08715  0.07805  0.09629
## strat1:EP_MOBILE           -0.01929 -0.02846 -0.01010
## strat1:EP_CROWD             0.02478  0.01474  0.03481
## strat1:EP_NOVEH             0.08258  0.06885  0.09628
## strat1:EP_GROUPQ            0.05083  0.04244  0.05912
## strat1:EP_UNINSUR          -0.03700 -0.04764 -0.02641
## strat1:co                   0.06102  0.02017  0.10133
## strat1:no2                 -0.04246 -0.09302  0.00745
## strat1:o3                   0.05695 -0.01796  0.14372
## strat1:pm10                -0.19691 -0.23145 -0.16208
## strat1:pm25                 0.33889  0.29001  0.38715
## strat1:so2                 -0.02935 -0.06536  0.00593
## strat1:summer_tmmx          0.06879  0.01527  0.12204
## strat1:winter_tmmx          0.10054 -0.03846  0.22683
## strat1:summer_rmax         -0.01007 -0.08150  0.05662
## strat1:winter_rmax          0.03626 -0.01704  0.08946
## strat1:Data_Value_CSMOKING  2.24505  2.22419  2.26591
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/MHLTH_rpl3
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                     "strat0:flood_risk_pc3"
##  [3] "strat0:EP_POV"              "strat0:EP_UNEMP"
##  [5] "strat0:EP_PCI"              "strat0:EP_NOHSDP"
##  [7] "strat0:EP_AGE65"            "strat0:EP_AGE17"
##  [9] "strat0:EP_DISABL"           "strat0:EP_SNGPNT"
## [11] "strat0:EP_MUNIT"            "strat0:EP_MOBILE"
## [13] "strat0:EP_CROWD"            "strat0:EP_NOVEH"
## [15] "strat0:EP_GROUPQ"           "strat0:EP_UNINSUR"
## [17] "strat0:no2"                 "strat0:pm10"
## [19] "strat0:pm25"                "strat0:summer_tmmx"
## [21] "strat0:Data_Value_CSMOKING" "strat1"
## [23] "strat1:EP_POV"              "strat1:EP_UNEMP"
## [25] "strat1:EP_PCI"              "strat1:EP_NOHSDP"
## [27] "strat1:EP_AGE65"            "strat1:EP_AGE17"
## [29] "strat1:EP_DISABL"           "strat1:EP_SNGPNT"
## [31] "strat1:EP_MUNIT"            "strat1:EP_MOBILE"
## [33] "strat1:EP_CROWD"            "strat1:EP_NOVEH"
## [35] "strat1:EP_GROUPQ"           "strat1:EP_UNINSUR"
## [37] "strat1:co"                  "strat1:pm10"
## [39] "strat1:pm25"                "strat1:summer_tmmx"
## [41] "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

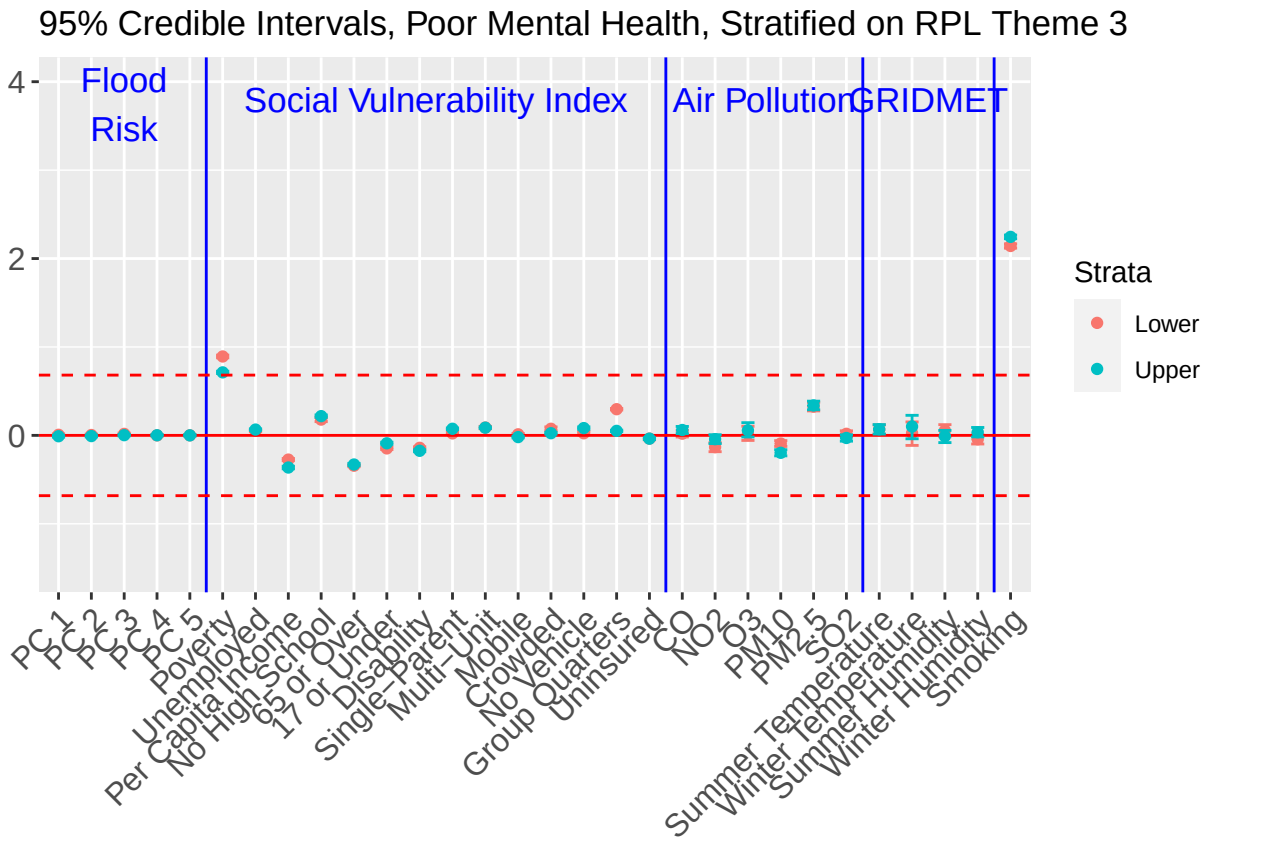
Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-1.5, 4)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
```

```
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 19.5, 25.5, 29.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 3.75, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 12.5, y = 3.8, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 22.5, y = 3.8, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 27.5, y = 3.8, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Poverty", "Unemployed", "Per Capita Income", "No High School",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hu
                              "Smoking")) + ggtitle("95% Credible Intervals, Poor Mental Health, Strati
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_MHLTH, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_MHLTH, col = "red", linetype = "dashed")

p
```




```
ggsave(here("figures/final_figures/stratified_analysis/MHLTH_CI_rpl3.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

Stratified on RPL_THEME4

Inference is based on 3 markov chains, each of which has been run for 110000 samples, the first 10000 of which has been removed for burn-in. The remaining 100000 samples are thinned by 2, resulting in 150000 samples for inference across the 3 Markov chains.

```
load(here("modeling_files/stratified_analysis/model_stratif_rpl4_MHLTH.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                                50%     2.5%    97.5%
## strat0                    14.21705 14.20969 14.22435
## strat0:flood_risk_pc1     -0.01832 -0.02924 -0.00741
## strat0:flood_risk_pc2      0.00439 -0.00637  0.01525
## strat0:flood_risk_pc3     -0.00121 -0.00979  0.00737
## strat0:flood_risk_pc4      0.00896  0.00106  0.01686
## strat0:flood_risk_pc5     -0.00577 -0.01417  0.00269
## strat0:EP_POV              0.74552  0.72895  0.76212
## strat0:EP_UNEMP            0.07732  0.06689  0.08773
```

```
## strat0:EP_PCI              -0.28143 -0.29403 -0.26885
## strat0:EP_NOHSDP            0.23421  0.21430  0.25411
## strat0:EP_AGE65            -0.36442 -0.37537 -0.35340
## strat0:EP_AGE17            -0.19201 -0.20319 -0.18077
## strat0:EP_DISABL           -0.11452 -0.12712 -0.10196
## strat0:EP_SNGPNT            0.06401  0.05208  0.07603
## strat0:EP_MINRTY           -0.07639 -0.09396 -0.05884
## strat0:EP_LIMENG            0.03336  0.01304  0.05358
## strat0:EP_UNINSUR          -0.04441 -0.05785 -0.03091
## strat0:co                   0.11632  0.07506  0.15726
## strat0:no2                  0.00020 -0.05230  0.05279
## strat0:o3                   0.02574 -0.04899  0.10476
## strat0:pm10                -0.07880 -0.11219 -0.04577
## strat0:pm25                 0.19286  0.14554  0.24085
## strat0:so2                 -0.00366 -0.03809  0.03002
## strat0:summer_tmmx          0.05402 -0.00166  0.10851
## strat0:winter_tmmx          0.06059 -0.07893  0.21928
## strat0:summer_rmax          0.04705 -0.02005  0.11733
## strat0:winter_rmax         -0.07058 -0.12516 -0.01885
## strat0:Data_Value_CSMOKING  2.27064  2.24713  2.29438
## strat1                     14.28590 14.27898 14.29285
## strat1:flood_risk_pc1      -0.00091 -0.01166  0.00983
## strat1:flood_risk_pc2       0.00092 -0.00933  0.01117
## strat1:flood_risk_pc3       0.01213  0.00363  0.02062
## strat1:flood_risk_pc4      -0.00305 -0.01019  0.00410
## strat1:flood_risk_pc5       0.00378 -0.00377  0.01136
## strat1:EP_POV               0.93987  0.92746  0.95226
## strat1:EP_UNEMP             0.08292  0.07388  0.09187
## strat1:EP_PCI              -0.53873 -0.55450 -0.52290
## strat1:EP_NOHSDP            0.32059  0.30471  0.33656
## strat1:EP_AGE65            -0.43006 -0.44189 -0.41828
## strat1:EP_AGE17            -0.23659 -0.24738 -0.22580
## strat1:EP_DISABL           -0.21476 -0.22601 -0.20347
## strat1:EP_SNGPNT            0.10071  0.09000  0.11140
## strat1:EP_MINRTY           -0.22483 -0.24179 -0.20786
## strat1:EP_LIMENG           -0.07034 -0.08418 -0.05650
## strat1:EP_UNINSUR          -0.06275 -0.07364 -0.05187
## strat1:co                   0.13750  0.10098  0.17380
## strat1:no2                 -0.02919 -0.07841  0.01952
## strat1:o3                   0.05539 -0.01912  0.13422
## strat1:pm10                -0.10599 -0.14023 -0.07229
## strat1:pm25                 0.19613  0.14927  0.24398
## strat1:so2                  0.03792  0.00430  0.07085
## strat1:summer_tmmx          0.07438  0.01909  0.12768
## strat1:winter_tmmx          0.07268 -0.06553  0.23060
## strat1:summer_rmax          0.05152 -0.01496  0.12219
## strat1:winter_rmax         -0.04478 -0.09878  0.00667
## strat1:Data_Value_CSMOKING  1.98174  1.96101  2.00253
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/MHLTH_rpl4
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                     "strat0:flood_risk_pc1"
##  [3] "strat0:flood_risk_pc4"      "strat0:EP_POV"
##  [5] "strat0:EP_UNEMP"            "strat0:EP_PCI"
##  [7] "strat0:EP_NOHSDP"           "strat0:EP_AGE65"
##  [9] "strat0:EP_AGE17"            "strat0:EP_DISABL"
## [11] "strat0:EP_SNGPNT"           "strat0:EP_MINRTY"
## [13] "strat0:EP_LIMENG"           "strat0:EP_UNINSUR"
## [15] "strat0:co"                  "strat0:pm10"
## [17] "strat0:pm25"                "strat0:winter_rmax"
## [19] "strat0:Data_Value_CSMOKING" "strat1"
## [21] "strat1:flood_risk_pc3"      "strat1:EP_POV"
## [23] "strat1:EP_UNEMP"            "strat1:EP_PCI"
## [25] "strat1:EP_NOHSDP"           "strat1:EP_AGE65"
## [27] "strat1:EP_AGE17"            "strat1:EP_DISABL"
## [29] "strat1:EP_SNGPNT"           "strat1:EP_MINRTY"
## [31] "strat1:EP_LIMENG"           "strat1:EP_UNINSUR"
## [33] "strat1:co"                  "strat1:pm10"
## [35] "strat1:pm25"                "strat1:so2"
## [37] "strat1:summer_tmmx"         "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

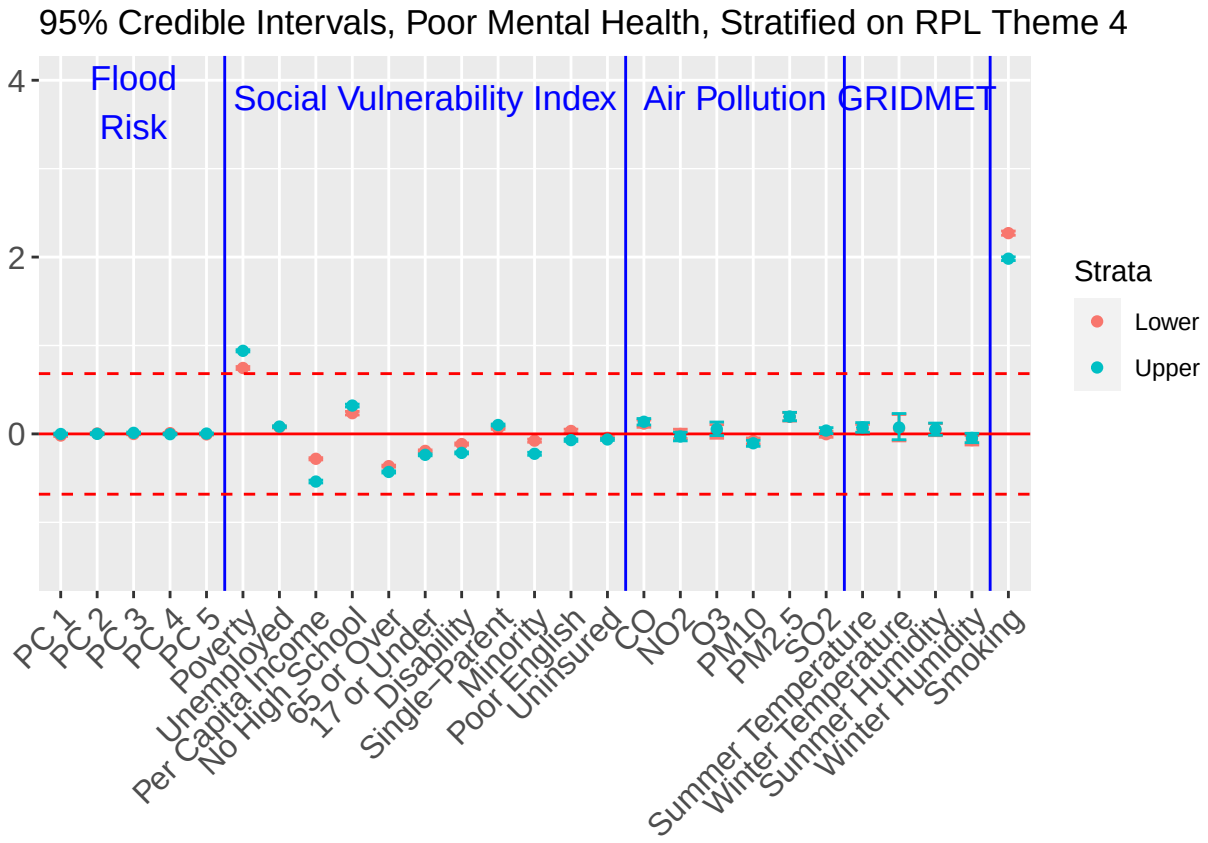
Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-1.5, 4)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 16.5, 22.5, 26.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
```

```
  annotate(geom = "text", x = 3, y = 3.75, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 11, y = 3.8, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 19.5, y = 3.8, label = "Air Pollution",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 24.5, y = 3.8, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Poverty", "Unemployed", "Per Capita Income", "No High School",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent",
                              "Minority", "Poor English",
                              "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hu
                              "Smoking")) + ggtitle("95% Credible Intervals, Poor Mental Health, Strati
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_MHLTH, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_MHLTH, col = "red", linetype = "dashed")

p
```



```
ggsave(here("figures/final_figures/stratified_analysis/MHLTH_CI_rpl4.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

Stratified on RPL_THEMES

Inference is based on 3 markov chains, each of which has been run for 110000 samples, the first 10000 of which has been removed for burn-in. The remaining 100000 samples are thinned by 2, resulting in 150000 samples for inference across the 3 Markov chains.

```
load(here("modeling_files/stratified_analysis/model_stratif_rpls_MHLTH.RData"))
```

```
beta_samples_matrix <- rbind(chain1$samples$beta, chain2$samples$beta, chain3$samples$beta)

colnames(beta_samples_matrix) <- var_names
```

```
(beta_inference <- round(t(apply(beta_samples_matrix, 2, quantile, c(0.5, 0.025, 0.975))),5))
```

```
##                               50%     2.5%    97.5%
## strat0                    14.15322 14.14057 14.16590
## strat0:flood_risk_pc1     -0.02848 -0.04326 -0.01384
## strat0:flood_risk_pc2     -0.00562 -0.02020  0.00924
## strat0:flood_risk_pc3     -0.00962 -0.02106  0.00208
## strat0:flood_risk_pc4      0.01434  0.00389  0.02473
## strat0:flood_risk_pc5     -0.00950 -0.02012  0.00107
## strat0:EP_UNINSUR          0.01647 -0.00246  0.03548
## strat0:co                  0.40496  0.35442  0.45552
## strat0:no2                 0.46901  0.40236  0.53896
## strat0:o3                 -0.19039 -0.30594 -0.09071
## strat0:pm10               -0.04864 -0.09815 -0.00026
## strat0:pm25                0.11860  0.04693  0.18744
## strat0:so2                 0.08033  0.03301  0.12896
## strat0:summer_tmmx         0.10493  0.02523  0.20102
## strat0:winter_tmmx        -0.11293 -0.39833  0.12251
## strat0:summer_rmax        -0.00356 -0.10116  0.09988
## strat0:winter_rmax        -0.03287 -0.10671  0.04033
## strat0:Data_Value_CSMOKING  3.31755  3.29608  3.33918
## strat1                    14.34642 14.33555 14.35723
## strat1:flood_risk_pc1     -0.00335 -0.01783  0.01113
## strat1:flood_risk_pc2      0.01008 -0.00377  0.02406
## strat1:flood_risk_pc3      0.02073  0.00897  0.03226
## strat1:flood_risk_pc4     -0.00463 -0.01438  0.00511
## strat1:flood_risk_pc5      0.00350 -0.00710  0.01421
## strat1:EP_UNINSUR          0.04817  0.03559  0.06080
## strat1:co                  0.43080  0.37442  0.48681
## strat1:no2                 0.41616  0.34708  0.48702
## strat1:o3                 -0.19144 -0.30770 -0.09000
## strat1:pm10               -0.04408 -0.09537  0.00637
## strat1:pm25                0.18795  0.11534  0.25583
## strat1:so2                 0.08487  0.03808  0.13352
## strat1:summer_tmmx         0.05060 -0.03003  0.14497
## strat1:winter_tmmx        -0.00511 -0.29074  0.22774
## strat1:summer_rmax        -0.10435 -0.20333 -0.00050
## strat1:winter_rmax        -0.00469 -0.07845  0.06942
```

```
## strat1:Data_Value_CSMOKING  3.29094  3.27488  3.30692
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/MHLTH_rpls
```

List of significant beta coefficients:

```
row.names(beta_inference)[sign(beta_inference[, 2]) == sign(beta_inference[, 3])]
```

```
##  [1] "strat0"                     "strat0:flood_risk_pc1"
##  [3] "strat0:flood_risk_pc4"      "strat0:co"
##  [5] "strat0:no2"                 "strat0:o3"
##  [7] "strat0:pm10"                "strat0:pm25"
##  [9] "strat0:so2"                 "strat0:summer_tmmx"
## [11] "strat0:Data_Value_CSMOKING" "strat1"
## [13] "strat1:flood_risk_pc3"      "strat1:EP_UNINSUR"
## [15] "strat1:co"                  "strat1:no2"
## [17] "strat1:o3"                  "strat1:pm25"
## [19] "strat1:so2"                 "strat1:summer_rmax"
## [21] "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `50%`,
                            post_2.5 = `2.5%`,
                            post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

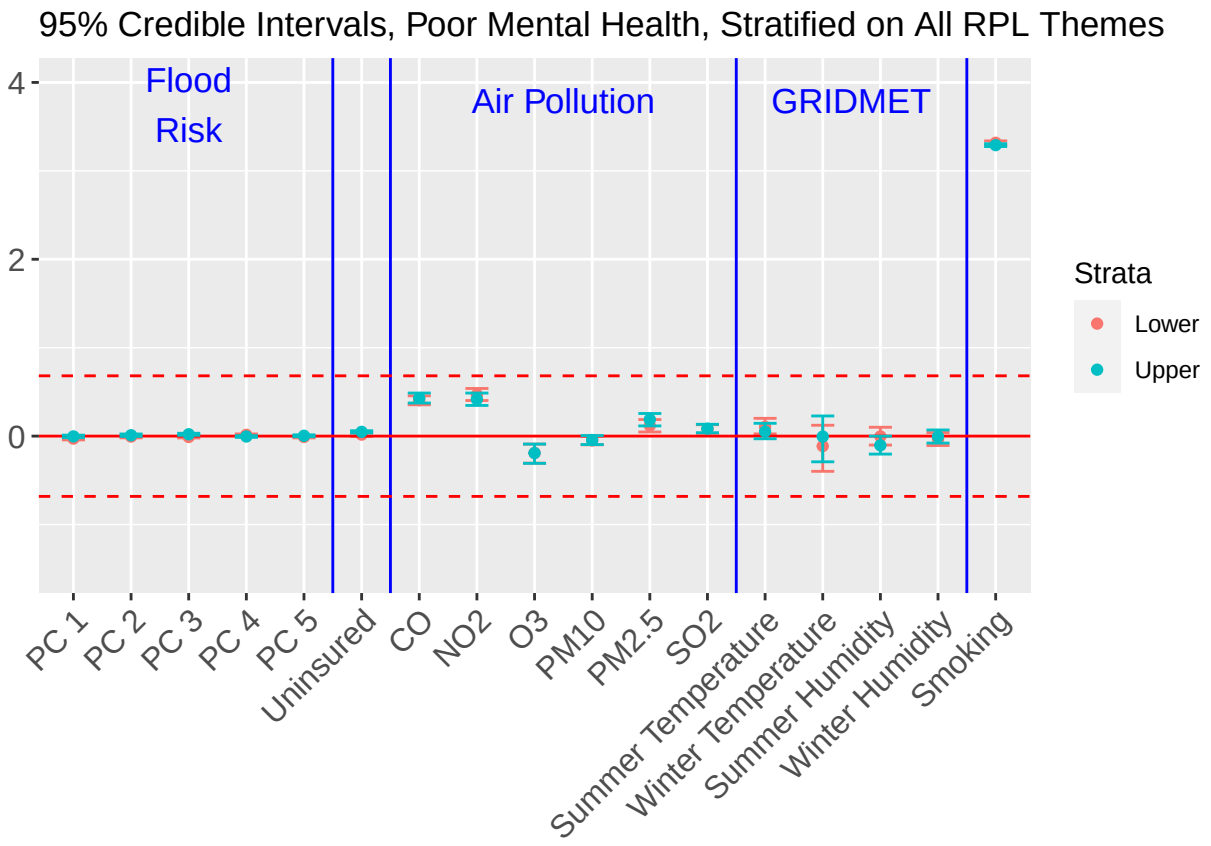
Splitting up the beta coefficients for each strata

```
beta_inference_df_strat0 <- beta_inference_df[1:(nrow(beta_inference_df)/2),]

beta_inference_df_strat1 <- beta_inference_df[(nrow(beta_inference_df)/2 + 1):nrow(beta_inference_df),]
```

Note: The intercept for both strata is not included.

```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-1.5, 4)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 10)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 6.5, 12.5, 16.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 3.75, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  annotate(geom = "text", x = 9.5, y = 3.8, label = "Air Pollution",
           col = "blue", size = 4.5) +
```

```
  annotate(geom = "text", x = 14.5, y = 3.8, label = "GRIDMET",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("PC 1", "PC 2", "PC 3", "PC 4", "PC 5",
                              "Uninsured",
                              "CO", "NO2", "O3", "PM10", "PM2.5", "SO2",
                              "Summer Temperature", "Winter Temperature", "Summer Humidity", "Winter Hu
                              "Smoking")) + ggtitle("95% Credible Intervals, Poor Mental Health, Strati
  geom_point(data = beta_inference_df_strat1[-1, ], col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_inference_df_strat1[-1, ], aes(ymin = post_2.5, ymax = post_97.5, width = 0
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE) +
  geom_hline(yintercept = 0.2 * sd_MHLTH, col = "red", linetype = "dashed") +
  geom_hline(yintercept = -0.2 * sd_MHLTH, col = "red", linetype = "dashed")

p
```




```
ggsave(here("figures/final_figures/stratified_analysis/MHLTH_CI_rpls.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```