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: $0.2 \times SD(Y) < |\hat{b}| < 0.5 \times SD(Y)$
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
## 65429.0835 38808.2958 36838.7351 55615.8623 68010.0728 79380.7020 85690.0250
##       var8       var9      var10      var11      var12      var13      var14
## 38422.4957 56790.5100 48521.0116 57172.4866 71649.6517 90378.5322 33566.3329
##      var15      var16      var17      var18      var19      var20      var21
## 59941.1962 63540.4625 61766.2861 68924.5434 31249.8247 89080.7241 56814.5853
##      var22      var23      var24      var25      var26      var27      var28
##  1666.7037   809.2370  1158.5110   432.0176   840.6966 22708.0255 83137.1246
##      var29      var30      var31      var32      var33      var34      var35
## 38701.6957 31747.5154 52808.4253 62504.0552 68801.5477 75216.2641 51680.7873
```

```
##      var36      var37      var38      var39      var40      var41      var42
## 46837.7945 50661.4531 58252.2681 62613.8433 83153.6616 25019.5055 41325.4137
##      var43      var44      var45      var46      var47      var48      var49
## 53834.6943 29893.0462 56588.1742 35028.7966 82020.6016 47433.0680  1527.7481
##      var50      var51      var52      var53      var54
##   818.3535  1100.0814   430.6309   819.9192 23805.3281
```

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
## 6935.705
```

```
effectiveSize(nu2_samples)
```

```
##     var1
## 10114.91
```

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
##  60957.98  34908.31  21751.41 100284.40 133869.48 110234.38  74924.91 105243.51
##      var9     var10
## 121474.38  53785.83
```

Inference

```
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                    6.43010  6.41640  6.44379
## strat0:flood_risk_pc1    -0.00680 -0.01786  0.00432
```

```
## strat0:flood_risk_pc2       0.00355 -0.00925  0.01614
## strat0:flood_risk_pc3       0.00105 -0.00859  0.01077
## strat0:flood_risk_pc4       0.00568 -0.00353  0.01494
## strat0:flood_risk_pc5       0.00115 -0.00776  0.00999
## strat0:EP_UNEMP             0.04812  0.03291  0.06324
## strat0:EP_PCI              -0.05152 -0.06545 -0.03766
## strat0:EP_NOHSDP            0.23764  0.20996  0.26522
## strat0:EP_AGE65             1.23299  1.21964  1.24641
## strat0:EP_AGE17             0.16314  0.14778  0.17842
## strat0:EP_DISABL            0.22687  0.21009  0.24353
## strat0:EP_SNGPNT            0.01697  0.00128  0.03264
## strat0:EP_MINRTY           -0.17920 -0.20132 -0.15682
## strat0:EP_LIMENG           -0.03425 -0.05955 -0.00882
## strat0:EP_MUNIT            -0.06208 -0.07486 -0.04929
## strat0:EP_MOBILE            0.07204  0.05893  0.08514
## strat0:EP_CROWD             0.00484 -0.01543  0.02519
## strat0:EP_NOVEH             0.09257  0.07053  0.11469
## strat0:EP_GROUPQ           -0.09493 -0.10792 -0.08195
## strat0:EP_UNINSUR           0.14060  0.12355  0.15778
## strat0:pollute_conc_pc1     0.16590  0.13417  0.19758
## strat0:pollute_conc_pc2    -0.24543 -0.28850 -0.20453
## strat0:pollute_conc_pc3    -0.05768 -0.09674 -0.01945
## strat0:tmmx                 0.06542  0.00379  0.12124
## strat0:rmax                 0.04805  0.00562  0.09015
## strat0:Data_Value_CSMOKING  0.71237  0.68380  0.74064
## strat1                      6.75132  6.73947  6.76317
## strat1:flood_risk_pc1      -0.01448 -0.02490 -0.00414
## strat1:flood_risk_pc2       0.00329 -0.00840  0.01492
## strat1:flood_risk_pc3       0.00767 -0.00164  0.01700
## strat1:flood_risk_pc4      -0.00226 -0.01067  0.00618
## strat1:flood_risk_pc5       0.00016 -0.00826  0.00860
## strat1:EP_UNEMP             0.05603  0.04714  0.06493
## strat1:EP_PCI              -0.08942 -0.11397 -0.06477
## strat1:EP_NOHSDP            0.14826  0.13120  0.16541
## strat1:EP_AGE65             1.63386  1.61963  1.64819
## strat1:EP_AGE17             0.29860  0.28469  0.31259
## strat1:EP_DISABL            0.22826  0.21639  0.24015
## strat1:EP_SNGPNT           -0.05535 -0.06662 -0.04410
## strat1:EP_MINRTY            0.01103 -0.00652  0.02841
## strat1:EP_LIMENG           -0.04532 -0.06046 -0.03003
## strat1:EP_MUNIT            -0.01531 -0.02657 -0.00425
## strat1:EP_MOBILE            0.04573  0.03613  0.05532
## strat1:EP_CROWD            -0.01750 -0.02913 -0.00576
## strat1:EP_NOVEH             0.19602  0.18136  0.21057
## strat1:EP_GROUPQ           -0.05703 -0.06560 -0.04848
## strat1:EP_UNINSUR           0.08446  0.07253  0.09631
## strat1:pollute_conc_pc1     0.14795  0.11551  0.18012
## strat1:pollute_conc_pc2    -0.18741 -0.22979 -0.14736
## strat1:pollute_conc_pc3    -0.00173 -0.04046  0.03635
## strat1:tmmx                 0.13259  0.07074  0.18857
## strat1:rmax                 0.03637 -0.00610  0.07836
## strat1:Data_Value_CSMOKING  1.02693  1.00636  1.04740
```

```
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:EP_UNEMP"
##  [3] "strat0:EP_PCI"              "strat0:EP_NOHSDP"
##  [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_NOVEH"            "strat0:EP_GROUPQ"
## [15] "strat0:EP_UNINSUR"          "strat0:pollute_conc_pc1"
## [17] "strat0:pollute_conc_pc2"    "strat0:pollute_conc_pc3"
## [19] "strat0:tmmx"                "strat0:rmax"
## [21] "strat0:Data_Value_CSMOKING" "strat1"
## [23] "strat1:flood_risk_pc1"      "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_LIMENG"           "strat1:EP_MUNIT"
## [33] "strat1:EP_MOBILE"           "strat1:EP_CROWD"
## [35] "strat1:EP_NOVEH"            "strat1:EP_GROUPQ"
## [37] "strat1:EP_UNINSUR"          "strat1:pollute_conc_pc1"
## [39] "strat1:pollute_conc_pc2"    "strat1:tmmx"
## [41] "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

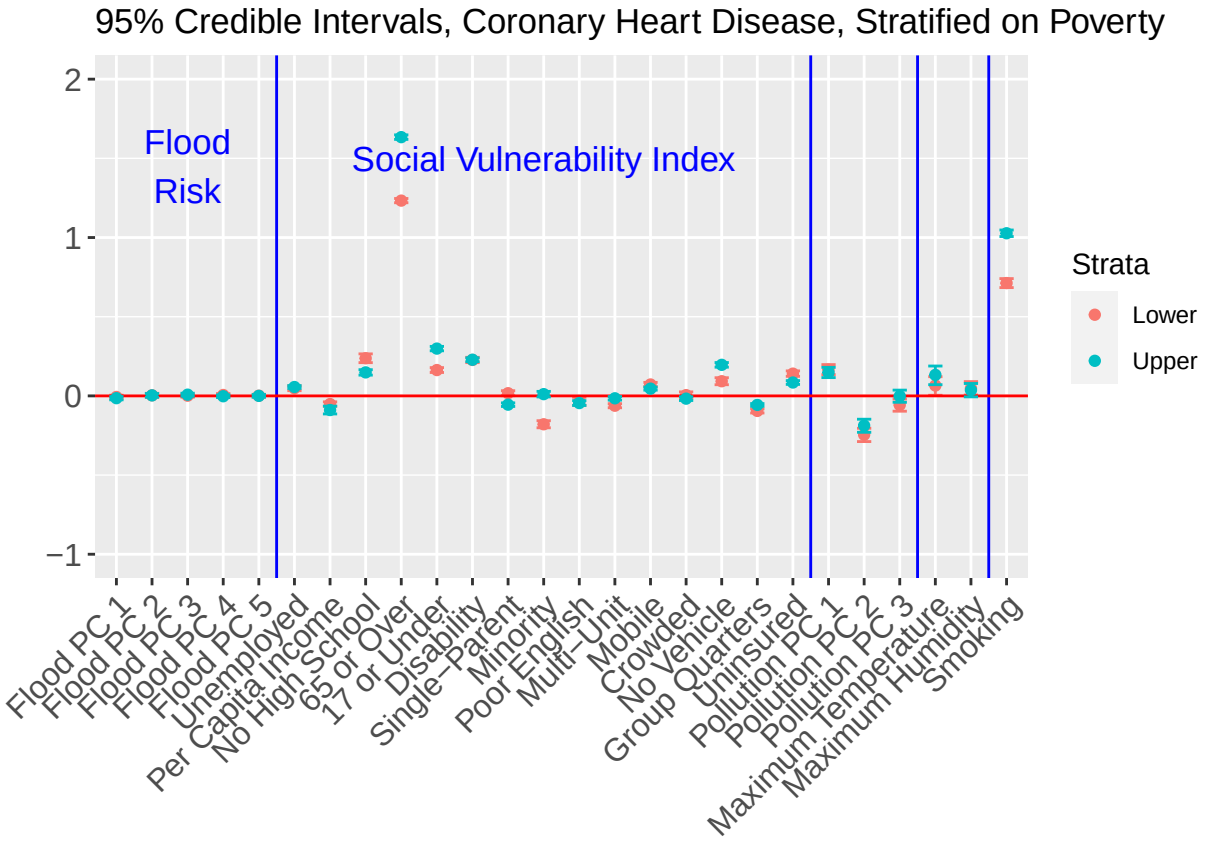
```
# first, process the beta_inference matrix in a form ggplot can understand

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, 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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 20.5, 23.5, 25.5), 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 = 13, y = 1.5, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood 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",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)

p
```




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

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                     6.45107  6.43585  6.46636
## strat0:flood_risk_pc1     -0.00370 -0.01486  0.00746
## strat0:flood_risk_pc2      0.01383  0.00094  0.02668
## strat0:flood_risk_pc3      0.00033 -0.00927  0.00992
## strat0:flood_risk_pc4      0.00879 -0.00047  0.01812
## strat0:flood_risk_pc5     -0.00104 -0.00996  0.00796
## strat0:EP_AGE65            1.25726  1.24427  1.27027
## strat0:EP_AGE17            0.19548  0.18050  0.21032
## strat0:EP_DISABL           0.23277  0.21669  0.24888
## strat0:EP_SNGPNT           0.00721 -0.00891  0.02319
## strat0:EP_MINRTY          -0.13538 -0.15813 -0.11283
```

```
## strat0:EP_LIMENG            0.05216  0.02545  0.07863
## strat0:EP_MUNIT            -0.05507 -0.06730 -0.04294
## strat0:EP_MOBILE            0.07707  0.06239  0.09183
## strat0:EP_CROWD             0.02912  0.00532  0.05255
## strat0:EP_NOVEH             0.11194  0.09068  0.13339
## strat0:EP_GROUPQ           -0.05762 -0.06826 -0.04687
## strat0:EP_UNINSUR           0.16446  0.14645  0.18240
## strat0:pollute_conc_pc1     0.19946  0.16788  0.23074
## strat0:pollute_conc_pc2    -0.25460 -0.29538 -0.21269
## strat0:pollute_conc_pc3    -0.07668 -0.11613 -0.03738
## strat0:tmmx                 0.07480  0.01403  0.13362
## strat0:rmax                 0.06097  0.01956  0.10172
## strat0:Data_Value_CSMOKING  0.89948  0.87546  0.92330
## strat1                      6.69059  6.67925  6.70201
## strat1:flood_risk_pc1      -0.02053 -0.03134 -0.00985
## strat1:flood_risk_pc2      -0.00324 -0.01504  0.00859
## strat1:flood_risk_pc3       0.00446 -0.00545  0.01433
## strat1:flood_risk_pc4      -0.00075 -0.00933  0.00790
## strat1:flood_risk_pc5      -0.00188 -0.01044  0.00666
## strat1:EP_AGE65             1.70608  1.69114  1.72106
## strat1:EP_AGE17             0.28763  0.27334  0.30189
## strat1:EP_DISABL            0.24922  0.23717  0.26122
## strat1:EP_SNGPNT           -0.02326 -0.03436 -0.01215
## strat1:EP_MINRTY            0.06527  0.04824  0.08217
## strat1:EP_LIMENG            0.02033  0.00735  0.03335
## strat1:EP_MUNIT            -0.02342 -0.03511 -0.01164
## strat1:EP_MOBILE            0.04984  0.04049  0.05914
## strat1:EP_CROWD             0.00928 -0.00209  0.02060
## strat1:EP_NOVEH             0.20889  0.19396  0.22389
## strat1:EP_GROUPQ           -0.03229 -0.04109 -0.02344
## strat1:EP_UNINSUR           0.10901  0.09734  0.12069
## strat1:pollute_conc_pc1     0.20177  0.16985  0.23422
## strat1:pollute_conc_pc2    -0.19690 -0.23678 -0.15607
## strat1:pollute_conc_pc3    -0.00289 -0.04183  0.03615
## strat1:tmmx                 0.13448  0.07360  0.19400
## strat1:rmax                 0.05955  0.01773  0.10021
## strat1:Data_Value_CSMOKING  1.19114  1.17330  1.20896
```

```
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_pc2"
##  [3] "strat0:EP_AGE65"           "strat0:EP_AGE17"
##  [5] "strat0:EP_DISABL"          "strat0:EP_MINRTY"
##  [7] "strat0:EP_LIMENG"          "strat0:EP_MUNIT"
##  [9] "strat0:EP_MOBILE"          "strat0:EP_CROWD"
## [11] "strat0:EP_NOVEH"           "strat0:EP_GROUPQ"
## [13] "strat0:EP_UNINSUR"         "strat0:pollute_conc_pc1"
## [15] "strat0:pollute_conc_pc2"   "strat0:pollute_conc_pc3"
## [17] "strat0:tmmx"               "strat0:rmax"
## [19] "strat0:Data_Value_CSMOKING" "strat1"
## [21] "strat1:flood_risk_pc1"     "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_NOVEH"
## [31] "strat1:EP_GROUPQ"           "strat1:EP_UNINSUR"
## [33] "strat1:pollute_conc_pc1"    "strat1:pollute_conc_pc2"
## [35] "strat1:tmmx"                "strat1:rmax"
## [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))))
```

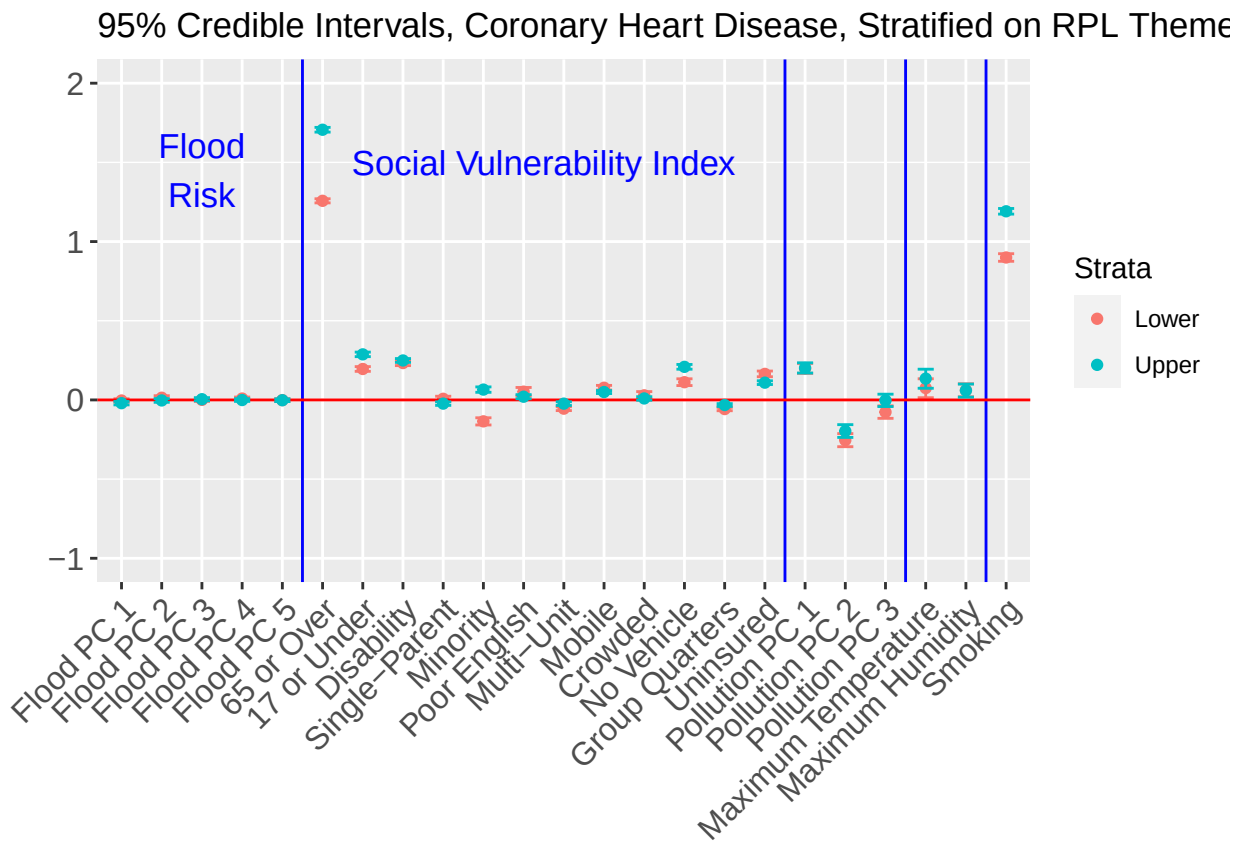
Splitting up the beta coefficients for each strata

```
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, 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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 17.5, 20.5, 22.5), 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) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood PC 5",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent", "Minority", "Poor English",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "Smoking")) + ggtitle("95% Credible Intervals, Coronary Heart Disease, Sti
  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)
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                     6.30307  6.28867  6.31746
## strat0:flood_risk_pc1     -0.05602 -0.07286 -0.03926
## strat0:flood_risk_pc2      0.02413  0.00521  0.04299
## strat0:flood_risk_pc3     -0.02612 -0.04039 -0.01179
## strat0:flood_risk_pc4      0.01361  0.00038  0.02690
```

```
## strat0:flood_risk_pc5      -0.02029 -0.03316 -0.00729
## strat0:EP_POV               0.18796  0.16360  0.21232
## strat0:EP_UNEMP             0.14430  0.12540  0.16329
## strat0:EP_PCI               0.05660  0.03664  0.07675
## strat0:EP_NOHSDP            0.85897  0.82627  0.89170
## strat0:EP_MINRTY           -0.68636 -0.71690 -0.65597
## strat0:EP_LIMENG           -0.03350 -0.06121 -0.00588
## strat0:EP_MUNIT            -0.08355 -0.09921 -0.06789
## strat0:EP_MOBILE            0.26571  0.24578  0.28552
## strat0:EP_CROWD            -0.25086 -0.27183 -0.23001
## strat0:EP_NOVEH             0.50373  0.47747  0.52987
## strat0:EP_GROUPQ           -0.29597 -0.30639 -0.28556
## strat0:EP_UNINSUR          -0.06351 -0.08491 -0.04219
## strat0:pollute_conc_pc1    -0.22885 -0.28167 -0.17712
## strat0:pollute_conc_pc2    -0.33306 -0.40223 -0.26130
## strat0:pollute_conc_pc3    -0.07685 -0.14430 -0.00934
## strat0:tmmx                -0.08191 -0.19096  0.02474
## strat0:rmax                -0.00529 -0.08237  0.06906
## strat0:Data_Value_CSMOKING -0.08162 -0.11858 -0.04482
## strat1                      7.03005  7.01522  7.04496
## strat1:flood_risk_pc1      -0.04647 -0.06386 -0.02919
## strat1:flood_risk_pc2      -0.00650 -0.02555  0.01254
## strat1:flood_risk_pc3      -0.00348 -0.01940  0.01245
## strat1:flood_risk_pc4       0.01027 -0.00390  0.02458
## strat1:flood_risk_pc5      -0.01424 -0.02835 -0.00019
## strat1:EP_POV               0.65703  0.63081  0.68307
## strat1:EP_UNEMP             0.06985  0.05496  0.08488
## strat1:EP_PCI              -0.05805 -0.09547 -0.02031
## strat1:EP_NOHSDP            0.60973  0.58074  0.63864
## strat1:EP_MINRTY           -0.55992 -0.58819 -0.53178
## strat1:EP_LIMENG           -0.18031 -0.20763 -0.15284
## strat1:EP_MUNIT             0.06258  0.04065  0.08476
## strat1:EP_MOBILE            0.19208  0.17755  0.20666
## strat1:EP_CROWD            -0.24340 -0.26371 -0.22296
## strat1:EP_NOVEH             0.53862  0.51233  0.56513
## strat1:EP_GROUPQ            0.12629  0.09797  0.15470
## strat1:EP_UNINSUR          -0.04780 -0.06757 -0.02778
## strat1:pollute_conc_pc1    -0.28616 -0.33946 -0.23266
## strat1:pollute_conc_pc2    -0.41318 -0.48241 -0.34136
## strat1:pollute_conc_pc3     0.01951 -0.04769  0.08741
## strat1:tmmx                -0.06457 -0.17314  0.04299
## strat1:rmax                 0.08756  0.00986  0.16197
## strat1:Data_Value_CSMOKING -0.20925 -0.24529 -0.17327
```

```
saveRDS(beta_inference, file = here("modeling_files/stratified_analysis/beta_inference_files/CHD_rpl2.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_pc3"
##  [5] "strat0:flood_risk_pc4"     "strat0:flood_risk_pc5"
##  [7] "strat0:EP_POV"             "strat0:EP_UNEMP"
##  [9] "strat0:EP_PCI"             "strat0:EP_NOHSDP"
```

```
## [11] "strat0:EP_MINRTY"           "strat0:EP_LIMENG"
## [13] "strat0:EP_MUNIT"            "strat0:EP_MOBILE"
## [15] "strat0:EP_CROWD"            "strat0:EP_NOVEH"
## [17] "strat0:EP_GROUPQ"           "strat0:EP_UNINSUR"
## [19] "strat0:pollute_conc_pc1"    "strat0:pollute_conc_pc2"
## [21] "strat0:pollute_conc_pc3"    "strat0:Data_Value_CSMOKING"
## [23] "strat1"                     "strat1:flood_risk_pc1"
## [25] "strat1:flood_risk_pc5"      "strat1:EP_POV"
## [27] "strat1:EP_UNEMP"            "strat1:EP_PCI"
## [29] "strat1:EP_NOHSDP"           "strat1:EP_MINRTY"
## [31] "strat1:EP_LIMENG"           "strat1:EP_MUNIT"
## [33] "strat1:EP_MOBILE"           "strat1:EP_CROWD"
## [35] "strat1:EP_NOVEH"            "strat1:EP_GROUPQ"
## [37] "strat1:EP_UNINSUR"          "strat1:pollute_conc_pc1"
## [39] "strat1:pollute_conc_pc2"    "strat1:rmax"
## [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))))
```

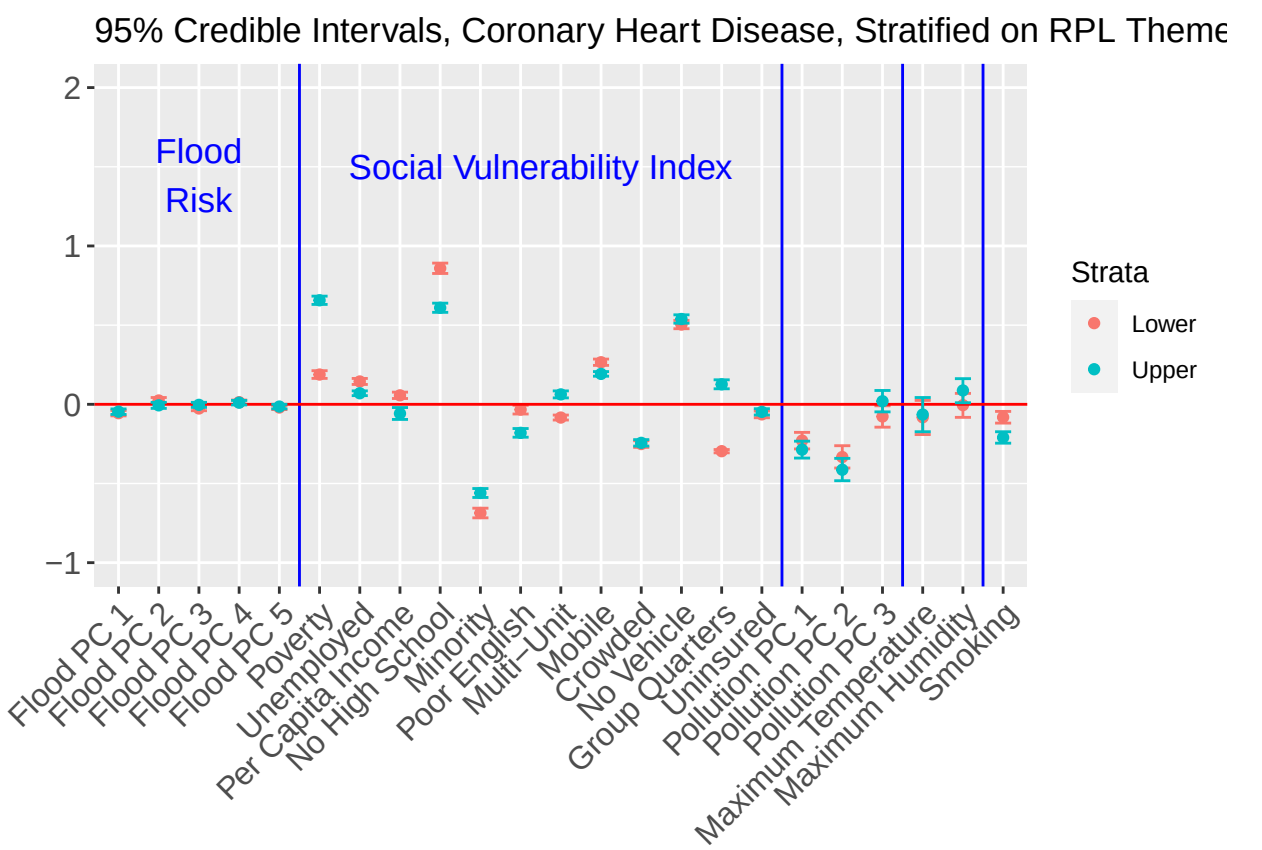
Splitting up the beta coefficients for each strata

```
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, 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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 17.5, 20.5, 22.5), 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) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood PC 5",
```

```
                              "Poverty", "Unemployed", "Per Capita Income", "No High School",
                              "Minority", "Poor English",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)

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.

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

```r
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                    6.77196  6.75475  6.78918
## strat0:flood_risk_pc1    -0.01166 -0.02305 -0.00018
## strat0:flood_risk_pc2     0.01228 -0.00112  0.02561
## strat0:flood_risk_pc3     0.01277  0.00242  0.02309
## strat0:flood_risk_pc4     0.01523  0.00462  0.02582
## strat0:flood_risk_pc5     0.00251 -0.00773  0.01275
## strat0:EP_POV             0.31341  0.29582  0.33100
## strat0:EP_UNEMP           0.03596  0.02400  0.04801
## strat0:EP_PCI            -0.03267 -0.04673 -0.01861
## strat0:EP_NOHSDP          0.27267  0.24623  0.29923
## strat0:EP_AGE65           1.30488  1.29226  1.31750
## strat0:EP_AGE17           0.29822  0.28352  0.31289
## strat0:EP_DISABL          0.26950  0.25542  0.28347
## strat0:EP_SNGPNT         -0.01396 -0.02844  0.00054
## strat0:EP_MUNIT          -0.06211 -0.07784 -0.04660
## strat0:EP_MOBILE          0.05922  0.04799  0.07041
## strat0:EP_CROWD          -0.00984 -0.03387  0.01436
## strat0:EP_NOVEH           0.13616  0.11528  0.15705
## strat0:EP_GROUPQ         -0.12993 -0.13999 -0.11979
## strat0:EP_UNINSUR         0.10877  0.09223  0.12534
## strat0:pollute_conc_pc1   0.10444  0.07092  0.13764
## strat0:pollute_conc_pc2  -0.20251 -0.24574 -0.16031
## strat0:pollute_conc_pc3  -0.02332 -0.06361  0.01692
## strat0:tmmx               0.03275 -0.02921  0.09580
## strat0:rmax               0.06782  0.02565  0.11094
## strat0:Data_Value_CSMOKING  0.69100  0.66387  0.71834
## strat1                    6.70954  6.69888  6.72024
## strat1:flood_risk_pc1    -0.02022 -0.03138 -0.00895
## strat1:flood_risk_pc2     0.00776 -0.00421  0.01972
## strat1:flood_risk_pc3    -0.00491 -0.01469  0.00479
## strat1:flood_risk_pc4    -0.00088 -0.00898  0.00706
## strat1:flood_risk_pc5     0.00126 -0.00647  0.00906
## strat1:EP_POV             0.33257  0.31738  0.34779
## strat1:EP_UNEMP           0.03135  0.02148  0.04117
## strat1:EP_PCI            -0.03679 -0.05372 -0.01983
## strat1:EP_NOHSDP          0.13294  0.11797  0.14788
## strat1:EP_AGE65           1.55364  1.53891  1.56835
## strat1:EP_AGE17           0.24118  0.22727  0.25511
## strat1:EP_DISABL          0.24880  0.23559  0.26212
## strat1:EP_SNGPNT         -0.06264 -0.07386 -0.05137
## strat1:EP_MUNIT          -0.06843 -0.07871 -0.05813
## strat1:EP_MOBILE          0.08830  0.07775  0.09882
## strat1:EP_CROWD          -0.02634 -0.03779 -0.01492
## strat1:EP_NOVEH           0.08900  0.07347  0.10453
## strat1:EP_GROUPQ         -0.07002 -0.07957 -0.06054
```

```
## strat1:EP_UNINSUR           0.08822  0.07601  0.10035
## strat1:pollute_conc_pc1     0.12899  0.09517  0.16314
## strat1:pollute_conc_pc2    -0.21128 -0.25355 -0.17028
## strat1:pollute_conc_pc3    -0.01485 -0.05584  0.02598
## strat1:tmmx                 0.07226  0.00887  0.13646
## strat1:rmax                 0.03170 -0.01039  0.07502
## strat1:Data_Value_CSMOKING  0.83942  0.81628  0.86257
```

```
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: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_MUNIT"
## [13] "strat0:EP_MOBILE"          "strat0:EP_NOVEH"
## [15] "strat0:EP_GROUPQ"          "strat0:EP_UNINSUR"
## [17] "strat0:pollute_conc_pc1"   "strat0:pollute_conc_pc2"
## [19] "strat0:rmax"               "strat0:Data_Value_CSMOKING"
## [21] "strat1"                    "strat1:flood_risk_pc1"
## [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:pollute_conc_pc1"   "strat1:pollute_conc_pc2"
## [39] "strat1:tmmx"               "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

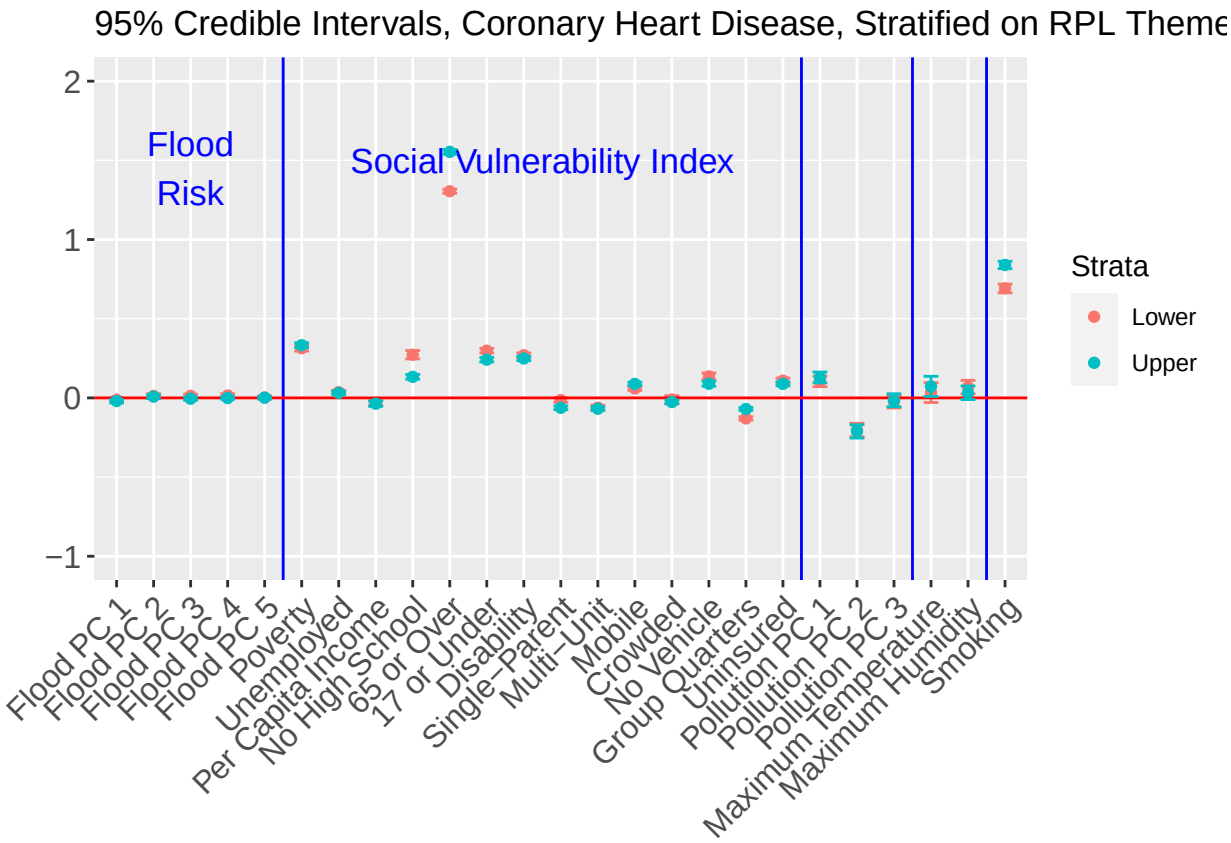
```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 19.5, 22.5, 24.5), 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) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood 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",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)

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                     6.63923  6.63061  6.64787
## strat0:flood_risk_pc1      0.00327 -0.00754  0.01409
## strat0:flood_risk_pc2      0.01695  0.00474  0.02929
## strat0:flood_risk_pc3      0.00422 -0.00530  0.01379
## strat0:flood_risk_pc4      0.00741 -0.00190  0.01677
## strat0:flood_risk_pc5     -0.00022 -0.00923  0.00877
## strat0:EP_POV              0.35715  0.33887  0.37550
## strat0:EP_UNEMP            0.02842  0.01677  0.04012
```

```
## strat0:EP_PCI               0.00167 -0.01210  0.01545
## strat0:EP_NOHSDP            0.25840  0.23608  0.28046
## strat0:EP_AGE65             1.31673  1.30459  1.32888
## strat0:EP_AGE17             0.28601  0.27368  0.29843
## strat0:EP_DISABL            0.24806  0.23395  0.26219
## strat0:EP_SNGPNT           -0.05232 -0.06583 -0.03880
## strat0:EP_MINRTY           -0.11621 -0.13497 -0.09734
## strat0:EP_LIMENG           -0.11527 -0.13797 -0.09263
## strat0:EP_UNINSUR           0.15446  0.13927  0.16977
## strat0:pollute_conc_pc1     0.09933  0.06938  0.12987
## strat0:pollute_conc_pc2    -0.22802 -0.27144 -0.18765
## strat0:pollute_conc_pc3    -0.04671 -0.08497 -0.00777
## strat0:tmmx                 0.09026  0.02976  0.14818
## strat0:rmax                 0.04709  0.00495  0.08858
## strat0:Data_Value_CSMOKING  0.76100  0.73547  0.78653
## strat1                      6.69455  6.68625  6.70285
## strat1:flood_risk_pc1      -0.01417 -0.02458 -0.00372
## strat1:flood_risk_pc2      -0.00399 -0.01569  0.00765
## strat1:flood_risk_pc3       0.00371 -0.00575  0.01317
## strat1:flood_risk_pc4       0.00366 -0.00476  0.01208
## strat1:flood_risk_pc5       0.00109 -0.00733  0.00945
## strat1:EP_POV               0.27590  0.26231  0.28945
## strat1:EP_UNEMP             0.03096  0.02086  0.04115
## strat1:EP_PCI              -0.02554 -0.04274 -0.00816
## strat1:EP_NOHSDP            0.13387  0.11632  0.15148
## strat1:EP_AGE65             1.58392  1.57074  1.59719
## strat1:EP_AGE17             0.37415  0.36217  0.38615
## strat1:EP_DISABL            0.29467  0.28214  0.30720
## strat1:EP_SNGPNT           -0.08409 -0.09612 -0.07207
## strat1:EP_MINRTY           -0.00822 -0.02626  0.00981
## strat1:EP_LIMENG           -0.04253 -0.05770 -0.02747
## strat1:EP_UNINSUR           0.10773  0.09568  0.11981
## strat1:pollute_conc_pc1     0.10181  0.07129  0.13237
## strat1:pollute_conc_pc2    -0.20202 -0.24450 -0.16227
## strat1:pollute_conc_pc3    -0.02911 -0.06707  0.00981
## strat1:tmmx                 0.12997  0.06934  0.18798
## strat1:rmax                 0.03855 -0.00344  0.08015
## strat1:Data_Value_CSMOKING  0.91684  0.89451  0.93915
```

```
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_pc2"
##  [3] "strat0:EP_POV"             "strat0:EP_UNEMP"
##  [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_UNINSUR"
## [13] "strat0:pollute_conc_pc1"   "strat0:pollute_conc_pc2"
## [15] "strat0:pollute_conc_pc3"   "strat0:tmmx"
## [17] "strat0:rmax"               "strat0:Data_Value_CSMOKING"
## [19] "strat1"                    "strat1:flood_risk_pc1"
```

```
## [21] "strat1:EP_POV"              "strat1:EP_UNEMP"
## [23] "strat1:EP_PCI"              "strat1:EP_NOHSDP"
## [25] "strat1:EP_AGE65"            "strat1:EP_AGE17"
## [27] "strat1:EP_DISABL"           "strat1:EP_SNGPNT"
## [29] "strat1:EP_LIMENG"           "strat1:EP_UNINSUR"
## [31] "strat1:pollute_conc_pc1"    "strat1:pollute_conc_pc2"
## [33] "strat1: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))))
```

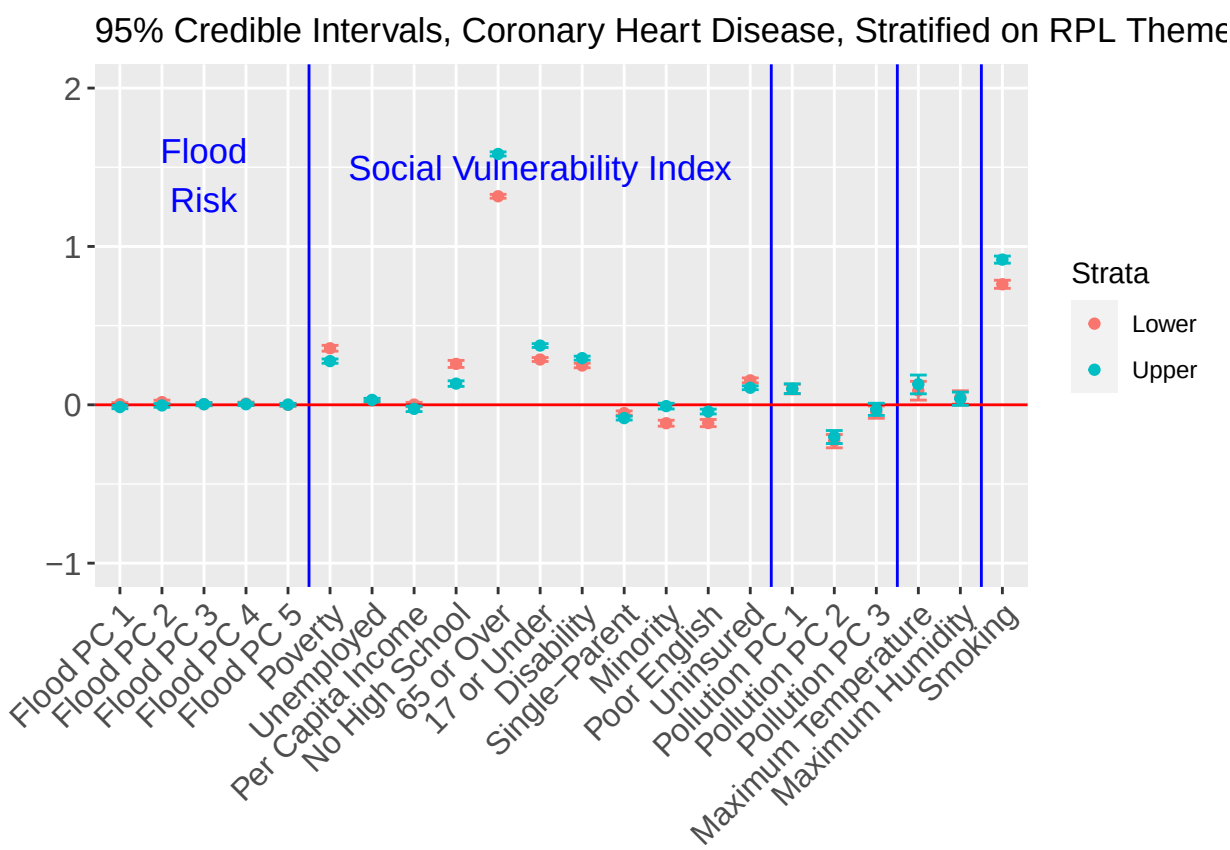
Splitting up the beta coefficients for each strata

```
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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 16.5, 19.5, 21.5), 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) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood PC 5",
                              "Poverty", "Unemployed", "Per Capita Income", "No High School",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent",
                              "Minority", "Poor English",
                              "Uninsured",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "Smoking")) + ggtitle("95% Credible Intervals, Coronary Heart Disease, Sti
  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)

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                   6.23209  6.21246  6.25169
```

```
## strat0:flood_risk_pc1      -0.08373 -0.10382 -0.06363
## strat0:flood_risk_pc2       0.02302  0.00020  0.04609
## strat0:flood_risk_pc3      -0.02606 -0.04329 -0.00885
## strat0:flood_risk_pc4       0.01393 -0.00306  0.03104
## strat0:flood_risk_pc5      -0.03263 -0.04893 -0.01630
## strat0:EP_UNINSUR          -0.00984 -0.03837  0.01849
## strat0:pollute_conc_pc1    -0.44324 -0.50010 -0.38607
## strat0:pollute_conc_pc2    -0.50848 -0.58991 -0.42453
## strat0:pollute_conc_pc3    -0.20743 -0.28364 -0.13087
## strat0:tmmx                 0.00821 -0.11455  0.13520
## strat0:rmax                 0.14028  0.05142  0.22966
## strat0:Data_Value_CSMOKING  0.38038  0.34925  0.41177
## strat1                      6.86974  6.85292  6.88645
## strat1:flood_risk_pc1      -0.06223 -0.08172 -0.04274
## strat1:flood_risk_pc2       0.01665 -0.00449  0.03779
## strat1:flood_risk_pc3      -0.01807 -0.03562 -0.00050
## strat1:flood_risk_pc4       0.00878 -0.00624  0.02391
## strat1:flood_risk_pc5      -0.00501 -0.02017  0.00997
## strat1:EP_UNINSUR          -0.13923 -0.15805 -0.12057
## strat1:pollute_conc_pc1    -0.28152 -0.33976 -0.22370
## strat1:pollute_conc_pc2    -0.40708 -0.48736 -0.32470
## strat1:pollute_conc_pc3    -0.27500 -0.35173 -0.19806
## strat1:tmmx                 0.09771 -0.02552  0.22613
## strat1:rmax                 0.13815  0.04949  0.22860
## strat1:Data_Value_CSMOKING  0.85708  0.83347  0.88046
```

```
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_pc3"
##  [5] "strat0:flood_risk_pc5"     "strat0:pollute_conc_pc1"
##  [7] "strat0:pollute_conc_pc2"   "strat0:pollute_conc_pc3"
##  [9] "strat0:rmax"               "strat0:Data_Value_CSMOKING"
## [11] "strat1"                    "strat1:flood_risk_pc1"
## [13] "strat1:flood_risk_pc3"     "strat1:EP_UNINSUR"
## [15] "strat1:pollute_conc_pc1"   "strat1:pollute_conc_pc2"
## [17] "strat1:pollute_conc_pc3"   "strat1:rmax"
## [19] "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,
```

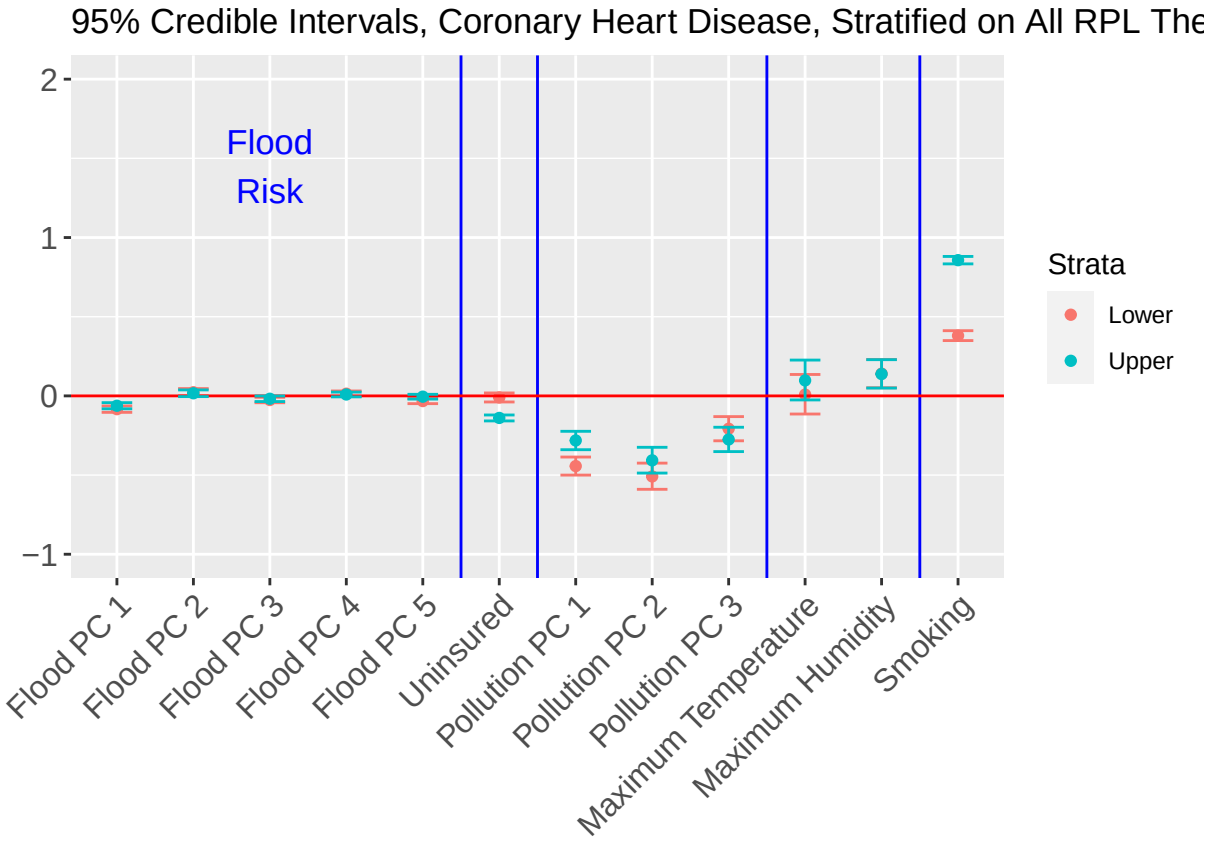
```
                                      levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 6.5, 9.5, 11.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 1.45, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood PC 5",
                              "Uninsured",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)

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                    31.81790 31.77551 31.86041
## strat0:flood_risk_pc1      0.01660 -0.01932  0.05241
## strat0:flood_risk_pc2      0.04277  0.00191  0.08293
## strat0:flood_risk_pc3      0.01649 -0.01430  0.04751
## strat0:flood_risk_pc4      0.04045  0.01100  0.06983
## strat0:flood_risk_pc5      0.01035 -0.01781  0.03844
```

```
## strat0:EP_UNEMP             0.09509  0.04787  0.14219
## strat0:EP_PCI               0.09678  0.05212  0.14111
## strat0:EP_NOHSDP            0.26048  0.17373  0.34722
## strat0:EP_AGE65             3.70448  3.66217  3.74724
## strat0:EP_AGE17             0.29060  0.24208  0.33872
## strat0:EP_DISABL            0.65070  0.59868  0.70272
## strat0:EP_SNGPNT            0.05788  0.00883  0.10673
## strat0:EP_MINRTY            1.75704  1.68543  1.82907
## strat0:EP_LIMENG           -0.85565 -0.93502 -0.77597
## strat0:EP_MUNIT            -0.71282 -0.75313 -0.67236
## strat0:EP_MOBILE            0.17448  0.13322  0.21559
## strat0:EP_CROWD            -0.02745 -0.09083  0.03566
## strat0:EP_NOVEH             0.26950  0.19959  0.33929
## strat0:EP_GROUPQ           -0.71692 -0.75788 -0.67586
## strat0:EP_UNINSUR           0.39621  0.34277  0.45005
## strat0:pollute_conc_pc1    -0.20677 -0.31520 -0.09840
## strat0:pollute_conc_pc2    -0.97509 -1.12468 -0.83324
## strat0:pollute_conc_pc3     0.16752  0.03045  0.30085
## strat0:tmmx                 0.08841 -0.13291  0.28861
## strat0:rmax                 0.07520 -0.07742  0.22940
## strat0:Data_Value_CSMOKING  1.86717  1.77639  1.95736
## strat1                     32.32870 32.29225 32.36506
## strat1:flood_risk_pc1      -0.03464 -0.06824 -0.00124
## strat1:flood_risk_pc2       0.07594  0.03835  0.11328
## strat1:flood_risk_pc3       0.07494  0.04522  0.10472
## strat1:flood_risk_pc4       0.03087  0.00416  0.05776
## strat1:flood_risk_pc5       0.00563 -0.02118  0.03235
## strat1:EP_UNEMP             0.10187  0.07382  0.12987
## strat1:EP_PCI               0.42663  0.34905  0.50438
## strat1:EP_NOHSDP           -0.11878 -0.17310 -0.06415
## strat1:EP_AGE65             4.42485  4.37970  4.47022
## strat1:EP_AGE17             0.71193  0.66806  0.75617
## strat1:EP_DISABL            0.76743  0.72989  0.80518
## strat1:EP_SNGPNT           -0.10096 -0.13645 -0.06564
## strat1:EP_MINRTY            3.09847  3.04095  3.15567
## strat1:EP_LIMENG           -0.88797 -0.93662 -0.83900
## strat1:EP_MUNIT            -0.53003 -0.56569 -0.49503
## strat1:EP_MOBILE            0.09708  0.06669  0.12740
## strat1:EP_CROWD            -0.13556 -0.17239 -0.09835
## strat1:EP_NOVEH             0.56556  0.51888  0.61193
## strat1:EP_GROUPQ           -0.50608 -0.53302 -0.47917
## strat1:EP_UNINSUR           0.18211  0.14426  0.21961
## strat1:pollute_conc_pc1    -0.19376 -0.30494 -0.08396
## strat1:pollute_conc_pc2    -0.89321 -1.04125 -0.75365
## strat1:pollute_conc_pc3     0.31365  0.17716  0.44729
## strat1:tmmx                 0.27306  0.05128  0.47414
## strat1:rmax                 0.18930  0.03588  0.34271
## strat1:Data_Value_CSMOKING  2.72016  2.65427  2.78611
```

```
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_pc2"
##  [3] "strat0:flood_risk_pc4"     "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_MUNIT"           "strat0:EP_MOBILE"
## [15] "strat0:EP_NOVEH"           "strat0:EP_GROUPQ"
## [17] "strat0:EP_UNINSUR"         "strat0:pollute_conc_pc1"
## [19] "strat0:pollute_conc_pc2"   "strat0:pollute_conc_pc3"
## [21] "strat0:Data_Value_CSMOKING" "strat1"
## [23] "strat1:flood_risk_pc1"     "strat1:flood_risk_pc2"
## [25] "strat1:flood_risk_pc3"     "strat1:flood_risk_pc4"
## [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:pollute_conc_pc1"
## [43] "strat1:pollute_conc_pc2"   "strat1:pollute_conc_pc3"
## [45] "strat1:tmmx"               "strat1: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))))
```

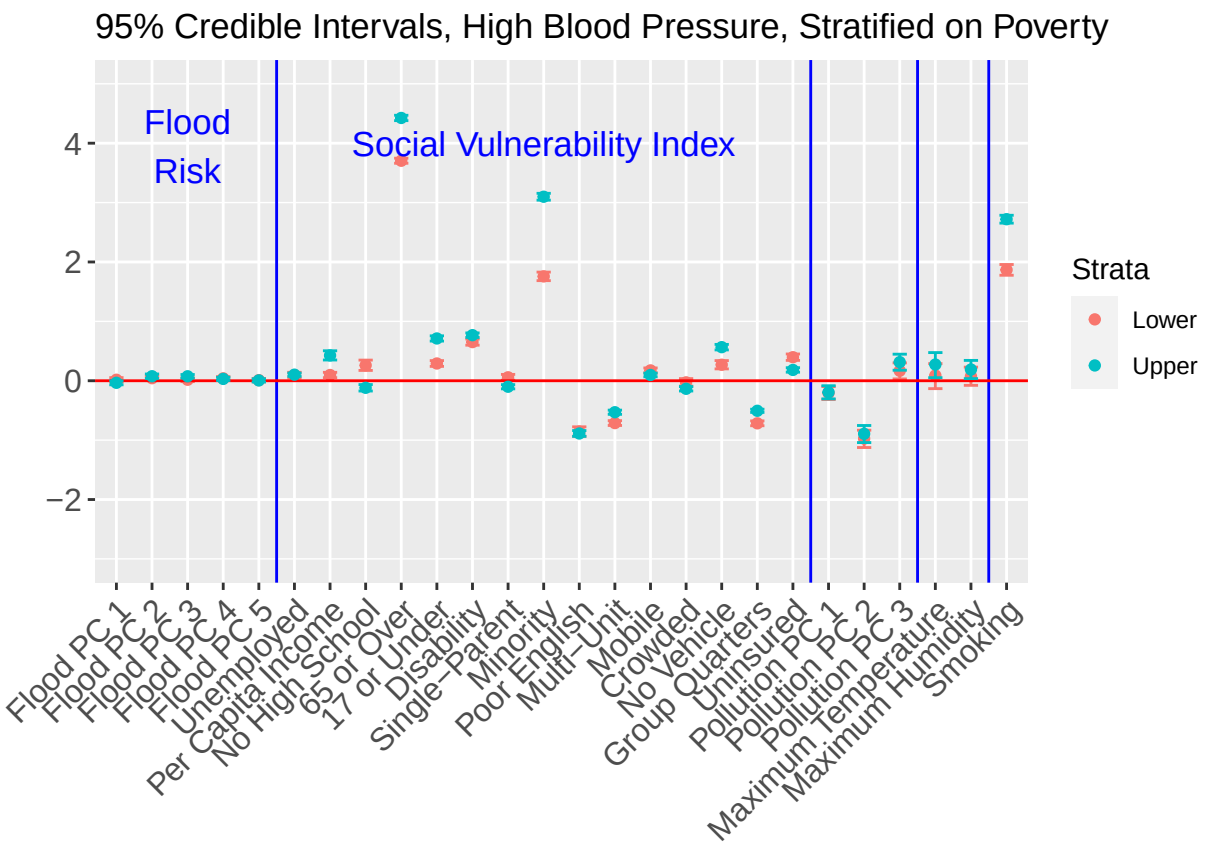
Splitting up the beta coefficients for each strata

```
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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 20.5, 23.5, 25.5), 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 = 13, y = 4, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood 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",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)

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                     31.75792 31.71069 31.80524
## strat0:flood_risk_pc1       0.01101 -0.02499  0.04688
## strat0:flood_risk_pc2       0.08485  0.04380  0.12553
## strat0:flood_risk_pc3       0.01912 -0.01141  0.04965
## strat0:flood_risk_pc4       0.04155  0.01221  0.07105
## strat0:flood_risk_pc5       0.01405 -0.01398  0.04240
## strat0:EP_AGE65             3.78870  3.74755  3.82975
## strat0:EP_AGE17             0.49036  0.44315  0.53680
## strat0:EP_DISABL            0.63806  0.58833  0.68802
## strat0:EP_SNGPNT           -0.06796 -0.11799 -0.01849
## strat0:EP_MINRTY            1.64908  1.57650  1.72132
## strat0:EP_LIMENG           -0.68387 -0.76673 -0.60185
## strat0:EP_MUNIT            -0.66407 -0.70241 -0.62584
## strat0:EP_MOBILE            0.18562  0.14006  0.23141
## strat0:EP_CROWD            -0.08274 -0.15613 -0.01003
## strat0:EP_NOVEH             0.23990  0.17283  0.30758
## strat0:EP_GROUPQ           -0.59203 -0.62573 -0.55815
## strat0:EP_UNINSUR           0.42929  0.37331  0.48515
## strat0:pollute_conc_pc1    -0.20898 -0.31521 -0.10409
## strat0:pollute_conc_pc2    -0.90680 -1.04677 -0.76274
## strat0:pollute_conc_pc3     0.12407 -0.01062  0.26013
## strat0:tmmx                 0.14946 -0.06410  0.35857
## strat0:rmax                 0.01273 -0.13720  0.15845
## strat0:Data_Value_CSMOKING  2.07134  1.99468  2.14694
## strat1                     32.05713 32.02224 32.09224
## strat1:flood_risk_pc1      -0.04930 -0.08379 -0.01509
## strat1:flood_risk_pc2       0.04508  0.00739  0.08263
## strat1:flood_risk_pc3       0.06664  0.03528  0.09764
## strat1:flood_risk_pc4       0.03725  0.00999  0.06457
## strat1:flood_risk_pc5      -0.00546 -0.03254  0.02141
## strat1:EP_AGE65             4.49189  4.44485  4.53939
## strat1:EP_AGE17             0.55476  0.50991  0.59944
## strat1:EP_DISABL            0.78206  0.74426  0.81970
## strat1:EP_SNGPNT           -0.00654 -0.04113  0.02820
## strat1:EP_MINRTY            3.07072  3.01504  3.12579
## strat1:EP_LIMENG           -1.00739 -1.04910 -0.96543
## strat1:EP_MUNIT            -0.44551 -0.48224 -0.40826
## strat1:EP_MOBILE            0.10281  0.07352  0.13207
```

```
## strat1:EP_CROWD            -0.11050 -0.14629 -0.07471
## strat1:EP_NOVEH             0.53631  0.48928  0.58341
## strat1:EP_GROUPQ           -0.58113 -0.60854 -0.55365
## strat1:EP_UNINSUR           0.20105  0.16443  0.23797
## strat1:pollute_conc_pc1    -0.22450 -0.33130 -0.11540
## strat1:pollute_conc_pc2    -0.94997 -1.08754 -0.80849
## strat1:pollute_conc_pc3     0.26086  0.12743  0.39677
## strat1:tmmx                 0.33784  0.12380  0.55009
## strat1:rmax                 0.19312  0.04196  0.33875
## strat1:Data_Value_CSMOKING  2.67983  2.62304  2.73670
```

```
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_pc4"     "strat0:EP_AGE65"
##  [5] "strat0:EP_AGE17"           "strat0:EP_DISABL"
##  [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:pollute_conc_pc1"
## [17] "strat0:pollute_conc_pc2"   "strat0:Data_Value_CSMOKING"
## [19] "strat1"                    "strat1:flood_risk_pc1"
## [21] "strat1:flood_risk_pc2"     "strat1:flood_risk_pc3"
## [23] "strat1:flood_risk_pc4"     "strat1:EP_AGE65"
## [25] "strat1:EP_AGE17"           "strat1:EP_DISABL"
## [27] "strat1:EP_MINRTY"          "strat1:EP_LIMENG"
## [29] "strat1:EP_MUNIT"           "strat1:EP_MOBILE"
## [31] "strat1:EP_CROWD"           "strat1:EP_NOVEH"
## [33] "strat1:EP_GROUPQ"          "strat1:EP_UNINSUR"
## [35] "strat1:pollute_conc_pc1"   "strat1:pollute_conc_pc2"
## [37] "strat1:pollute_conc_pc3"   "strat1:tmmx"
## [39] "strat1:rmax"               "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

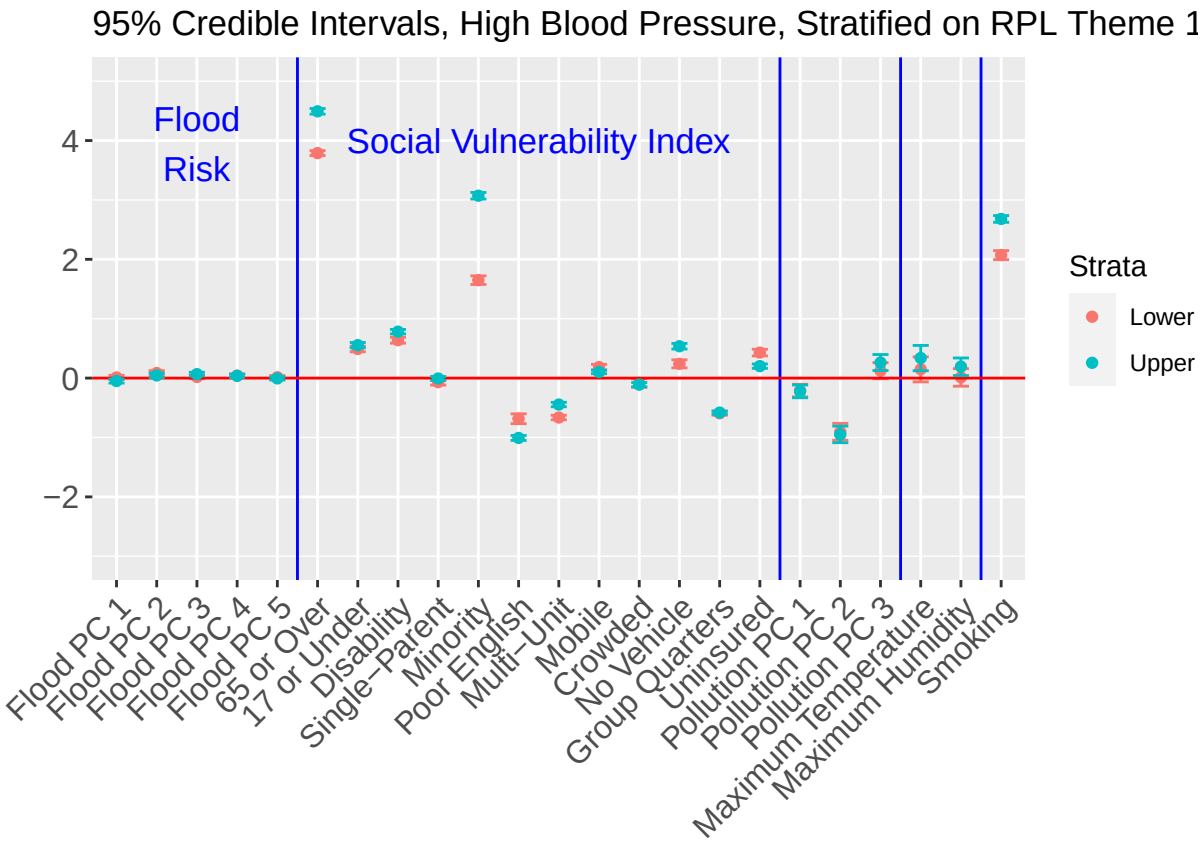
```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 17.5, 20.5, 22.5), 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) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood PC 5",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent", "Minority", "Poor English",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)
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                     31.45564 31.41291 31.49820
## strat0:flood_risk_pc1      -0.13830 -0.18958 -0.08701
## strat0:flood_risk_pc2       0.07560  0.01823  0.13280
## strat0:flood_risk_pc3      -0.04974 -0.09310 -0.00618
## strat0:flood_risk_pc4       0.05663  0.01650  0.09706
## strat0:flood_risk_pc5      -0.06340 -0.10237 -0.02412
## strat0:EP_POV              -0.28609 -0.36005 -0.21184
## strat0:EP_UNEMP             0.48956  0.43264  0.54667
## strat0:EP_PCI               0.60149  0.54100  0.66284
## strat0:EP_NOHSDP            2.18645  2.08787  2.28497
## strat0:EP_MINRTY            0.20002  0.10723  0.29272
```

```
## strat0:EP_LIMENG           -0.76632 -0.85046 -0.68283
## strat0:EP_MUNIT            -0.59815 -0.64558 -0.55082
## strat0:EP_MOBILE            0.68581  0.62596  0.74561
## strat0:EP_CROWD            -0.74270 -0.80592 -0.67926
## strat0:EP_NOVEH             1.68435  1.60459  1.76354
## strat0:EP_GROUPQ           -1.14509 -1.17659 -1.11364
## strat0:EP_UNINSUR          -0.19285 -0.25752 -0.12851
## strat0:pollute_conc_pc1    -1.37903 -1.54266 -1.22056
## strat0:pollute_conc_pc2    -1.12977 -1.34421 -0.90560
## strat0:pollute_conc_pc3    -0.06523 -0.27660  0.14424
## strat0:tmmx                -0.38174 -0.72316 -0.04731
## strat0:rmax                -0.10388 -0.34934  0.12988
## strat0:Data_Value_CSMOKING  0.23082  0.11838  0.34249
## strat1                     33.47368 33.42956 33.51793
## strat1:flood_risk_pc1      -0.15161 -0.20451 -0.09911
## strat1:flood_risk_pc2       0.04127 -0.01659  0.09918
## strat1:flood_risk_pc3       0.04401 -0.00432  0.09233
## strat1:flood_risk_pc4       0.06830  0.02516  0.11153
## strat1:flood_risk_pc5      -0.02301 -0.06568  0.01938
## strat1:EP_POV               1.11022  1.03088  1.18868
## strat1:EP_UNEMP             0.23427  0.18943  0.27964
## strat1:EP_PCI               0.12942  0.01629  0.24335
## strat1:EP_NOHSDP            1.09431  1.00634  1.18144
## strat1:EP_MINRTY            1.38320  1.29691  1.46943
## strat1:EP_LIMENG           -1.27361 -1.35631 -1.19017
## strat1:EP_MUNIT            -0.25505 -0.32133 -0.18792
## strat1:EP_MOBILE            0.47719  0.43323  0.52126
## strat1:EP_CROWD            -0.78294 -0.84413 -0.72112
## strat1:EP_NOVEH             1.75563  1.67626  1.83598
## strat1:EP_GROUPQ            0.04404 -0.04099  0.12952
## strat1:EP_UNINSUR          -0.23994 -0.29966 -0.17945
## strat1:pollute_conc_pc1    -1.43015 -1.59564 -1.26524
## strat1:pollute_conc_pc2    -1.51219 -1.72574 -1.28689
## strat1:pollute_conc_pc3     0.21400  0.00352  0.42420
## strat1:tmmx                -0.37256 -0.71390 -0.03477
## strat1:rmax                 0.32049  0.07268  0.55536
## strat1:Data_Value_CSMOKING -0.68245 -0.79176 -0.57287
```

```
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:flood_risk_pc4"     "strat0:flood_risk_pc5"
##  [7] "strat0:EP_POV"             "strat0:EP_UNEMP"
##  [9] "strat0:EP_PCI"             "strat0:EP_NOHSDP"
## [11] "strat0:EP_MINRTY"          "strat0:EP_LIMENG"
## [13] "strat0:EP_MUNIT"           "strat0:EP_MOBILE"
## [15] "strat0:EP_CROWD"           "strat0:EP_NOVEH"
## [17] "strat0:EP_GROUPQ"          "strat0:EP_UNINSUR"
## [19] "strat0:pollute_conc_pc1"   "strat0:pollute_conc_pc2"
## [21] "strat0:tmmx"               "strat0:Data_Value_CSMOKING"
```

```
## [23] "strat1"                    "strat1:flood_risk_pc1"
## [25] "strat1:flood_risk_pc4"     "strat1:EP_POV"
## [27] "strat1:EP_UNEMP"           "strat1:EP_PCI"
## [29] "strat1:EP_NOHSDP"          "strat1:EP_MINRTY"
## [31] "strat1:EP_LIMENG"          "strat1:EP_MUNIT"
## [33] "strat1:EP_MOBILE"          "strat1:EP_CROWD"
## [35] "strat1:EP_NOVEH"           "strat1:EP_UNINSUR"
## [37] "strat1:pollute_conc_pc1"   "strat1:pollute_conc_pc2"
## [39] "strat1:pollute_conc_pc3"   "strat1:tmmx"
## [41] "strat1: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))))
```

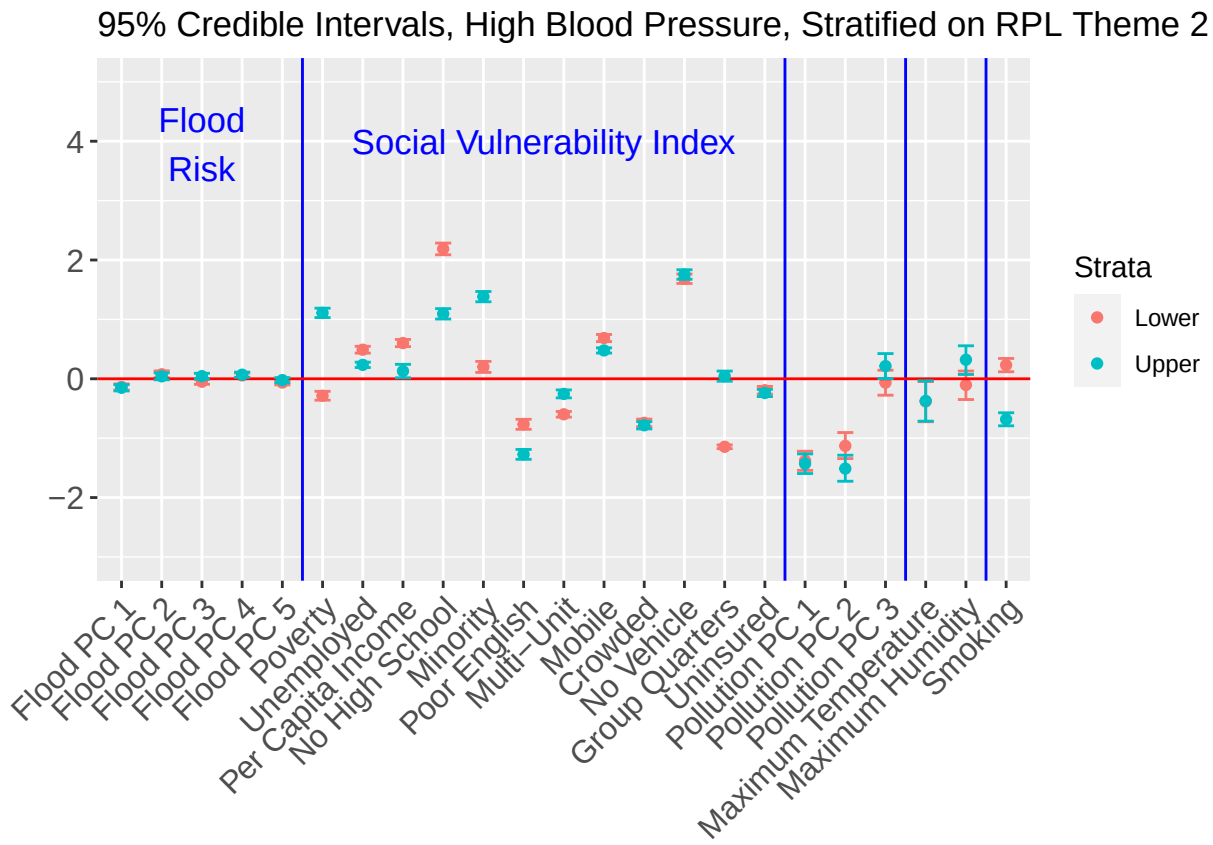
Splitting up the beta coefficients for each strata

```
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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 17.5, 20.5, 22.5), 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) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood PC 5",
                              "Poverty", "Unemployed", "Per Capita Income", "No High School",
                              "Minority", "Poor English",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
```

```
                                "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)

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                     32.31661 32.25914 32.37413
## strat0:flood_risk_pc1       0.02803 -0.01149  0.06834
## strat0:flood_risk_pc2       0.06497  0.01828  0.11132
## strat0:flood_risk_pc3       0.05842  0.02276  0.09407
## strat0:flood_risk_pc4       0.08040  0.04411  0.11659
## strat0:flood_risk_pc5      -0.00036 -0.03516  0.03460
## strat0:EP_POV               0.19443  0.13402  0.25459
## strat0:EP_UNEMP             0.27564  0.23565  0.31597
## strat0:EP_PCI              -0.00016 -0.04836  0.04787
## strat0:EP_NOHSDP            0.37158  0.28242  0.46110
## strat0:EP_AGE65             3.75818  3.71523  3.80117
## strat0:EP_AGE17             0.74326  0.69371  0.79267
## strat0:EP_DISABL            0.63065  0.58347  0.67793
## strat0:EP_SNGPNT            0.23595  0.18728  0.28473
## strat0:EP_MUNIT            -0.62516 -0.67832 -0.57249
## strat0:EP_MOBILE           -0.05986 -0.09808 -0.02215
## strat0:EP_CROWD            -0.09953 -0.18015 -0.01886
## strat0:EP_NOVEH             0.87271  0.80220  0.94330
## strat0:EP_GROUPQ           -0.76143 -0.79519 -0.72742
## strat0:EP_UNINSUR           0.22983  0.17430  0.28562
## strat0:pollute_conc_pc1    -0.23826 -0.36180 -0.11612
## strat0:pollute_conc_pc2    -0.85698 -1.02565 -0.69480
## strat0:pollute_conc_pc3     0.33214  0.17870  0.48794
## strat0:tmmx                 0.14379 -0.09913  0.39765
## strat0:rmax                -0.07107 -0.24527  0.10513
## strat0:Data_Value_CSMOKING  2.24449  2.15053  2.33930
## strat1                     32.55389 32.51898 32.58899
## strat1:flood_risk_pc1       0.00759 -0.03149  0.04702
## strat1:flood_risk_pc2      -0.00645 -0.04766  0.03463
## strat1:flood_risk_pc3       0.01091 -0.02274  0.04431
## strat1:flood_risk_pc4      -0.01533 -0.04302  0.01186
## strat1:flood_risk_pc5      -0.01372 -0.04025  0.01280
## strat1:EP_POV               0.08247  0.03144  0.13393
## strat1:EP_UNEMP             0.33271  0.29968  0.36569
## strat1:EP_PCI              -0.18677 -0.24433 -0.12887
## strat1:EP_NOHSDP           -0.12603 -0.17775 -0.07452
## strat1:EP_AGE65             4.03476  3.98498  4.08417
## strat1:EP_AGE17             0.53606  0.48911  0.58277
## strat1:EP_DISABL            0.87848  0.83387  0.92296
## strat1:EP_SNGPNT            0.25100  0.21351  0.28892
## strat1:EP_MUNIT            -0.56543 -0.60052 -0.53039
## strat1:EP_MOBILE            0.05314  0.01761  0.08860
## strat1:EP_CROWD            -0.12383 -0.16242 -0.08516
## strat1:EP_NOVEH             0.64708  0.59389  0.70020
## strat1:EP_GROUPQ           -0.43710 -0.46915 -0.40526
## strat1:EP_UNINSUR           0.24110  0.19968  0.28218
## strat1:pollute_conc_pc1     0.11185 -0.01243  0.23689
## strat1:pollute_conc_pc2    -1.11784 -1.28239 -0.95984
## strat1:pollute_conc_pc3     0.08041 -0.07419  0.23948
## strat1:tmmx                 0.50820  0.26101  0.76697
## strat1:rmax                -0.07675 -0.25180  0.09979
## strat1:Data_Value_CSMOKING  2.62888  2.54878  2.70937
```

```
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_pc2"
##  [3] "strat0:flood_risk_pc3"      "strat0:flood_risk_pc4"
##  [5] "strat0:EP_POV"              "strat0:EP_UNEMP"
##  [7] "strat0:EP_NOHSDP"           "strat0:EP_AGE65"
##  [9] "strat0:EP_AGE17"            "strat0:EP_DISABL"
## [11] "strat0:EP_SNGPNT"           "strat0:EP_MUNIT"
## [13] "strat0:EP_MOBILE"           "strat0:EP_CROWD"
## [15] "strat0:EP_NOVEH"            "strat0:EP_GROUPQ"
## [17] "strat0:EP_UNINSUR"          "strat0:pollute_conc_pc1"
## [19] "strat0:pollute_conc_pc2"    "strat0:pollute_conc_pc3"
## [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:pollute_conc_pc2"    "strat1:tmmx"
## [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))))
```

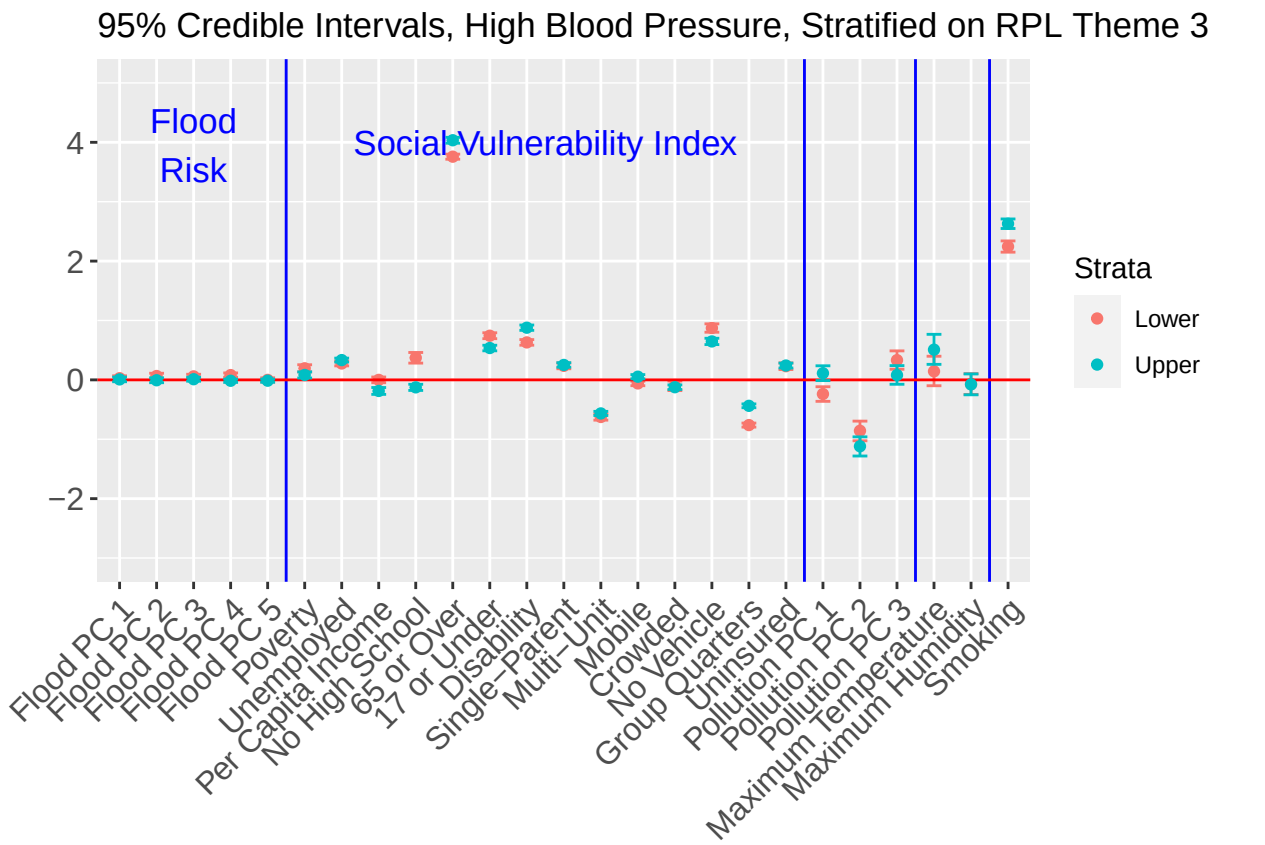
Splitting up the beta coefficients for each strata

```
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(-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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 19.5, 22.5, 24.5), 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) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood 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",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)

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                     32.34696 32.32013 32.37382
## strat0:flood_risk_pc1       0.07069  0.03460  0.10665
## strat0:flood_risk_pc2       0.03747 -0.00286  0.07812
## strat0:flood_risk_pc3       0.03962  0.00822  0.07110
## strat0:flood_risk_pc4       0.03773  0.00715  0.06844
## strat0:flood_risk_pc5       0.00854 -0.02103  0.03805
## strat0:EP_POV               0.03023 -0.02953  0.09002
## strat0:EP_UNEMP             0.13077  0.09300  0.16866
## strat0:EP_PCI               0.41456  0.36916  0.46014
## strat0:EP_NOHSDP            0.20922  0.13646  0.28105
## strat0:EP_AGE65             4.17674  4.13673  4.21679
## strat0:EP_AGE17             0.96408  0.92383  1.00455
## strat0:EP_DISABL            0.70891  0.66326  0.75470
## strat0:EP_SNGPNT           -0.08438 -0.12817 -0.04082
## strat0:EP_MINRTY            2.39285  2.32988  2.45627
## strat0:EP_LIMENG           -1.24367 -1.31751 -1.16986
## strat0:EP_UNINSUR           0.47073  0.42160  0.52042
## strat0:pollute_conc_pc1    -0.20243 -0.30795 -0.09608
## strat0:pollute_conc_pc2    -1.25034 -1.40629 -1.10695
## strat0:pollute_conc_pc3     0.22099  0.08402  0.36066
## strat0:tmmx                 0.00936 -0.21540  0.22418
## strat0:rmax                 0.09064 -0.06529  0.24719
## strat0:Data_Value_CSMOKING  2.56027  2.47576  2.64441
## strat1                     32.21081 32.18513 32.23640
## strat1:flood_risk_pc1      -0.01614 -0.05097  0.01867
## strat1:flood_risk_pc2       0.03437 -0.00425  0.07281
## strat1:flood_risk_pc3       0.04137  0.01029  0.07248
## strat1:flood_risk_pc4       0.02137 -0.00635  0.04898
## strat1:flood_risk_pc5       0.00998 -0.01765  0.03738
## strat1:EP_POV              -0.20395 -0.24875 -0.15916
## strat1:EP_UNEMP             0.11688  0.08426  0.14969
## strat1:EP_PCI               0.35825  0.30170  0.41585
## strat1:EP_NOHSDP           -0.21037 -0.26832 -0.15237
## strat1:EP_AGE65             4.58475  4.54174  4.62792
## strat1:EP_AGE17             1.18867  1.14977  1.22780
## strat1:EP_DISABL            0.92714  0.88646  0.96782
## strat1:EP_SNGPNT           -0.11986 -0.15882 -0.08086
```

```
## strat1:EP_MINRTY            2.80533  2.74451  2.86615
## strat1:EP_LIMENG           -0.78160 -0.83206 -0.73183
## strat1:EP_UNINSUR           0.28173  0.24236  0.32131
## strat1:pollute_conc_pc1    -0.12978 -0.23697 -0.02326
## strat1:pollute_conc_pc2    -1.17359 -1.32704 -1.03240
## strat1:pollute_conc_pc3     0.22292  0.08597  0.36249
## strat1:tmmx                 0.19626 -0.02951  0.41156
## strat1:rmax                 0.14166 -0.01339  0.29819
## strat1:Data_Value_CSMOKING  2.98525  2.91071  3.05926
```

```
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_pc3"     "strat0:flood_risk_pc4"
##  [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:pollute_conc_pc1"   "strat0:pollute_conc_pc2"
## [17] "strat0:pollute_conc_pc3"   "strat0:Data_Value_CSMOKING"
## [19] "strat1"                    "strat1:flood_risk_pc3"
## [21] "strat1:EP_POV"             "strat1:EP_UNEMP"
## [23] "strat1:EP_PCI"             "strat1:EP_NOHSDP"
## [25] "strat1:EP_AGE65"           "strat1:EP_AGE17"
## [27] "strat1:EP_DISABL"          "strat1:EP_SNGPNT"
## [29] "strat1:EP_MINRTY"          "strat1:EP_LIMENG"
## [31] "strat1:EP_UNINSUR"         "strat1:pollute_conc_pc1"
## [33] "strat1:pollute_conc_pc2"   "strat1:pollute_conc_pc3"
## [35] "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

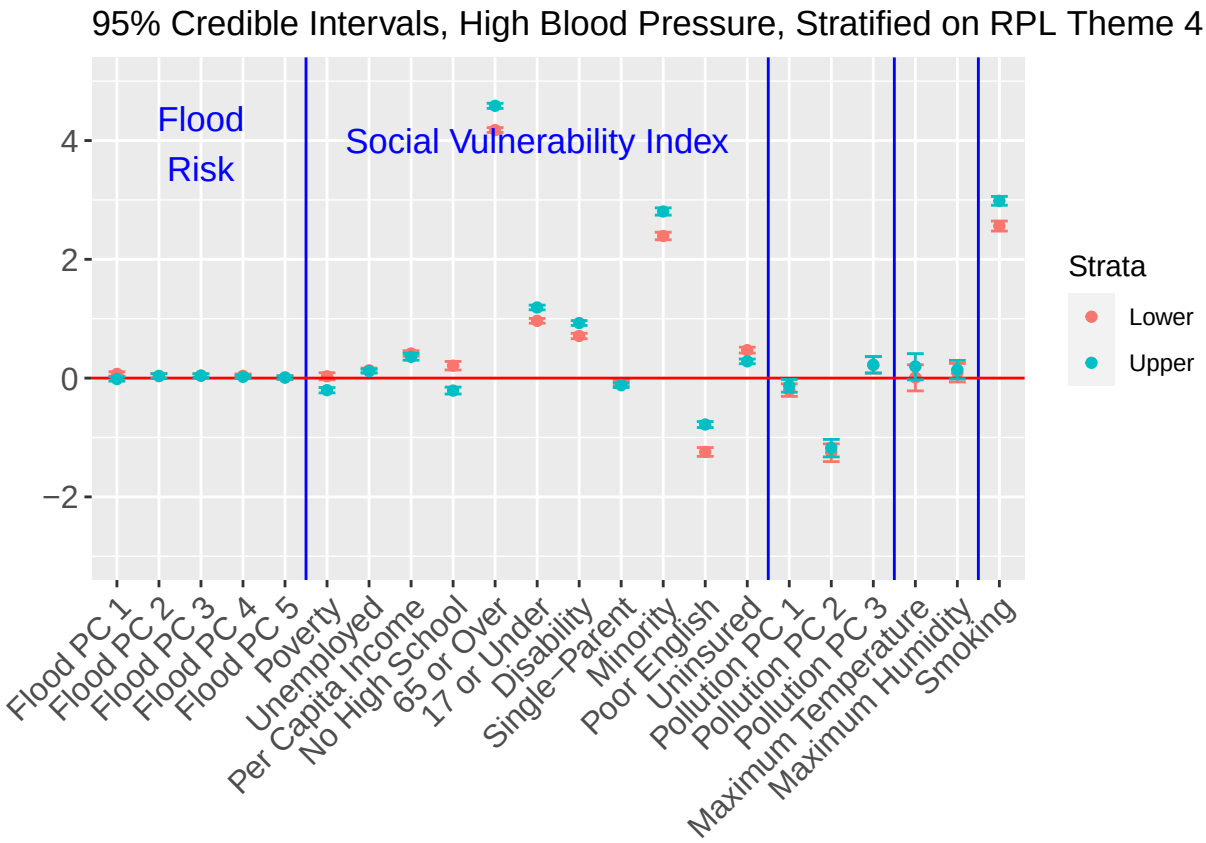
```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 16.5, 19.5, 21.5), 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) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood PC 5",
                              "Poverty", "Unemployed", "Per Capita Income", "No High School",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent",
                              "Minority", "Poor English",
                              "Uninsured",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)

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                    31.04700 30.98875 31.10449
## strat0:flood_risk_pc1     -0.16790 -0.22916 -0.10693
## strat0:flood_risk_pc2      0.10969  0.04052  0.17977
## strat0:flood_risk_pc3     -0.07504 -0.12722 -0.02306
## strat0:flood_risk_pc4      0.05497  0.00369  0.10667
## strat0:flood_risk_pc5     -0.09495 -0.14416 -0.04563
## strat0:EP_UNINSUR         -0.09869 -0.18426 -0.01377
## strat0:pollute_conc_pc1   -1.67389 -1.85077 -1.49747
```

```
## strat0:pollute_conc_pc2    -2.35971 -2.61167 -2.09921
## strat0:pollute_conc_pc3     0.36048  0.12169  0.60249
## strat0:tmmx                -0.01164 -0.40453  0.39202
## strat0:rmax                 0.19804 -0.08899  0.48539
## strat0:Data_Value_CSMOKING  0.72754  0.63244  0.82301
## strat1                     32.84366 32.79438 32.89289
## strat1:flood_risk_pc1      -0.00372 -0.06277  0.05570
## strat1:flood_risk_pc2      -0.10805 -0.17186 -0.04422
## strat1:flood_risk_pc3      -0.03974 -0.09254  0.01341
## strat1:flood_risk_pc4      -0.03983 -0.08485  0.00586
## strat1:flood_risk_pc5      -0.04918 -0.09481 -0.00378
## strat1:EP_UNINSUR          -0.47505 -0.53168 -0.41855
## strat1:pollute_conc_pc1    -0.80553 -0.98656 -0.62823
## strat1:pollute_conc_pc2    -2.23481 -2.48389 -1.97741
## strat1:pollute_conc_pc3    -0.19752 -0.43830  0.04540
## strat1:tmmx                 0.51460  0.12023  0.91955
## strat1:rmax                 0.28146 -0.00526  0.57001
## strat1:Data_Value_CSMOKING  2.12775  2.05577  2.19907
```

```
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_pc3"
##  [5] "strat0:flood_risk_pc4"      "strat0:flood_risk_pc5"
##  [7] "strat0:EP_UNINSUR"          "strat0:pollute_conc_pc1"
##  [9] "strat0:pollute_conc_pc2"    "strat0:pollute_conc_pc3"
## [11] "strat0:Data_Value_CSMOKING" "strat1"
## [13] "strat1:flood_risk_pc2"      "strat1:flood_risk_pc5"
## [15] "strat1:EP_UNINSUR"          "strat1:pollute_conc_pc1"
## [17] "strat1:pollute_conc_pc2"    "strat1:tmmx"
## [19] "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))))
```

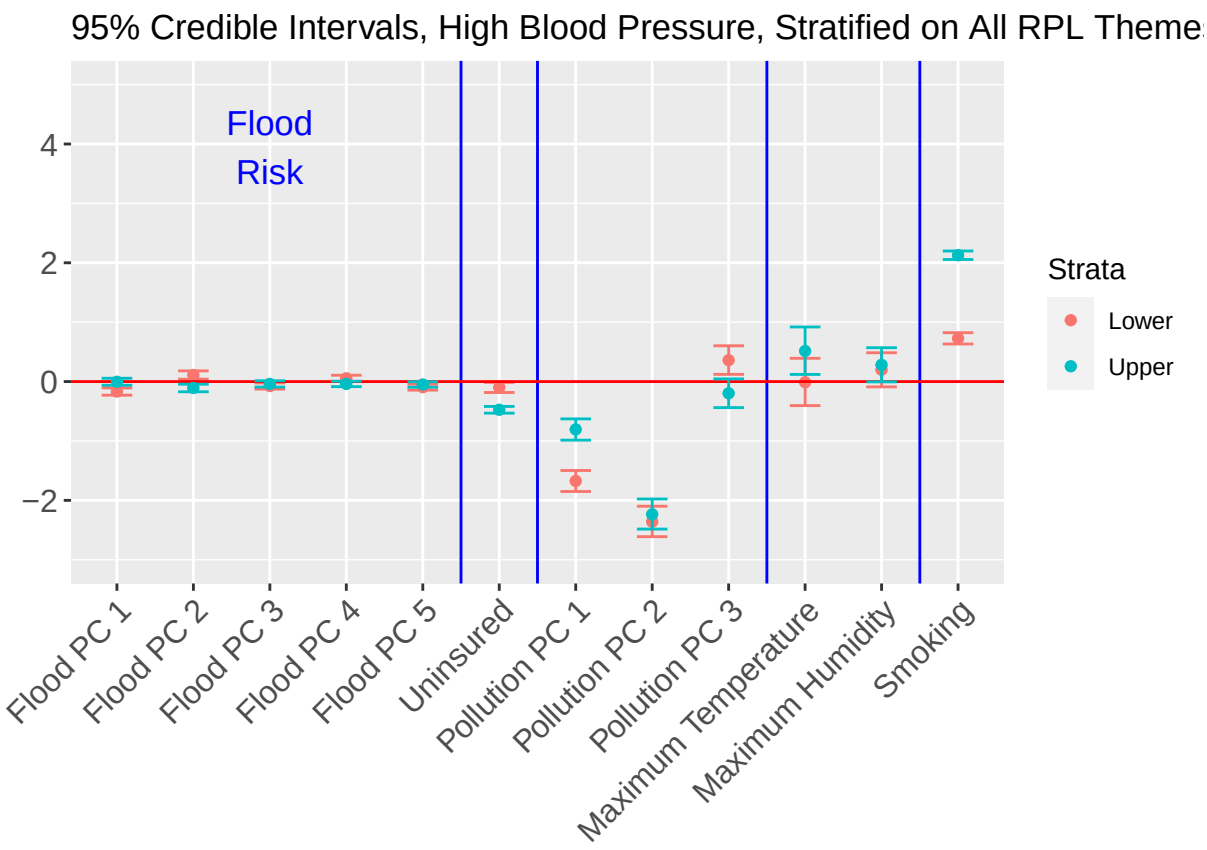
Splitting up the beta coefficients for each strata

```
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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 6.5, 9.5, 11.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 3.95, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood PC 5",
                              "Uninsured",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)

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                     9.77647  9.76918  9.78376
## strat0:flood_risk_pc1      0.01189  0.00549  0.01826
## strat0:flood_risk_pc2     -0.00633 -0.01350  0.00074
## strat0:flood_risk_pc3     -0.00285 -0.00826  0.00265
## strat0:flood_risk_pc4     -0.00938 -0.01456 -0.00422
## strat0:flood_risk_pc5      0.00205 -0.00289  0.00694
## strat0:EP_UNEMP            0.06173  0.05362  0.06983
## strat0:EP_PCI             -0.02738 -0.03527 -0.01957
## strat0:EP_NOHSDP           0.07823  0.06318  0.09333
## strat0:EP_AGE65            0.07309  0.06574  0.08049
## strat0:EP_AGE17           -0.00707 -0.01551  0.00129
## strat0:EP_DISABL          -0.00554 -0.01449  0.00341
## strat0:EP_SNGPNT           0.04596  0.03750  0.05435
## strat0:EP_MINRTY           0.18438  0.17171  0.19711
## strat0:EP_LIMENG          -0.15554 -0.16924 -0.14169
## strat0:EP_MUNIT           -0.02756 -0.03460 -0.02050
## strat0:EP_MOBILE          -0.01626 -0.02340 -0.00915
## strat0:EP_CROWD           -0.02583 -0.03676 -0.01489
## strat0:EP_NOVEH            0.12222  0.10998  0.13445
## strat0:EP_GROUPQ          -0.05026 -0.05737 -0.04310
## strat0:EP_UNINSUR          0.01767  0.00838  0.02700
## strat0:pollute_conc_pc1    0.00989 -0.01041  0.02974
## strat0:pollute_conc_pc2   -0.15967 -0.18793 -0.13361
## strat0:pollute_conc_pc3   -0.01975 -0.04545  0.00511
## strat0:tmmx                0.03188 -0.01056  0.07003
## strat0:rmax               -0.05396 -0.08291 -0.02377
## strat0:Data_Value_CSMOKING  0.97349  0.95759  0.98925
## strat1                     9.87473  9.86853  9.88089
## strat1:flood_risk_pc1     -0.00575 -0.01172  0.00019
## strat1:flood_risk_pc2      0.00626 -0.00040  0.01286
## strat1:flood_risk_pc3     -0.00065 -0.00587  0.00459
## strat1:flood_risk_pc4     -0.00544 -0.01014 -0.00072
```

```
## strat1:flood_risk_pc5      -0.00166 -0.00636  0.00303
## strat1:EP_UNEMP             0.09417  0.08931  0.09905
## strat1:EP_PCI              -0.28007 -0.29364 -0.26650
## strat1:EP_NOHSDP            0.03404  0.02444  0.04363
## strat1:EP_AGE65             0.12031  0.11253  0.12815
## strat1:EP_AGE17            -0.00564 -0.01329  0.00207
## strat1:EP_DISABL           -0.08835 -0.09489 -0.08174
## strat1:EP_SNGPNT            0.05768  0.05153  0.06384
## strat1:EP_MINRTY            0.38866  0.37842  0.39890
## strat1:EP_LIMENG           -0.27077 -0.27935 -0.26211
## strat1:EP_MUNIT             0.03461  0.02837  0.04075
## strat1:EP_MOBILE           -0.02763 -0.03292 -0.02229
## strat1:EP_CROWD            -0.00495 -0.01139  0.00155
## strat1:EP_NOVEH             0.19769  0.18950  0.20587
## strat1:EP_GROUPQ           -0.04526 -0.04994 -0.04058
## strat1:EP_UNINSUR          -0.05410 -0.06072 -0.04753
## strat1:pollute_conc_pc1    -0.06185 -0.08263 -0.04192
## strat1:pollute_conc_pc2    -0.17661 -0.20451 -0.15091
## strat1:pollute_conc_pc3     0.02556 -0.00002  0.05040
## strat1:tmmx                 0.02028 -0.02251  0.05856
## strat1:rmax                -0.04762 -0.07669 -0.01760
## strat1:Data_Value_CSMOKING  0.99779  0.98621  1.00942
```

```
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_pc1"
##  [3] "strat0:flood_risk_pc4"     "strat0:EP_UNEMP"
##  [5] "strat0:EP_PCI"             "strat0:EP_NOHSDP"
##  [7] "strat0:EP_AGE65"           "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:pollute_conc_pc2"   "strat0:rmax"
## [19] "strat0:Data_Value_CSMOKING" "strat1"
## [21] "strat1:flood_risk_pc4"     "strat1:EP_UNEMP"
## [23] "strat1:EP_PCI"             "strat1:EP_NOHSDP"
## [25] "strat1:EP_AGE65"           "strat1:EP_DISABL"
## [27] "strat1:EP_SNGPNT"          "strat1:EP_MINRTY"
## [29] "strat1:EP_LIMENG"          "strat1:EP_MUNIT"
## [31] "strat1:EP_MOBILE"          "strat1:EP_NOVEH"
## [33] "strat1:EP_GROUPQ"          "strat1:EP_UNINSUR"
## [35] "strat1:pollute_conc_pc1"   "strat1:pollute_conc_pc2"
## [37] "strat1: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))
```

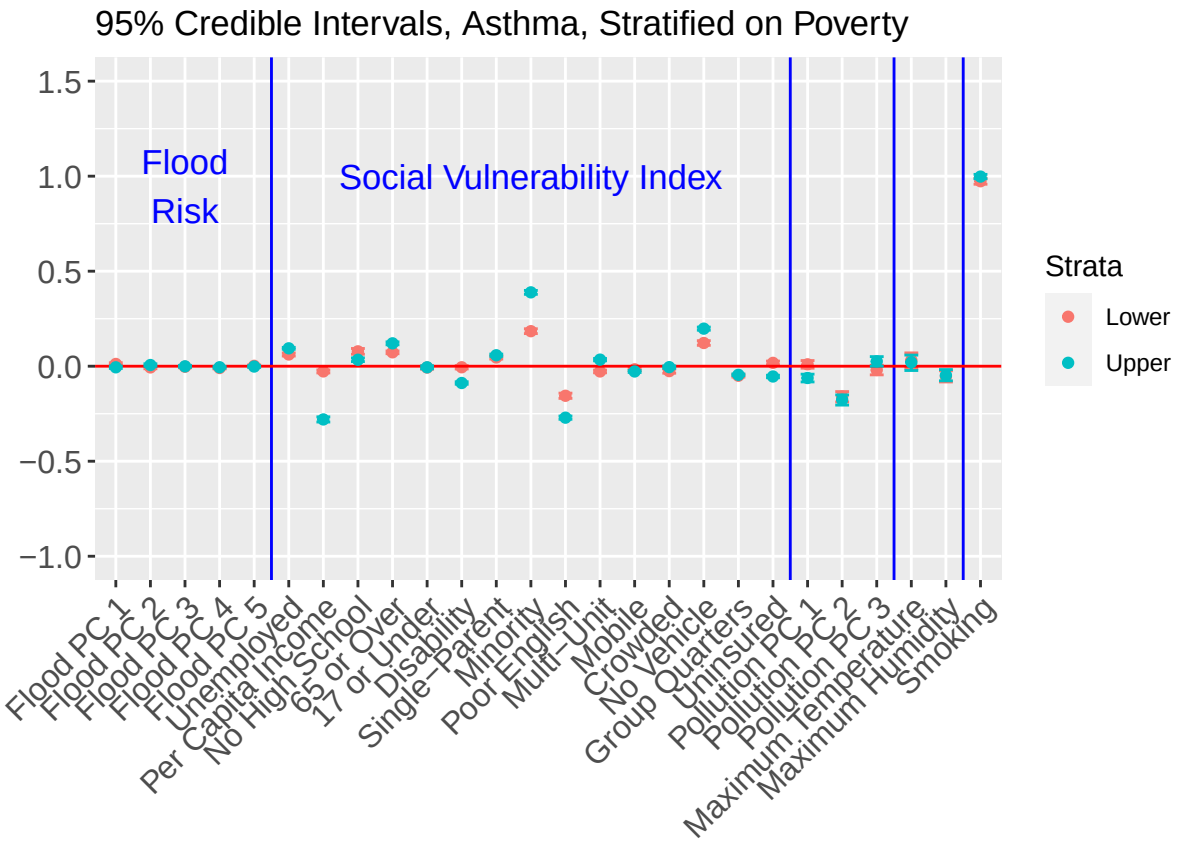
```
beta_inference_df <- rename(beta_inference_df,
                           post_median = `50%`,
                           post_2.5 = `2.5%`,
                           post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 20.5, 23.5, 25.5), 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 = 13, y = 1, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood 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",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)

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                     9.75389  9.74556  9.76223
## strat0:flood_risk_pc1      0.01133  0.00476  0.01787
## strat0:flood_risk_pc2     -0.00247 -0.00986  0.00488
## strat0:flood_risk_pc3     -0.00388 -0.00941  0.00163
## strat0:flood_risk_pc4     -0.01520 -0.02049 -0.00991
## strat0:flood_risk_pc5      0.00068 -0.00434  0.00577
## strat0:EP_AGE65            0.06946  0.06216  0.07677
## strat0:EP_AGE17           -0.01313 -0.02153 -0.00486
## strat0:EP_DISABL          -0.00966 -0.01846 -0.00078
## strat0:EP_SNGPNT           0.05372  0.04490  0.06241
## strat0:EP_MINRTY           0.17224  0.15920  0.18525
```

```
## strat0:EP_LIMENG           -0.12310 -0.13769 -0.10862
## strat0:EP_MUNIT            -0.02797 -0.03483 -0.02113
## strat0:EP_MOBILE           -0.00705 -0.01510  0.00109
## strat0:EP_CROWD            -0.01448 -0.02747 -0.00163
## strat0:EP_NOVEH             0.13885  0.12678  0.15090
## strat0:EP_GROUPQ           -0.03532 -0.04137 -0.02927
## strat0:EP_UNINSUR           0.02366  0.01375  0.03355
## strat0:pollute_conc_pc1     0.04281  0.02294  0.06222
## strat0:pollute_conc_pc2    -0.16909 -0.19552 -0.14155
## strat0:pollute_conc_pc3    -0.02541 -0.05106  0.00021
## strat0:tmmx                 0.03577 -0.00558  0.07616
## strat0:rmax                -0.05025 -0.08016 -0.02197
## strat0:Data_Value_CSMOKING  1.02275  1.00900  1.03626
## strat1                      9.92901  9.92293  9.93513
## strat1:flood_risk_pc1      -0.00441 -0.01064  0.00179
## strat1:flood_risk_pc2      -0.00023 -0.00702  0.00655
## strat1:flood_risk_pc3       0.00061 -0.00501  0.00620
## strat1:flood_risk_pc4      -0.00320 -0.00808  0.00172
## strat1:flood_risk_pc5       0.00168 -0.00317  0.00651
## strat1:EP_AGE65             0.13110  0.12281  0.13946
## strat1:EP_AGE17             0.00134 -0.00671  0.00932
## strat1:EP_DISABL           -0.07440 -0.08117 -0.06768
## strat1:EP_SNGPNT            0.06883  0.06269  0.07502
## strat1:EP_MINRTY            0.46161  0.45144  0.47168
## strat1:EP_LIMENG           -0.26317 -0.27076 -0.25551
## strat1:EP_MUNIT             0.03653  0.02996  0.04321
## strat1:EP_MOBILE           -0.02052 -0.02574 -0.01524
## strat1:EP_CROWD             0.00585 -0.00056  0.01228
## strat1:EP_NOVEH             0.22046  0.21203  0.22894
## strat1:EP_GROUPQ           -0.00516 -0.01003 -0.00026
## strat1:EP_UNINSUR          -0.04310 -0.04966 -0.03646
## strat1:pollute_conc_pc1    -0.03045 -0.05048 -0.01016
## strat1:pollute_conc_pc2    -0.18036 -0.20616 -0.15329
## strat1:pollute_conc_pc3     0.02874  0.00319  0.05438
## strat1:tmmx                 0.01822 -0.02329  0.05933
## strat1:rmax                -0.04389 -0.07395 -0.01533
## strat1:Data_Value_CSMOKING  1.14033  1.13020  1.15058
```

```
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_pc4"     "strat0:EP_AGE65"
##  [5] "strat0:EP_AGE17"           "strat0:EP_DISABL"
##  [7] "strat0:EP_SNGPNT"          "strat0:EP_MINRTY"
##  [9] "strat0:EP_LIMENG"          "strat0:EP_MUNIT"
## [11] "strat0:EP_CROWD"           "strat0:EP_NOVEH"
## [13] "strat0:EP_GROUPQ"          "strat0:EP_UNINSUR"
## [15] "strat0:pollute_conc_pc1"   "strat0:pollute_conc_pc2"
## [17] "strat0:rmax"               "strat0:Data_Value_CSMOKING"
## [19] "strat1"                    "strat1:EP_AGE65"
## [21] "strat1:EP_DISABL"          "strat1:EP_SNGPNT"
```

```
## [23] "strat1:EP_MINRTY"           "strat1:EP_LIMENG"
## [25] "strat1:EP_MUNIT"            "strat1:EP_MOBILE"
## [27] "strat1:EP_NOVEH"            "strat1:EP_GROUPQ"
## [29] "strat1:EP_UNINSUR"          "strat1:pollute_conc_pc1"
## [31] "strat1:pollute_conc_pc2"    "strat1:pollute_conc_pc3"
## [33] "strat1: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))))
```

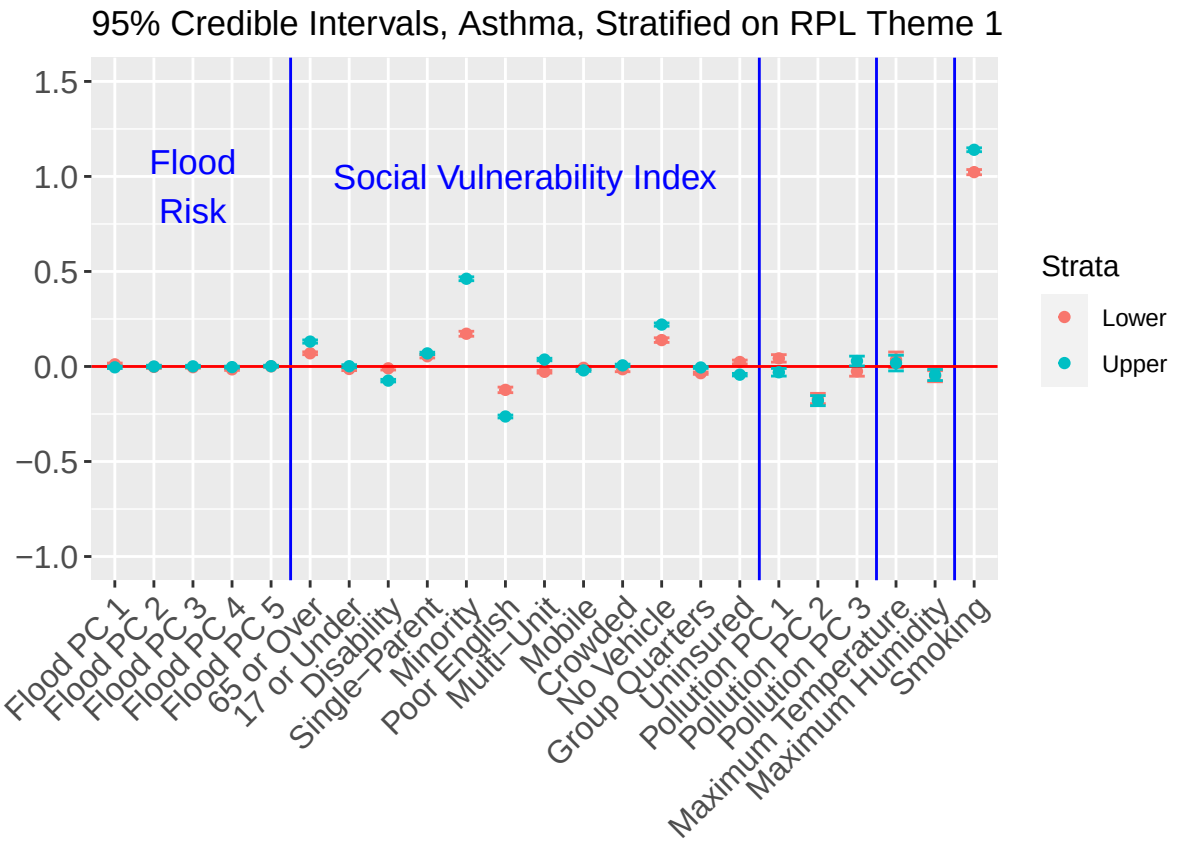
Splitting up the beta coefficients for each strata

```
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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 17.5, 20.5, 22.5), 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) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood PC 5",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent", "Minority", "Poor English",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)
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                   9.83196  9.82712  9.83679
## strat0:flood_risk_pc1    0.01412  0.00832  0.01994
## strat0:flood_risk_pc2   -0.00662 -0.01311 -0.00014
## strat0:flood_risk_pc3   -0.00695 -0.01186 -0.00202
## strat0:flood_risk_pc4   -0.01460 -0.01914 -0.01003
## strat0:flood_risk_pc5   -0.00080 -0.00522  0.00365
## strat0:EP_POV            0.35381  0.34544  0.36222
```

```
## strat0:EP_UNEMP             0.09316  0.08670  0.09963
## strat0:EP_PCI              -0.08362 -0.09048 -0.07668
## strat0:EP_NOHSDP            0.10164  0.09047  0.11279
## strat0:EP_MINRTY            0.13472  0.12422  0.14523
## strat0:EP_LIMENG           -0.19147 -0.20104 -0.18196
## strat0:EP_MUNIT            -0.03202 -0.03740 -0.02666
## strat0:EP_MOBILE           -0.02528 -0.03208 -0.01851
## strat0:EP_CROWD            -0.02252 -0.02970 -0.01533
## strat0:EP_NOVEH             0.10880  0.09977  0.11778
## strat0:EP_GROUPQ           -0.03395 -0.03752 -0.03039
## strat0:EP_UNINSUR          -0.00122 -0.00855  0.00605
## strat0:pollute_conc_pc1    -0.03681 -0.05530 -0.01888
## strat0:pollute_conc_pc2    -0.20970 -0.23394 -0.18439
## strat0:pollute_conc_pc3     0.03894  0.01509  0.06261
## strat0:tmmx                 0.04225  0.00368  0.07999
## strat0:rmax                -0.03243 -0.06012 -0.00604
## strat0:Data_Value_CSMOKING  0.66445  0.65170  0.67709
## strat1                      9.89699  9.89198  9.90200
## strat1:flood_risk_pc1      -0.00569 -0.01168  0.00026
## strat1:flood_risk_pc2       0.01105  0.00450  0.01760
## strat1:flood_risk_pc3       0.00596  0.00049  0.01144
## strat1:flood_risk_pc4       0.00143 -0.00346  0.00633
## strat1:flood_risk_pc5      -0.00005 -0.00488  0.00477
## strat1:EP_POV               0.20301  0.19402  0.21191
## strat1:EP_UNEMP             0.05064  0.04556  0.05579
## strat1:EP_PCI               0.00226 -0.01055  0.01518
## strat1:EP_NOHSDP            0.09036  0.08038  0.10025
## strat1:EP_MINRTY            0.45621  0.44643  0.46599
## strat1:EP_LIMENG           -0.28128 -0.29069 -0.27182
## strat1:EP_MUNIT             0.00770  0.00019  0.01531
## strat1:EP_MOBILE           -0.01484 -0.01983 -0.00985
## strat1:EP_CROWD            -0.02192 -0.02886 -0.01493
## strat1:EP_NOVEH             0.17002  0.16103  0.17912
## strat1:EP_GROUPQ           -0.18246 -0.19210 -0.17275
## strat1:EP_UNINSUR          -0.04608 -0.05286 -0.03923
## strat1:pollute_conc_pc1    -0.08258 -0.10128 -0.06393
## strat1:pollute_conc_pc2    -0.17790 -0.20201 -0.15246
## strat1:pollute_conc_pc3     0.07882  0.05504  0.10259
## strat1:tmmx                 0.00927 -0.02927  0.04738
## strat1:rmax                -0.04174 -0.06970 -0.01523
## strat1:Data_Value_CSMOKING  0.91702  0.90463  0.92943
```

```
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_pc2"     "strat0:flood_risk_pc3"
##  [5] "strat0:flood_risk_pc4"     "strat0:EP_POV"
##  [7] "strat0:EP_UNEMP"           "strat0:EP_PCI"
##  [9] "strat0:EP_NOHSDP"          "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:pollute_conc_pc1"    "strat0:pollute_conc_pc2"
## [19] "strat0:pollute_conc_pc3"    "strat0:tmmx"
## [21] "strat0:rmax"                "strat0:Data_Value_CSMOKING"
## [23] "strat1"                     "strat1:flood_risk_pc2"
## [25] "strat1:flood_risk_pc3"      "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:pollute_conc_pc1"    "strat1:pollute_conc_pc2"
## [39] "strat1:pollute_conc_pc3"    "strat1:rmax"
## [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))))
```

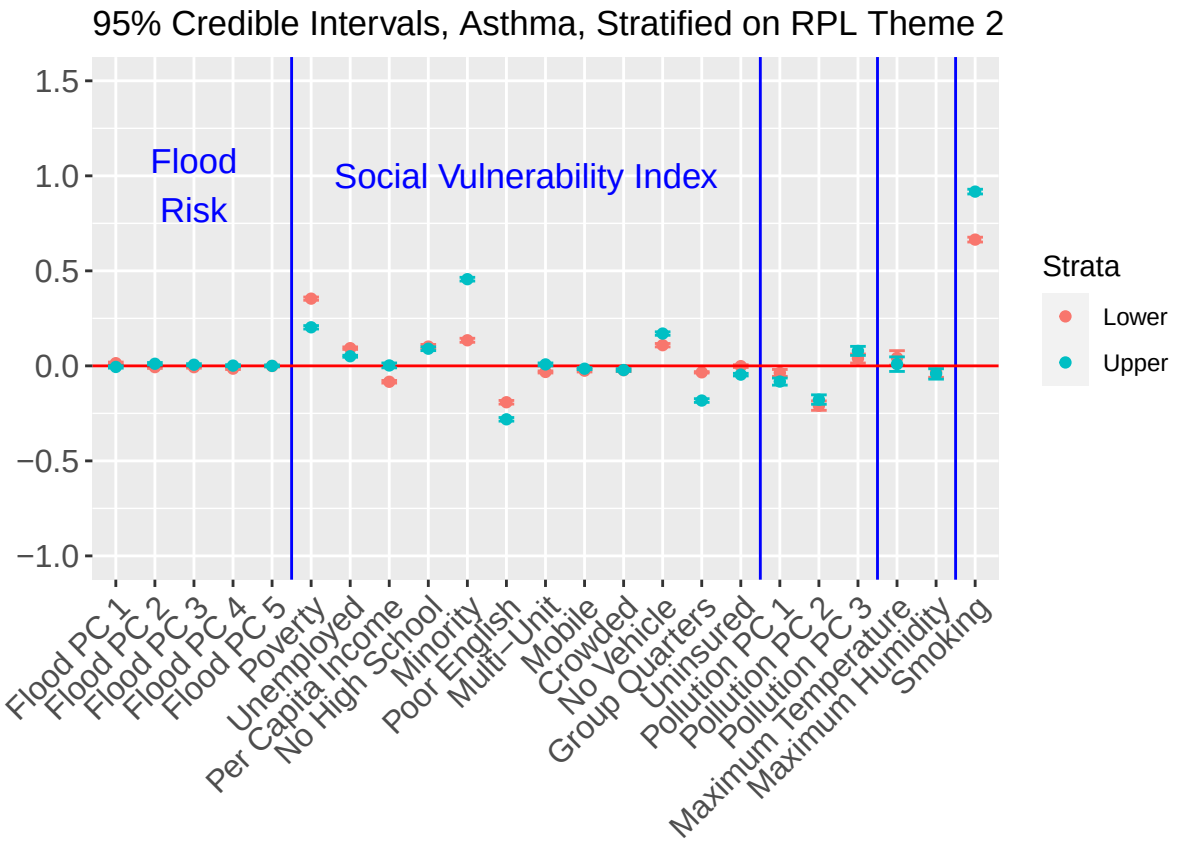
Splitting up the beta coefficients for each strata

```
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, 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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 17.5, 20.5, 22.5), 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) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood PC 5",
                              "Poverty", "Unemployed", "Per Capita Income", "No High School",
                              "Minority", "Poor English",
```

```
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)

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)
```

```r
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                     10.00466  9.99522 10.01417
## strat0:flood_risk_pc1       0.01059  0.00399  0.01731
## strat0:flood_risk_pc2      -0.00841 -0.01617 -0.00067
## strat0:flood_risk_pc3      -0.00997 -0.01592 -0.00406
## strat0:flood_risk_pc4      -0.00590 -0.01192  0.00011
## strat0:flood_risk_pc5      -0.00364 -0.00941  0.00213
## strat0:EP_POV               0.34496  0.33493  0.35494
## strat0:EP_UNEMP             0.07895  0.07236  0.08560
## strat0:EP_PCI              -0.09270 -0.10067 -0.08476
## strat0:EP_NOHSDP            0.14644  0.13177  0.16126
## strat0:EP_AGE65             0.04762  0.04050  0.05468
## strat0:EP_AGE17             0.01006  0.00187  0.01819
## strat0:EP_DISABL           -0.04545 -0.05327 -0.03763
## strat0:EP_SNGPNT            0.06474  0.05669  0.07280
## strat0:EP_MUNIT            -0.03513 -0.04394 -0.02639
## strat0:EP_MOBILE           -0.03155 -0.03790 -0.02531
## strat0:EP_CROWD             0.01328 -0.00002  0.02662
## strat0:EP_NOVEH             0.13631  0.12466  0.14805
## strat0:EP_GROUPQ            0.00886  0.00328  0.01449
## strat0:EP_UNINSUR          -0.01731 -0.02645 -0.00808
## strat0:pollute_conc_pc1    -0.04458 -0.06540 -0.02397
## strat0:pollute_conc_pc2    -0.18868 -0.21791 -0.16086
## strat0:pollute_conc_pc3     0.06890  0.04303  0.09566
## strat0:tmmx                 0.05163  0.01013  0.09636
## strat0:rmax                -0.04820 -0.07855 -0.01805
## strat0:Data_Value_CSMOKING  0.74603  0.73038  0.76178
## strat1                      9.93021  9.92450  9.93593
## strat1:flood_risk_pc1       0.00662  0.00010  0.01317
## strat1:flood_risk_pc2       0.00684 -0.00001  0.01364
## strat1:flood_risk_pc3       0.00339 -0.00222  0.00893
## strat1:flood_risk_pc4      -0.00858 -0.01317 -0.00404
## strat1:flood_risk_pc5      -0.00021 -0.00462  0.00419
## strat1:EP_POV               0.22353  0.21511  0.23202
## strat1:EP_UNEMP             0.10657  0.10113  0.11202
## strat1:EP_PCI              -0.11692 -0.12645 -0.10736
## strat1:EP_NOHSDP           -0.03325 -0.04183 -0.02467
## strat1:EP_AGE65             0.09391  0.08573  0.10199
## strat1:EP_AGE17             0.00440 -0.00337  0.01211
## strat1:EP_DISABL           -0.04016 -0.04749 -0.03280
## strat1:EP_SNGPNT            0.08254  0.07637  0.08881
## strat1:EP_MUNIT            -0.01441 -0.02020 -0.00858
## strat1:EP_MOBILE           -0.03188 -0.03772 -0.02603
## strat1:EP_CROWD            -0.04878 -0.05513 -0.04236
## strat1:EP_NOVEH             0.16370  0.15489  0.17251
## strat1:EP_GROUPQ           -0.09402 -0.09931 -0.08875
## strat1:EP_UNINSUR          -0.06179 -0.06866 -0.05499
## strat1:pollute_conc_pc1    -0.04263 -0.06329 -0.02139
## strat1:pollute_conc_pc2    -0.20034 -0.22894 -0.17313
## strat1:pollute_conc_pc3     0.07429  0.04831  0.10164
```

```
## strat1:tmmx                 0.08636  0.04421  0.13175
## strat1:rmax                -0.05516 -0.08566 -0.02476
## strat1:Data_Value_CSMOKING  1.00277  0.98955  1.01606
```

```
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_pc2"      "strat0:flood_risk_pc3"
##  [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_MUNIT"            "strat0:EP_MOBILE"
## [15] "strat0:EP_NOVEH"            "strat0:EP_GROUPQ"
## [17] "strat0:EP_UNINSUR"          "strat0:pollute_conc_pc1"
## [19] "strat0:pollute_conc_pc2"    "strat0:pollute_conc_pc3"
## [21] "strat0:tmmx"                "strat0:rmax"
## [23] "strat0:Data_Value_CSMOKING" "strat1"
## [25] "strat1:flood_risk_pc1"      "strat1:flood_risk_pc4"
## [27] "strat1:EP_POV"              "strat1:EP_UNEMP"
## [29] "strat1:EP_PCI"              "strat1:EP_NOHSDP"
## [31] "strat1:EP_AGE65"            "strat1:EP_DISABL"
## [33] "strat1:EP_SNGPNT"           "strat1:EP_MUNIT"
## [35] "strat1:EP_MOBILE"           "strat1:EP_CROWD"
## [37] "strat1:EP_NOVEH"            "strat1:EP_GROUPQ"
## [39] "strat1:EP_UNINSUR"          "strat1:pollute_conc_pc1"
## [41] "strat1:pollute_conc_pc2"    "strat1:pollute_conc_pc3"
## [43] "strat1:tmmx"                "strat1:rmax"
## [45] "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

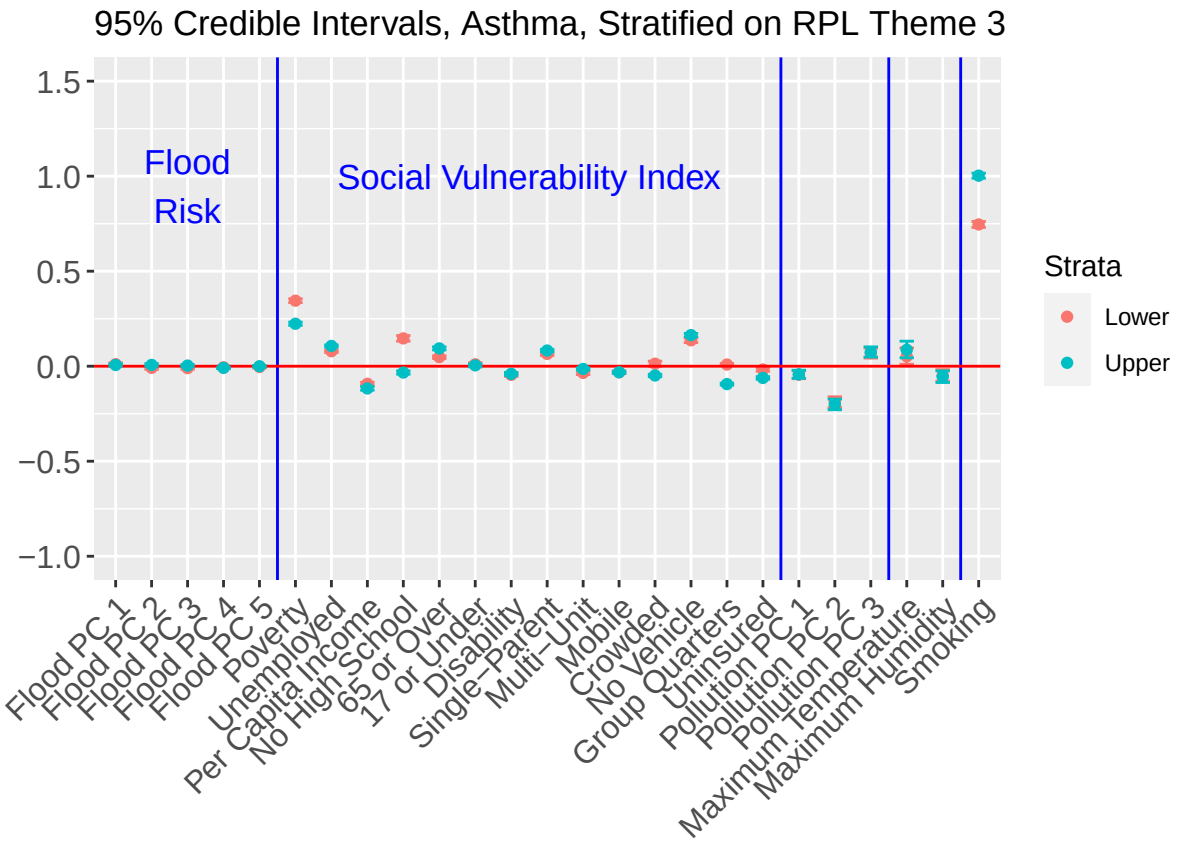
```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 19.5, 22.5, 24.5), 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) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood 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",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)

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                     9.88655  9.88224  9.89089
## strat0:flood_risk_pc1      0.01241  0.00630  0.01845
## strat0:flood_risk_pc2     -0.00787 -0.01465 -0.00103
## strat0:flood_risk_pc3     -0.00305 -0.00833  0.00221
## strat0:flood_risk_pc4     -0.01435 -0.01946 -0.00921
## strat0:flood_risk_pc5      0.00353 -0.00141  0.00847
## strat0:EP_POV              0.25718  0.24723  0.26715
## strat0:EP_UNEMP            0.06548  0.05917  0.07176
```

```
## strat0:EP_PCI              -0.02584 -0.03349 -0.01821
## strat0:EP_NOHSDP            0.07287  0.06075  0.08483
## strat0:EP_AGE65             0.11713  0.11050  0.12381
## strat0:EP_AGE17             0.04107  0.03438  0.04782
## strat0:EP_DISABL           -0.01902 -0.02660 -0.01143
## strat0:EP_SNGPNT            0.02959  0.02239  0.03685
## strat0:EP_MINRTY            0.33222  0.32156  0.34288
## strat0:EP_LIMENG           -0.24843 -0.26080 -0.23614
## strat0:EP_UNINSUR          -0.01137 -0.01952 -0.00312
## strat0:pollute_conc_pc1    -0.00428 -0.02270  0.01418
## strat0:pollute_conc_pc2    -0.17214 -0.19961 -0.14738
## strat0:pollute_conc_pc3    -0.00965 -0.03375  0.01444
## strat0:tmmx                 0.01067 -0.02945  0.04925
## strat0:rmax                -0.05458 -0.08234 -0.02645
## strat0:Data_Value_CSMOKING  0.88956  0.87542  0.90366
## strat1                      9.88411  9.88001  9.88820
## strat1:flood_risk_pc1       0.00227 -0.00363  0.00817
## strat1:flood_risk_pc2       0.00643 -0.00008  0.01290
## strat1:flood_risk_pc3      -0.00100 -0.00621  0.00419
## strat1:flood_risk_pc4      -0.00518 -0.00985 -0.00055
## strat1:flood_risk_pc5       0.00084 -0.00378  0.00544
## strat1:EP_POV               0.31752  0.31003  0.32498
## strat1:EP_UNEMP             0.07577  0.07037  0.08122
## strat1:EP_PCI              -0.08964 -0.09917 -0.08001
## strat1:EP_NOHSDP            0.05195  0.04224  0.06165
## strat1:EP_AGE65             0.13959  0.13245  0.14673
## strat1:EP_AGE17             0.04139  0.03492  0.04793
## strat1:EP_DISABL           -0.04376 -0.05055 -0.03699
## strat1:EP_SNGPNT            0.04489  0.03838  0.05135
## strat1:EP_MINRTY            0.35590  0.34561  0.36615
## strat1:EP_LIMENG           -0.25960 -0.26811 -0.25125
## strat1:EP_UNINSUR          -0.02626 -0.03283 -0.01963
## strat1:pollute_conc_pc1    -0.00222 -0.02093  0.01629
## strat1:pollute_conc_pc2    -0.16981 -0.19680 -0.14543
## strat1:pollute_conc_pc3    -0.00297 -0.02707  0.02109
## strat1:tmmx                 0.00691 -0.03339  0.04541
## strat1:rmax                -0.05981 -0.08755 -0.03154
## strat1:Data_Value_CSMOKING  0.85512  0.84247  0.86756
```

```
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_pc2"     "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:pollute_conc_pc2"
## [17] "strat0:rmax"               "strat0:Data_Value_CSMOKING"
## [19] "strat1"                    "strat1:flood_risk_pc4"
```

```
## [21] "strat1:EP_POV"              "strat1:EP_UNEMP"
## [23] "strat1:EP_PCI"              "strat1:EP_NOHSDP"
## [25] "strat1:EP_AGE65"            "strat1:EP_AGE17"
## [27] "strat1:EP_DISABL"           "strat1:EP_SNGPNT"
## [29] "strat1:EP_MINRTY"           "strat1:EP_LIMENG"
## [31] "strat1:EP_UNINSUR"          "strat1:pollute_conc_pc2"
## [33] "strat1: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))))
```

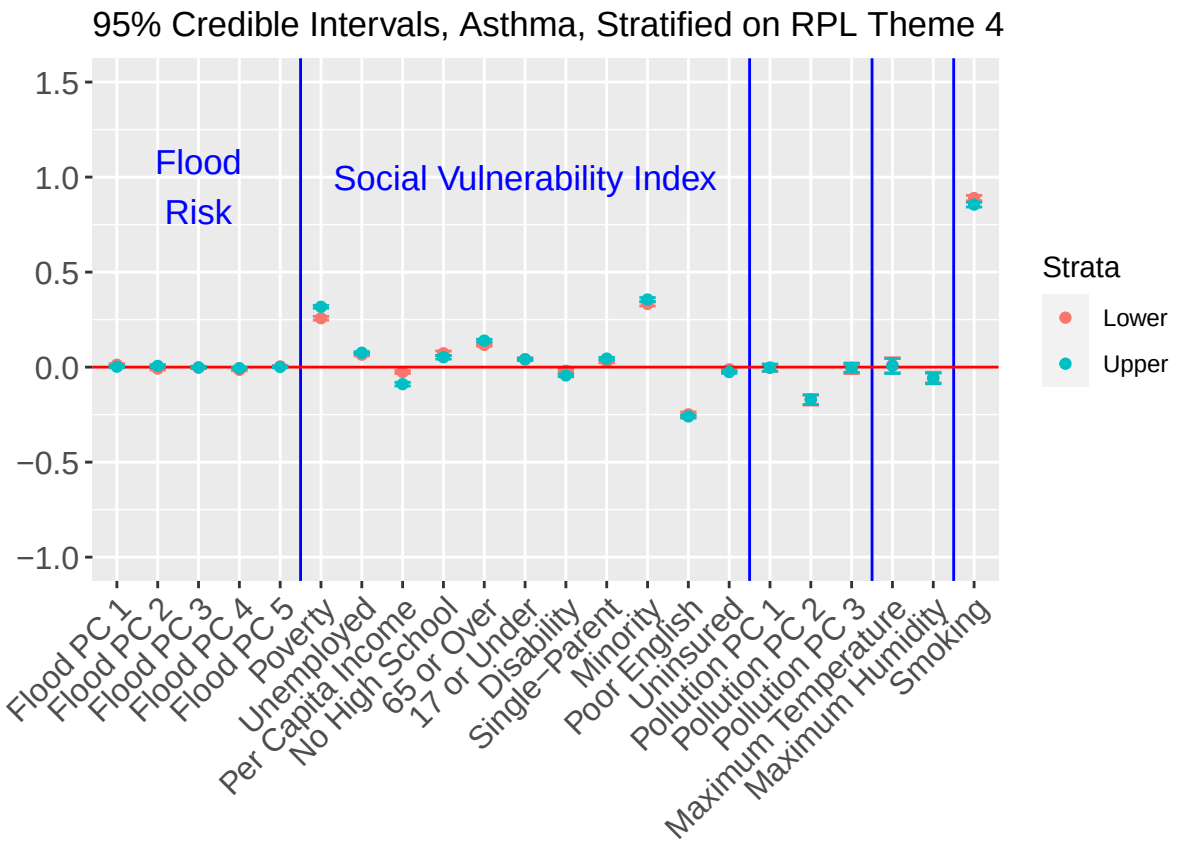
Splitting up the beta coefficients for each strata

```
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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 16.5, 19.5, 21.5), 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) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood PC 5",
                              "Poverty", "Unemployed", "Per Capita Income", "No High School",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent",
                              "Minority", "Poor English",
                              "Uninsured",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)

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                   9.76076  9.75395  9.76748
```

```
## strat0:flood_risk_pc1       0.00458 -0.00267  0.01180
## strat0:flood_risk_pc2       0.00997  0.00176  0.01829
## strat0:flood_risk_pc3      -0.00056 -0.00675  0.00559
## strat0:flood_risk_pc4      -0.01479 -0.02086 -0.00867
## strat0:flood_risk_pc5      -0.00079 -0.00661  0.00504
## strat0:EP_UNINSUR          -0.02870 -0.03883 -0.01866
## strat0:pollute_conc_pc1     0.11316  0.09205  0.13405
## strat0:pollute_conc_pc2    -0.17287 -0.20289 -0.14199
## strat0:pollute_conc_pc3    -0.05384 -0.08222 -0.02497
## strat0:tmmx                -0.00261 -0.04994  0.04632
## strat0:rmax                -0.08513 -0.12024 -0.05037
## strat0:Data_Value_CSMOKING  1.12452  1.11321  1.13587
## strat1                      9.94430  9.93853  9.95009
## strat1:flood_risk_pc1       0.01460  0.00758  0.02168
## strat1:flood_risk_pc2      -0.02661 -0.03415 -0.01900
## strat1:flood_risk_pc3      -0.00789 -0.01417 -0.00162
## strat1:flood_risk_pc4      -0.01651 -0.02184 -0.01107
## strat1:flood_risk_pc5      -0.00403 -0.00940  0.00136
## strat1:EP_UNINSUR          -0.08542 -0.09212 -0.07873
## strat1:pollute_conc_pc1     0.17748  0.15583  0.19842
## strat1:pollute_conc_pc2    -0.16727 -0.19680 -0.13662
## strat1:pollute_conc_pc3    -0.10765 -0.13644 -0.07859
## strat1:tmmx                 0.04356 -0.00410  0.09269
## strat1:rmax                -0.12048 -0.15574 -0.08583
## strat1:Data_Value_CSMOKING  1.31076  1.30223  1.31926
```

```
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_pc2"
##  [3] "strat0:flood_risk_pc4"     "strat0:EP_UNINSUR"
##  [5] "strat0:pollute_conc_pc1"   "strat0:pollute_conc_pc2"
##  [7] "strat0:pollute_conc_pc3"   "strat0:rmax"
##  [9] "strat0:Data_Value_CSMOKING" "strat1"
## [11] "strat1:flood_risk_pc1"     "strat1:flood_risk_pc2"
## [13] "strat1:flood_risk_pc3"     "strat1:flood_risk_pc4"
## [15] "strat1:EP_UNINSUR"         "strat1:pollute_conc_pc1"
## [17] "strat1:pollute_conc_pc2"   "strat1:pollute_conc_pc3"
## [19] "strat1: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,
```

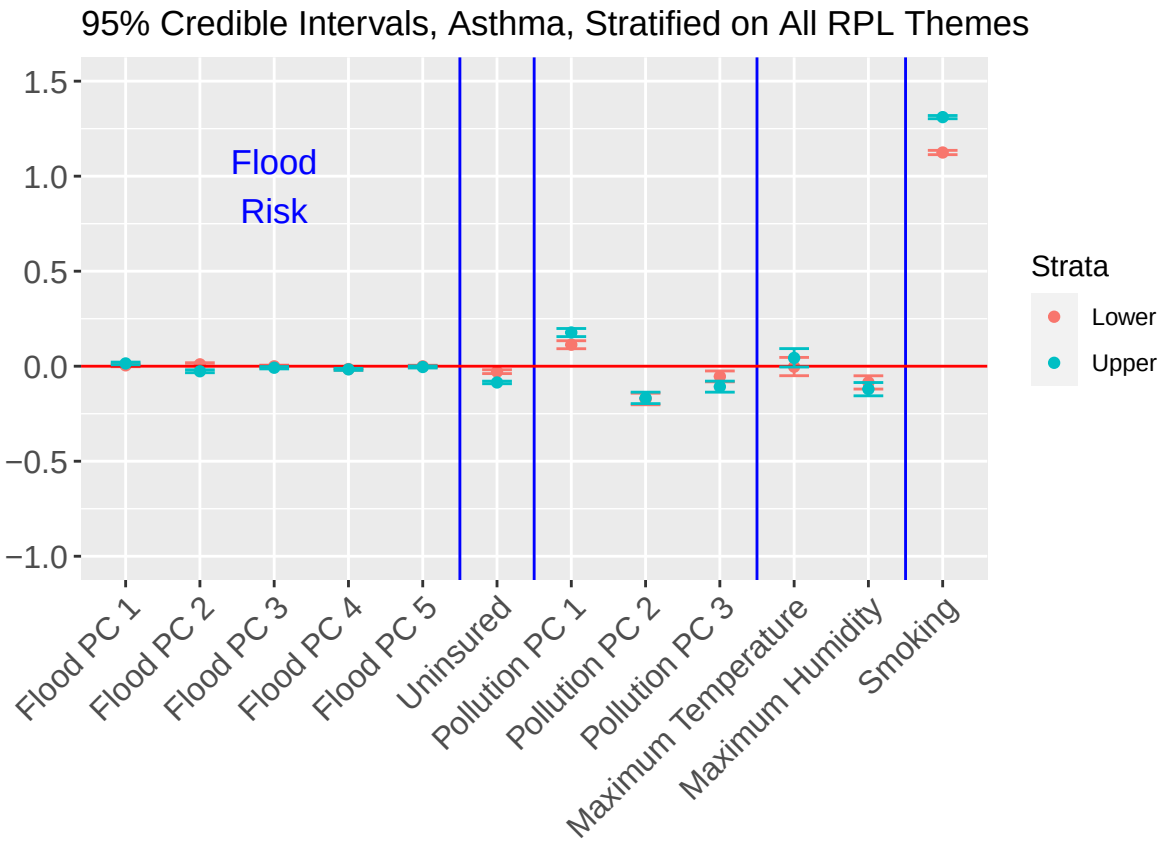
```
                                      levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- as.factor(c(rep("Lower", (nrow(beta_inference_df)/2)),
                                       rep("Upper", (nrow(beta_inference_df)/2))))
```

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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 6.5, 9.5, 11.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 0.95, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood PC 5",
                              "Uninsured",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)

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                    14.06217 14.04944 14.07489
## strat0:flood_risk_pc1      0.00429 -0.00682  0.01535
## strat0:flood_risk_pc2      0.01084 -0.00166  0.02315
## strat0:flood_risk_pc3      0.00782 -0.00160  0.01738
## strat0:flood_risk_pc4     -0.00784 -0.01685  0.00115
## strat0:flood_risk_pc5      0.00452 -0.00406  0.01306
```

```
## strat0:EP_UNEMP             0.08714  0.07296  0.10128
## strat0:EP_PCI              -0.17008 -0.18375 -0.15652
## strat0:EP_NOHSDP            0.11438  0.08809  0.14066
## strat0:EP_AGE65            -0.22405 -0.23689 -0.21117
## strat0:EP_AGE17            -0.03074 -0.04546 -0.01617
## strat0:EP_DISABL           -0.03882 -0.05444 -0.02320
## strat0:EP_SNGPNT            0.07467  0.05994  0.08929
## strat0:EP_MINRTY           -0.07641 -0.09848 -0.05435
## strat0:EP_LIMENG            0.05842  0.03456  0.08251
## strat0:EP_MUNIT             0.08370  0.07145  0.09600
## strat0:EP_MOBILE           -0.02687 -0.03929 -0.01446
## strat0:EP_CROWD             0.07066  0.05162  0.08973
## strat0:EP_NOVEH             0.12727  0.10595  0.14856
## strat0:EP_GROUPQ            0.17683  0.16444  0.18929
## strat0:EP_UNINSUR           0.04290  0.02671  0.05914
## strat0:pollute_conc_pc1     0.29352  0.25850  0.32787
## strat0:pollute_conc_pc2    -0.02574 -0.07444  0.01946
## strat0:pollute_conc_pc3    -0.19268 -0.23711 -0.14970
## strat0:tmmx                 0.05219 -0.02076  0.11785
## strat0:rmax                -0.04001 -0.09002  0.01161
## strat0:Data_Value_CSMOKING  2.75133  2.72356  2.77878
## strat1                     14.22208 14.21127 14.23286
## strat1:flood_risk_pc1      -0.00852 -0.01887  0.00182
## strat1:flood_risk_pc2      -0.01112 -0.02267  0.00035
## strat1:flood_risk_pc3      -0.01463 -0.02372 -0.00550
## strat1:flood_risk_pc4      -0.00975 -0.01793 -0.00154
## strat1:flood_risk_pc5      -0.00698 -0.01517  0.00120
## strat1:EP_UNEMP             0.14155  0.13307  0.15006
## strat1:EP_PCI              -0.98576 -1.00948 -0.96200
## strat1:EP_NOHSDP            0.18857  0.17191  0.20529
## strat1:EP_AGE65            -0.40990 -0.42351 -0.39623
## strat1:EP_AGE17            -0.18166 -0.19503 -0.16818
## strat1:EP_DISABL           -0.24325 -0.25465 -0.23172
## strat1:EP_SNGPNT            0.14703  0.13630  0.15777
## strat1:EP_MINRTY           -0.23426 -0.25200 -0.21658
## strat1:EP_LIMENG           -0.03395 -0.04885 -0.01893
## strat1:EP_MUNIT             0.21539  0.20456  0.22607
## strat1:EP_MOBILE           -0.04588 -0.05511 -0.03659
## strat1:EP_CROWD             0.07784  0.06665  0.08917
## strat1:EP_NOVEH             0.24721  0.23299  0.26144
## strat1:EP_GROUPQ            0.14882  0.14067  0.15698
## strat1:EP_UNINSUR          -0.09249 -0.10400 -0.08105
## strat1:pollute_conc_pc1     0.17616  0.14019  0.21075
## strat1:pollute_conc_pc2    -0.09646 -0.14441 -0.05197
## strat1:pollute_conc_pc3    -0.13906 -0.18317 -0.09607
## strat1:tmmx                 0.16430  0.09100  0.23030
## strat1:rmax                -0.00674 -0.05709  0.04459
## strat1:Data_Value_CSMOKING  2.50770  2.48747  2.52796
```

```
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:EP_UNEMP"
##  [3] "strat0:EP_PCI"              "strat0:EP_NOHSDP"
##  [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:pollute_conc_pc1"    "strat0:pollute_conc_pc3"
## [19] "strat0:Data_Value_CSMOKING" "strat1"
## [21] "strat1:flood_risk_pc3"      "strat1:flood_risk_pc4"
## [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_MUNIT"
## [33] "strat1:EP_MOBILE"           "strat1:EP_CROWD"
## [35] "strat1:EP_NOVEH"            "strat1:EP_GROUPQ"
## [37] "strat1:EP_UNINSUR"          "strat1:pollute_conc_pc1"
## [39] "strat1:pollute_conc_pc2"    "strat1:pollute_conc_pc3"
## [41] "strat1: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))))
```

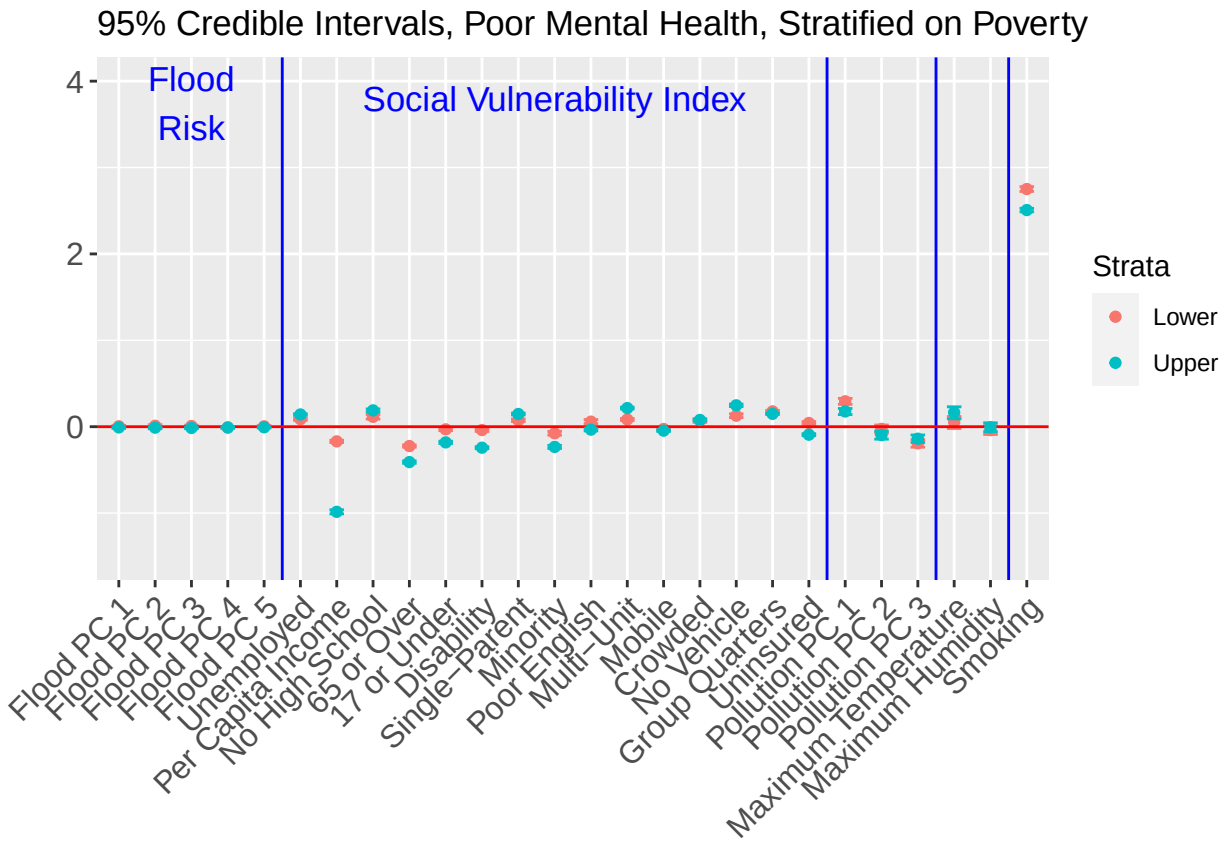
Splitting up the beta coefficients for each strata

```
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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
```

```
  geom_vline(xintercept = c(5.5, 20.5, 23.5, 25.5), 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 = 13, y = 3.8, label = "Social Vulnerability Index",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood 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",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)

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                     14.08162 14.06663 14.09659
## strat0:flood_risk_pc1       0.00878 -0.00302  0.02056
## strat0:flood_risk_pc2       0.00482 -0.00846  0.01807
## strat0:flood_risk_pc3       0.00436 -0.00558  0.01427
## strat0:flood_risk_pc4      -0.01552 -0.02502 -0.00601
## strat0:flood_risk_pc5       0.00103 -0.00800  0.01017
## strat0:EP_AGE65            -0.25433 -0.26747 -0.24121
## strat0:EP_AGE17            -0.09515 -0.11024 -0.08031
## strat0:EP_DISABL           -0.04008 -0.05587 -0.02414
## strat0:EP_SNGPNT            0.10743  0.09159  0.12304
## strat0:EP_MINRTY           -0.02978 -0.05324 -0.00640
## strat0:EP_LIMENG            0.05500  0.02883  0.08087
## strat0:EP_MUNIT             0.08569  0.07336  0.09797
## strat0:EP_MOBILE           -0.00899 -0.02343  0.00562
## strat0:EP_CROWD             0.09012  0.06678  0.11325
## strat0:EP_NOVEH             0.20112  0.17940  0.22279
## strat0:EP_GROUPQ            0.21125  0.20039  0.22209
## strat0:EP_UNINSUR           0.05737  0.03957  0.07515
## strat0:pollute_conc_pc1     0.39538  0.35960  0.43028
## strat0:pollute_conc_pc2    -0.05067 -0.09828 -0.00118
## strat0:pollute_conc_pc3    -0.20008 -0.24639 -0.15404
## strat0:tmmx                 0.05722 -0.01730  0.13012
## strat0:rmax                -0.00336 -0.05739  0.04768
## strat0:Data_Value_CSMOKING  2.90931  2.88455  2.93362
## strat1                     14.46021 14.44931 14.47118
## strat1:flood_risk_pc1      -0.00048 -0.01169  0.01067
## strat1:flood_risk_pc2      -0.02080 -0.03302 -0.00862
## strat1:flood_risk_pc3      -0.01041 -0.02052 -0.00037
## strat1:flood_risk_pc4      -0.01161 -0.02039 -0.00278
## strat1:flood_risk_pc5       0.00448 -0.00424  0.01316
## strat1:EP_AGE65            -0.41474 -0.42973 -0.39967
## strat1:EP_AGE17            -0.11917 -0.13366 -0.10483
## strat1:EP_DISABL           -0.20464 -0.21679 -0.19257
## strat1:EP_SNGPNT            0.15792  0.14687  0.16902
## strat1:EP_MINRTY           -0.04756 -0.06577 -0.02955
## strat1:EP_LIMENG            0.06671  0.05314  0.08036
## strat1:EP_MUNIT             0.18454  0.17273  0.19653
## strat1:EP_MOBILE           -0.02409 -0.03349 -0.01464
## strat1:EP_CROWD             0.11818  0.10664  0.12972
## strat1:EP_NOVEH             0.31251  0.29737  0.32775
## strat1:EP_GROUPQ            0.27326  0.26451  0.28207
## strat1:EP_UNINSUR          -0.06687 -0.07865 -0.05494
## strat1:pollute_conc_pc1     0.29667  0.26054  0.33317
```

```
## strat1:pollute_conc_pc2    -0.08521 -0.13163 -0.03647
## strat1:pollute_conc_pc3    -0.11945 -0.16560 -0.07329
## strat1:tmmx                 0.18268  0.10774  0.25692
## strat1:rmax                 0.02175 -0.03262  0.07330
## strat1:Data_Value_CSMOKING  2.92027  2.90204  2.93868
```

```
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:flood_risk_pc4"
##  [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:pollute_conc_pc1"
## [15] "strat0:pollute_conc_pc2"    "strat0:pollute_conc_pc3"
## [17] "strat0:Data_Value_CSMOKING" "strat1"
## [19] "strat1:flood_risk_pc2"      "strat1:flood_risk_pc3"
## [21] "strat1:flood_risk_pc4"      "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:pollute_conc_pc1"
## [35] "strat1:pollute_conc_pc2"    "strat1:pollute_conc_pc3"
## [37] "strat1:tmmx"                "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

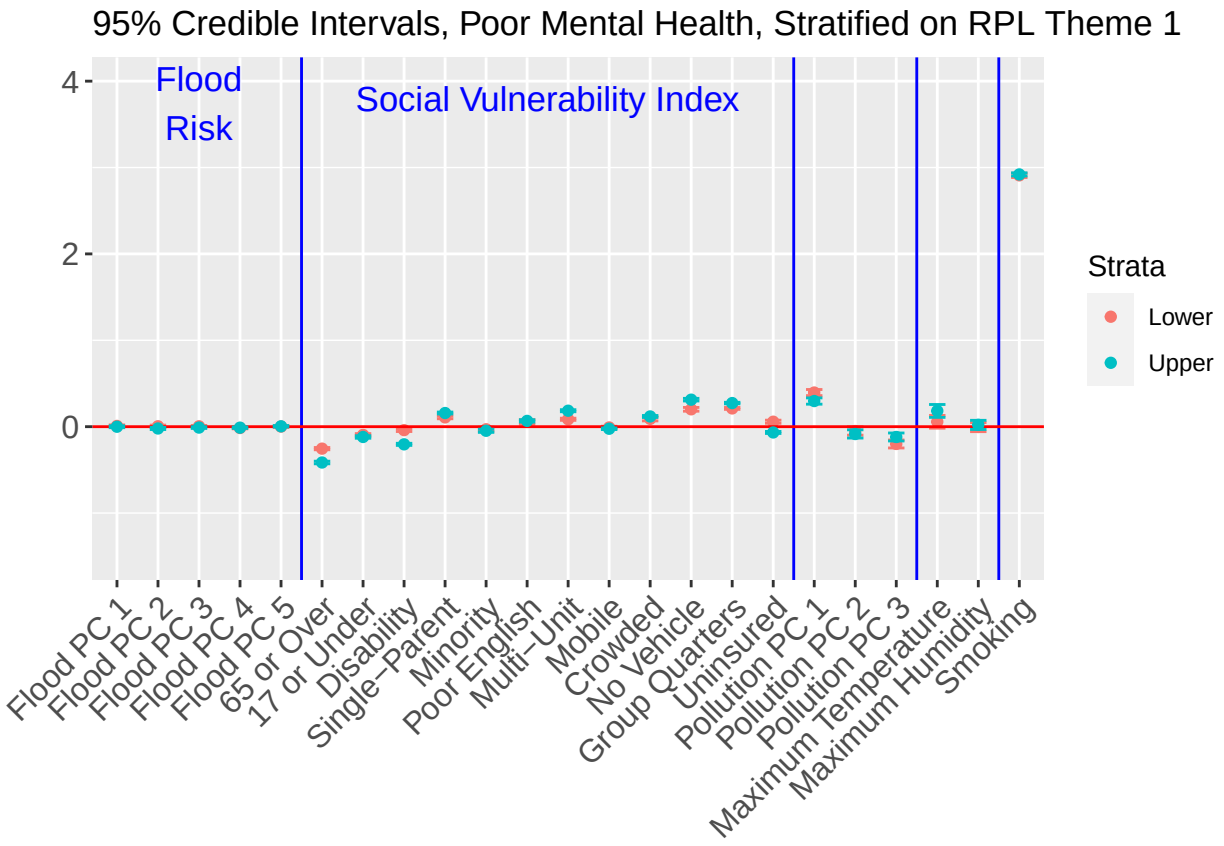
```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median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

```r
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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 17.5, 20.5, 22.5), 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) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood PC 5",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent", "Minority", "Poor English",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)
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                   14.30482 14.29631 14.31332
## strat0:flood_risk_pc1     0.02504  0.01500  0.03505
## strat0:flood_risk_pc2    -0.00071 -0.01195  0.01051
## strat0:flood_risk_pc3     0.00031 -0.00819  0.00884
## strat0:flood_risk_pc4    -0.01848 -0.02635 -0.01056
## strat0:flood_risk_pc5     0.00555 -0.00210  0.01330
## strat0:EP_POV             1.06589  1.05115  1.08071
## strat0:EP_UNEMP           0.08284  0.07159  0.09414
## strat0:EP_PCI            -0.35998 -0.37185 -0.34799
## strat0:EP_NOHSDP         -0.00560 -0.02503  0.01379
## strat0:EP_MINRTY         -0.09563 -0.11380 -0.07746
```

```
## strat0:EP_LIMENG            0.01453 -0.00204  0.03100
## strat0:EP_MUNIT             0.05108  0.04177  0.06039
## strat0:EP_MOBILE           -0.09267 -0.10448 -0.08089
## strat0:EP_CROWD             0.12767  0.11520  0.14011
## strat0:EP_NOVEH            -0.09486 -0.11051 -0.07929
## strat0:EP_GROUPQ            0.25072  0.24452  0.25691
## strat0:EP_UNINSUR           0.05576  0.04304  0.06843
## strat0:pollute_conc_pc1     0.30159  0.27001  0.33246
## strat0:pollute_conc_pc2    -0.11248 -0.15375 -0.06952
## strat0:pollute_conc_pc3    -0.03976 -0.08024  0.00063
## strat0:tmmx                 0.17544  0.11002  0.23937
## strat0:rmax                 0.04238 -0.00420  0.08703
## strat0:Data_Value_CSMOKING  2.14944  2.12730  2.17147
## strat1                     14.12044 14.11166 14.12928
## strat1:flood_risk_pc1       0.01066  0.00029  0.02097
## strat1:flood_risk_pc2       0.00122 -0.01013  0.01255
## strat1:flood_risk_pc3       0.00388 -0.00559  0.01335
## strat1:flood_risk_pc4      -0.00603 -0.01447  0.00249
## strat1:flood_risk_pc5       0.00246 -0.00593  0.01084
## strat1:EP_POV               0.45543  0.43982  0.47092
## strat1:EP_UNEMP             0.02857  0.01972  0.03751
## strat1:EP_PCI              -0.29762 -0.31989 -0.27515
## strat1:EP_NOHSDP            0.18349  0.16620  0.20069
## strat1:EP_MINRTY            0.11819  0.10139  0.13499
## strat1:EP_LIMENG            0.00182 -0.01445  0.01815
## strat1:EP_MUNIT             0.09978  0.08675  0.11296
## strat1:EP_MOBILE           -0.05881 -0.06747 -0.05014
## strat1:EP_CROWD             0.10625  0.09416  0.11840
## strat1:EP_NOVEH            -0.00227 -0.01790  0.01355
## strat1:EP_GROUPQ           -0.11703 -0.13382 -0.10012
## strat1:EP_UNINSUR           0.00877 -0.00298  0.02068
## strat1:pollute_conc_pc1     0.26755  0.23571  0.29956
## strat1:pollute_conc_pc2    -0.02691 -0.06818  0.01613
## strat1:pollute_conc_pc3    -0.01976 -0.06005  0.02089
## strat1:tmmx                 0.19469  0.12942  0.25934
## strat1:rmax                -0.01001 -0.05697  0.03462
## strat1:Data_Value_CSMOKING  2.62606  2.60452  2.64754
```

```
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_pc4"     "strat0:EP_POV"
##  [5] "strat0:EP_UNEMP"           "strat0:EP_PCI"
##  [7] "strat0:EP_MINRTY"          "strat0:EP_MUNIT"
##  [9] "strat0:EP_MOBILE"          "strat0:EP_CROWD"
## [11] "strat0:EP_NOVEH"           "strat0:EP_GROUPQ"
## [13] "strat0:EP_UNINSUR"         "strat0:pollute_conc_pc1"
## [15] "strat0:pollute_conc_pc2"   "strat0:tmmx"
## [17] "strat0:Data_Value_CSMOKING" "strat1"
## [19] "strat1:flood_risk_pc1"     "strat1:EP_POV"
## [21] "strat1:EP_UNEMP"           "strat1:EP_PCI"
```

```
## [23] "strat1:EP_NOHSDP"           "strat1:EP_MINRTY"
## [25] "strat1:EP_MUNIT"            "strat1:EP_MOBILE"
## [27] "strat1:EP_CROWD"            "strat1:EP_GROUPQ"
## [29] "strat1:pollute_conc_pc1"    "strat1:tmmx"
## [31] "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))))
```

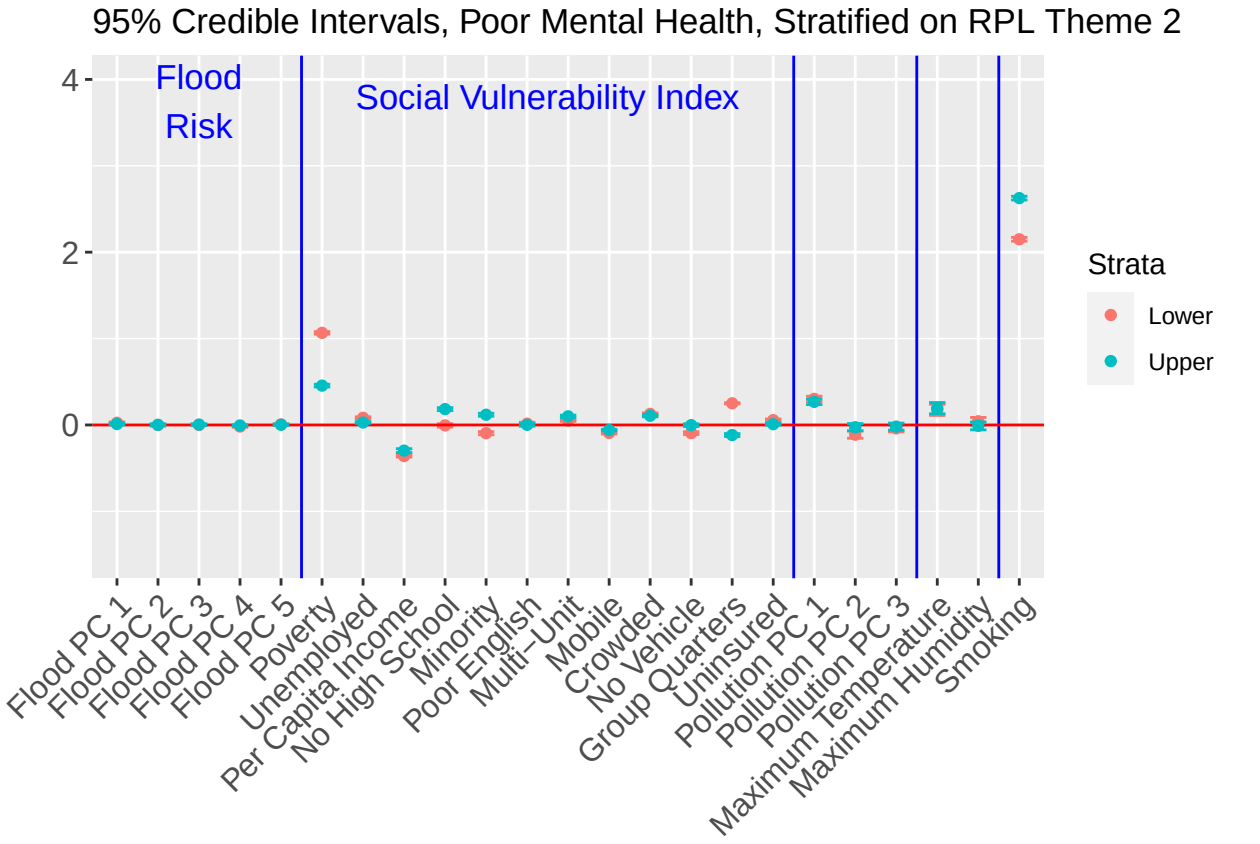
Splitting up the beta coefficients for each strata

```
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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 17.5, 20.5, 22.5), 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) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood PC 5",
                              "Poverty", "Unemployed", "Per Capita Income", "No High School",
                              "Minority", "Poor English",
                              "Multi-Unit", "Mobile", "Crowded",
                              "No Vehicle", "Group Quarters", "Uninsured",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)

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                    14.29523 14.28040 14.31011
## strat0:flood_risk_pc1      0.00549 -0.00466  0.01585
## strat0:flood_risk_pc2     -0.00242 -0.01440  0.00950
## strat0:flood_risk_pc3     -0.01520 -0.02436 -0.00602
```

```
## strat0:flood_risk_pc4      -0.01323 -0.02258 -0.00389
## strat0:flood_risk_pc5      -0.00591 -0.01488  0.00311
## strat0:EP_POV               0.88772  0.87203  0.90340
## strat0:EP_UNEMP             0.04882  0.03848  0.05922
## strat0:EP_PCI              -0.27798 -0.29040 -0.26561
## strat0:EP_NOHSDP            0.17502  0.15205  0.19816
## strat0:EP_AGE65            -0.33748 -0.34855 -0.32648
## strat0:EP_AGE17            -0.14238 -0.15518 -0.12962
## strat0:EP_DISABL           -0.14382 -0.15602 -0.13166
## strat0:EP_SNGPNT            0.02300  0.01043  0.03559
## strat0:EP_MUNIT             0.08349  0.06979  0.09705
## strat0:EP_MOBILE            0.00864 -0.00121  0.01836
## strat0:EP_CROWD             0.06886  0.04803  0.08974
## strat0:EP_NOVEH             0.02610  0.00793  0.04431
## strat0:EP_GROUPQ            0.29721  0.28847  0.30601
## strat0:EP_UNINSUR          -0.03765 -0.05199 -0.02324
## strat0:pollute_conc_pc1     0.13113  0.09958  0.16228
## strat0:pollute_conc_pc2    -0.12841 -0.17093 -0.08732
## strat0:pollute_conc_pc3    -0.00837 -0.04743  0.03110
## strat0:tmmx                 0.15256  0.09103  0.21656
## strat0:rmax                 0.03428 -0.00948  0.07867
## strat0:Data_Value_CSMOKING  2.15424  2.12994  2.17866
## strat1                     14.20849 14.19942 14.21761
## strat1:flood_risk_pc1       0.00823 -0.00181  0.01835
## strat1:flood_risk_pc2       0.00844 -0.00216  0.01902
## strat1:flood_risk_pc3       0.00808 -0.00058  0.01667
## strat1:flood_risk_pc4      -0.00382 -0.01094  0.00318
## strat1:flood_risk_pc5       0.00383 -0.00302  0.01065
## strat1:EP_POV               0.72100  0.70772  0.73437
## strat1:EP_UNEMP             0.06816  0.05964  0.07667
## strat1:EP_PCI              -0.36201 -0.37683 -0.34708
## strat1:EP_NOHSDP            0.21776  0.20448  0.23104
## strat1:EP_AGE65            -0.32935 -0.34211 -0.31665
## strat1:EP_AGE17            -0.09312 -0.10525 -0.08103
## strat1:EP_DISABL           -0.17014 -0.18167 -0.15864
## strat1:EP_SNGPNT            0.07705  0.06738  0.08684
## strat1:EP_MUNIT             0.08242  0.07339  0.09143
## strat1:EP_MOBILE           -0.02244 -0.03160 -0.01329
## strat1:EP_CROWD             0.02813  0.01816  0.03812
## strat1:EP_NOVEH             0.07952  0.06581  0.09319
## strat1:EP_GROUPQ            0.04812  0.03982  0.05633
## strat1:EP_UNINSUR          -0.03471 -0.04540 -0.02413
## strat1:pollute_conc_pc1     0.12439  0.09261  0.15642
## strat1:pollute_conc_pc2    -0.09735 -0.13885 -0.05723
## strat1:pollute_conc_pc3    -0.00242 -0.04183  0.03778
## strat1:tmmx                 0.17092  0.10804  0.23599
## strat1:rmax                 0.02964 -0.01425  0.07424
## strat1:Data_Value_CSMOKING  2.23095  2.21032  2.25165
```

```
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: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_MUNIT"
## [13] "strat0:EP_CROWD"            "strat0:EP_NOVEH"
## [15] "strat0:EP_GROUPQ"           "strat0:EP_UNINSUR"
## [17] "strat0:pollute_conc_pc1"    "strat0:pollute_conc_pc2"
## [19] "strat0:tmmx"                "strat0:Data_Value_CSMOKING"
## [21] "strat1"                     "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_MUNIT"
## [31] "strat1:EP_MOBILE"           "strat1:EP_CROWD"
## [33] "strat1:EP_NOVEH"            "strat1:EP_GROUPQ"
## [35] "strat1:EP_UNINSUR"          "strat1:pollute_conc_pc1"
## [37] "strat1:pollute_conc_pc2"    "strat1:tmmx"
## [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))))
```

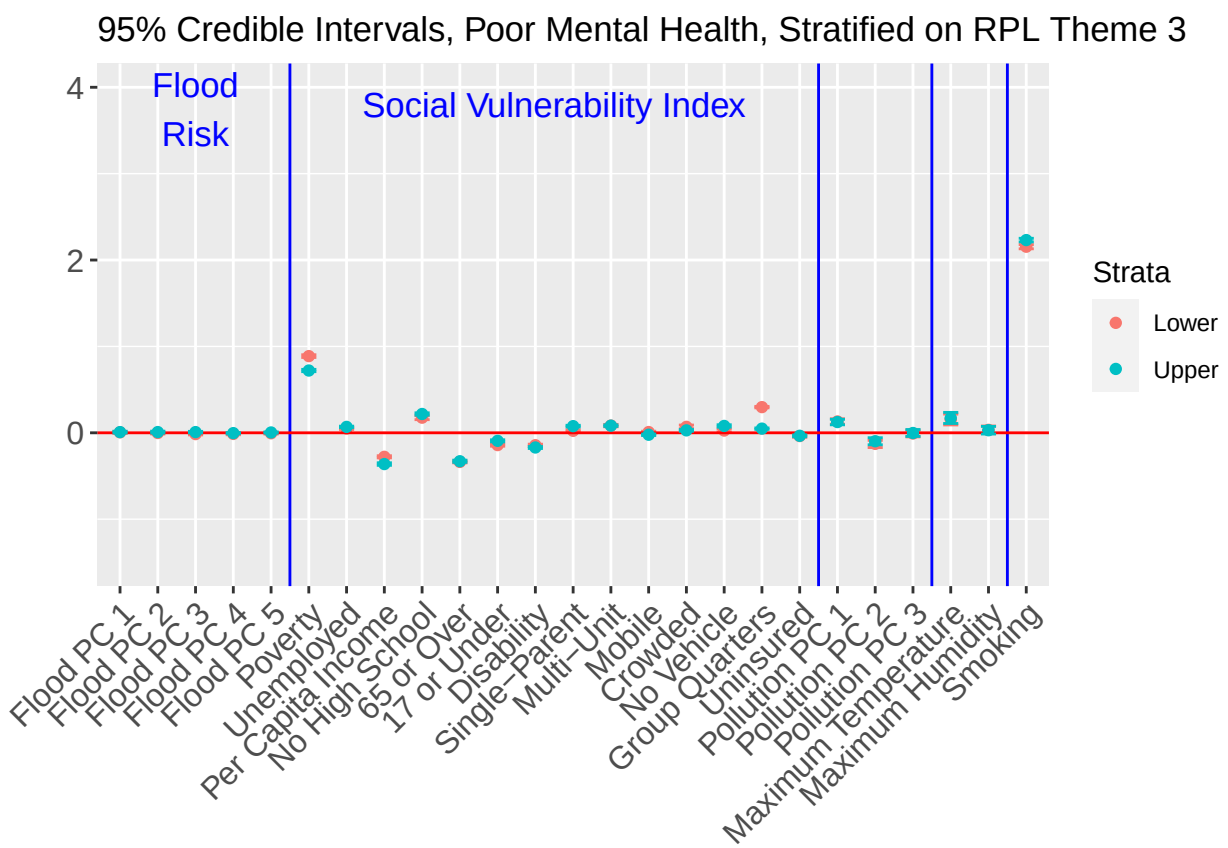
Splitting up the beta coefficients for each strata

```
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(-1.5, 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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 19.5, 22.5, 24.5), 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) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood 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",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)

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                     14.21812 14.21087 14.22538
## strat0:flood_risk_pc1      -0.00835 -0.01833  0.00156
## strat0:flood_risk_pc2       0.01598  0.00488  0.02720
## strat0:flood_risk_pc3       0.00681 -0.00184  0.01546
## strat0:flood_risk_pc4      -0.01376 -0.02216 -0.00533
## strat0:flood_risk_pc5       0.00804 -0.00007  0.01617
## strat0:EP_POV               0.74626  0.72979  0.76277
## strat0:EP_UNEMP             0.07751  0.06713  0.08790
## strat0:EP_PCI              -0.28026 -0.29280 -0.26776
## strat0:EP_NOHSDP            0.23577  0.21584  0.25551
## strat0:EP_AGE65            -0.36352 -0.37442 -0.35254
## strat0:EP_AGE17            -0.19172 -0.20275 -0.18064
## strat0:EP_DISABL           -0.11452 -0.12702 -0.10198
## strat0:EP_SNGPNT            0.06424  0.05229  0.07619
## strat0:EP_MINRTY           -0.07604 -0.09343 -0.05860
## strat0:EP_LIMENG            0.03265  0.01242  0.05288
## strat0:EP_UNINSUR          -0.04487 -0.05831 -0.03129
## strat0:pollute_conc_pc1     0.16932  0.13985  0.19900
## strat0:pollute_conc_pc2     0.01598 -0.02755  0.05587
## strat0:pollute_conc_pc3    -0.08409 -0.12263 -0.04507
## strat0:tmmx                 0.10913  0.04537  0.16996
## strat0:rmax                -0.02866 -0.07276  0.01572
## strat0:Data_Value_CSMOKING  2.26987  2.24649  2.29319
## strat1                     14.28519 14.27826 14.29210
## strat1:flood_risk_pc1       0.00178 -0.00782  0.01139
## strat1:flood_risk_pc2       0.00005 -0.01058  0.01067
## strat1:flood_risk_pc3      -0.00527 -0.01383  0.00328
## strat1:flood_risk_pc4      -0.00478 -0.01241  0.00282
## strat1:flood_risk_pc5      -0.00413 -0.01175  0.00342
## strat1:EP_POV               0.94011  0.92760  0.95255
## strat1:EP_UNEMP             0.08282  0.07389  0.09180
## strat1:EP_PCI              -0.54116 -0.55677 -0.52536
## strat1:EP_NOHSDP            0.31817  0.30221  0.33411
## strat1:EP_AGE65            -0.42890 -0.44065 -0.41710
## strat1:EP_AGE17            -0.23560 -0.24628 -0.22487
## strat1:EP_DISABL           -0.21436 -0.22553 -0.20321
## strat1:EP_SNGPNT            0.10173  0.09103  0.11242
## strat1:EP_MINRTY           -0.22847 -0.24518 -0.21177
## strat1:EP_LIMENG           -0.07000 -0.08392 -0.05635
## strat1:EP_UNINSUR          -0.06184 -0.07265 -0.05094
```

```
## strat1:pollute_conc_pc1     0.16040  0.13036  0.19016
## strat1:pollute_conc_pc2    -0.03502 -0.07790  0.00445
## strat1:pollute_conc_pc3    -0.09369 -0.13228 -0.05486
## strat1:tmmx                 0.13625  0.07209  0.19731
## strat1:rmax                -0.01915 -0.06298  0.02535
## strat1:Data_Value_CSMOKING  1.98071  1.95994  2.00127
```

```
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_pc2"
##  [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:pollute_conc_pc1"   "strat0:pollute_conc_pc3"
## [17] "strat0:tmmx"               "strat0:Data_Value_CSMOKING"
## [19] "strat1"                    "strat1:EP_POV"
## [21] "strat1:EP_UNEMP"           "strat1:EP_PCI"
## [23] "strat1:EP_NOHSDP"          "strat1:EP_AGE65"
## [25] "strat1:EP_AGE17"           "strat1:EP_DISABL"
## [27] "strat1:EP_SNGPNT"          "strat1:EP_MINRTY"
## [29] "strat1:EP_LIMENG"          "strat1:EP_UNINSUR"
## [31] "strat1:pollute_conc_pc1"   "strat1:pollute_conc_pc3"
## [33] "strat1: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))))
```

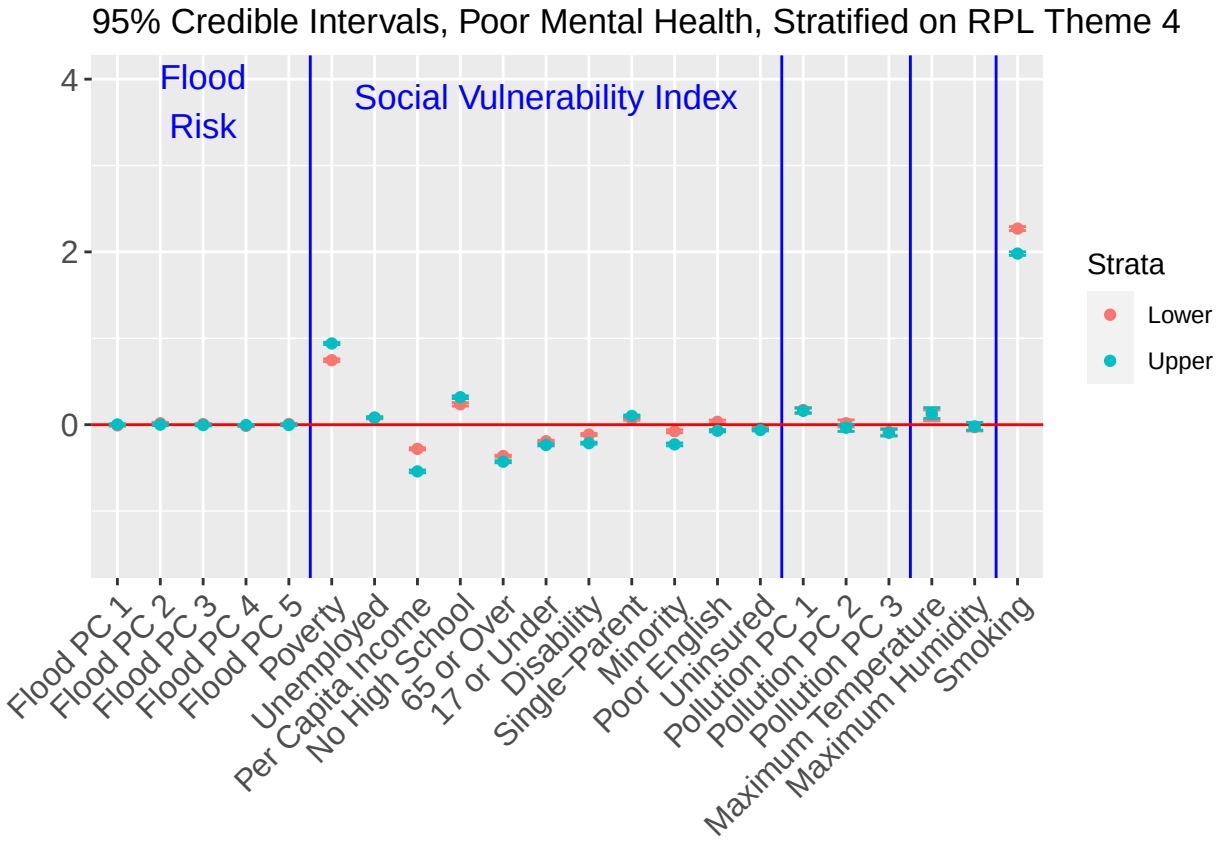
Splitting up the beta coefficients for each strata

```
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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 16.5, 19.5, 21.5), 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) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood PC 5",
                              "Poverty", "Unemployed", "Per Capita Income", "No High School",
                              "65 or Over", "17 or Under", "Disability",
                              "Single-Parent",
                              "Minority", "Poor English",
                              "Uninsured",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)

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                   14.15610 14.14334 14.16861
## strat0:flood_risk_pc1    -0.00043 -0.01402  0.01316
## strat0:flood_risk_pc2     0.02607  0.01062  0.04171
## strat0:flood_risk_pc3     0.02572  0.01408  0.03725
## strat0:flood_risk_pc4    -0.01763 -0.02904 -0.00616
## strat0:flood_risk_pc5     0.01276  0.00185  0.02372
## strat0:EP_UNINSUR         0.01688 -0.00219  0.03563
## strat0:pollute_conc_pc1   0.65005  0.61009  0.68925
```

```
## strat0:pollute_conc_pc2     0.37531  0.31891  0.43291
## strat0:pollute_conc_pc3    -0.50855 -0.56206 -0.45460
## strat0:tmmx                 0.04079 -0.04975  0.13415
## strat0:rmax                -0.08806 -0.15546 -0.02204
## strat0:Data_Value_CSMOKING  3.32359  3.30239  3.34501
## strat1                     14.34803 14.33728 14.35881
## strat1:flood_risk_pc1      -0.00513 -0.01833  0.00824
## strat1:flood_risk_pc2      -0.01272 -0.02687  0.00154
## strat1:flood_risk_pc3       0.00459 -0.00721  0.01639
## strat1:flood_risk_pc4      -0.00453 -0.01456  0.00564
## strat1:flood_risk_pc5       0.00468 -0.00542  0.01481
## strat1:EP_UNINSUR           0.04674  0.03420  0.05931
## strat1:pollute_conc_pc1     0.68795  0.64660  0.72707
## strat1:pollute_conc_pc2     0.38455  0.32901  0.44190
## strat1:pollute_conc_pc3    -0.48826 -0.54269 -0.43393
## strat1:tmmx                 0.08937 -0.00171  0.18311
## strat1:rmax                -0.09632 -0.16389 -0.03068
## strat1:Data_Value_CSMOKING  3.28623  3.27023  3.30226
```

```
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_pc2"
##  [3] "strat0:flood_risk_pc3"      "strat0:flood_risk_pc4"
##  [5] "strat0:flood_risk_pc5"      "strat0:pollute_conc_pc1"
##  [7] "strat0:pollute_conc_pc2"    "strat0:pollute_conc_pc3"
##  [9] "strat0:rmax"                "strat0:Data_Value_CSMOKING"
## [11] "strat1"                     "strat1:EP_UNINSUR"
## [13] "strat1:pollute_conc_pc1"    "strat1:pollute_conc_pc2"
## [15] "strat1:pollute_conc_pc3"    "strat1:rmax"
## [17] "strat1:Data_Value_CSMOKING"
```

Credible Interval plots for the coefficients, in ggplot

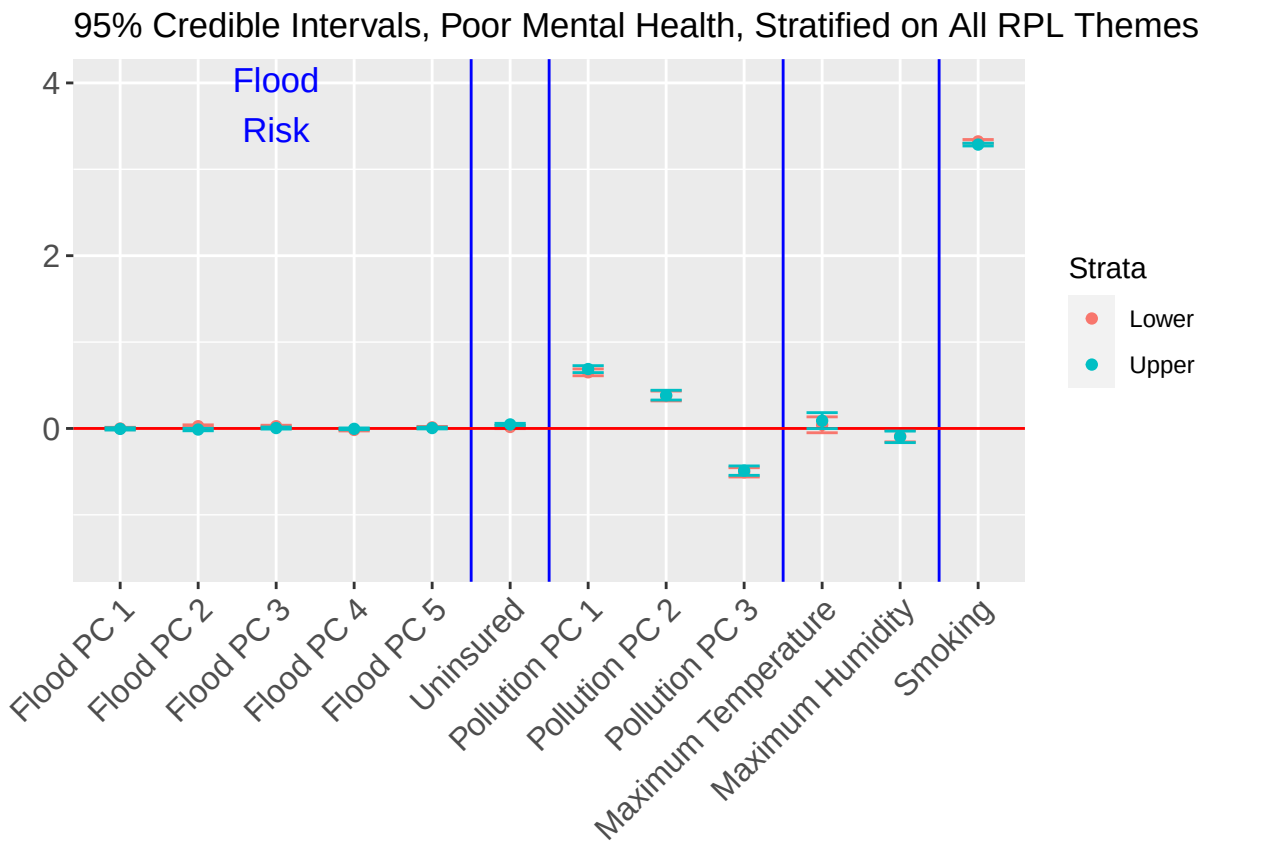
```
# first, process the beta_inference matrix in a form ggplot can understand
beta_inference_df <- as.data.frame(beta_inference)
beta_inference_df <- mutate(beta_inference_df, var_name = row.names(beta_inference_df))
beta_inference_df <- rename(beta_inference_df,
                            post_median = `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, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(5.5, 6.5, 9.5, 11.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 3, y = 3.75, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("Flood PC 1", "Flood PC 2", "Flood PC 3", "Flood PC 4", "Flood PC 5",
                              "Uninsured",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "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)

p
```




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

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