Sensitivity Analysis: Flood Factor Groupings

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Contents

```
library(here)
```

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

```
## 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  3.1.8      v dplyr   1.0.10
## v tidyr   1.2.1      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/sensitivity_analysis/fhs_model_df_ff_grouped.rds"))

var_names <- c("Intercept", "flood_ff_group1", "flood_ff_group2", "flood_ff_group3",
               "EP_UNINSUR", "pollute_conc_pc1", "pollute_conc_pc2",
               "pollute_conc_pc3", "tmmx", "rmax", "Data_Value_CSMOKING")
```

```
names_ff_grouped_strat <- c(paste("strat0", var_names, sep = ":"),
                            paste("strat1", var_names, sep = ":"))
```

Helper Functions

Function for post-processing the inference

```
# extract the flood risk PC coefficients
# pc_idx is the vector of indices of the flood risk PC coefficients, after splitting data frame by stra
beta_data_frames_extract <- function(beta_inference_df, pc_idx) {

  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)

  beta_pcs_strat0 <- beta_inference_df_strat0[pc_idx, ]

  beta_pcs_strat1 <- beta_inference_df_strat1[pc_idx, ]
```

```
  beta_pcs_strat0 <- mutate(beta_pcs_strat0, var_idx = factor(1:nrow(beta_pcs_strat0)))
  beta_pcs_strat1 <- mutate(beta_pcs_strat1, var_idx = factor(1:nrow(beta_pcs_strat1)))

  return(list(beta_pcs_strat0 = beta_pcs_strat0, beta_pcs_strat1 = beta_pcs_strat1))

}
```

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/sensitivity_analysis/ff_grouped/all_census_tract_CHD.RData"))
```

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

colnames(beta_samples_matrix) <- names_ff_grouped_strat
```

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

beta_inference
```

```
##                                50%     2.5%    97.5%
## strat0:Intercept           6.23243  6.21298  6.25191
## strat0:flood_ff_group1     0.01407 -0.00782  0.03585
## strat0:flood_ff_group2     0.01823 -0.00077  0.03706
## strat0:flood_ff_group3     0.08804  0.07019  0.10586
## strat0:EP_UNINSUR         -0.01044 -0.03871  0.01806
## strat0:pollute_conc_pc1   -0.44536 -0.50037 -0.38884
## strat0:pollute_conc_pc2   -0.50906 -0.58969 -0.42809
## strat0:pollute_conc_pc3   -0.20659 -0.28198 -0.12932
## strat0:tmmx               -0.00061 -0.12178  0.12021
## strat0:rmax                0.14099  0.04885  0.23051
## strat0:Data_Value_CSMOKING 0.38124  0.35020  0.41219
## strat1:Intercept           6.86954  6.85271  6.88619
## strat1:flood_ff_group1     0.00488 -0.01267  0.02231
## strat1:flood_ff_group2     0.01922  0.00378  0.03465
## strat1:flood_ff_group3     0.06069  0.04108  0.08031
## strat1:EP_UNINSUR         -0.13900 -0.15783 -0.12044
## strat1:pollute_conc_pc1   -0.28413 -0.34123 -0.22545
## strat1:pollute_conc_pc2   -0.40869 -0.48847 -0.32956
## strat1:pollute_conc_pc3   -0.27477 -0.35068 -0.19704
## strat1:tmmx                0.08883 -0.03322  0.21065
## strat1:rmax                0.13936  0.04691  0.22889
## strat1:Data_Value_CSMOKING 0.85763  0.83422  0.88101
```

```
saveRDS(beta_inference, file = here("modeling_files/sensitivity_analysis/ff_grouped/beta_inference_files
```

List of significant beta coefficients:

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

```
##  [1] "strat0:Intercept"           "strat0:flood_ff_group3"
##  [3] "strat0:pollute_conc_pc1"    "strat0:pollute_conc_pc2"
##  [5] "strat0:pollute_conc_pc3"    "strat0:rmax"
##  [7] "strat0:Data_Value_CSMOKING" "strat1:Intercept"
##  [9] "strat1:flood_ff_group2"     "strat1:flood_ff_group3"
## [11] "strat1:EP_UNINSUR"          "strat1:pollute_conc_pc1"
## [13] "strat1:pollute_conc_pc2"    "strat1:pollute_conc_pc3"
## [15] "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 <- factor(c(rep("Low SV", (nrow(beta_inference_df)/2)),
                                    rep("High SV", (nrow(beta_inference_df)/2))), levels = c("Low SV",
```

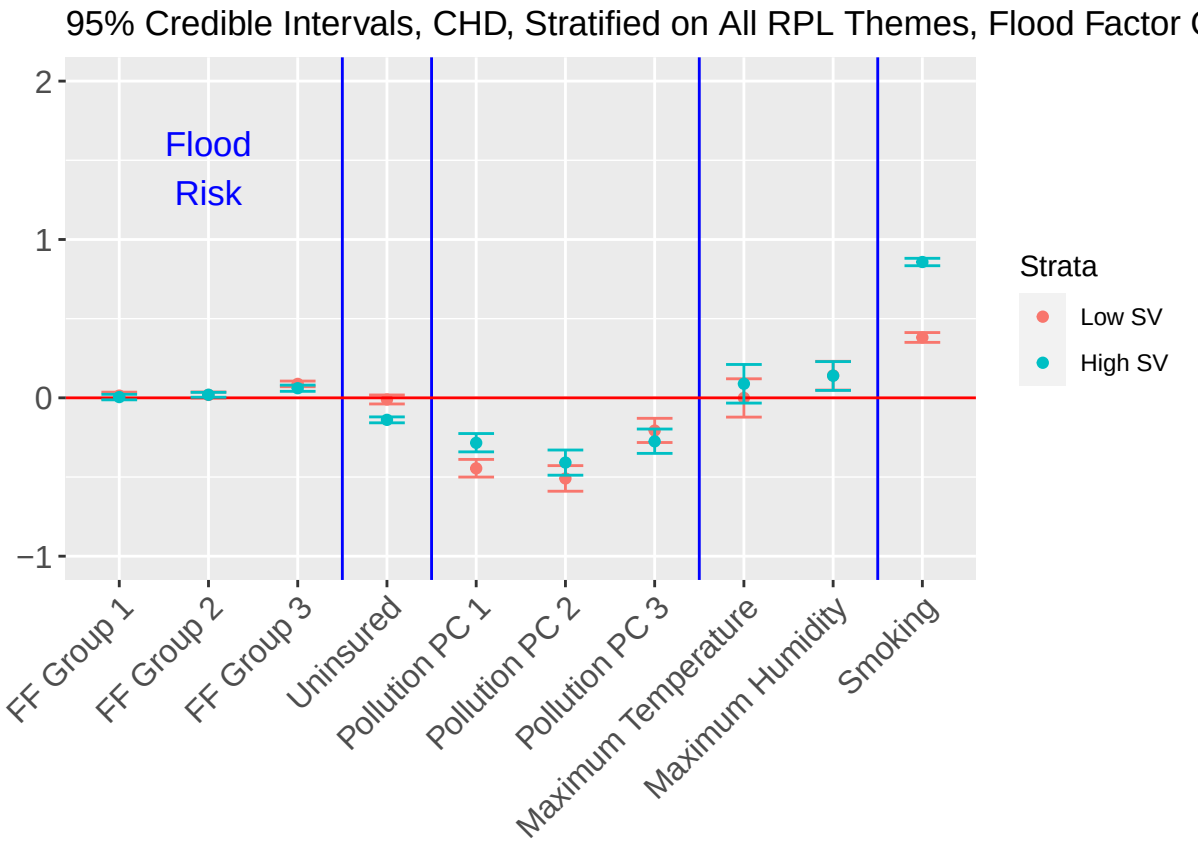
Splitting up the beta coefficients for each strata

```
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(3.5, 4.5, 7.5, 9.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 2, y = 1.45, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("FF Group 1", "FF Group 2", "FF Group 3", "Uninsured",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "Smoking")) + ggtitle("95% Credible Intervals, CHD, Stratified on All 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)
```

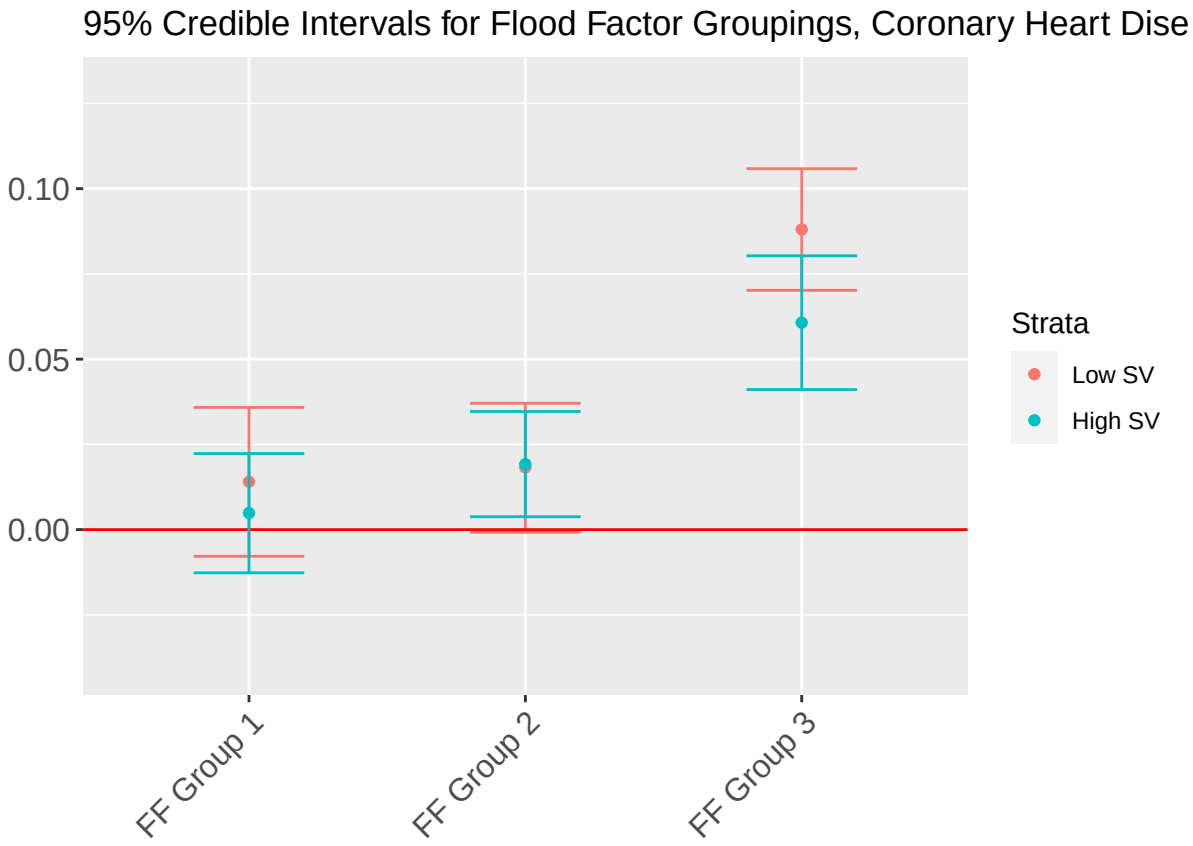
```
p
```




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

```
pc_extract_idx <- 2:4

beta_CHD_pcs <- beta_data_frames_extract(beta_inference_df, pc_extract_idx)
```

```
p <- ggplot(beta_CHD_pcs$beta_pcs_strat0, aes(x = var_idx, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-0.04, 0.13)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_hline(yintercept = 0, col = "red") +
  scale_x_discrete(labels = c("FF Group 1", "FF Group 2", "FF Group 3"), 6) + ggtitle("95% Credible Inte
  geom_point(data = beta_CHD_pcs$beta_pcs_strat1, col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_CHD_pcs$beta_pcs_strat1, aes(ymin = post_2.5, ymax = post_97.5, width = 0.4)
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE)
p
```




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

CAR model results, High Blood Pressure Stratified on RPL_THEMES

```
load(here("modeling_files/sensitivity_analysis/ff_grouped/all_census_tract_BPHIGH.RData"))
```

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

colnames(beta_samples_matrix) <- names_ff_grouped_strat
```

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

beta_inference
```

```
##                                50%     2.5%    97.5%
## strat0:Intercept           31.05190 30.99444 31.10923
## strat0:flood_ff_group1     -0.01803 -0.08435  0.04823
## strat0:flood_ff_group2      0.01329 -0.04422  0.07048
## strat0:flood_ff_group3      0.20867  0.15438  0.26284
## strat0:EP_UNINSUR          -0.09963 -0.18484 -0.01406
## strat0:pollute_conc_pc1    -1.66675 -1.83825 -1.49119
## strat0:pollute_conc_pc2    -2.39616 -2.64341 -2.14154
## strat0:pollute_conc_pc3     0.37656  0.14324  0.62196
## strat0:tmmx                -0.03531 -0.40350  0.34643
```

```
## strat0:rmax                 0.19324 -0.10026  0.47757
## strat0:Data_Value_CSMOKING  0.73863  0.64527  0.83213
## strat1:Intercept           32.84111 32.79177 32.88981
## strat1:flood_ff_group1      0.00855 -0.04487  0.06165
## strat1:flood_ff_group2      0.03385 -0.01288  0.08071
## strat1:flood_ff_group3     -0.02314 -0.08271  0.03620
## strat1:EP_UNINSUR          -0.47514 -0.53158 -0.41884
## strat1:pollute_conc_pc1    -0.74064 -0.91870 -0.55859
## strat1:pollute_conc_pc2    -2.22077 -2.46508 -1.97155
## strat1:pollute_conc_pc3    -0.17637 -0.41242  0.07120
## strat1:tmmx                 0.49442  0.12109  0.88122
## strat1:rmax                 0.28215 -0.01326  0.56640
## strat1:Data_Value_CSMOKING  2.12807  2.05691  2.19935
```

```
saveRDS(beta_inference, file = here("modeling_files/sensitivity_analysis/ff_grouped/beta_inference_files
```

List of significant beta coefficients:

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

```
##  [1] "strat0:Intercept"           "strat0:flood_ff_group3"
##  [3] "strat0:EP_UNINSUR"          "strat0:pollute_conc_pc1"
##  [5] "strat0:pollute_conc_pc2"    "strat0:pollute_conc_pc3"
##  [7] "strat0:Data_Value_CSMOKING" "strat1:Intercept"
##  [9] "strat1:EP_UNINSUR"          "strat1:pollute_conc_pc1"
## [11] "strat1:pollute_conc_pc2"    "strat1:tmmx"
## [13] "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 <- factor(c(rep("Low SV", (nrow(beta_inference_df)/2)),
                                    rep("High SV", (nrow(beta_inference_df)/2))), levels = c("Low SV",
```

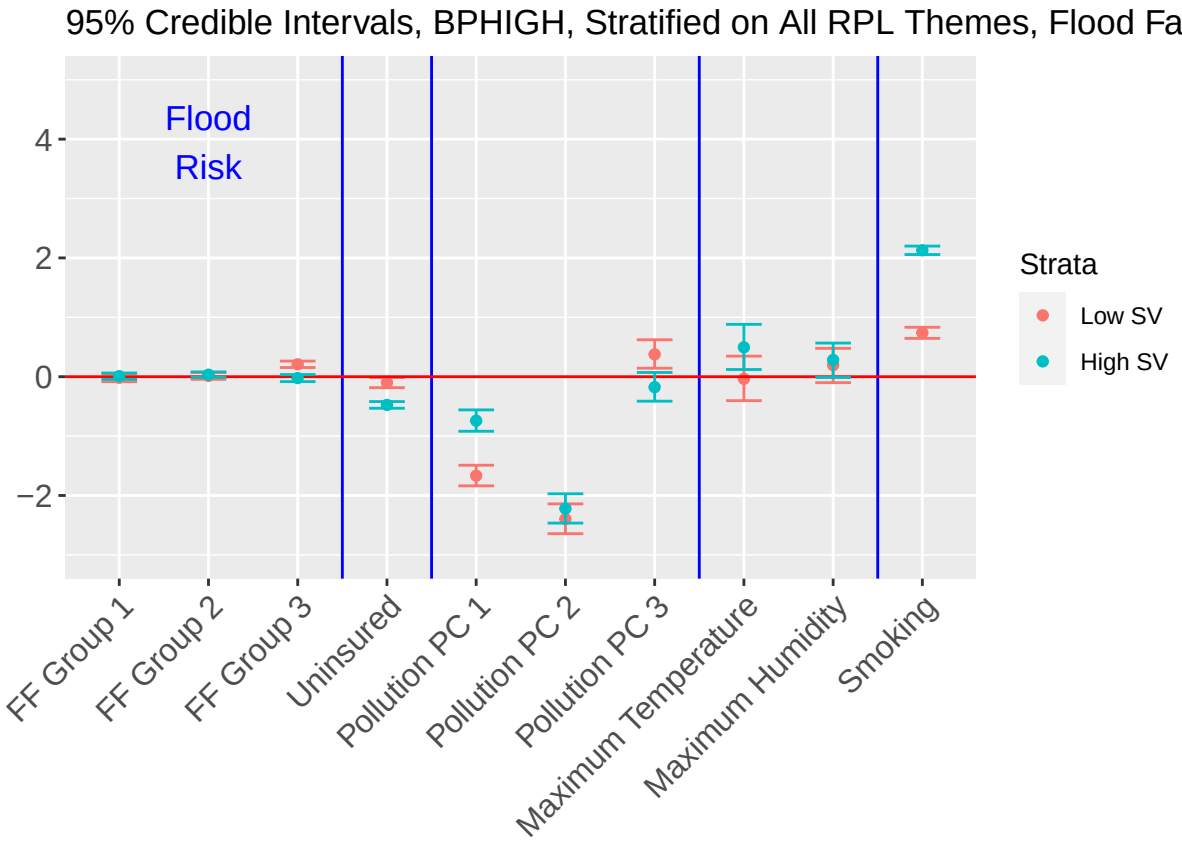
Splitting up the beta coefficients for each strata

```
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),
```

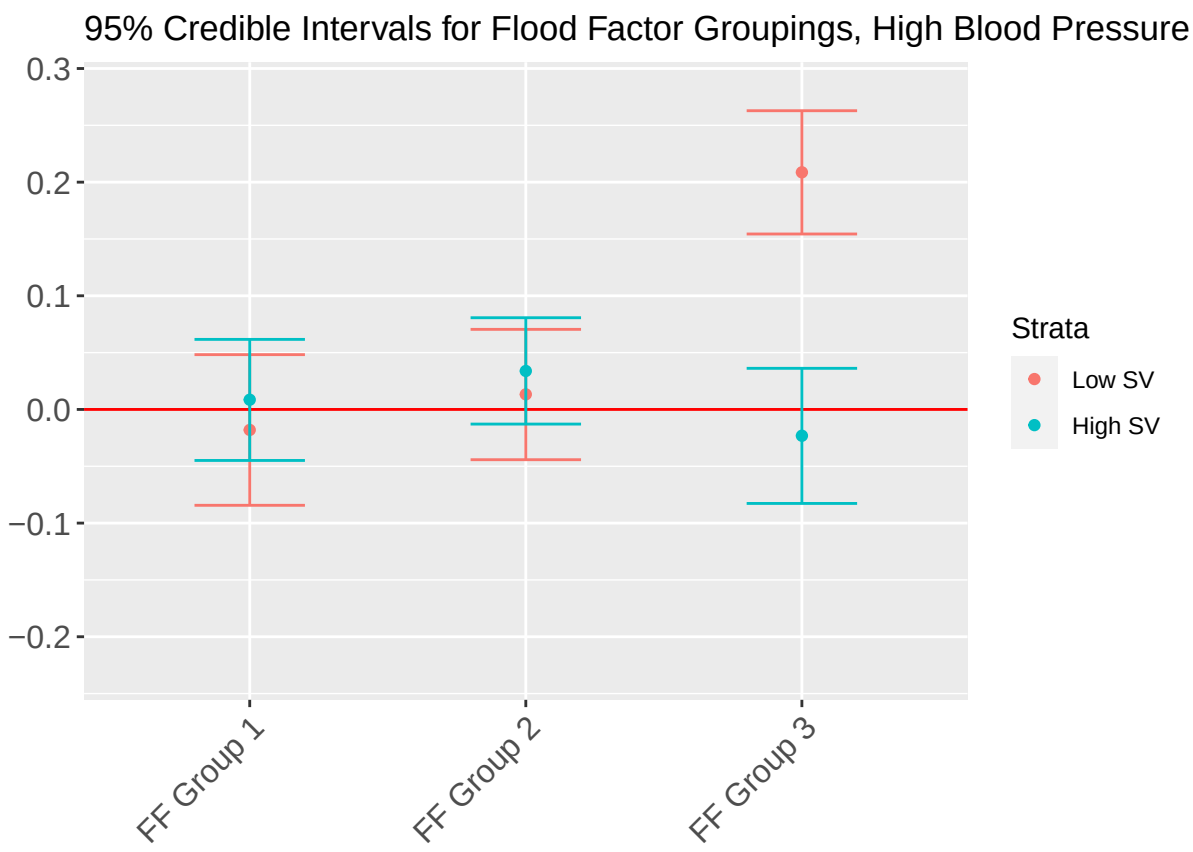
```
        plot.margin = margin(5.5, 5.5, 5.5, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(3.5, 4.5, 7.5, 9.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 2, y = 3.95, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("FF Group 1", "FF Group 2", "FF Group 3", "Uninsured",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "Smoking")) + ggtitle("95% Credible Intervals, BPHIGH, 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/sensitivity_analysis/ff_grouped/BPHIGH_CI_rpls.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

```
pc_extract_idx <- 2:4

beta_BPHIGH_pcs <- beta_data_frames_extract(beta_inference_df, pc_extract_idx)
```

```
p <- ggplot(beta_BPHIGH_pcs$beta_pcs_strat0, aes(x = var_idx, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-0.23, 0.28)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_hline(yintercept = 0, col = "red") +
  scale_x_discrete(labels = c("FF Group 1", "FF Group 2", "FF Group 3"), 6) + ggtitle("95% Credible Inte
  geom_point(data = beta_BPHIGH_pcs$beta_pcs_strat1, col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_BPHIGH_pcs$beta_pcs_strat1, aes(ymin = post_2.5, ymax = post_97.5, width = 
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE)
p
```




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

CAR model results, Asthma Stratified on RPL_THEMES

```
load(here("modeling_files/sensitivity_analysis/ff_grouped/all_census_tract_CASTHMA.RData"))
```

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

colnames(beta_samples_matrix) <- names_ff_grouped_strat
```

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

beta_inference
```

```
##                                50%     2.5%    97.5%
## strat0:Intercept            9.76095  9.75423  9.76770
## strat0:flood_ff_group1     -0.02519 -0.03306 -0.01736
## strat0:flood_ff_group2      0.00145 -0.00539  0.00825
## strat0:flood_ff_group3     -0.00239 -0.00883  0.00405
## strat0:EP_UNINSUR          -0.02874 -0.03881 -0.01864
## strat0:pollute_conc_pc1     0.12192  0.10144  0.14282
## strat0:pollute_conc_pc2    -0.17891 -0.20813 -0.14853
## strat0:pollute_conc_pc3    -0.04918 -0.07685 -0.01945
## strat0:tmmx                -0.00275 -0.04600  0.04327
## strat0:rmax                -0.08532 -0.12032 -0.05156
## strat0:Data_Value_CSMOKING  1.12509  1.11403  1.13615
## strat1:Intercept            9.94379  9.93804  9.94947
## strat1:flood_ff_group1     -0.00499 -0.01134  0.00132
## strat1:flood_ff_group2      0.00200 -0.00354  0.00756
## strat1:flood_ff_group3     -0.02300 -0.03007 -0.01599
## strat1:EP_UNINSUR          -0.08558 -0.09225 -0.07890
## strat1:pollute_conc_pc1     0.19612  0.17499  0.21787
## strat1:pollute_conc_pc2    -0.16418 -0.19330 -0.13449
## strat1:pollute_conc_pc3    -0.10285 -0.13069 -0.07291
## strat1:tmmx                 0.04393  0.00036  0.09082
## strat1:rmax                -0.12043 -0.15573 -0.08667
## strat1:Data_Value_CSMOKING  1.31047  1.30207  1.31894
```

```
saveRDS(beta_inference, file = here("modeling_files/sensitivity_analysis/ff_grouped/beta_inference_files
```

List of significant beta coefficients:

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

```
##  [1] "strat0:Intercept"           "strat0:flood_ff_group1"
##  [3] "strat0:EP_UNINSUR"          "strat0:pollute_conc_pc1"
##  [5] "strat0:pollute_conc_pc2"    "strat0:pollute_conc_pc3"
##  [7] "strat0:rmax"                "strat0:Data_Value_CSMOKING"
##  [9] "strat1:Intercept"           "strat1:flood_ff_group3"
## [11] "strat1:EP_UNINSUR"          "strat1:pollute_conc_pc1"
## [13] "strat1:pollute_conc_pc2"    "strat1:pollute_conc_pc3"
## [15] "strat1:tmmx"                "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,
```

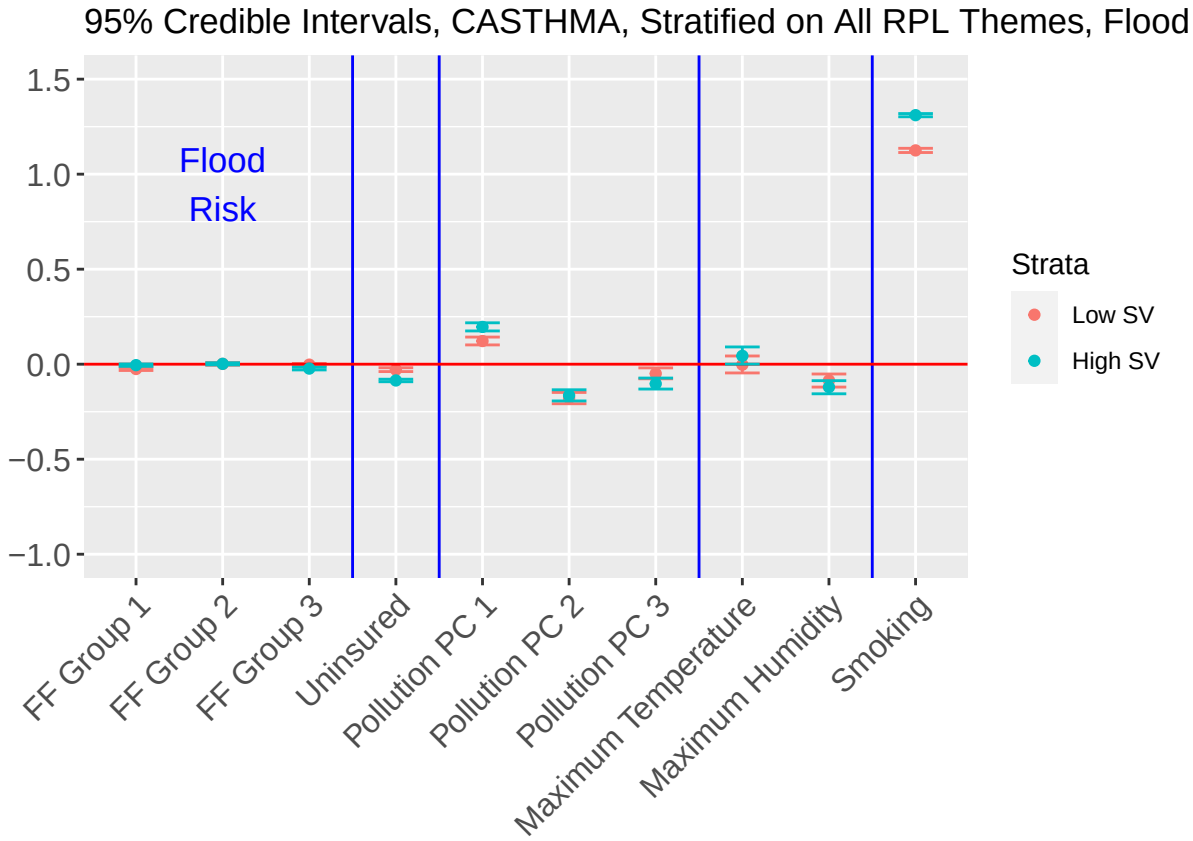
```
                              post_median = `50%`,
                              post_2.5 = `2.5%`,
                              post_97.5 = `97.5%`)
beta_inference_df$var_name <- substring(beta_inference_df$var_name, first = 8)
beta_inference_df$var_name <- factor(beta_inference_df$var_name,
                                     levels = unique(beta_inference_df$var_name))
beta_inference_df$strat <- factor(c(rep("Low SV", (nrow(beta_inference_df)/2)),
                                    rep("High SV", (nrow(beta_inference_df)/2))), levels = c("Low SV",
```

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.

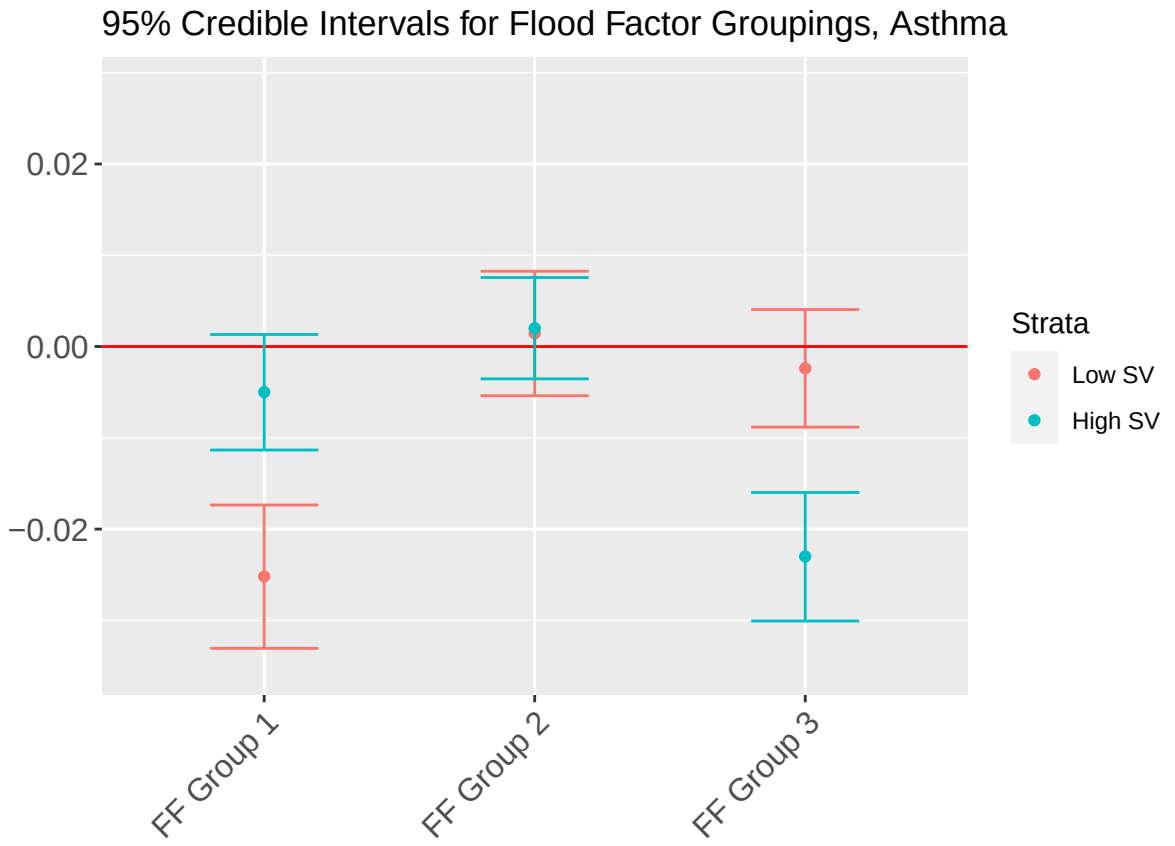
```
p <- ggplot(beta_inference_df_strat0[-1, ], aes(x = var_name, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-1, 1.5)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = 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(3.5, 4.5, 7.5, 9.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 2, y = 0.95, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("FF Group 1", "FF Group 2", "FF Group 3", "Uninsured",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "Smoking")) + ggtitle("95% Credible Intervals, CASTHMA, 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/sensitivity_analysis/ff_grouped/CASTHMA_CI_rpls.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

```
pc_extract_idx <- 2:4

beta_CASTHMA_pcs <- beta_data_frames_extract(beta_inference_df, pc_extract_idx)
```

```
p <- ggplot(beta_CASTHMA_pcs$beta_pcs_strat0, aes(x = var_idx, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-0.035, 0.0285)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_hline(yintercept = 0, col = "red") +
  scale_x_discrete(labels = c("FF Group 1", "FF Group 2", "FF Group 3"), 6) + ggtitle("95% Credible Inte
  geom_point(data = beta_CASTHMA_pcs$beta_pcs_strat1, col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_CASTHMA_pcs$beta_pcs_strat1, aes(ymin = post_2.5, ymax = post_97.5, width =
  scale_color_manual(name = "Strata",
                     values = c("#F8766D", "#00BFC4"),
                     drop = FALSE)
p
```




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

CAR model results, Poor Mental Health Stratified on RPL_THEMES

```
load(here("modeling_files/sensitivity_analysis/ff_grouped/all_census_tract_MHLTH.RData"))
```

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

colnames(beta_samples_matrix) <- names_ff_grouped_strat
```

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

beta_inference
```

```
##                                50%     2.5%    97.5%
## strat0:Intercept           14.15665 14.14412 14.16921
## strat0:flood_ff_group1     -0.03445 -0.04925 -0.01971
## strat0:flood_ff_group2      0.01115 -0.00176  0.02397
## strat0:flood_ff_group3     -0.00953 -0.02160  0.00255
## strat0:EP_UNINSUR           0.01660 -0.00228  0.03552
## strat0:pollute_conc_pc1     0.63611  0.59754  0.67546
## strat0:pollute_conc_pc2     0.36459  0.30962  0.42152
## strat0:pollute_conc_pc3    -0.50878 -0.56017 -0.45241
## strat0:tmmx                 0.03138 -0.04920  0.11907
```

```
## strat0:rmax                -0.09012 -0.15538 -0.02700
## strat0:Data_Value_CSMOKING  3.32658  3.30587  3.34740
## strat1:Intercept           14.34677 14.33603 14.35735
## strat1:flood_ff_group1      0.00661 -0.00534  0.01848
## strat1:flood_ff_group2      0.00410 -0.00631  0.01457
## strat1:flood_ff_group3     -0.01257 -0.02586  0.00057
## strat1:EP_UNINSUR           0.04707  0.03457  0.05962
## strat1:pollute_conc_pc1     0.68425  0.64453  0.72515
## strat1:pollute_conc_pc2     0.38458  0.32977  0.44015
## strat1:pollute_conc_pc3    -0.48958 -0.54141 -0.43260
## strat1:tmmx                 0.07988 -0.00084  0.16941
## strat1:rmax                -0.09826 -0.16434 -0.03545
## strat1:Data_Value_CSMOKING  3.28702  3.27128  3.30301
```

```
saveRDS(beta_inference, file = here("modeling_files/sensitivity_analysis/ff_grouped/beta_inference_files
```

List of significant beta coefficients:

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

```
##  [1] "strat0:Intercept"           "strat0:flood_ff_group1"
##  [3] "strat0:pollute_conc_pc1"    "strat0:pollute_conc_pc2"
##  [5] "strat0:pollute_conc_pc3"    "strat0:rmax"
##  [7] "strat0:Data_Value_CSMOKING" "strat1:Intercept"
##  [9] "strat1:EP_UNINSUR"          "strat1:pollute_conc_pc1"
## [11] "strat1:pollute_conc_pc2"    "strat1:pollute_conc_pc3"
## [13] "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 <- factor(c(rep("Low SV", (nrow(beta_inference_df)/2)),
                                    rep("High SV", (nrow(beta_inference_df)/2))), levels = c("Low SV",
```

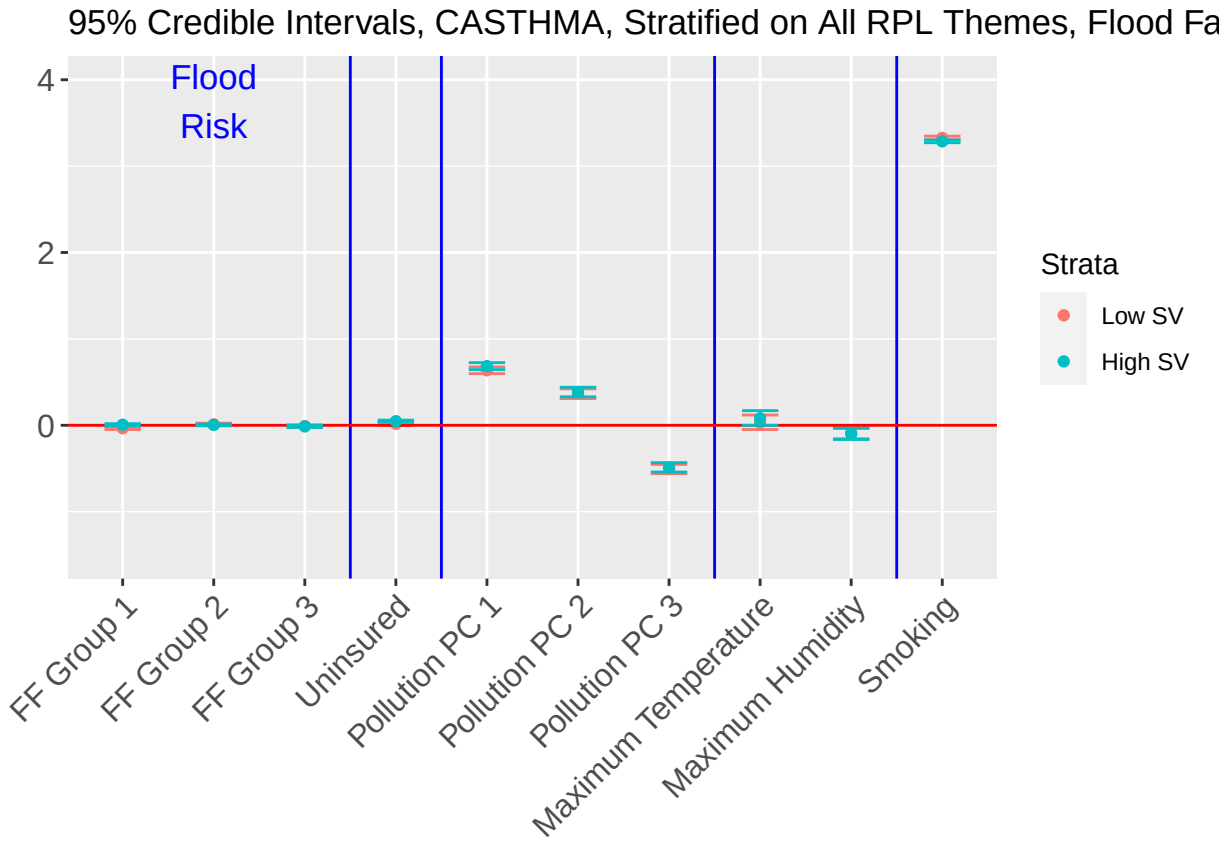
Splitting up the beta coefficients for each strata

```
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),
```

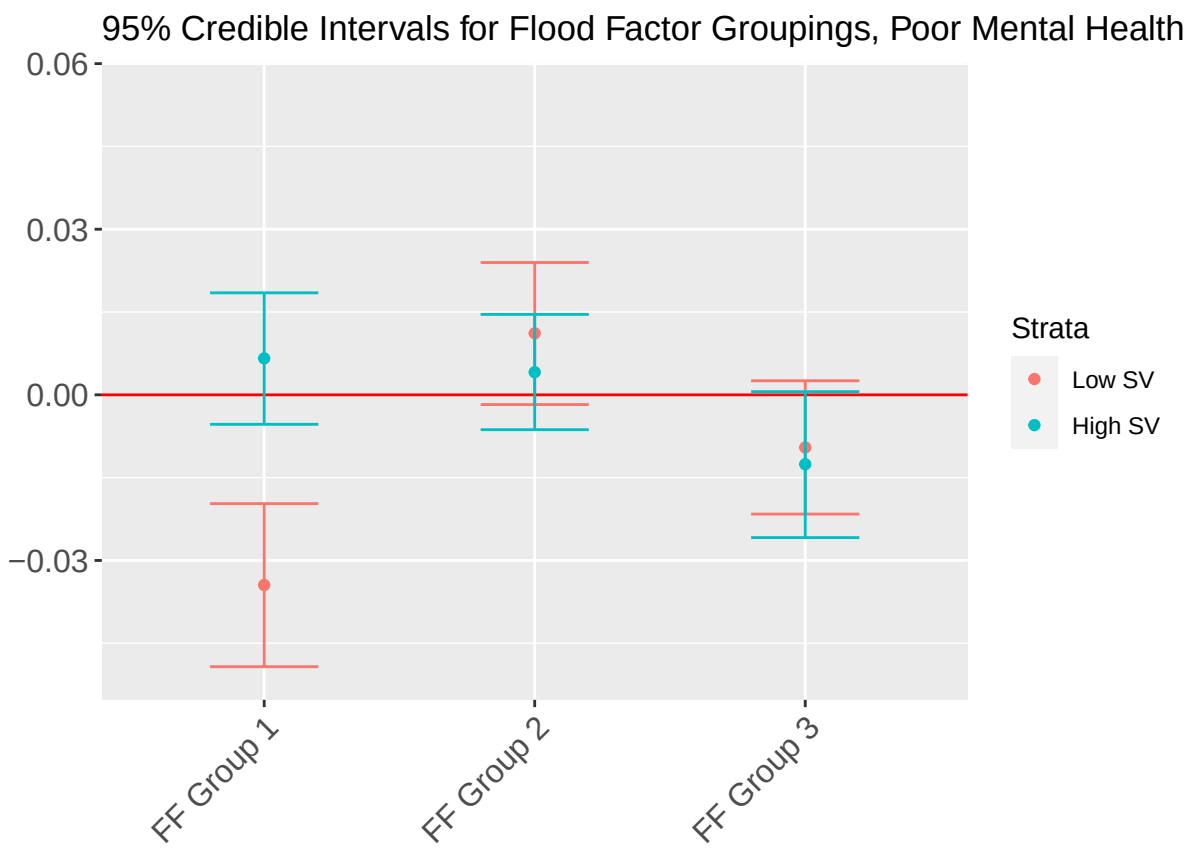
```
        plot.margin = margin(5.5, 5.5, 5.5, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_vline(xintercept = c(3.5, 4.5, 7.5, 9.5), col = "blue") +
  geom_hline(yintercept = 0, col = "red") +
  annotate(geom = "text", x = 2, y = 3.75, label = "Flood\nRisk",
           col = "blue", size = 4.5) +
  scale_x_discrete(labels = c("FF Group 1", "FF Group 2", "FF Group 3", "Uninsured",
                              "Pollution PC 1", "Pollution PC 2", "Pollution PC 3",
                              "Maximum Temperature", "Maximum Humidity",
                              "Smoking")) + ggtitle("95% Credible Intervals, CASTHMA, 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/sensitivity_analysis/ff_grouped/MHLTH_CI_rpls.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```

```
pc_extract_idx <- 2:4

beta_MHLTH_pcs <- beta_data_frames_extract(beta_inference_df, pc_extract_idx)
```

```
p <- ggplot(beta_MHLTH_pcs$beta_pcs_strat0, aes(x = var_idx, y = post_median, color = strat)) +
  geom_point() +
  ylim(c(-0.05, 0.055)) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1), axis.title.x = element_blank(), axis
        axis.text=element_text(size=12),
        plot.margin = margin(5.5, 5.5, 5.5, 25)) +
  geom_errorbar(aes(ymin = post_2.5, ymax = post_97.5, width = 0.4), col = "#F8766D") +
  geom_hline(yintercept = 0, col = "red") +
  scale_x_discrete(labels = c("FF Group 1", "FF Group 2", "FF Group 3"), 6) + ggtitle("95% Credible Inte
  geom_point(data = beta_MHLTH_pcs$beta_pcs_strat1, col = "#00BFC4") + # strat 1
  geom_errorbar(data = beta_MHLTH_pcs$beta_pcs_strat1, 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/sensitivity_analysis/ff_grouped/MHLTH_cred_intervals_fr_only.pdf"),
       plot = p, device = "pdf",
       width = 8, height = 6, units = "in")
```