

ABCD Simulations for Manuscript

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```
abcd= read.csv("data/simulated_data_with_family.csv")
```

Model 1 observing effects of covariates without heat as a moderator

```
results <- tidy(model_1)
# Doing Benjamini-Hochberg (FDR)
results$p.adjusted <- p.adjust(results$p.value, method = "BH")
results %>% mutate(
  p.value = round(p.value, 3),
  p.adjusted = round(p.adjusted, 3))

## # A tibble: 9 x 6
##   term                  estimate std.error statistic p.value p.adjusted
##   <chr>                 <dbl>     <dbl>      <dbl>    <dbl>      <dbl>
## 1 (Intercept)            3.94e+0    0.373     10.6     0         0
## 2 le_l_adi_addr1_national_prcnt 3.49e-3   0.00217     1.61    0.108     0.324
## 3 sdev_y_ders_total     1.01e-2   0.00942     1.07    0.284     0.615
## 4 mh_y_upps_pers_sum   -2.17e-2   0.0261    -0.831    0.406     0.615
## 5 sex                   1.82e-2   0.117      0.156    0.876     0.97
## 6 Days_Above_90        -9.40e-3   0.0745    -0.126    0.9       0.97
## 7 le_l_coi_addr1_coi_total_nati~ 7.97e-5   0.00214     0.0372   0.97      0.97
## 8 le_l_svi_addr1_total_prcntile 9.81e-3   0.00604     1.62    0.104     0.324
## 9 mh_y_upps_nurg_sum    1.82e-2   0.0220     0.824    0.41      0.615
```

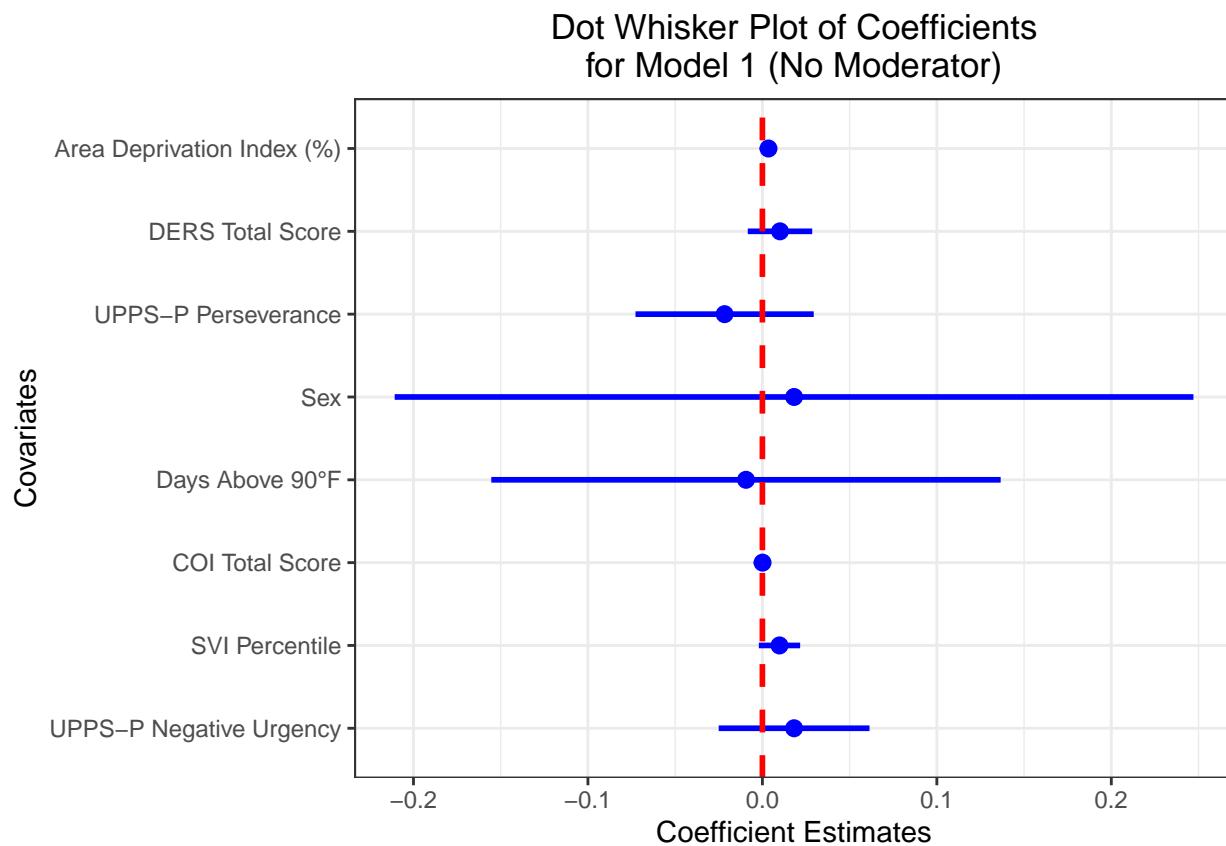
Dot Whisker Plot of Coefficients for Model 1 (No Moderator)

```
dwplot(model_1,
       dot_args = list(color = "blue", size = 2.5),
       whisker_args = list(color="blue",size = 1)) %>%
relabel_predictors(c(
  "(Intercept)" = "Intercept",
  "le_l_adi_addr1_national_prcnt" = "Area Deprivation Index (%)",
  "sdev_y_ders_total" = "DERS Total Score",
  "mh_y_upps_pers_sum" = "UPPS-P Perseverance",
  "sex" = "Sex",
  "Days_Above_90" = "Days Above 90°F",
```

```

  "le_l_coi_addr1_coi_total_national_score" = "COI Total Score",
  "le_l_svi_addr1_total_prcntile" = "SVI Percentile",
  "mh_y_upps_nurg_sum" = "UPPS-P Negative Urgency"
)) +
  geom_vline(xintercept = 0, colour = "red", linetype = 2, linewidth = 1) +
  ggtitle(str_wrap("Dot Whisker Plot of Coefficients for Model 1 (No Moderator)", width =35)) +
  xlab("Coefficient Estimates") +
  ylab("Covariates") +
  theme_bw()+
  theme(plot.title = element_text(hjust = 0.5))

```



Model 1 Post-hoc and effects size (no moderator)

```

# Eta squared
eta_squared(model_1, partial = TRUE)

## # Effect Size for ANOVA (Type I)
## 
## Parameter | Eta2 (partial) |      95% CI
## -----
## le_l_adi_addr1_national_prcnt | 2.56e-04 | [0.00, 1.00]
## sdev_y_ders_total | 1.12e-04 | [0.00, 1.00]
## mh_y_upps_pers_sum | 6.85e-05 | [0.00, 1.00]

```

```

## sex | 1.77e-06 | [0.00, 1.00]
## Days_Above_90 | 1.48e-06 | [0.00, 1.00]
## le_l_coi_addr1_coi_total_national_score | 4.53e-08 | [0.00, 1.00]
## le_l_svi_addr1_total_prcntile | 2.65e-04 | [0.00, 1.00]
## mh_y_upps_nurg_sum | 6.79e-05 | [0.00, 1.00]
##
## - One-sided CIs: upper bound fixed at [1.00].
#
# Standardized betas
standardize_parameters(model_1)

```

```

## # Standardization method: refit
##
## Parameter | Std. Coef. | 95% CI
## -----
## (Intercept) | 6.08e-17 | [-0.02, 0.02]
## le_l_adl_addr1_national_prcnt | 0.02 | [ 0.00, 0.04]
## sdev_y_ders_total | 0.01 | [-0.01, 0.03]
## mh_y_upps_pers_sum | -8.31e-03 | [-0.03, 0.01]
## sex | 1.56e-03 | [-0.02, 0.02]
## Days_Above_90 | -1.26e-03 | [-0.02, 0.02]
## le_l_coi_addr1_coi_total_national_score | 3.73e-04 | [-0.02, 0.02]
## le_l_svi_addr1_total_prcntile | 0.02 | [ 0.00, 0.04]
## mh_y_upps_nurg_sum | 8.24e-03 | [-0.01, 0.03]

```

Model 2 observing effects of covariates with heat as a moderator

```

results2<- tidy(model_2)
# Doing Benjamini-Hochberg (FDR)
results2$p.adjusted <- p.adjust(results2$p.value, method = "BH")
results2%>% mutate(
  p.value = round(p.value, 3),
  p.adjusted = round(p.adjusted, 3))

```

```

## # A tibble: 16 x 6
##   term          estimate std.error statistic p.value p.adjusted
##   <chr>        <dbl>     <dbl>      <dbl>    <dbl>      <dbl>
## 1 (Intercept)  3.72e+0   0.498      7.47     0         0
## 2 le_l_adl_addr1_national_prcnt 1.73e-3   0.00293   0.591    0.554    0.755
## 3 Days_Above_90 2.98e-1   0.482      0.618    0.537    0.755
## 4 sdev_y_ders_total 1.62e-2   0.0127     1.28     0.202    0.538
## 5 mh_y_upps_pers_sum 5.52e-3   0.0349     0.158    0.874    0.874
## 6 sex           2.14e-1   0.157      1.37     0.172    0.538
## 7 le_l_coi_addr1_coi_total_nat~ -4.82e-4  0.00287   -0.168   0.867    0.874
## 8 le_l_svi_addr1_total_prcntile 1.76e-2   0.00808     2.17     0.03     0.238
## 9 mh_y_upps_nurg_sum 7.26e-3   0.0294     0.247    0.805    0.874
## 10 le_l_adl_addr1_national_prcn~ 2.50e-3   0.00281     0.890    0.374    0.747
## 11 Days_Above_90:sdev_y_ders_to~ -8.39e-3  0.0121     -0.692   0.489    0.755
## 12 Days_Above_90:mh_y_upps_pers~ -3.81e-2  0.0335     -1.14     0.255    0.583
## 13 Days_Above_90:sex            -2.73e-1  0.149      -1.83     0.068    0.361
## 14 Days_Above_90:le_l_coi_addr1~  6.79e-4  0.00272     0.250    0.803    0.874

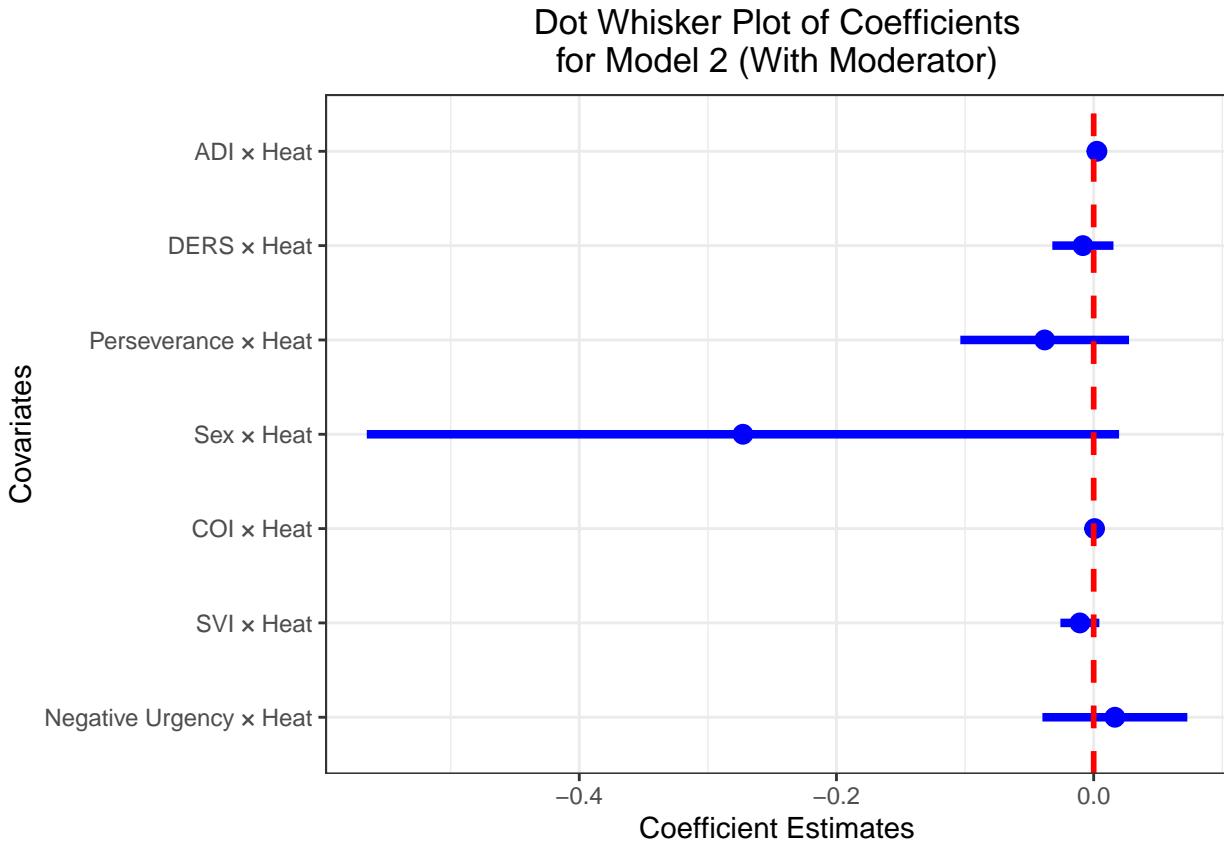
```

```

## 15 Days_Above_90:le_l_svi_addr1~ -1.07e-2  0.00773   -1.39    0.165    0.538
## 16 Days_Above_90:mh_y_upps_nurg~  1.65e-2   0.0288     0.573    0.566    0.755

interaction <- tidy(model_2) %>% filter(str_detect(term, ":"))
dwplot(interaction,
       dot_args = list(color = "blue", size = 3),
       whisker_args = list(color = "blue", size = 1.5)) %>%
relabel_predictors(c(
  "le_l_adi_addr1_national_prcnt:Days_Above_90" = "ADI × Heat",
  "Days_Above_90:sdev_y_ders_total" = "DERS × Heat",
  "Days_Above_90:mh_y_upps_pers_sum" = "Perseverance × Heat",
  "Days_Above_90:sex" = "Sex × Heat",
  "Days_Above_90:le_l_coi_addr1_coi_total_national_score" = "COI × Heat",
  "Days_Above_90:le_l_svi_addr1_total_prcntile" = "SVI × Heat",
  "Days_Above_90:mh_y_upps_nurg_sum" = "Negative Urgency × Heat"
)) +
geom_vline(xintercept = 0, colour = "red", linetype = 2, linewidth = 1) +
ggtitle(str_wrap("Dot Whisker Plot of Coefficients for Model 2 (With Moderator)", width = 35)) +
xlab("Coefficient Estimates") +
ylab("Covariates") +
theme_bw() +
theme(plot.title = element_text(hjust = 0.5))

```



Model 2 Post-hoc and effects size for moderation effects of heat

```
# eta squared
eta_squared(model_2, partial = TRUE)

## # Effect Size for ANOVA (Type I)
##
## Parameter | Eta2 (partial) | 95% CI
## -----
## le_l_adi_addr1_national_prcnt | 2.56e-04 | [0.00, 1.00]
## Days_Above_90 | 1.42e-06 | [0.00, 1.00]
## sdev_y_ders_total | 1.12e-04 | [0.00, 1.00]
## mh_y_upps_pers_sum | 6.85e-05 | [0.00, 1.00]
## sex | 1.78e-06 | [0.00, 1.00]
## le_l_coi_addr1_coi_total_national_score | 4.54e-08 | [0.00, 1.00]
## le_l_svi_addr1_total_prcntile | 2.66e-04 | [0.00, 1.00]
## mh_y_upps_nurg_sum | 6.80e-05 | [0.00, 1.00]
## le_l_adi_addr1_national_prcnt:Days_Above_90 | 8.28e-05 | [0.00, 1.00]
## Days_Above_90:sdev_y_ders_total | 5.46e-05 | [0.00, 1.00]
## Days_Above_90:mh_y_upps_pers_sum | 1.29e-04 | [0.00, 1.00]
## Days_Above_90:sex | 3.52e-04 | [0.00, 1.00]
## Days_Above_90:le_l_coi_addr1_coi_total_national_score | 6.96e-06 | [0.00, 1.00]
## Days_Above_90:le_l_svi_addr1_total_prcntile | 1.91e-04 | [0.00, 1.00]
## Days_Above_90:mh_y_upps_nurg_sum | 3.29e-05 | [0.00, 1.00]
##
## - One-sided CIs: upper bound fixed at [1.00]. 

# standardized betas
standardize_parameters(model_2)

## # Standardization method: refit
##
## Parameter | Std. Coef. | 95% CI
## -----
## (Intercept) | 4.00e-04 | [-0.02, 0.02]
## le l adi addr1 national prcnt | 0.02 | [ 0.00, 0.04]
## Days Above 90 | -7.11e-04 | [-0.02, 0.02]
## sdev y ders total | 0.01 | [-0.01, 0.03]
## mh y upps pers sum | -8.12e-03 | [-0.03, 0.01]
## sex | 1.97e-03 | [-0.02, 0.02]
## le l coi addr1 coi total national score | -3.04e-05 | [-0.02, 0.02]
## le l svi addr1 total prcntile | 0.02 | [ 0.00, 0.04]
## mh y upps nurg sum | 8.53e-03 | [-0.01, 0.03]
## le l adi addr1 national prcnt × Days Above 90 | 9.02e-03 | [-0.01, 0.03]
## Days Above 90 × sdev y ders total | -6.98e-03 | [-0.03, 0.01]
## Days Above 90 × mh y upps pers sum | -0.01 | [-0.03, 0.01]
## Days Above 90 × sex | -0.02 | [-0.04, 0.00]
## Days Above 90 × le l coi addr1 coi total national score | 2.49e-03 | [-0.02, 0.02]
## Days Above 90 × le l svi addr1 total prcntile | -0.01 | [-0.03, 0.01]
## Days Above 90 × mh y upps nurg sum | 5.87e-03 | [-0.01, 0.03]
```

Finally... The differences in R^2 ...

```
#R2
r2model1 = summary(model_1)$r.squared
r2model2 = summary(model_2)$r.squared

# adj R2
r2adjmodel1 = summary(model_1)$adj.r.squared
r2adjmodel2 = summary(model_2)$adj.r.squared

# data frame for comparison
df = data.frame(
  Models = c("Residual Squared for model 1", "Residual squared for model 2"),
  R2 = c(r2model1, r2model2),
  AdjustedR2= c(r2adjmodel1, r2adjmodel2)
)
print(df)

##                               Models          R2      AdjustedR2
## 1 Residual Squared for model 1 0.0007732181 -2.688341e-05
## 2 Residual squared for model 2 0.0016221356  1.221688e-04

# Testing for each site
# Parsing data
# california <- abcd %>% filter(site_id==5)
# head(california)
#
# lme_test <- lmer(mh_p_cbcl_synd_ext_sum ~ le_l_adi_addr1_national_prcnt +
#   sdev_y_ders_total +
#   mh_y_upps_pers_sum+
#   sex+
#   Days_Above_90+
#   le_l_coi_addr1_coi_total_national_score+
#   le_l_svi_addr1_total_prcntile+
#   mh_y_upps_nurg_sum,
#   data = california)
#
# summary(lme_test)
```

Conclusions...

- The model has low adjusted R^2 , with the moderator it increases a bit (still pretty low).
- With moderation effects, Social Vulnerability Index is the only significant covariate.
- It may be interesting to see how this changes state by state since this model looks at things nationally.