

# 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

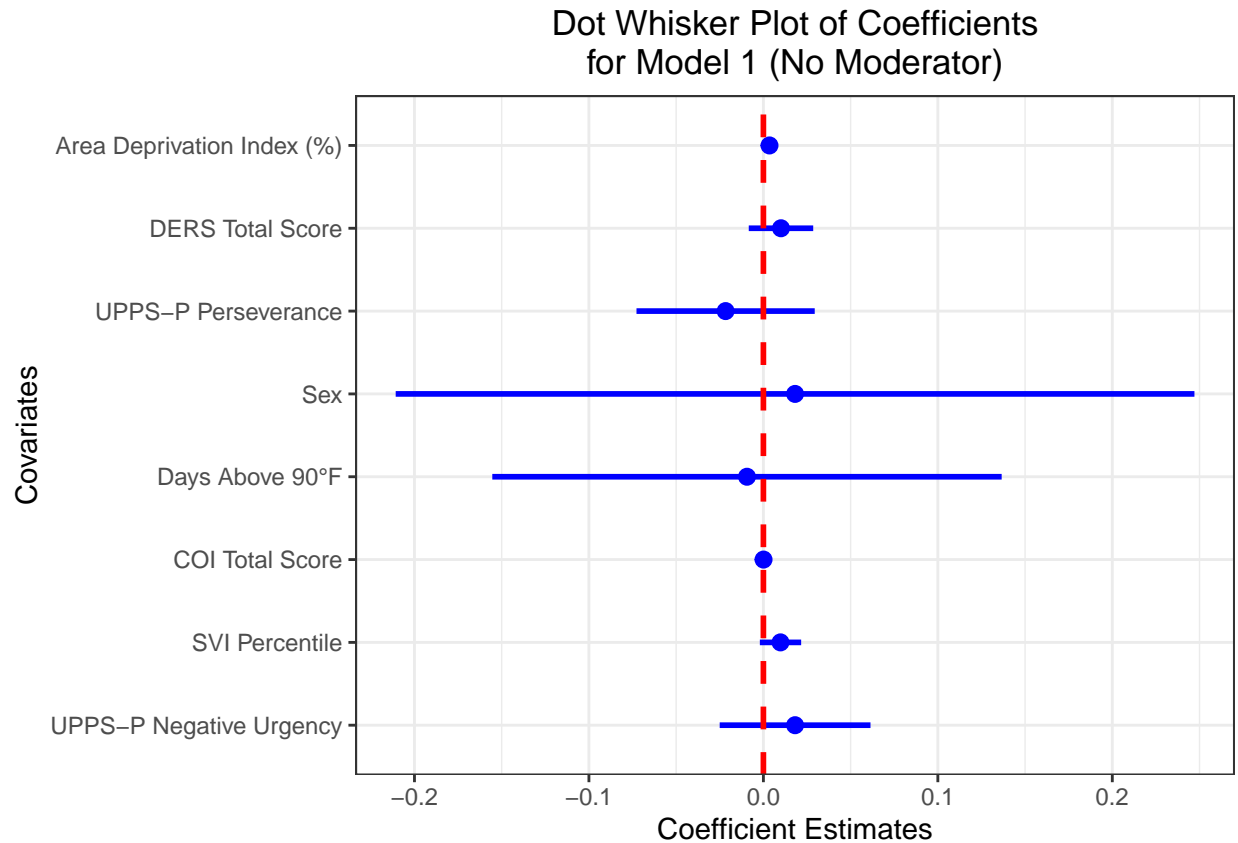
```
summary(model_1)
```

```
##
## Call:
## lm(formula = mh_p_cbcl__synd__ext_sum ~ le_l_adi_addr1_national_prct +
##      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_prctile +
##      mh_y_upps_nurg_sum, data = abcd)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -21.4871  -4.0130  -0.0402   3.9501  23.3224
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      3.943e+00  3.734e-01  10.560  <2e-16
## le_l_adi_addr1_national_prct      3.489e-03  2.171e-03   1.607   0.108
## sdev_y_ders_total      1.009e-02  9.424e-03   1.071   0.284
## mh_y_upps_pers_sum     -2.165e-02  2.606e-02  -0.831   0.406
## sex                1.816e-02  1.168e-01   0.156   0.876
## Days_Above_90       -9.399e-03  7.447e-02  -0.126   0.900
## le_l_coi_addr1_coi_total_national_score  7.966e-05  2.139e-03   0.037   0.970
## le_l_svi_addr1_total_prctile      9.807e-03  6.039e-03   1.624   0.104
## mh_y_upps_nurg_sum      1.817e-02  2.205e-02   0.824   0.410
##
## (Intercept)                ***
## le_l_adi_addr1_national_prct
## 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_prctile
## mh_y_upps_nurg_sum
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.838 on 9991 degrees of freedom
## Multiple R-squared:  0.0007732, Adjusted R-squared:  -2.688e-05
## F-statistic: 0.9664 on 8 and 9991 DF,  p-value: 0.4602
```

## 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_prnt" = "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_adi_addr1_national_prct | 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_prctile | 0.02 | [ 0.00, 0.04]
## mh_y_upps_nurg_sum | 8.24e-03 | [-0.01, 0.03]
```

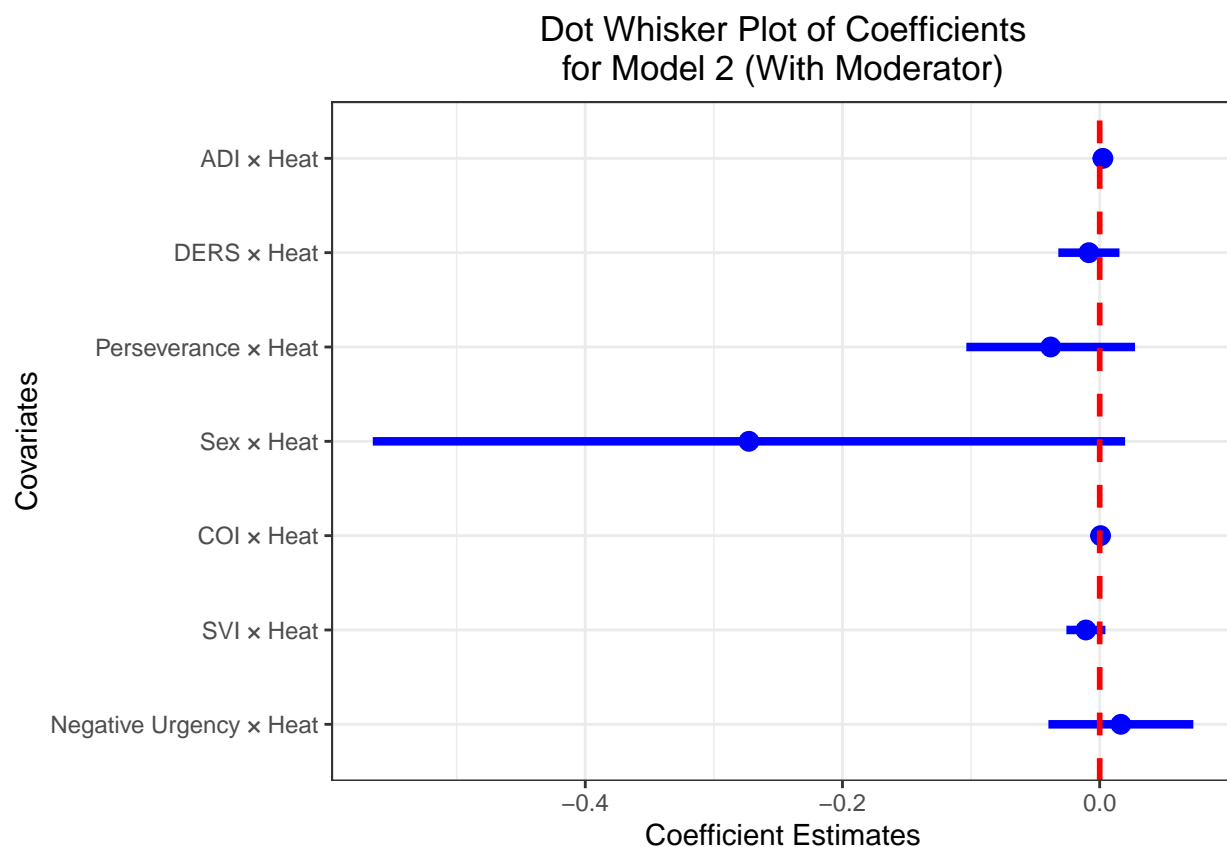
Model 2 observing effects of covariates with heat as a moderator

```
summary(model_2)
```

```
##
## Call:
## lm(formula = mh_p_cbcl__synd__ext_sum ~ le_l_adi_addr1_national_prct *
##   Days_Above_90 + sdev_y_ders_total * Days_Above_90 + mh_y_upps_pers_sum *
##   Days_Above_90 + sex * Days_Above_90 + le_l_coi_addr1_coi_total_national_score *
##   Days_Above_90 + le_l_svi_addr1_total_prctile * Days_Above_90 +
##   mh_y_upps_nurg_sum * Days_Above_90, data = abcd)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -21.4457  -3.9967  -0.0284   3.9621  23.3317
##
## Coefficients:
##                                Estimate Std. Error
## (Intercept)                   3.7193710  0.4976331
## le_l_adi_addr1_national_prct    0.0017343  0.0029323
## Days_Above_90                   0.2978868  0.4820770
## sdev_y_ders_total               0.0162085  0.0126971
## mh_y_upps_pers_sum              0.0055157  0.0349103
## sex                           0.2139535  0.1566375
## le_l_coi_addr1_coi_total_national_score -0.0004819  0.0028728
## le_l_svi_addr1_total_prctile    0.0175650  0.0080807
## mh_y_upps_nurg_sum              0.0072606  0.0294011
## le_l_adi_addr1_national_prct:Days_Above_90 0.0024964  0.0028062
## Days_Above_90:sdev_y_ders_total -0.0083859  0.0121240
## Days_Above_90:mh_y_upps_pers_sum -0.0381012  0.0334656
## Days_Above_90:sex               -0.2727332  0.1492309
## Days_Above_90:le_l_coi_addr1_coi_total_national_score 0.0006791  0.0027217
## Days_Above_90:le_l_svi_addr1_total_prctile -0.0107246  0.0077311
## Days_Above_90:mh_y_upps_nurg_sum 0.0164876  0.0287513
##                                t value Pr(>|t|)
## (Intercept)                   7.474 8.42e-14 ***
## le_l_adi_addr1_national_prct    0.591  0.5542
## Days_Above_90                   0.618  0.5366
```

```
## sdev_y_ders_total          1.277    0.2018
## mh_y_upps_pers_sum         0.158    0.8745
## sex                        1.366    0.1720
## le_l_coi_addr1_coi_total_national_score -0.168    0.8668
## le_l_svi_addr1_total_prcntile 2.174    0.0298 *
## mh_y_upps_nurg_sum         0.247    0.8050
## le_l_adi_addr1_national_prcnt:Days_Above_90 0.890    0.3737
## Days_Above_90:sdev_y_ders_total -0.692    0.4892
## Days_Above_90:mh_y_upps_pers_sum -1.139    0.2549
## Days_Above_90:sex          -1.828    0.0676 .
## Days_Above_90:le_l_coi_addr1_coi_total_national_score 0.250    0.8030
## Days_Above_90:le_l_svi_addr1_total_prcntile -1.387    0.1654
## Days_Above_90:mh_y_upps_nurg_sum 0.573    0.5663
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.838 on 9984 degrees of freedom
## Multiple R-squared:  0.001622, Adjusted R-squared:  0.0001222
## F-statistic: 1.081 on 15 and 9984 DF, p-value: 0.3676
```

```
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_prct	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_prctile	2.66e-04	[0.00, 1.00]
## mh_y_upps_nurg_sum	6.80e-05	[0.00, 1.00]
## le_l_adi_addr1_national_prct: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_prctile	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 1 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 1 coi addr1 coi total national score | -3.04e-05 | [-0.02, 0.02]
## le 1 svi addr1 total prcntile | 0.02 | [ 0.00, 0.04]
## mh y upps nurg sum | 8.53e-03 | [-0.01, 0.03]
## le 1 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 1 coi addr1 coi total national score | 2.49e-03 | [-0.02, 0.02]
## Days Above 90 × le 1 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.