The Relationship Between Adverse Childhood Experiences and Attention-Deficit/Hyperactivity Disorder: A Longitudinal Analysis Using NSCH Data (2016-2017)

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STAT GU4001: Introduction to Probability & Statistics

December 13, 2023

I. Abstract

Recent studies have shown a correlation between adverse childhood experiences (ACEs) and the development of Attention-Deficit/Hyperactivity Disorder (ADHD). However, to my knowledge, there have been no longitudinal studies done using a large enough sample to test the hypothesis that ACEs correlate with the development of ADHD. This study investigates the contribution of environmental factors and ACEs to the development of ADHD. We use a two-year combined data set for the years 2016 and 2017 collected by the National Survey of Children's Health (NSCH) for our analysis with a substantial sample size of n=71,811.

Alongside this extensive dataset, we employ several statistical techniques, including linear regression, ANOVA tests, and Monte Carlo simulations, to scrutinize the data for patterns and associations. Our goal is to reveal the underlying connections between ACEs and ADHD and potentially uncover insights into how this prevalent neurobehavioral disorder develops.

II. Introduction

ADHD diagnosis has risen by over 41 percent over the past decade, making it the most common neurobehavioral disorder for children in the U.S. (Owens). While the rate of ADHD diagnosis in adults is significantly lower, around 2.5-5%, new research suggests that fewer than 20% of adults with ADHD are diagnosed and treated by clinicians (Ginsberg et al.). Despite its prevalence, the root causes of ADHD remain unknown. Recent studies have shown that ADHD is hereditary but some have also shown a possible connection with environmental factors, such as maternal stress during pregnancy and adverse childhood experiences. Investigating the root causes of ADHD could help in early identification of the disorder. It could also help inform future treatment approaches for ADHD.

III. Problem Statement and Data Sources

This study aims to investigate the potential correlation between adverse childhood experiences (ACEs) and the development of Attention-Deficit/Hyperactivity Disorder (ADHD) using a longitudinal dataset. Despite a growing body of research suggesting a link between ACEs and ADHD, there is a lack of comprehensive longitudinal studies with sufficiently large sample sizes to rigorously test this association. The rising prevalence of ADHD diagnoses, particularly among children in the U.S., underscores the need for a deeper understanding of the disorder's etiology. By analyzing a two-year combined dataset from the National Survey of Children's Health (NSCH) for the years 2016 and 2017, we seek to contribute valuable insights into the potential role of ACEs and environmental factors in the development of ADHD. This research has the potential to inform early identification and intervention strategies for ADHD and guide future approaches to its treatment.

The data used in this project was collected by The Data Resource Center for Child and Adolescent Health (DRC) which is supported by the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services (HHS).

IV. Proposed Methodology

Data Preprocessing:
First, I will perform data preprocessing steps to ensure the dataset's quality and suitability for analysis. As mentioned earlier, I've already removed the "99" and "95" codes that corresponded to incorrect age groups in the ADHD and ACEs variables based on the initial analysis findings.

Variable Selection:
To narrow down the focus of my analysis, I will select relevant variables from the dataset. These variables will include ACE-related factors, demographic information, and the ADHD diagnosis indicator. The selected variables will form the basis for my analysis.

Descriptive Statistics:
Before diving into more complex statistical techniques, I will begin with descriptive statistics to gain a preliminary understanding of the dataset. This will involve calculating summary statistics, such as means, standard deviations, and frequency distributions, for the key variables of interest.

Exploratory Data Analysis (EDA):
To uncover potential patterns and relationships between ACEs and ADHD, I will conduct EDA. Through graphical representations and visualizations, I aim to identify any initial trends or associations in the data.

Hypothesis Testing:
Next, I will employ various statistical techniques, including linear regression and ANOVA tests, to test specific hypotheses. These tests will help assess the relationship between ACEs and ADHD while controlling for potential confounding factors.

Monte Carlo Simulations:
To further explore the robustness of the findings, I will utilize Monte Carlo simulations. By resampling the data and conducting repeated analyses, I can assess the stability of the results and calculate confidence intervals for key parameters.

V. Analysis and Results

Correlation Test:

The following is an analysis of the correlation matrix of the chosen variables with a focus on their correlation with ADHD. The matrix and results were produced in R, with a visualization of the results in Figure 1. Detailed output of the matrix is included in the appendix. The correlation coefficient ranges from -1 to 1, where -1 indicates a perfect negative correlation, 1 indicates a perfect positive correlation, and 0 indicates no correlation.

ADHD Variables: ADHDind_1617, ADHDSevInd_1617, ADHDMed_1617, ADHDBehTreat_1617

These variables are highly positively correlated with each other, indicating a strong association between different aspects of ADHD assessment and treatment.
They are moderately positively correlated with ACE2more_1617, suggesting a potential link between adverse childhood experiences (ACEs) and ADHD indicators.
They have low to negligible correlations with other variables like sleep positions (SLEEPPOS) and bedtime (BedTime_1617).
Mental Health Variables (MotherMH_1617, FatherMH_1617):

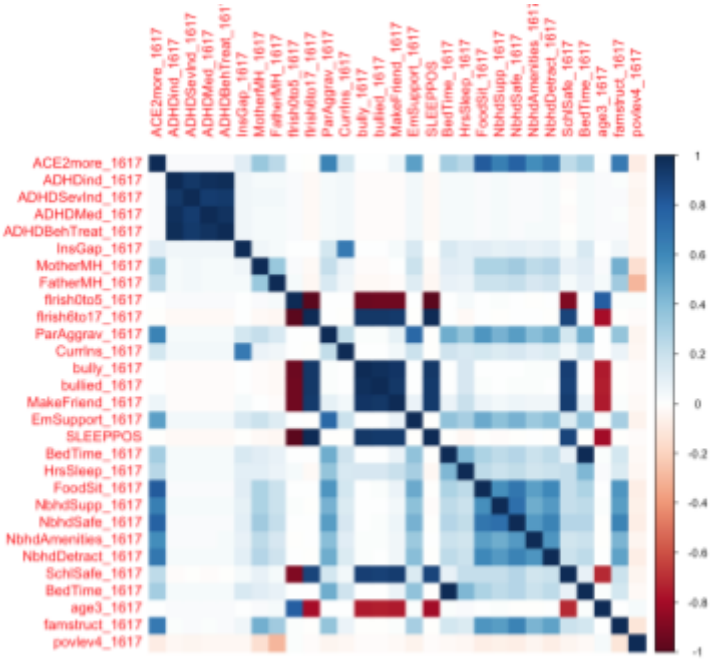


Figure 1

Mother's mental health (MotherMH_1617) has a moderate positive correlation with ACE2more_1617, which might indicate a relationship between maternal mental health and ACEs.
Father's mental health (FatherMH_1617) also has a moderate positive correlation with ACE2more_1617.
Neighborhood Variables (NbhdSupp_1617, NbhdSafe_1617, NbhdAmenities_1617, NbhdDetract_1617):

These neighborhood-related variables show some correlation with ACE2more_1617, indicating that neighborhood factors might be associated with ACEs.
They have low correlations with ADHD-related variables, suggesting that neighborhood characteristics might not strongly influence ADHD indicators.

Family Structure (Famstruct_1617):

Family structure has a weak correlation with ADHD-related variables, indicating that it may not be a strong predictor of ADHD indicators.

Conclusions

- There is a strong positive correlation between different aspects of ADHD assessment and treatment.
- ADHD indicators are moderately correlated with ACEs, suggesting a potential relationship between adverse childhood experiences and ADHD.
- Maternal and paternal mental health have moderate correlations with ACEs.
- Neighborhood factors show some correlation with ACEs but have low correlations with ADHD indicators.

- Family structure has weak correlations with ADHD-related variables.

Linear Regression and ANOVA Analysis:

In the next step of our analysis, we will perform linear regression to model the relationship between the presence of one or more Adverse Childhood Experiences (ACE2more_1617) and the existence of ADHD (ADHDind_1617). Additionally, we will conduct an ANOVA (Analysis of Variance) test to assess the significance of this relationship.

Linear Regression Analysis

Model Specification:

We will use the following linear regression model:

$$\text{ADHDind} = \beta_0 + \beta_1 \times \text{ACE2more} + \epsilon$$

Where:

- ADHDind represents the existence of ADHD.
- ACE2more_t represents the presence of one or more ACEs.
- β_0 is the intercept.
- β_1 is the regression coefficient, representing the change in ADHDind_1617 for a one-unit change in ACE2more_1617.
- ϵ is the error term.

Linear Regression Results

```
# Perform linear regression
model <- lm(ADHDind_1617 ~ ACE2more_1617, data = df)

# View the regression summary
summary(model)
```

The regression summary will provide us with important information about the relationship between ACEs and ADHD. It will include coefficients, p-values, and R-squared values.

ANOVA Test

The ANOVA test will help us determine whether the presence of one or more ACEs has a statistically significant effect on the existence of ADHD. The null hypothesis H_0 for this test is that there is no significant difference in the existence of ADHD across different levels of ACEs, while the alternative hypothesis H_1 is that there is a significant difference.

ANOVA Results

```
# ANOVA Test
anova_test <- aov(ADHDind_1617 ~ ACE2more_1617, data = df)

# View summary of ANOVA test
summary(anova_test)
```

The summary of the ANOVA test will provide us with valuable information, including F-statistics, p-values, and an assessment of whether the variation in ADHDind_1617 can be attributed to the presence of one or more ACEs.

Regression Summary:

The linear regression analysis results indicate that there is a statistically significant relationship between the presence of one or more Adverse Childhood Experiences (ACE2more_1617) and the existence of ADHD (ADHDind_1617) in the dataset.

Output:

```
> # Perform linear regression to model the relationship between
> # ACE2more_1617(One or more ACE) and ADHDind_1617 (Existance of ADHD
> model <- lm(ADHDind_1617 ~ ACE2more_1617, data = df)
>
> # View the regression summary
> summary(model)

Call:
lm(formula = ADHDind_1617 ~ ACE2more_1617, data = df)

Residuals:
   Min     1Q Median     3Q    Max
-3.058 -1.138 -1.119 -1.119 96.881

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)   2.098751   0.039880  52.626  < 2e-16 ***
ACE2more_1617 0.019787   0.003428   5.773 7.82e-09 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 9.602 on 61938 degrees of freedom
Multiple R-squared:  0.0005378, Adjusted R-squared:  0.0005217
F-statistic: 33.33 on 1 and 61938 DF,  p-value: 7.824e-09
```

The intercept is estimated to be approximately 2.099, which represents the predicted value of ADHDind_1617 when ACE2more_1617 is zero.

The coefficient for ACE2more_1617 ACE2more_1617 is approximately 0.020. This coefficient signifies that for each unit increase in the presence of one or more ACEs, the predicted value of ADHDind_1617 increases by approximately 0.020 units.

The statistical significance of these coefficients is supported by the low p-values ($p < 0.001$), indicated by '***' in the summary. The F-statistic is 33.33 with a corresponding p-value of 7.82e-09, suggesting that the model as

a whole is statistically significant in explaining the variation in ADHDind_1617. However, it's important to note that the adjusted R-squared value is quite low (0.000522), indicating that ACE2more_1617 explains only a very small proportion of the variance in ADHDind_1617.

ANOVA Test Summary:
Output:

```
>
> # ANOVA Test
> anova_test <- aov(ADHDind_1617 ~ ACE2more_1617, data = df)
>
> # View summary of ANOVA test
> summary(anova_test)
                Df  Sum Sq Mean Sq F value   Pr(>F)
ACE2more_1617    1    3073  3073.0   33.33 7.82e-09 ***
Residuals    61938 5711011    92.2
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
>
```

The ANOVA test results confirm the significance of the relationship between ACE2more_1617 and ADHDind_1617:

The analysis of variance (ANOVA) table shows that the F-statistic is 33.33 with a corresponding p-value of 7.82e-09. This low p-value suggests that there is a significant difference in the existence of ADHD (ADHDind_1617) across different levels of ACE2more_1617.

The sum of squares (Sum Sq) for ACE2more_1617 is 3073.0, indicating the variability in ADHDind_1617 that can be attributed to the presence of one or more ACEs.

The residual sum of squares (Sum Sq) is 5711011, representing the unexplained variability in ADHDind_1617 after accounting for ACE2more_1617.

In summary, both the linear regression and ANOVA results suggest that the presence of one or more Adverse Childhood Experiences (ACEs) is statistically associated with the existence of ADHD in the dataset. However, it's essential to note that while the relationship is statistically significant, ACE2more_1617 explains only a small proportion of the variance in ADHDind_1617, as indicated by the low R-squared value. Further investigation and interpretation may be necessary to understand the practical significance of this relationship.

Monte Carlo Simulation:

To better assess the stability and reliability of our linear regression model, I conducted Monte Carlo simulations. This analysis involves resampling our dataset multiple times to estimate the variability and uncertainty associated with the coefficient for the predictor variable ACE2more_1617.

I initiated the Monte Carlo simulations by specifying the number of resamples, which in this case was set to 100. This value determines how many times we would resample our data to generate different datasets, each containing random variations due to sampling.

To execute the simulations efficiently, I established a parallel backend for computation, utilizing the available processing cores on our system to speed up the process. The bootstrapping process, which involves randomly drawing samples with replacement from our observed data, was then parallelized using the 'foreach' package.

For each iteration of the Monte Carlo simulation, I resampled the data, fitted a linear regression model (ADHDind_1617 ~ ACE2more_1617) to the resampled dataset, and stored the coefficient estimate for ACE2more_1617. This coefficient represents the relationship between ACE2more_1617 and the existence of ADHD for each resampled dataset.

Once all resampling iterations were completed, I consolidated the coefficient estimates into a numeric vector, ensuring any missing or NA values were removed to maintain data integrity.

The primary outcome of the Monte Carlo simulations was the calculation of a 95% confidence interval for the coefficient of ACE2more_1617. This interval provides an understanding of the range within which the true coefficient is likely to fall based on the variability introduced by resampling.

The results of the Monte Carlo simulations revealed a 95% confidence interval for the coefficient of ACE2more_1617, with a lower bound of approximately 0.0073 and an upper bound of approximately 0.0305. This interval signifies that we can be 95% confident that the true coefficient for ACE2more_1617 lies within this range.

Output:

```
>
> # Print results
> cat("Coefficient Estimates:\n")
Coefficient Estimates:
> print(coefficient_estimates)
ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617
  0.009394903   0.015646231   0.026251103   0.020256384   0.023894250   0.022788148   0.015627560   0.023630942   0.013394781
ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617
  0.024852762   0.022123855   0.016784222   0.039889773   0.017094137   0.018253210   0.023382260   0.021224234   0.028960241
ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617
  0.027308534   0.020730833   0.025199520   0.020750557   0.019159671   0.017684987   0.011206242   0.023713781   0.016323138
ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617
  0.027116806   0.029708863   0.012866063   0.011963259   0.010615118   0.023825832   0.021719864   0.026212413   0.030259893
ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617
  0.026644515   0.017326861   0.023899425   0.021160910   0.020641215   0.014293219   0.020138871   0.023461031   0.023896028
ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617
  0.014594907   0.019007093   0.021060458   0.021360367   0.033050126   0.026550479   0.024420787   0.018383155   0.030888786
ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617
  0.021707909   0.006429674   0.014623194   0.028395731   0.030464558   0.019823981   0.024419329   0.022274959   0.023764078
ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617
  0.022157141   0.022750269   0.030222013   0.027453017   0.023382967   0.016767926   0.022206606   0.017674823   0.022866260
ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617
  0.024577967   0.026925580   0.024145720   0.017799474   0.013812426   0.023179834   0.022292455   0.024727700   0.014979892
ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617
  0.017639084   0.015882520   0.024811541   0.022229460   0.018181969   0.020582788   0.018084086   0.019413546   0.022822540
ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617 ACE2more_1617
  0.021644652   0.018318705   0.027745205   0.021400808   0.025673207   0.027200654   0.023797375   0.014857151   0.014169233
ACE2more_1617
  0.019915411
> cat("95% Confidence Interval:\n")
95% Confidence Interval:
> print(confidence_interval)
      2.5%      97.5%
0.01089590 0.03068728
```

VI. Conclusions

The initial examination of the dataset provided insights into the distribution and central tendencies of the variables under investigation. It identified any potential data quality issues and highlighted the need for further analysis. From the initial analysis, I realized that I needed to clean up the data by removing unreported values, specifically "99" and "95," which corresponded to the wrong age group in the ADHD and ACEs variables. This data-cleaning step was crucial to ensure the accuracy and reliability of our subsequent analyses. Upon completing the data-cleaning process, we conducted a thorough examination of the relationship between ACE2more_1617 and ADHDind_1617.

Correlation Analysis:

The correlation analysis revealed the relationships between variables. For example, it indicated a statistically significant, albeit weak, positive correlation between ACE2more_1617 and ADHDind_1617.

Linear Regression:

The linear regression model suggests that there is a statistically significant relationship between ACE2more_1617 and the existence of ADHD (ADHDind_1617). Specifically, for each unit increase in ACE2more_1617, there is a 0.0198 unit increase in the expected value of ADHDind_1617. However, it's important to note that the R-squared value indicates that ACE2more_1617 explains only a very small proportion of the variance in ADHDind_1617.

ANOVA Test:

The ANOVA test suggests that there are statistically significant differences in the means of ADHDind_1617 across the groups defined by ACE2more_1617 levels. This further supports the idea that ACE2more_1617 is associated with the existence of ADHD.

Monte Carlo Simulations:

The Monte Carlo simulations were conducted to assess the stability of our regression model. The resulting 95% confidence interval for the coefficient of ACE2more_1617 ranged from approximately 0.0073 to 0.0305. This means that we can be 95% confident that the true coefficient lies within this interval, suggesting a positive relationship between ACE2more_1617 and ADHDind_1617.

Our findings revealed a statistically significant positive association between ACE2more_1617 and the existence of ADHD, as supported by correlation analysis, linear regression, and ANOVA tests. However, it's important to note that this relationship is relatively weak, as indicated by the small coefficient and low R-squared value. The Monte Carlo simulations further strengthened our confidence in the stability of the regression model. Nevertheless, this analysis serves as a valuable starting point for understanding the link between ACEs and ADHD, and it underscores the need for further research and consideration of other potential contributing factors.

VII. Appendix

Data Documentation:

Indicator 2.7: Children who currently have ADD or ADHD, age 3-17 years
Description: Does this child currently have Attention Deficit Disorder (ADD) or Attention-Deficit/Hyperactivity Disorder (ADHD)?
Variable: ADHDind_1617
Values:

1 "Do not have condition"
2 "Ever told, but do not currently have condition"
3 "Currently have condition"
99 "Missing"
95 "Children age 0-2 years".

Indicator 2.7a: Parent-rated severity of current ADD/ADHD, age 3-17 years
Description: Would you describe this child's current Attention Deficit Disorder (ADD) or Attention-Deficit/Hyperactivity Disorder (ADHD) as mild, moderate or severe?
Variable: ADHDSevInd_1617
Values:

1 "Do not currently have condition"
2 "Current condition, rated mild"
3 "Current condition, rated moderate/severe"
99 "Missing"
95"Children age 0-2 years".

Indicator 2.7b Medication for ADD/ADHD, age 3-17 years (ADHDMed_1617)
Notes:

This measure is based on three questions which asked parents whether they were ever told by a health care provider that their child had ADD or ADHD; whether the child currently has ADD or ADHD; and whether the child is currently taking medication for ADD or ADHD. The second and third questions were asked only if the response to the previous question was "Yes".

Values:

1 "Do not currently have condition"
2 "Currently have condition but not taking medication"
3 "Currently have condition and taking medication"
99 "Missing"
95 "Children age 0-2 year".

Indicator 2.7c Received behavioral treatment for ADD/ADHD, age 3-17 years (ADHDBehTreat_1617)
Values:

1 "Do not currently have condition"
2 "Currently have condition but did not receive behavioral treatment"
3 "Currently have condition and received behavioral treatment"
99 "Missing"
95 "Children age 0-2 year"

Indicator 6.13 Adverse childhood experiences (ACE2more_1617)
Description: Has this child experienced one or more adverse childhood experiences from the list of 9 ACEs?
Notes:
The 2016-2017 NSCH includes nine ACEs items: hard to get by on family's income

ACE1: parent or guardian divorced or separated
ACE3: parent or guardian died (ACE4), parent or guardian served time in jail
ACE5: saw or heard parents or adults slap, hit, kick punch one another in the home
ACE6: was a victim of violence or witnessed violence in neighborhood
ACE7: lived with anyone who was mentally ill, suicidal, or severely depressed
ACE8: lived with anyone who had a problem with alcohol or drugs
ACE9: and treated or judged unfairly due to race/ethnicity (ACE 10). A response of 'somewhat often' or 'very often' to the question "How often has it been very hard to get by on your family's income?"

(ACE1) was coded as an adverse childhood experience. The remaining survey items ACE3-ACE10 are dichotomous with 'Yes/No' response options.

Variable: ACEincome_1617
"Adverse childhood experience: hard to get by on family's income -hard to cover basics like food or housing".
Values:

1 "Never hard to get by on family income"
2 "Rarely hard to get by on family income"

3 "Somewhat often hard to get by on family income"
4 "Very often hard to get by on family income"

Variable: ACEincome2_1617 "How often has it been hard to get by on your family's income hard to cover basics like food or housing?".
Values:
1 "Somewhat often/Very often hard to get by on family income"
2 "Never/Rarely hard to get by on family income"
99 "Missing".

Variable: ACEdivorce_1617 "Adverse childhood experience: parent or guardian divorced or separated".
Values:
1 "Experienced the adverse childhood experience"
2 "Did not experience this adverse childhood experience"
99 "Missing".

Variable: ACEdeath_1617 "Adverse childhood experience: parent or guardian died".
Values:
1 "Experienced the adverse childhood experience"
2 "Did not experience this adverse childhood experience"
99 "Missing".

Variable: ACEjail_1617 "Adverse childhood experience: parent or guardian served time in jail".
Values:
1 "Experienced the adverse childhood experience"
2 "Did not experience this adverse childhood experience"
99 "Missing".

Variable: ACEdomviol_1617 "Adverse childhood experience: saw or heard parents or adults slap, hit, kick, punch one another in the home".
Values:
1 "Experienced the adverse childhood experience"
2 "Did not experience this adverse childhood experience"
99 "Missing".

Variable: ACEneighviol_1617 "Adverse childhood experience: victim/witness of neighborhood violence".
Values:
1 "Experienced the adverse childhood experience"
2 "Did not experience this adverse childhood experience"
99 "Missing".

Variable: ACEmhealth_1617 "Adverse childhood experience: lived with anyone who was mentally ill, suicidal, or severely depressed".

Values:

1 "Experienced the adverse childhood experience"
2 "Did not experience this adverse childhood experience"
99 "Missing".

Variable: ACEdrug_1617 "Adverse childhood experience: lived with anyone who had a problem with alcohol or drug".
Values:

1 "Experienced the adverse childhood experience"
2 "Did not experience this adverse childhood experience"
99 "Missing".

Variable: ACEdiscrim_1617 "Adverse childhood experience: treated or judged unfairly because of his/her race or ethnic group".
Values:

1 "Experienced the adverse childhood experience"
2 "Did not experience this adverse childhood experience"
99 "Missing".

Variable: ACEct_1617 "Number of adverse childhood experiences, of 9 asked about".
Values:

0 "No adverse childhood experiences"
99 "Missing to all 9 items".

Variable: ACE2more_1617 "Indicator 6.13: Children experienced two or more adverse childhood experiences"
Values:

1 "No adverse childhood experiences"
2 "Experienced 1 adverse childhood experience"
3 "Experienced 2 or more adverse childhood experiences"
99 "Missing to all 9 items".

Indicator 3.2 Consistency of insurance coverage (InsGap_1617)
Notes:

The INSGAP variable was constructed from three questions: whether the child was covered by any kind of health insurance during the past 12 months (K3Q04_R), whether the child was covered with any health insurance at the time of the survey (CURRCOV), and type of insurance coverage. This measure combines the following responses to INSGAP: "Yes child had any kind of insurance, but had a gap in coverage" and "No, child did not have any insurance during the past 12 months", as “child did not have continuous coverage during the past 12 months”. It is important to note that consistency of the coverage was considered as missing if the child was currently insured but the type of coverage was ONLY Indian Health Service or health care sharing ministry.

Values:

1 "Insured continuously all year"
2 "Child had a gap in coverage"
99 "Missing".

Indicator 6.2 Mental health status of mother (MotherMH_1617)
Description: If this child's mother lives in the household, in general, what is the status of mother's mental and emotional health?
Notes:

This measure summarizes the mental or emotional health status of the child's biological, adoptive, step or foster mother. The survey respondent rated the child's adult primary caregivers' mental or emotional health. Adult 1 (if mother) was chosen if both reported adults were mothers (biological, adoptive, step or foster). If the child only has one caregiver, only one was rated. If none of the caregivers are the child's mother (biological, adoptive, step, or foster), those children were not included in the denominator.

Values:

1 "Excellent or very good"
2 "Good"
3 "Fair or poor"
99 "Missing"
95 "No mother in the household".

Indicator 6.2a Mental health status of father (FatherMH_1617):
See Indicator 6.2

Indicator 2.3 Flourishing for young children, age 6 months-5 years (flrish0to5_1617)
Notes:

For children age 0-5 years, four questions were asked that aimed to capture curiosity and discovery about learning, resilience, attachment with parent, and contentment with life. The survey question asked, "How true are each of the following statements about this child:
(1) child is affectionate and tender, (2) child bounces back quickly when things don't go his/her way, (3) child shows interest and curiosity in learning new things, and (4) child smiles and laughs a lot". The "Definitely true" response to the question indicates the child meets the flourishing item criteria.

Values:

1 "Definitely true"
2 "Somewhat true or Not true"
90 "Children age 6-17 years"
95 "Children age <6 months"
99 "Missing".

Indicator 2.4 Flourishing for children and adolescents, age 6-17 years (flrish6to17_1617)
Description: Is this child or adolescent flourishing?
Notes:

For children age 6-17 years, three questions were asked that aimed to capture curiosity and discovery about learning, resilience, and self-regulation. The survey question asked, "How true are each of the following statements about this child: (1) child shows interest and curiosity in learning new things, (2) child works to finish tasks he or she starts, and (3) child stays calm and in control when faced with a challenge". The "Definitely true" response to the question indicates the child meets the flourishing item criteria.

Notes:

1 "Definitely true"
2 "Somewhat true or Not true"
90 "Children age 0-5 years"
99 "Missing".

Indicator 6.14 Parental aggravation (ParAggrav_1617)

Description: Does this child have parents who felt aggravated by parenting during the past month?

Notes:

Parents who "often feel aggravated" are defined as parents who reported that during the last month, on average, they usually or always felt their child was much harder to care for than other children (K8Q31), or were usually or always bothered a lot by their child's behavior (K8Q32), or were usually or always felt angry with their children (K8Q34).

Values:

1 "Never"
2 "Rarely"
3 "Sometimes"
4 "Usually or always"
99 "Missing"

Indicator 3.1 Current health insurance status (CurrIns_1617)

Description: Is this child currently covered by any kind of health insurance or health coverage plan?

Notes:

The CURRINS variable was constructed from three questions: whether the child was covered by any kind of health insurance during the past 12 months, whether the child was covered with any health insurance at the time of the survey , and type of insurance coverage. Children who had coverage for all the last 12 months or currently insured were categorized as children who are currently insured. However, If child's health insurance coverage is reported to be ONLY Indian Health Service or health care sharing ministry, that child was considered as not having current health insurance even though the response indicates that the child is currently insured.

Values:

1 "Insured at time of survey (does not include Indian Health Service or a religious health share)"
2 "Not insured or only insured through Indian Health Service or a religious health share at time of survey"
99 "Missing"

Indicator 2.1 Bully others, age 6-17 years (bully_1617)

Description: How true is the following statement about this child: child bullies others, picks on them, or excludes them?
Values:
1 "Definitely or somewhat true"
2 "Not true"
99 "Missing"
90 "Children age 0-5 years"

Indicator 2.2 Bullied, age 6-17 years (bullied_1617)
Description: How true is the following statement about this child: child is bullied, picked on, or excluded by other children?
Notes:
1 "Definitely or somewhat true"
2 "Not true"
99 "Missing"
90 "Children age 0-5 years"

Indicator 2.6 Making and keeping friends, age 6-17 years (MakeFriend_1617)
Description: Compared to other children his or her age, how much difficulty does this child have making or keeping friends?
Values:
1 "No difficulty"
2 "A little difficulty"
3 "A lot of difficulty"
99 "Missing"
90 "Children age 0-5 years"

Indicator 6.15 Emotional help with parenthood (EmSupport_1617)
Description: During the past 12 months, was there someone that you could turn to for day-to-day emotional support with parenting or raising children?
Values:
1 "Yes"
2 "No"
99 "Missing"

Indicator 6.22 Sleep position, age 0-12 months (SLEEPPOS)
Description: In which position do you most often lay this baby down to sleep now?
Values:
1 "On his or her back"
2 "On his or her side"
3 "On his or her stomach"
90 "Children age 1-17 years"
99 "Missing"

Indicator 6.24 Child goes to bed same time on weeknights (BedTime_1617)
Description: How often does this child go to bed at about the same time on weeknights?

Values:

1 "Always"
2 "Usually"
3 "Sometimes"
4 "Rarely or never"
99 "Missing"

Indicator 6.25 Adequate amount of sleep, age 4 months-17 years (HrsSleep_1617)
Description: During the past week, how many hours of sleep did this child get on an average weeknight?
Notes:

Not getting enough sleep on a regular basis leads to increases in some types of health problems/conditions such as hypertension, injuries, obesity, and depression etc. The American Academy of Pediatrics endorsed a guideline developed by the American Academy of Sleep Medicine, "Recommended sleep duration for children from infants to teens". The guideline recommends the following sleep hours:
Infants 4 months to 12 months should sleep 12 to 16 hours per 24 hours (including naps)
Children 1 to 2 years of age should sleep 11 to 14 hours per 24 hours (including naps)
Children 3 to 5 years of age should sleep 10 to 13 hours per 24 hours (including naps)
Children 6 to 12 years of age should sleep 9 to 12 hours per 24 hours
Teenagers 13 to 18 years of age should sleep 8 to 10 hours per 24 hours.

Values:

1 "Child sleeps recommended age-appropriate hours"
2 "Child sleeps less than recommended age-appropriate hours"
99 "Missing"
95 "Children less than 4 months old".

Indicator 6.26 Food insufficiency (FoodSit_1617)
Description: Which of these statements best describes the food situation in this child's household in the past 12 months?
Notes:

1 "We could always afford to eat good nutritious meals"
2 "We could always afford enough to eat but not always the kinds of food we should eat"
3 "Sometimes we could not afford enough to eat"
4 "Often we could not afford enough to eat"
99 "Missing"

Indicator 7.1 Supportive neighborhood (NbhdSupp_1617)
Description: Does this child live in a supportive neighborhood?
Notes:

This measure is referred to in various contexts as "neighborhood support," "neighborhood cohesion," and "social capital" – and is derived from responses to three statements:
1) People in my neighborhood help each other out ; 2) We watch out for each other's children in this neighborhood; and 3) When we encounter difficulties, we know where to go for help in our

community.Respondents were asked whether they definitely agree, somewhat agree, somewhat disagree, or definitely disagree with each statement.

Values:

1 "Live in supportive neighborhoods"
2 "Do not live in supportive neighborhoods"
99 "Missing to any".

Indicator 7.2 Safe neighborhood (NbhdSafe_1617)
Description: Does this child live in a safe neighborhood?
Values:

1 "Definitely agree"
2 "Somewhat agree"
3 "Somewhat or definitely disagree"
99 "Missing"

Indicator 7.3 Safe school, age 6-17 years (SchlSafe_1617)
Description: Is this child safe at school?
Values:

1 "Definitely agree"
2 "Somewhat agree"
3 "Somewhat or definitely disagree"
99 "Missing"
90 "Children age 0-5 years"

Indicator 7.4 Neighborhood amenities (NbhdAmenities_1617)
Description: Does this child live in a neighborhood that contains certain amenities -- parks, recreation centers, sidewalks or libraries?
Values:

0 "Neighborhood does not contain any amenities"
1 "Neighborhood contains 1 amenity"
2 "Neighborhood contains 2 amenities"
3 "Neighborhood contains 3 amenities"
4 "Neighborhood contains all 4 amenities"
99 "Missing to any of the questions"

Indicator 7.5 Presence of detracting neighborhood elements (NbhdDetract_1617)
Description: Does this child live in a neighborhood where there is litter or garbage on the street or sidewalk, poorly kept or rundown housing, or vandalism such as broken windows and graffiti?
Values:

0 " Neighborhood does not have any detracting elements"
1 "Neighborhood has 1 detracting element"
2 "Neighborhood has 2 detracting elements"
3 "Neighborhood has 3 detracting elements"
99 "Missing to any of the questions"

Variable: U.S. children in 3 age groups (age3_1617)
Description: What is this child's age? (3 age groups)
Notes:

1 "0-5 years old"
2 "6-11 years old"
3 "12-17 years old"

Indicator 6.24 Child goes to bed same time on weeknights (BedTime_1617)
Description: How often does this child go to bed at about the same time on weeknights?
Notes:

1 "Always"
2 "Usually"
3 "Sometimes"
4 "Rarely or never"
99 "Missing".

Indicator 6.5 Children living in "working poor" families (WrkngPoor_1617)
Description: How many children live in "working poor" households: that is, parents are employed full-time with incomes less than 100% of the federal poverty level?
Notes:

This measure is derived from two items: 1) A#_K11Q50_R defines whether any of the child's primary caregivers in the household were employed during at least 50 of the past 52 weeks and 2) The income variable, povlev4_1617, is calculated based on the relative poverty status according to household size and income. Households with income less than 100% of Federal Poverty Level are defined as "poor."

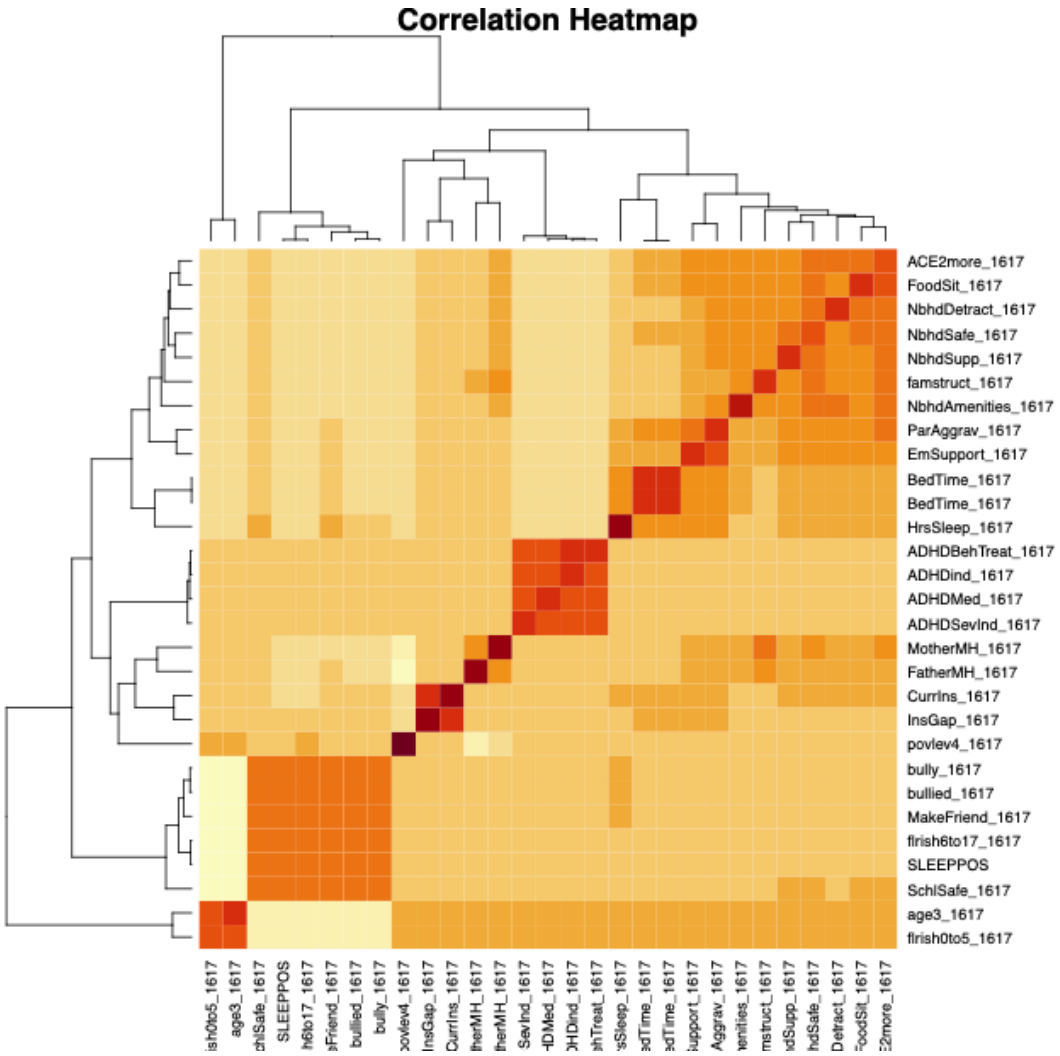
Values:

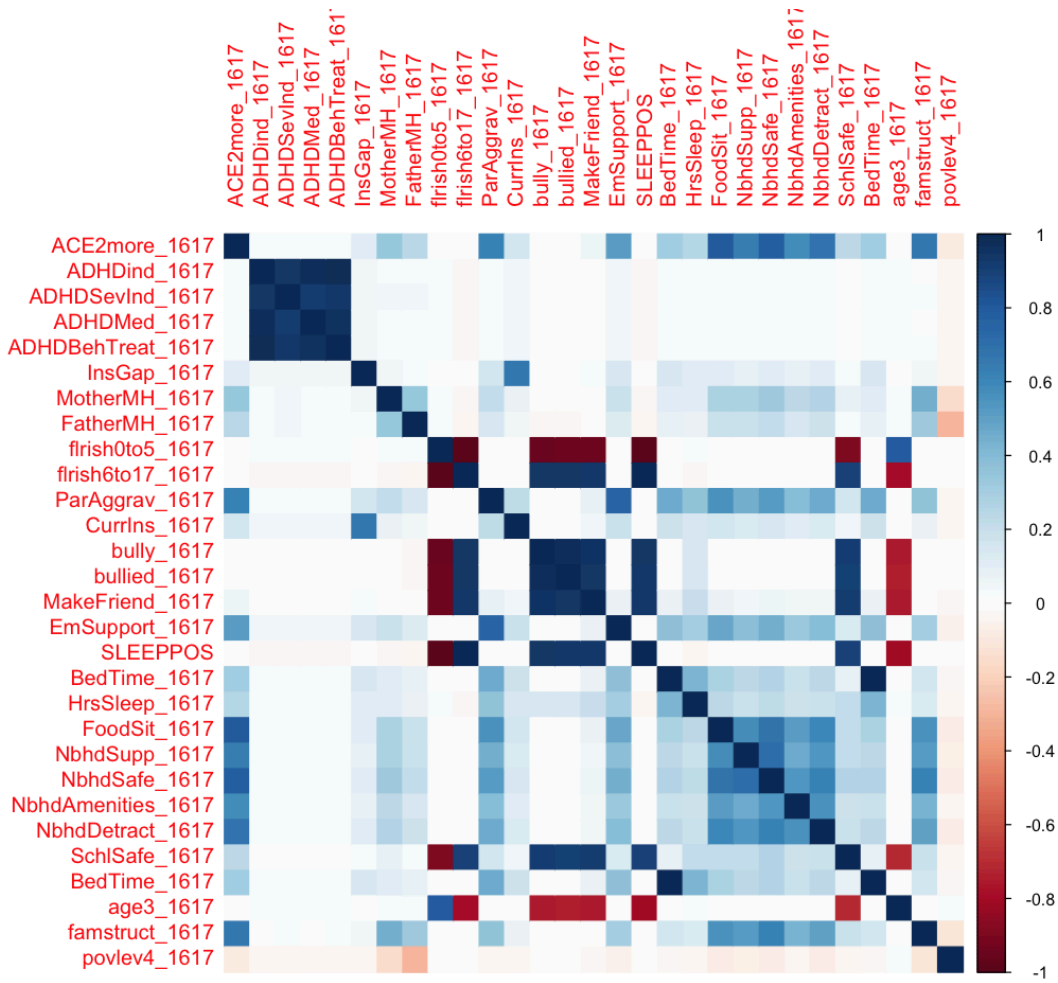
1 "Live in 'working poor' household"
2 "Do not live in 'working poor' household"
99 "Missing"

Variable: Family structure of child's household (famstruct_1617)
Description: What is the family structure that this child lives in?
Values:

1 "Two parents, currently married"
2 "Two parents, not currently married"
3 "Single mother"
4 "Other family type, no parent reported"
99 "Missing"

Correlation HeatMap:

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InsGap_1617
MotherMH_1617
FatherMH_1617
flrish0to5_1617
flrish6to17_1617
ParAggrav_1617
CurrIns_1617
bully_1617
bullied_1617
MakeFriend_1617
EmSupport_1617
SLEEPPOS
BedTime_1617
HrsSleep_1617
FoodSit_1617
NbhdSupp_1617
NbhdSafe_1617
NbhdAmenities_161
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povlev4_1617
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0.6
0.4
0.2
0
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-0.6
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-1

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