

**Note to readers with disabilities:** *EHP* strives to ensure that all journal content is accessible to all readers. However, some figures and Supplemental Material published in *EHP* articles may not conform to [508 standards](#) due to the complexity of the information being presented. If you need assistance accessing journal content, please contact [ehpsubmissions@niehs.nih.gov](mailto:ehpsubmissions@niehs.nih.gov). Our staff will work with you to assess and meet your accessibility needs within 3 working days.

### **Supplemental Material**

#### **Associations between Fine Particulate Matter Components, Their Sources, and Cognitive Outcomes in Children Ages 9–10 Years Old from the United States**

Kirthana Sukumaran, Katherine L. Botterhorn, Joel Schwartz, Jim Gauderman, Carlos Cardenas-Iniguez, Rob McConnell, Daniel A. Hackman, Kiros Berhane, Hedyeh Ahmadi, Shermaine Abad, Rima Habre, and Megan M. Herting

#### **Table of Contents**

##### **Supplemental Methods**

**Table S1.** Comparison of ABCD Study Cohort and analytic sample demographics.

**Table S2.** Prediction performance metrics (root mean square error) from ensemble models of PM<sub>2.5</sub> components, as previously reported.

**Table S3.** Grouped Weighted quantile sum results showing cumulative associations between groups of PM components, based on six identified source factors, and neurocognitive performance in 9–10-year-old participants from the ABCD Study cohort (n=8,589), 2016-2018 also adjusting for exposure to ozone.

**Table S4.** Associations between each PM<sub>2.5</sub> source factor and cognitive outcome in 9–10-year-old participants from the ABCD Study cohort (n=8,588), 2016-2018 also adjusting for exposure to ozone.

**Table S5.** Weighted Quantile Sum (WQS) regression results examining the mixture of 15 PM components on neurocognitive performance in 9–10-year-old participants from the ABCD Study cohort (n=8,580), 2016-2018, also adjusting for parental education.

**Table S6.** Grouped Weighted quantile sum results showing cumulative associations between groups of PM components, based on six identified source factors, and neurocognitive performance in 9–10-year-old participants from the ABCD Study cohort (n=8,580), 2016-2018, including parental education as an additional covariate.

**Table S7.** Associations between each PM<sub>2.5</sub> source factor and cognitive outcome in 9–10-year-old participants from the ABCD Study cohort (n=8,580), 2016-2018, including parental education as an additional covariate.

**Figure S1.** Directed Acyclic Graph (DAG) of potential confounders that may predict link between exposure to air pollution (based on residential location) and cognitive performance of children. A) Dagitty model of potential confounders to identify minimally sufficient set (i.e. adjusted variables = white circles). B) Simplified DAG of confounders adjusted for in final models based on A.

**Figure S2.** Correlation [Spearman] matrix of 15 PM<sub>2.5</sub> components estimated at the child's residence of all 9–10-year-old participants from the ABCD Study cohort (n=8,589), 2016-2018.

**Figure S3.** Distributions of residential PM<sub>2.5</sub> component exposure concentrations of all 9–10-year-old participants from the ABCD Study cohort (n=8,589), 2016-2018, plot by site. Study sites are color coded by U.S. geographical region. Abbreviations: SO<sub>4</sub><sup>2-</sup> for sulfate; NO<sub>3</sub><sup>-</sup> for nitrate; NH<sub>4</sub><sup>+</sup> for ammonium; OC for organic carbon; EC for elemental carbon; Zn for zinc; V or vanadium; K for potassium; Si for silicon; Pb for lead; Ni for nickel; Fe for iron; Cu for copper; Ca for calcium; Br for bromine. Numeric data for Supplemental Figure 3 can be found in Excel Table S9.

**Figure S4.** Weights of PM components, clustered by source factor groups, contributing to significant grouped mixture effects on neurocognitive outcomes in 9–10-year-old participants from the ABCD Study cohort (n=8,589), 2016-2018. A) Weights for associations seen for general cognitive ability and crustal (negative association), industrial (negative association), and traffic (positive association) related components. B) Weights for association seen for learning & memory and ammonium nitrate-related components (negative association). C) Weights for associations seen for executive function and traffic (negative association) and biomass burning (positive association) related components. Abbreviations: NO<sub>3</sub><sup>-</sup> for nitrate; NH<sub>4</sub><sup>+</sup> for ammonium; OC for organic carbon; EC for elemental carbon; Zn for zinc; K for potassium; Si for silicon; Pb for lead; Ni for nickel; Fe for iron; Cu for copper; Ca for calcium; Br for bromine. Numeric data for Supplemental Figure 4 can be found in Excel Table S10.

## References

**Additional File-** Excel Document