Supplemental Table 1. Characteristics of Children Aged 6–12 Years in Hair Metals Analyses by Inclusion Status, C8 Health Project Neurobehavioral Follow-up Study, Mid-Ohio Valley, 2009–2010 (n = 322)

	Included			Excluded			
Characteristic	N	Percent (Mean)	Standard Deviation	N	Percent (Mean)	Standard Deviation	p-value
Full Population	222	68.9		100	31.1		
Child age, years	222	9.8	1.7	100	9.9	1.8	0.95
Child sex							
Male	53	23.9		96	96.0		<.001
Female	169	76.1		4	4.0		
Secondhand smoke age 0–2 years							
Yes	41	18.0		14	14.0		0.32
No	181	82.0		86	86.0		
HOME score, maternal section							
Cognitive scale	222	6.9	1.7	100	6.5	2.0	0.08
Emotional scale	222	9.8	1.5	100	9.7	1.5	0.65
Maternal age, years	221	38.6	6.0	100	37.7	5.5	0.17
Maternal Full Scale IQ (M100, SD 15) ▲	221	99.4	12.6	100	98.8	11.9	0.67
Maternal education							
Less than high school	10	4.5		1	1.0		0.03
High school graduate	64	28.8		38	38.0		
Some college	87	39.2		45	45.0		
College graduate	61	27.5		16	16.0		
Child Neuropsychological Measures							
WASI (M100, SD 15) ▲							
Full Scale IQ	220	101.9	12.9	100	99.3	13.5	0.11
Verbal IQ	221	103.2	13.1	100	101.0	14.3	0.12
Performance IQ	220	99.5	13.0	100	97.7	13.9	0.29
WIAT (M100, SD 15) ▲							
Word Reading/Pseudoword Decoding standard score mean	212	102.4	11.1	93	100.8	11.9	0.27
Numerical Operations standard score	221	97.8	14.3	100	97.0	16.7	0.71
NEPSY (M 10, SD 3) ▲							
Comprehension of Instructions scaled score	221	10.5	2.9	99	10.8	2.7	0.33
Design Copying Total scaled score	209	8.6	3.4	94	7.6	3.3	0.02
Narrative Memory Free and Cued Recall scaled score	221	9.3	2.9	98	9.7	2.7	0.27
Semantic/Initial Letter scaled score mean	209	9.7	2.5	90	9.1	2.6	0.09
CPT (M 50, SD 10) ▼							
Clinical Confidence Index	215	47.8	23.5	90	58.7	22.2	<.001

	Included			Excluded			
Characteristic	N	Percent (Mean)	Standard Deviation	N	Percent (Mean)	Standard Deviation	p-value
Omissions T-score	215	53.6	12.3	90	53.8	12.4	0.87
Commissions T-score	215	56.3	8.2	90	54.9	9.2	0.23
Hit Reaction Time T-score	215	47.5	11.0	90	49.0	9.4	0.23
CADS, mother report (M 50, SD 10) ▼							
ADHD Index	221	54.1	11.6	100	53.4	11.0	0.59
Combined Type	221	53.9	10.6	100	53.7	10.6	0.85
Inattentive Type	221	52.3	10.7	100	50.9	9.9	0.25
Hyperactive-Impulsive Type	221	55.3	10.7	100	56.9	11.4	0.30
CADS, teacher report (M 50, SD 10) ▼							
ADHD Index	134	53.5	12.1	54	54.6	14.3	0.62
Combined Type	134	51.9	11.5	54	51.8	12.2	0.95
Inattentive Type	134	48.2	9.2	54	51.1	12.9	0.14
Hyperactive-Impulsive Type	134	51.7	11.5	54	51.1	10.7	0.77
BRIEF, mother report (M 50, SD 10) ▼							
Global Executive Composite	219	50.5	11.3	100	51.5	11.3	0.47
Behavioral Regulation Index	220	49.6	10.9	100	51.8	11.3	0.10
Metacognition Index	219	50.9	11.3	100	51.1	11.0	0.90
BRIEF, teacher report (M 50, SD 10) ▼							
Global Executive Composite	134	56.2	14.2	55	58.3	14.8	0.37
Behavioral Regulation Index	134	54.0	13.3	55	56.8	14.7	0.22
Metacognition Index	134	56.7	14.7	55	58.2	14.3	0.50
BASC-2, mother report (M 50, SD 10) ▼							
Behavioral Symptom Index	214	50.2	10.2	100	51.1	9.7	0.44
Adaptive Skills (▲)	214	50.5	10.0	100	49.4	9.9	0.35
Internalizing Problems	214	52.3	11.8	100	54.6	12.0	0.12
Externalizing Problems	214	50.3	9.4	100	50.8	8.7	0.63
BASC-2, teacher report (M 50, SD 10) ▼							
Behavioral Symptom Index	104	48.9	8.8	36	49.7	11.0	0.94
Adaptive Skills (▲)	104	51.9	9.9	36	52.3	10.8	0.56
Internalizing Problems	104	51.3	11.2	36	51.3	13.4	0.55
Externalizing Problems	104	47.8	7.2	36	49.4	10.5	0.61

M, mean; SD standard deviation
▲ higher score reflects better/more favorable performance
▼ lower score reflects better/more favorable performance

Supplemental Table 2. Imputed Variables for Children Aged 6–12 Years with Hair Metals Measurements, C8 Health Project Neurobehavioral Follow-up Study, Mid-Ohio Valley, 2009–2010 (n = 222)

Variable	Imputed (N)	Percent
Hair Arsenic	8	3.6
Hair Cadmium	2	0.9
Hair Lead	1	0.5
Maternal Age	1	0.5
Maternal Full Scale IQ (M100, SD 15)	1	0.5
Examiner	1	0.5
Child Neuropsychological Measures		
WASI		
Full Scale IQ	2	0.9
Verbal IQ	1	0.5
Performance IQ	2	0.9
WIAT		
Word Reading/Pseudoword Decoding standard score mean	10	4.5
Numerical Operations standard score	1	0.5
NEPSY		
Comprehension of Instructions scaled score	1	0.5
Design Copying Total scaled score	13	5.9
Narrative Memory Free and Cued Recall scaled score	1	0.5
Semantic/Initial Letter scaled score mean	13	5.9
CPT		
Clinical Confidence Index	7	3.2
Omissions T-score	7	3.2
Commissions T-score	7	3.2
Hit Reaction Time T-score	7	3.2
CADS, mother report		
ADHD Index	1	0.5
Combined Type	1	0.5
Inattentive Type	1	0.5
Hyperactive-Impulsive Type	1	0.5
BRIEF, mother report		
Global Executive Composite	3	1.4
Behavioral Regulation Index	2	0.9
Metacognition Index	3	1.4
BASC-2, mother report		
Behavioral Symptom Index	8	3.6
Adaptive Skills	8	3.6
Internalizing Problems	8	3.6
Externalizing Problems	8	3.6

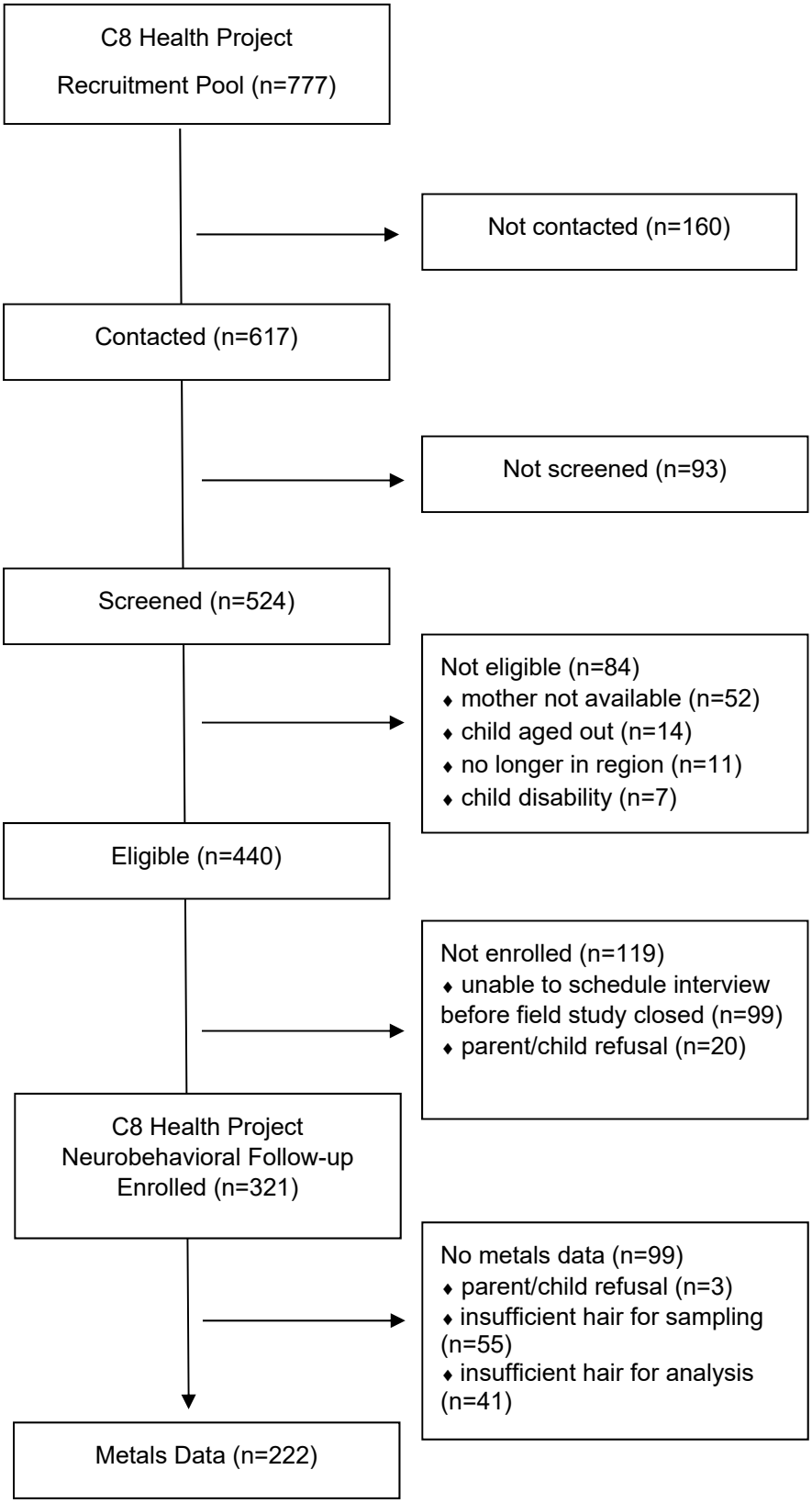
Supplemental Table 3. Estimated *Adjusted Change (ψ; 95% confidence interval) in Neuropsychological Measure per Decile Increase in All Hair Metals, Children Aged 6 to 12 Years, C8 Health Project Neurobehavioral Follow-up Study, Mid-Ohio Valley, 2009–2010 (n = 222). Effect estimates from Quantile G-Computation are interpreted as the change in outcome per decile increase in all metals (arsenic, cadmium, manganese, lead).

Measure	*Adjusted Pooled Psi (ψ)	95% CI
WASI (M 100, SD 15) ▲		
Full Scale IQ	–1.01	–1.88, –0.15
Verbal IQ	–1.11	–1.97, –0.25
Performance IQ	–0.48	–1.35, 0.39
WIAT (M 100, SD 15) ▲		
Word Reading/Pseudoword Decoding standard score mean	–0.64	–1.39, 0.11
Numerical Operations standard score	–0.91	–1.92, 0.09
NEPSY (M 10, SD 3) ▲		
Comprehension of Instructions scaled score	–0.06	–0.27, 0.14
Design Copying Total scaled score	–0.12	–0.38, 0.13
Narrative Memory Free and Cued Recall scaled score	–0.06	–0.27, 0.15
Semantic/Initial Letter scaled score mean	–0.08	–0.25, 0.10
CPT (M 50, SD 10) ▼		
Clinical Confidence Index	0.28	–1.35, 1.90
Omissions T–score	0.35	–0.54, 1.23
Commissions T–score	0.22	–0.40, 0.85
Hit Reaction Time T–score		
CADS, mother report (M 50, SD 10) ▼		
ADHD Index	0.70	–0.15, 1.55
Combined Type	0.80	0.04, 1.57
Inattentive Type	0.90	0.12, 1.68
Hyperactive–Impulsive Type	0.56	–0.21, 1.33
CADS, teacher report (M 50, SD 10) ▼		
ADHD Index	0.15	-0.95, 1.25
Combined Type	0.19	-0.89, 1.27
Inattentive Type	0.32	-0.51, 1.15
Hyperactive–Impulsive Type	-0.16	-1.26, 0.94
BRIEF, mother report (M 50, SD 10) ▼		
Global Executive Composite	0.78	–0.02, 1.58
Behavioral Regulation Index	0.56	–0.20, 1.33
Metacognition Index	0.83	0.01, 1.65
BRIEF, teacher report (M 50, SD 10) ▼		
Global Executive Composite	0.54	-0.77, 1.84
Behavioral Regulation Index	0.39	-0.86, 1.63
Metacognition Index	0.61	-0.73, 1.94
BASC-2, mother report (M 50, SD 10) ▼		
Behavioral Symptom Index	0.53	–0.2, 1.25
Adaptive Skills (▲)	–0.52	–1.22, 0.19

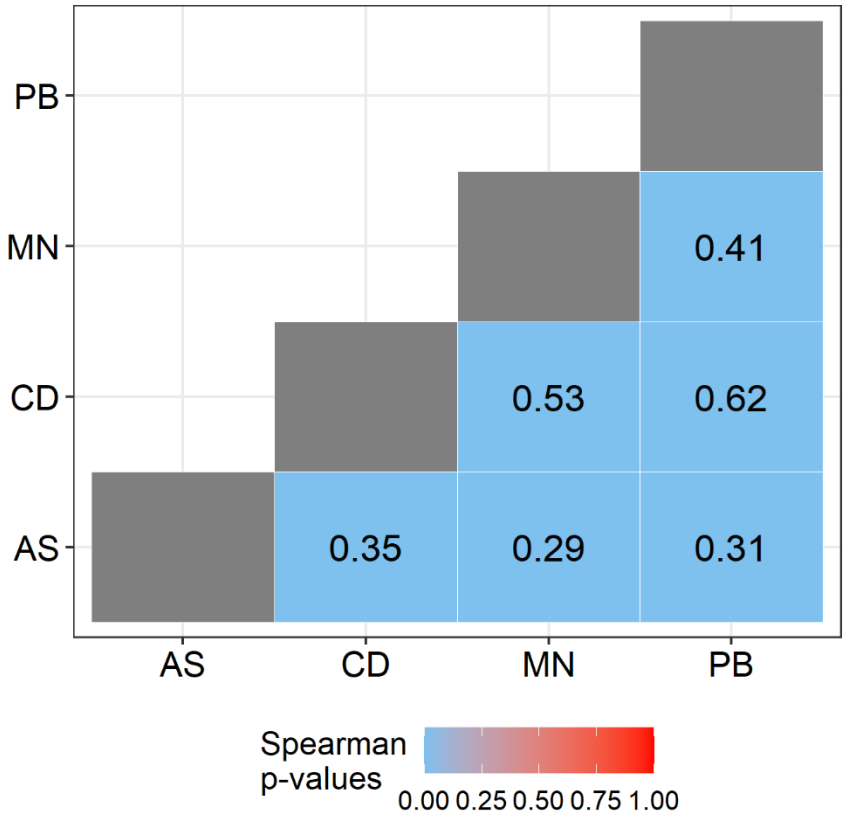
Measure	*Adjusted Pooled Psi (ψ)	95% CI
Internalizing Problems	0.26	–0.58, 1.11
Externalizing Problems	0.63	–0.05, 1.31
BASC-2, teacher report (M 50, SD 10) ▼		
Behavioral Symptom Index	0.83	-0.16, 1.82
Adaptive Skills (▲)	-0.77	-1.91, 0.37
Internalizing Problems	0.86	-0.47, 2.19
Externalizing Problems	0.13	-0.7, 0.96

*Adjusted for child age, sex, secondhand smoke exposure from birth to 2 years of age, HOME score (cognitive and emotional), maternal education, maternal IQ, and child examiner (WASI, WIAT, NEPSY, CPT).
CI, confidence Interval; M, mean; SD standard deviation
▲ higher score reflects better/more favorable performance
▼ lower score reflects better/more favorable performance

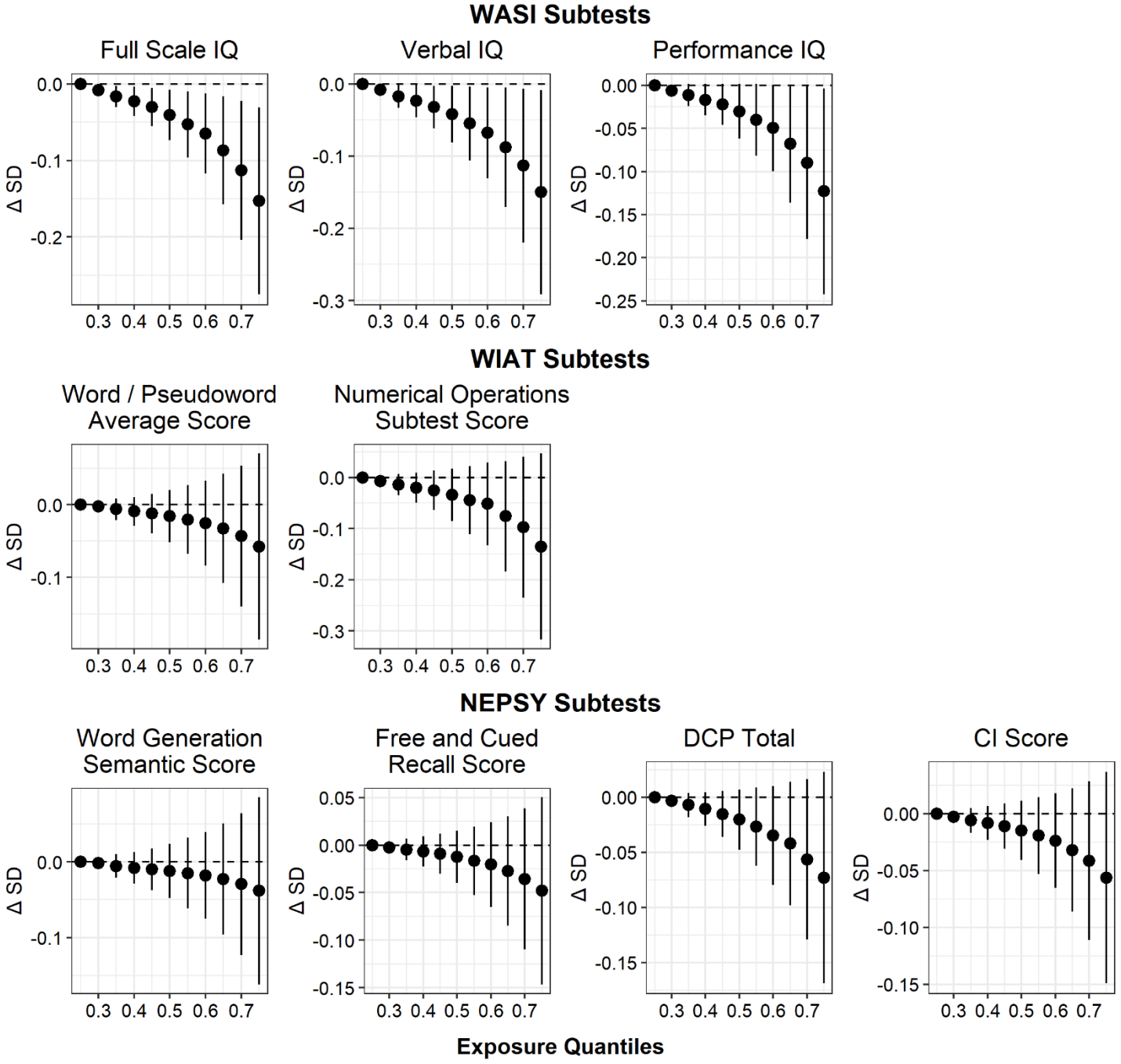
Supplemental Figure 1. Enrollment Scheme, Children Aged 6–12 Years with Hair Metals Measurements, C8 Health Project Neurobehavioral Follow-up Study, Mid-Ohio Valley, 2009–2010 (n = 222)

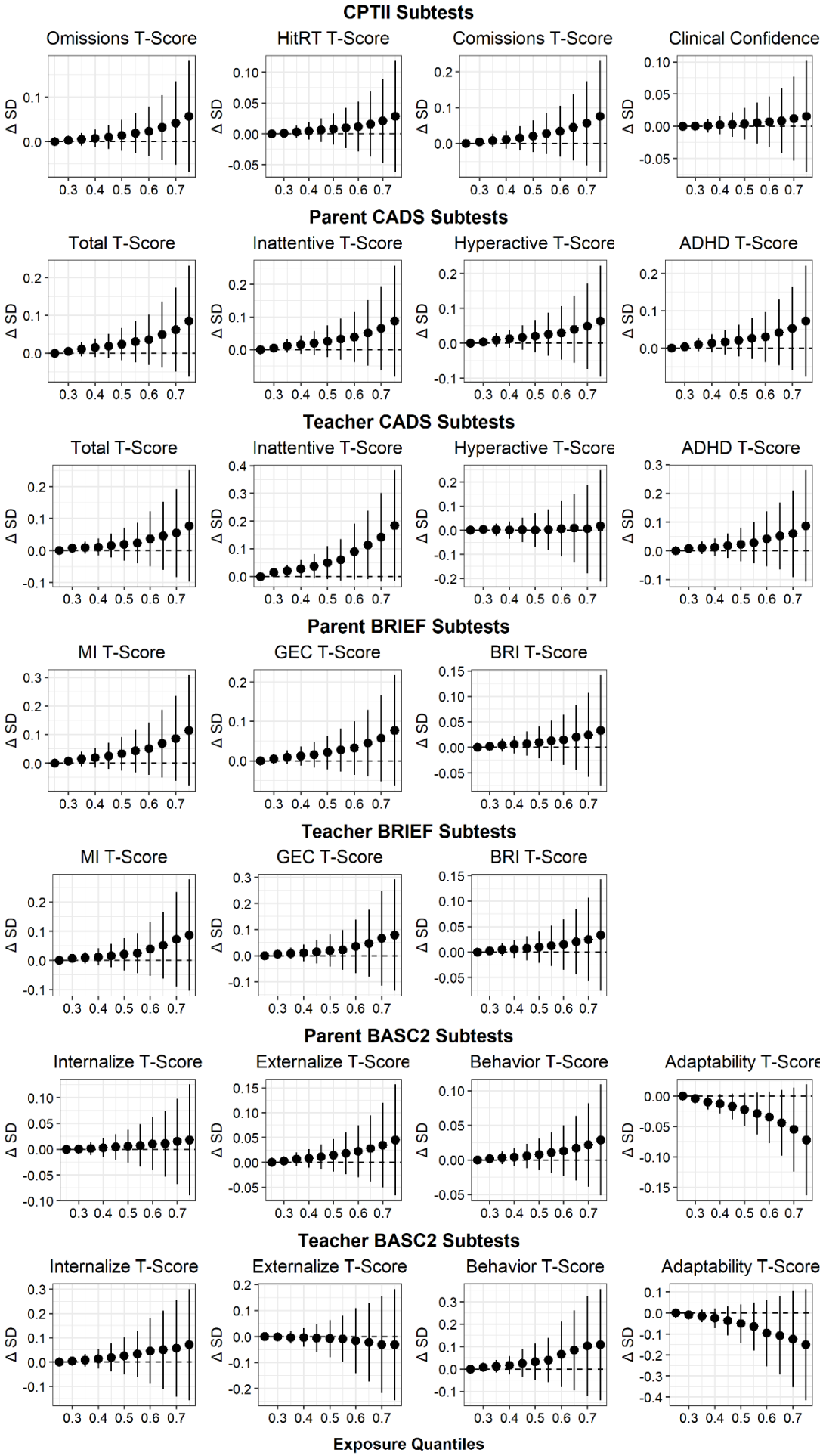


Supplemental Figure 2. Spearman's Rank Correlations of Hair Metal Concentrations (µg/g) Among Children Ages 6–12 Years, C8 Health Project Neurobehavioral Follow-up Study, Mid-Ohio Valley, 2009–2010 (n = 222)

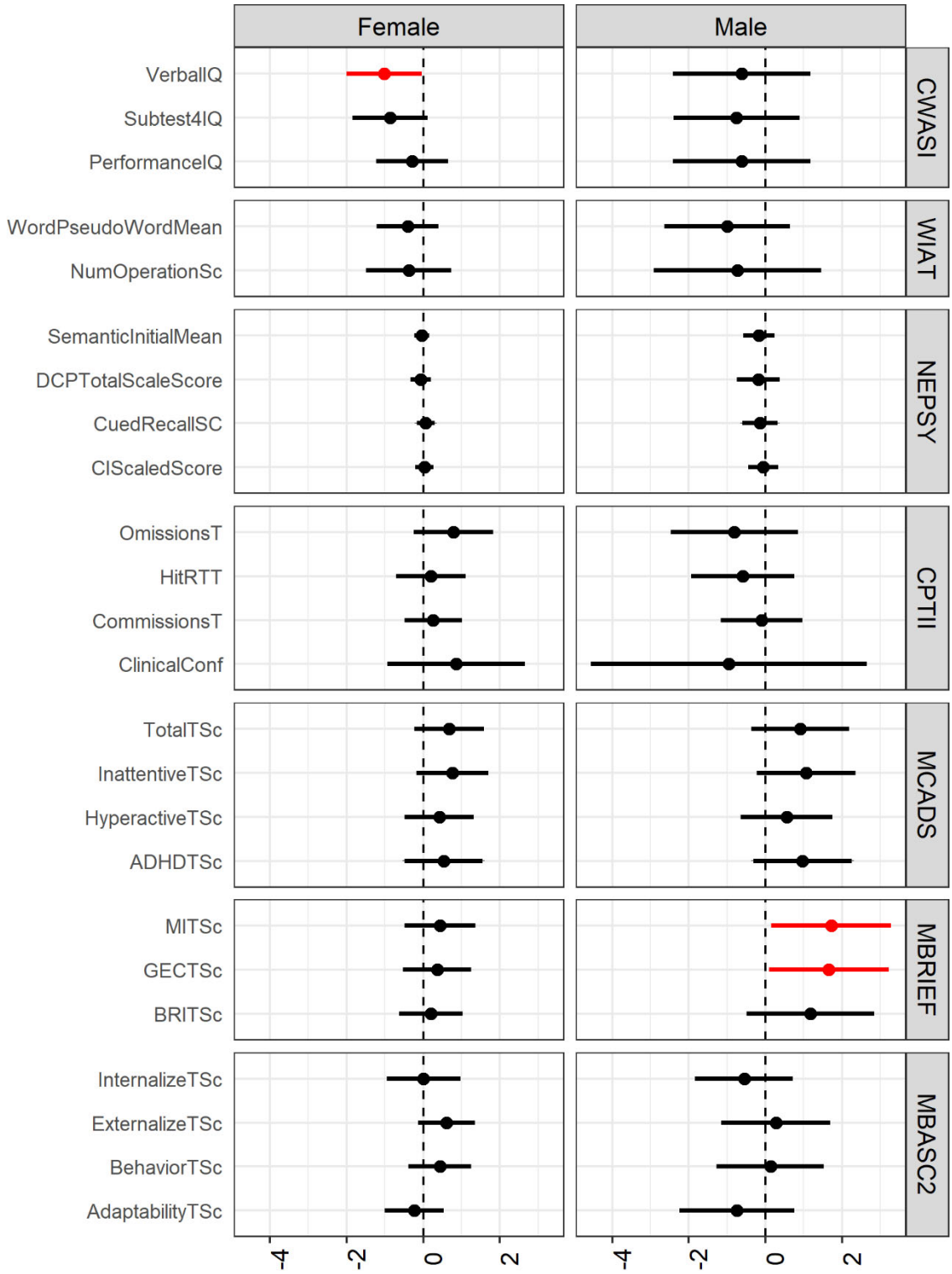


Supplemental Figure 3. Estimated adjusted change (standard deviation; 95% confidence interval; y-axis) when all components of hair metal mixture are at a given percentile (x-axis) compared to all components at the 25th percentile. Children aged 6–12 years, C8 Health Project Neurobehavioral Follow-up Study, Mid-Ohio Valley, 2009–2010 (n = 222). Effect estimates from Bayesian Kernel Machine Regression models adjusted for child age, sex, secondhand smoke exposure from birth to 2 years of age, HOME score (cognitive and emotional), maternal education, maternal IQ, and child examiner (WASI, WIAT, NEPSY, CPT). Plots range from 25th to 75th percentile, in increments of 5 percent.

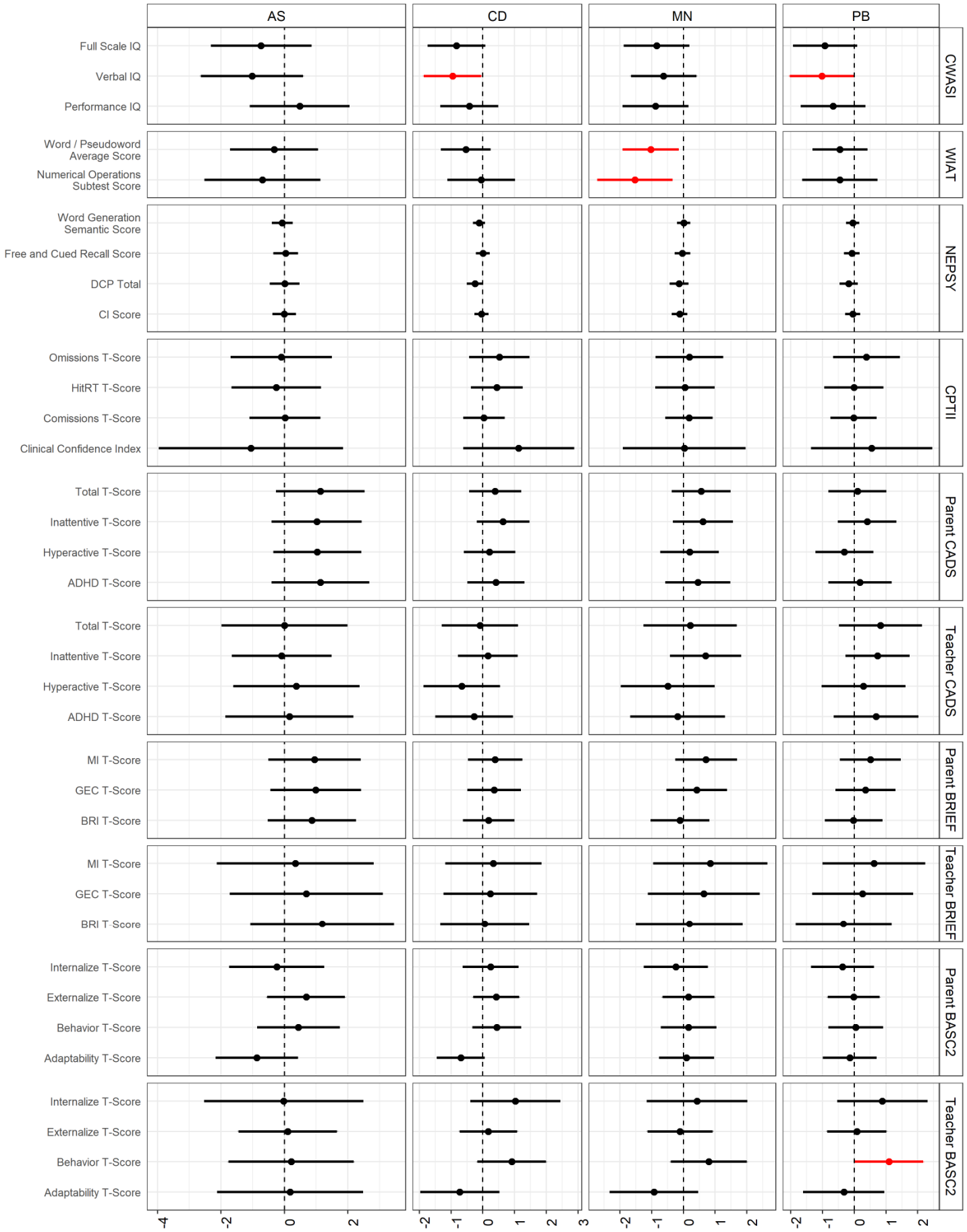



CPTII Subtests
Omissions T-Score
HitRT T-Score
Comissions T-Score
Clinical Confidence
Parent CADS Subtests
Total T-Score
Inattentive T-Score
Hyperactive T-Score
ADHD T-Score
Teacher CADS Subtests
Total T-Score
Inattentive T-Score
Hyperactive T-Score
ADHD T-Score
Parent BRIEF Subtests
MI T-Score
GEC T-Score
BRI T-Score
Teacher BRIEF Subtests
MI T-Score
GEC T-Score
BRI T-Score
Parent BASC2 Subtests
Internalize T-Score
Externalize T-Score
Behavior T-Score
Adaptability T-Score
Teacher BASC2 Subtests
Internalize T-Score
Externalize T-Score
Behavior T-Score
Adaptability T-Score
Δ SD
0.3 0.4 0.5 0.6 0.7
Exposure Quantiles

Supplemental Figure 4. Estimated adjusted change (ψ; 95% confidence interval) in neuropsychological measure per decile increase in all hair metals by child sex. Children aged 6–12 years, C8 Health Project Neurobehavioral Follow-up Study, Mid-Ohio Valley, 2009–2010 (n = 222). Effect estimates from Quantile G-Computation are interpreted as change in outcome per decile increase in all metals (arsenic, cadmium, manganese, lead), adjusted for child age, sex, metal mixture*sex, secondhand smoke exposure from birth to 2 years of age, HOME score (cognitive and emotional), maternal education, maternal IQ, and child examiner (WASI, WIAT, NEPSY, CPT).



Supplemental Figure 5. Estimated adjusted change (β; 95% confidence interval) in neuropsychological measure per doubling of individual metal concentration. Children aged 6–12 years, C8 Health Project Neurobehavioral Follow-up Study, Mid-Ohio Valley, 2009–2010 (n = 222). Effect estimates from linear regression models adjusted for child age, sex, secondhand smoke exposure from birth to 2 years of age, HOME score (cognitive and emotional), maternal education, maternal IQ, and child examiner (WASI, WIAT, NEPSY, CPT).


AS
CD
MN
PB
CWASI
Full Scale IQ
Verbal IQ
Performance IQ
WIAT
Word / Pseudoword Average Score
Numerical Operations Subtest Score
NEPSY
Word Generation Semantic Score
Free and Cued Recall Score
DCP Total
CI Score
CPTII
Omissions T-Score
HitRT T-Score
Comissions T-Score
Clinical Confidence Index
Parent CADS
Total T-Score
Inattentive T-Score
Hyperactive T-Score
ADHD T-Score
Teacher CADS
Total T-Score
Inattentive T-Score
Hyperactive T-Score
ADHD T-Score
Parent BRIEF
MI T-Score
GEC T-Score
BRI T-Score
Teacher BRIEF
MI T-Score
GEC T-Score
BRI T-Score
Parent BASC2
Internalize T-Score
Externalize T-Score
Behavior T-Score
Adaptability T-Score
Teacher BASC2
Internalize T-Score
Externalize T-Score
Behavior T-Score
Adaptability T-Score
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-2
0
2
-2
-1
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1
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3
-2
-1
0
1
2
-2
-1
0
1
2