Supplementary Information

Supplementary Table 1. NDA Data Release 2.0/2.0.1 Variables

Data Tables and Variables (NDA Release 2.0/2.0.1)	Variable Labels in Current Report
Demographics (pdem02)	
demo_comb_income_v2b	Family Income
demo_prnt_ed_v2b	Caregiver (Parent) 1 Education Level
demo_prtnr_ed_v2b	Caregiver (Parent) 2 Education Level
NIH Toolbox (abcd_tbss01)	
nihtbx_totalcomp_uncorrected	Cognitive Test Score
Structural MRI (abcd_smrip101)	
smri_thick_cdk_mean	Whole-Brain Mean Cortical Thickness
smri_area_cdk_total	Whole-Brain Total Cortical Surface Area
smri_vol_cdk_total	Whole-Brain Total Cortical Volume
Residential History (abcd_rhds01)	
reshist_addr1_valid	Validity of Primary Residential Address
reshist_addr1_leadrisk	Lead Risk
reshist_addr1_adi_perc	Area Deprivation Index (ADI)
Longitudinal Tracking (abcd_lt01)	
site_id_l	Site ID Number
American Community Survey Post Stratification Weights (acspsw03)	
interview_age	Age
gender	Sex
race_ethnicity	Race/Ethnicity
rel_family_id	Family ID Number

Note: The non-imaging data from the current manuscript came from Public Data Release 2.0. The imaging (structural MRI) data came from the ABCD Fix Release 2.0.1.

Supplementary Table 2. Source and details of the elevated blood lead level (EBLL) data and number of data points included and census tracts represented in the analysis.

Region	Year(s) Included	Criterion (µg/dL)	Age Range	Suppression Rule	Census Tracts (Data Points)
Chicago[67]	2009-13	6	0-5 yr	N/A	796 (547,829)
Colorado[68]	2010-14	5	0-6 yr	EBLL: <3	321 (65,181)
Indiana[68]	2011-15	5	0-7 yr	N/A	1,503 (203,828)
Maryland[69]	2010-14	5	0-6 yr	EBLL: <11	992 (377,336)
Massachusetts[70]	2012-16	5	9 mo – 4 yr	EBLL: 1-5; Total: <1200	1,200 (323,826)[α]
Michigan[71]	2017	4.5	0-6 yr	Total: <6	2,691 (142,813)
Minnesota[72]	2012-16	5	0-6 yr	EBLL: 1-4	649 (150,394)
Missouri[68]	2010-15	5	0-72 mo	N/A	1,310 (533,005)
New York City[68]	2010-15	5	0-72 mo	5 U.S. Code §552 (b)(6)	1,711 (726,519)
Ohio[68]	2010-15	5	0-72 mo	5 U.S. Code §552 (b)(6)	2,792 (378,873)
Oregon*	2013-16	5	0-6 yr	N/A	393 (35,334)
Pennsylvania[68]	2010-15	5	0-72 mo	5 U.S. Code §552 (b)(6)	1,336 (62,145)
Rhode Island[†]	2012-16	5	0-6 yr	N/A	240 (128,623)
Washington[§]	2012-16	5	0-72 mo	N/A	1,408 (33,482)
Wisconsin[73]	2013-16	5	0-6 yr	Total: <5	1,384 (177,749)

Note: The data provided for this analysis were initially formatted in terms of the number of tests and the number of positive tests (i.e., an EBLL). These data were re-coded, as described in the main text. While some of these data may reflect multiple tests per child, depending on the state or city, some of these data may reflect the highest test result. Thus, we generally referred to the number of data points as the number of reported tests. "Region" and "Year(s) Included" refer to the state or city for which data were retrieved and the testing year(s) of those data. "Criterion (µg/dL)" refers to the BLL signifying EBLLs vs. non-EBLLs. "Age Range" refers to the age(s) of the children, as specified in the data table or by the person(s) providing the data. "Suppression Rule" refers to the criterion used to dictate the provision of data at the census-tract level. In the "Suppression Rule" column, "N/A" means that a suppression rule was either not used or was not apparent based on inspection of data; "5 U.S. Code §552 (b)(6)" refers to U.S. Code, Section 552, Exemption 6 (https://www.justice.gov/oip/freedom-information-act-5-usc-552), which was indicated as "(b)(6)" in the data files used to generate the Reuters report; for the data from Maryland, when the total EBLL value was suppressed, we back-calculated an approximate EBLL count value based on the reported EBLL percentage and the total number screened. In the "Suppression Rule" column, "EBLL" refers to the values of EBLLs that were suppressed, while "Total" refers to the values of total number of tests that were suppressed. The Reuters data were kindly provided by the authors of the corresponding article.[68] *Oregon's data were kindly provided on request by Department of Human Services and Oregon Health Authority. [†]Rhode Island's data were kindly provided on request by the Rhode Island Department of Health. [§]Washington's data were kindly provided on request by the Washington State Department of Health. [α]Massachusetts' data were explicitly identified as including only confirmed EBLLs.

Supplementary Table 3. Linear mixed-effects model output for the analysis of lead risk, family income, and cognitive test scores.

	t(9699)	*p*	*b*	95% CI
Intercept	295.27	< .001	83.79	[83.23, 84.34]
Sex	4.06	< .001	0.31	[0.16, 0.46]
Race/Ethnicity (Asian)	5.31	< .001	2.43	[1.53, 3.33]
Race/Ethnicity (Black)	-17.16	< .001	-4.08	[-4.54, -3.61]
Race/Ethnicity (Hispanic)	-1.37	.171	-0.29	[-0.71, 0.13]
Race/Ethnicity (Other)	2.63	.009	0.61	[0.16, 1.07]
Family Income (High)	8.24	< .001	1.16	[0.89, 1.44]
Family Income (Low)	-9.62	< .001	-1.47	[-1.77, -1.17]
Age	36.82	< .001	0.37	[0.35, 0.39]
Lead Risk	-2.17	.030	-0.07	[-0.13, -0.01]
Maximum Parental Education	19.32	< .001	1.72	[1.55, 1.90]
Family Income (High) × Lead Risk	3.51	< .001	0.13	[0.06, 0.21]
Family Income (Low) × Lead Risk	-3.04	.002	-0.12	[-0.20, -0.04]

Note: The linear mixed-effects model incorporates testing the statistical significance of coefficients against a *t*-distribution. Family Income was a categorical, effects-coded factor, in which the level "Mid" served as the reference level. Family Income was operationally defined as the self-reported combined family income and partitioned into three levels: Low Income: ≤ $50K; Mid Income: $50K-$100K; High Income: ≥ $100K. Sex was also a categorical factor, effect coded with Male/Female as -1/+1. Race/Ethnicity was also a categorical factor, in which "White" served as the reference level. Age, Maximum Parental Education (i.e., highest education level between parents/caregivers), and Lead Risk were centered continuous factors. The random effects structure included a random intercept for study site and family identification number. Random effects were restricted to be uncorrelated. Analysis included 9,712 data points. The model accounted for 64.8% of the variance in the cognitive test score data (R^2 = .648, adjusted R^2 = .647).

Supplementary Table 4. Linear mixed-effects model output for the analysis of lead risk, family income, and whole-brain mean cortical thickness.

	t(9699)	*p*	*b*	95% CI
Intercept	238.02	< .001	2.75	[2.73, 2.77]
Sex	5.74	< .001	0.01	[0.004, 0.01]
Race/Ethnicity (Asian)	-2.72	.007	-0.02	[-0.03, -0.004]
Race/Ethnicity (Black)	-6.23	< .001	-0.02	[-0.03, -0.01]
Race/Ethnicity (Hispanic)	0.21	.830	0.001	[-0.005, 0.01]
Race/Ethnicity (Other)	2.50	.012	0.01	[0.002, 0.01]
Family Income (High)	2.10	.036	0.004	[0.0003, 0.01]
Family Income (Low)	-2.37	.018	-0.005	[-0.01, -0.001]
Age	-9.86	< .001	-0.001	[-0.002, -0.001]
Lead Risk	0.30	.765	0.0001	[-0.001, 0.001]
Maximum Parental Education	2.09	.037	0.002	[0.0001, 0.005]
Family Income (High) × Lead Risk	1.55	.122	0.001	[-0.0002, 0.002]
Family Income (Low) × Lead Risk	-0.12	.908	-0.0001	[-0.001, 0.001]

Note: The linear mixed-effects model incorporates testing the statistical significance of coefficients against a *t*-distribution. Family Income was a categorical, effects-coded factor, in which the level "Mid" served as the reference level. Family Income was operationally defined as the self-reported combined family income and partitioned into three levels: Low Income: ≤ $50K; Mid Income: $50K-$100K; High Income: ≥ $100K. Sex was also a categorical factor, effect coded with Male/Female as -1/+1. Race/Ethnicity was also a categorical factor, in which "White" served as the reference level. Age, Maximum Parental Education (i.e., highest education level between parents/caregivers), and Lead Risk were centered continuous factors. The random effects structure included a random intercept for study site and family identification number. Random effects were restricted to be uncorrelated. Analysis included 9,712 data points. The model accounted for 59.5% of the variance in the cortical thickness data (R^2 = .595, adjusted R^2 = .595).

Supplementary Table 5. Linear mixed-effects model output for the analysis of lead risk, family income, and whole-brain total cortical surface area.

	t(9699)	*p*	*b*	95% CI
Intercept	157.08	< .001	181957.08	[179686.45, 184227.72]
Sex	-55.75	< .001	-8267.19	[-8557.89, -7976.50]
Race/Ethnicity (Asian)	0.04	.966	38.90	[-1752.55, 1830.34]
Race/Ethnicity (Black)	-13.21	< .001	-6307.13	[-7243.24, -5371.02]
Race/Ethnicity (Hispanic)	0.93	.354	397.49	[-443.03, 1238.02]
Race/Ethnicity (Other)	2.27	.023	1057.35	[143.88, 1970.82]
Family Income (High)	3.97	< .001	1122.57	[567.70, 1677.44]
Family Income (Low)	-4.49	< .001	-1379.70	[-1981.67, -777.73]
Age	0.32	.749	6.15	[-31.57, 43.86]
Lead Risk	-0.39	.699	-24.03	[-145.81, 97.75]
Maximum Parental Education	6.71	< .001	1198.43	[848.42, 1548.44]
Family Income (High) × Lead Risk	0.12	.902	9.46	[-140.56, 159.49]
Family Income (Low) × Lead Risk	-2.51	.012	-205.12	[-365.03, -45.21]

Note: The linear mixed-effects model incorporates testing the statistical significance of coefficients against a *t*-distribution. Family Income was a categorical, effects-coded factor, in which the level "Mid" served as the reference level. Family Income was operationally defined as the self-reported combined family income and partitioned into three levels: Low Income: ≤ $50K; Mid Income: $50K-$100K; High Income: ≥ $100K. Sex was also a categorical factor, effect coded with Male/Female as -1/+1. Race/Ethnicity was also a categorical factor, in which "White" served as the reference level. Age, Maximum Parental Education (i.e., highest education level between parents/caregivers), and Lead Risk were centered continuous factors. The random effects structure included a random intercept for study site and family identification number. Random effects were restricted to be uncorrelated. Analysis included 9,712 data points. The model accounted for 79.1% of the variance in the cortical surface area data (R^2 = .791, adjusted R^2 = .791).

Supplementary Table 6. Linear mixed-effects model output for the analysis of lead risk, family income, and whole-brain total cortical volume.

	t(9699)	*p*	*b*	95% CI
Intercept	302.28	< .001	576599.07	[572860.02, 580338.11]
Sex	-49.60	< .001	-23727.95	[-24665.62, -22790.29]
Race/Ethnicity (Asian)	-1.64	.102	-4802.45	[-10552.96, 948.06]
Race/Ethnicity (Black)	-15.25	< .001	-23290.06	[-26284.10, -20296.03]
Race/Ethnicity (Hispanic)	0.99	.321	1354.97	[-1322.99, 4032.92]
Race/Ethnicity (Other)	3.41	.001	5118.25	[2180.22, 8056.28]
Family Income (High)	4.98	< .001	4522.01	[2740.77, 6303.26]
Family Income (Low)	-5.43	< .001	-5352.81	[-7286.30, -3419.32]
Age	-5.54	< .001	-344.06	[-465.76, -222.35]
Lead Risk	-0.01	.991	-2.16	[-388.92, 384.59]
Maximum Parental Education	7.41	< .001	4255.53	[3129.91, 5381.15]
Family Income (High) × Lead Risk	1.05	.292	258.92	[-222.81, 740.66]
Family Income (Low) × Lead Risk	-2.46	.014	-643.67	[-1156.87, -130.47]

Note: The linear mixed-effects model incorporates testing the statistical significance of coefficients against a *t*-distribution. Family Income was a categorical, effects-coded factor, in which the level "Mid" served as the reference level. Family Income was operationally defined as the self-reported combined family income and partitioned into three levels: Low Income: ≤ $50K; Mid Income: $50K-$100K; High Income: ≥ $100K. Sex was also a categorical factor, effect coded with Male/Female as -1/+1. Race/Ethnicity was also a categorical factor, in which "White" served as the reference level. Age, Maximum Parental Education (i.e., highest education level between parents/caregivers), and Lead Risk were centered continuous factors. The random effects structure included a random intercept for study site and family identification number. Random effects were restricted to be uncorrelated. Analysis included 9,712 data points. The model accounted for 76.4% of the variance in the cortical volume data (R^2 = .764, adjusted R^2 = .764).

Supplementary Table 7. Linear mixed-effects model output for the analysis of lead risk, area deprivation index (ADI), and cognitive test scores.

	t(9699)	*p*	*b*	95% CI
Intercept	326.42	< .001	82.85	[82.36, 83.35]
Sex	4.11	< .001	0.31	[0.16, 0.46]
Race/Ethnicity (Asian)	5.49	< .001	2.52	[1.62, 3.42]
Race/Ethnicity (Black)	-17.69	< .001	-4.24	[-4.71, -3.77]
Race/Ethnicity (Hispanic)	-2.04	.042	-0.43	[-0.85, -0.02]
Race/Ethnicity (Other)	2.83	.005	0.66	[0.20, 1.12]
Age	36.90	< .001	0.37	[0.35, 0.39]
Lead Risk	-0.56	.575	-0.02	[-0.10, 0.05]
Maximum Parental Education	25.89	< .001	2.05	[1.89, 2.20]
ADI (High)	-5.82	< .001	-1.20	[-1.60, -0.80]
ADI (Low)	7.13	< .001	1.08	[0.78, 1.38]
ADI (High) × Lead Risk	0.14	.892	0.01	[-0.11, 0.13]
ADI (Low) × Lead Risk	1.80	.072	0.08	[-0.01, 0.16]

Note: The linear mixed-effects model incorporates testing the statistical significance of coefficients against a *t*-distribution. Area Deprivation Index (ADI) was a categorical, effects-coded factor, in which the level "Mid" served as the reference level. ADI was computed in accordance with the coefficient values described in Kind et al. [36], re-coded in terms of national percentile (i.e., higher values reflect greater levels of disadvantage), and then discretized into Low- (ADI: 0-32), Mid- (33-66), and High-ADI categories (67-100). Sex was also a categorical factor, effect coded with Male/Female as -1/+1. Race/Ethnicity was also a categorical factor, in which "White" served as the reference level. Age, Maximum Parental Education (i.e., highest education level between parents/caregivers), and Lead Risk were centered continuous factors. The random effects structure included a random intercept for study site and family identification number. Random effects were restricted to be uncorrelated. Analysis included 9,712 data points. The model accounted for 64.8% of the variance in the cognitive test score data (R^2 = .648, adjusted R^2 = .648).

Supplementary Table 8. Linear mixed-effects model output for the analysis of lead risk, area deprivation index (ADI), and whole-brain mean cortical thickness.

	t(9699)	*p*	*b*	95% CI
Intercept	237.87	< .001	2.75	[2.73, 2.77]
Sex	5.73	< .001	0.01	[0.004, 0.01]
Race/Ethnicity (Asian)	-2.67	.008	-0.02	[-0.03, -0.004]
Race/Ethnicity (Black)	-6.50	< .001	-0.02	[-0.03, -0.01]
Race/Ethnicity (Hispanic)	0.07	.944	0.0002	[-0.01, 0.01]
Race/Ethnicity (Other)	2.58	.010	0.01	[0.002, 0.01]
Age	-9.84	< .001	-0.001	[-0.002, -0.001]
Lead Risk	0.95	.344	0.0005	[-0.001, 0.001]
Maximum Parental Education	3.45	.001	0.004	[0.002, 0.01]
ADI (High)	-1.34	.180	-0.004	[-0.01, 0.002]
ADI (Low)	1.16	.247	0.002	[-0.002, 0.01]
ADI (High) × Lead Risk	0.89	.376	0.001	[-0.001, 0.002]
ADI (Low) × Lead Risk	-0.53	.596	-0.0003	[-0.001, 0.001]

Note: The linear mixed-effects model incorporates testing the statistical significance of coefficients against a *t*-distribution. Area Deprivation Index (ADI) was a categorical, effects-coded factor, in which the level "Mid" served as the reference level. ADI was computed in accordance with the coefficient values described in Kind et al. [36], re-coded in terms of national percentile (i.e., higher values reflect greater levels of disadvantage), and then discretized into Low- (ADI: 0-32), Mid- (33-66), and High-ADI categories (67-100). Sex was also a categorical factor, effect coded with Male/Female as -1/+1. Race/Ethnicity was also a categorical factor, in which "White" served as the reference level. Age, Maximum Parental Education (i.e., highest education level between parents/caregivers), and Lead Risk were centered continuous factors. The random effects structure included a random intercept for study site and family identification number. Random effects were restricted to be uncorrelated. Analysis included 9,712 data points. The model accounted for 59.5% of the variance in the cortical thickness data (R^2 = .595, adjusted R^2 = .595).

Supplementary Table 9. Linear mixed-effects model output for the analysis of lead risk, area deprivation index (ADI), and whole-brain total cortical surface area.

	t(9699)	*p*	*b*	95% CI
Intercept	155.20	< .001	181086.73	[178799.56, 183373.91]
Sex	-55.58	< .001	-8249.36	[-8540.30, -7958.42]
Race/Ethnicity (Asian)	0.04	.967	38.34	[-1755.13, 1831.82]
Race/Ethnicity (Black)	-13.24	< .001	-6364.22	[-7306.73, -5421.71]
Race/Ethnicity (Hispanic)	0.65	.517	278.60	[-563.54, 1120.74]
Race/Ethnicity (Other)	2.37	.018	1102.59	[189.16, 2016.01]
Age	0.48	.634	9.15	[-28.56, 46.87]
Lead Risk	-0.12	.907	-9.25	[-164.12, 145.63]
Maximum Parental Education	9.65	< .001	1530.30	[1219.42, 1841.19]
ADI (High)	-2.53	.012	-1066.67	[-1894.19, -239.15]
ADI (Low)	3.34	.001	1053.14	[434.58, 1671.70]
ADI (High) × Lead Risk	-1.20	.231	-149.30	[-393.50, 94.90]
ADI (Low) × Lead Risk	0.15	.883	12.82	[-157.71, 183.36]

Note: The linear mixed-effects model incorporates testing the statistical significance of coefficients against a *t*-distribution. Area Deprivation Index (ADI) was a categorical, effects-coded factor, in which the level "Mid" served as the reference level. ADI was computed in accordance with the coefficient values described in Kind et al. [36], re-coded in terms of national percentile (i.e., higher values reflect greater levels of disadvantage), and then discretized into Low- (ADI: 0-32), Mid- (33-66), and High-ADI categories (67-100). Sex was also a categorical factor, effect coded with Male/Female as -1/+1. Race/Ethnicity was also a categorical factor, in which "White" served as the reference level. Age, Maximum Parental Education (i.e., highest education level between parents/caregivers), and Lead Risk were centered continuous factors. The random effects structure included a random intercept for study site and family identification number. Random effects were restricted to be uncorrelated. Analysis included 9,712 data points. The model accounted for 79.1% of the variance in the cortical surface area data (R^2 = .791, adjusted R^2 = .791).

Supplementary Table 10. Linear mixed-effects model output for the analysis of lead risk, area deprivation index (ADI), and whole-brain total cortical volume.

	t(9699)	*p*	*b*	95% CI
Intercept	298.07	< .001	572919.63	[569151.96, 576687.30]
Sex	-49.45	< .001	-23681.37	[-24620.07, -22742.67]
Race/Ethnicity (Asian)	-1.63	.104	-4781.29	[-10543.10, 980.52]
Race/Ethnicity (Black)	-15.37	< .001	-23700.13	[-26723.17, -20677.09]
Race/Ethnicity (Hispanic)	0.60	.549	821.47	[-1866.73, 3509.66]
Race/Ethnicity (Other)	3.58	< .001	5361.87	[2422.47, 8301.28]
Age	-5.39	< .001	-334.44	[-456.17, -212.71]
Lead Risk	0.62	.534	155.67	[-334.93, 646.27]
Maximum Parental Education	10.95	< .001	5577.17	[4578.46, 6575.88]
ADI (High)	-3.16	.002	-4237.52	[-6864.49, -1610.55]
ADI (Low)	3.77	< .001	3754.26	[1804.58, 5703.95]
ADI (High) × Lead Risk	-0.41	.683	-162.36	[-941.45, 616.73]
ADI (Low) × Lead Risk	-0.24	.808	-67.47	[-611.99, 477.06]

Note: The linear mixed-effects model incorporates testing the statistical significance of coefficients against a *t*-distribution. Area Deprivation Index (ADI) was a categorical, effects-coded factor, in which the level "Mid" served as the reference level. ADI was computed in accordance with the coefficient values described in Kind et al. [36], re-coded in terms of national percentile (i.e., higher values reflect greater levels of disadvantage), and then discretized into Low- (ADI: 0-32), Mid- (33-66), and High-ADI categories (67-100). Sex was also a categorical factor, effect coded with Male/Female as -1/+1. Race/Ethnicity was also a categorical factor, in which "White" served as the reference level. Age, Maximum Parental Education (i.e., highest education level between parents/caregivers), and Lead Risk were centered continuous factors. The random effects structure included a random intercept for study site and family identification number. Random effects were restricted to be uncorrelated. Analysis included 9,712 data points. The model accounted for 76.5% of the variance in the cortical volume data (R^2 = .765, adjusted R^2 = .765).

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