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Supplemental Material

Children's Lead Exposure: A Multimedia Modeling Analysis to Guide Public Health Decision-Making

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Table of Contents

Table S2. Comparison of SHEDS-IEUBK and IEUBK batch for a population of 8872 individuals with nominal blood values of 1-5 Pb μg/dL.

Table S3. Summary of Main SHEDS-IEUBK Inputs for Multimedia Pb Analysis

Table S4. Pb Statistics from NHEXAS Region 5 Study (based on Clayton et al., 1999)

Table S5. Correlation Coefficients Inputs for Lead Exposure Assessment based on Clayton et al., 1999 and HUD data

Table S6. SHEDS-IEUBK Evaluation (National Scale, 2-day averaging time analysis)

Table S7. Prediction of Blood Lead Concentration (μg/dL) for NHEXAS Region 5 Study

Table S8. Sensitivity analyses on Dietary Pb Intake and Soil/Dust Ingestion factors (ages 1 to <6 years; NHANES 2009-2014)

Table S9. Impact of Using Alternate Soil/Dust Ingestion Rate from von Lindern et al. 2016

Table S10. Impact of Using Alternate Soil/Dust Ingestion Rate Assuming 80mg/day

SUPPLEMENTARY MATERIAL

S1. SHEDS-IEUBK Model Coupling Methodology

IEUBK is comprised of four components: exposure, uptake, biokinetic, and probability distribution. The aim for this analysis was to have SHEDS serve the role of IEUBK's exposure component. The IEUBK exposure component maps, by age, user-specified media concentration (e.g., µg-Pb per L-water, mg-Pb per kg-soil) to consumption or intake of media (e.g., liters water consumed, grams soil ingested), giving age–specific lead intakes (µg/day). Similarly, through Monte Carlo simulation SHEDS produces a population of lead intakes (µg/day). Ordinarily, lead intakes are processed by IEUBK's uptake and biokinetic components to give a corresponding age-specific blood lead (µg/dL). Conveniently, IEUBK batch mode allows for users to directly input a set of lead intakes (µg/day), associated child ages (months), and associated bioavailability (dimensionless, 0 – 100) to provide blood lead predictions. However, an aggregate assessment has a minor complication because each media has its own media-specific bioavailability. In order to allow for an aggregate simulation (across all media) it is necessary to *pre-apply* the media-specific bioavailability factors, sum the available intakes and consider that this total available intake is 100% available for gastrointestinal (GI) uptake. For GI bioavailability of children, we assumed 30% for soil and dust; 50% for water and food based on IEUBK model defaults as described in Chapter 4 of the IEUBK Guidance Manual (U.S. EPA, 1994).

In order to render this process efficient for population simulation, regression equations relating lead uptake (µg/day) to blood lead (µg/dL) were developed using IEUBK, thereby allowing

SHEDS to make blood predictions completely standalone. This approach constitutes 'SHEDS-IEUBK'. Figure S1 shows age-specific relationships between available intake (μg/day) and blood lead (μg/dL). These relationships are deterministic yet non-linear due to saturable uptake in the GI. By considering the passive and saturable processes in the GI which determine uptake (via IEUBK methodology), the age-dependent relationship between lead intake and uptake was determined. The relationship between lead uptake and blood lead was shown to be approximately linear (Figure S1, right panel). Thus it was more desirable to have SHEDS extend its calculation of available intake to uptake and then apply regression equations to compute blood lead (ug/dL). IEUBK methodology assumes a fraction of GI intake (PAF) to be passively and completely absorbed. The PAF is pre-set at 20%. The compliment, a fraction (1-PAF), 80%, is subject to a saturable process. The amount of lead that is absorbed by this saturable process as described in the IEUBK Technical Support Document (U.S. EPA, 1994b):

$$\frac{(1 - PAF)\ x\ AVINTAKE(t)}{1 + \frac{AVINTAKE(t)}{SATINTAKE(t)}} \qquad (Equation\ S-1)$$

Where the variable AVINTAKE(t) is the total available intake (μg/day) for a child of age t (months). SATINTAKE(t) is constant for specific age (months), and given by Equation U-3 in the IEUBK Technical Support Document:

$$SATINTAKE(t) = SATINTAKE(24)\ x \frac{WTBODY(t)}{WTBODY(24)} \qquad (Equation\ S-2)$$

Where SATINTAKE(24) is the value for a 24 month,100 μg/day. Body weight, WTBODY(t) for a given month is given by Equations B5-f in the IEUBK Technical Support Document. The weight for a 24 month old, WTBODY(24), is 12.34 kg. Thus, the GI uptake is calculated as 20% available intake plus the amount of GI returned by Equation S-1. Available intake via the inhalation pathway is not subject to saturation and is added directly to the total uptake (μg/day). Although the relationship between total uptake and blood lead appears linear it is not perfectly linear. Polynomial regression was used to address slight departures from linearity thought to arise from non-linear binding of lead to red blood cells (not addressed by the GI saturation process). Additionally, there is a small intercept because of the assumption of maternal blood lead of 1 μg/dL. Table S1 shows age-specific regressions used to describe these age-dependent relationships. The coefficients pertain to a third-order polynomial regression.

$$\text{Blood Pb } (\mu g/dL) = \beta o + \beta_1 \text{ Uptake} + \beta_2 \text{ Uptake}^2 + \beta_3 \text{ Uptake}^3 + \varepsilon \qquad (Equation\ S-3)$$

Because of the high precision of the regressions (R^2>0.995), the outcome is essentially an analytical solution. Table S2 shows that regression estimates (SHEDS-IEUBK) and SHEDS available intakes processed by IEUBK (IEUBK Batch) agree to within 0.5% relative error on average. By applying regression equations in SHEDS relating lead uptake (μg/day) to lead blood (μg/dL) which were derived directly from IEUBK, the direct use of IEUBK is circumvented. This was an important practical matter to enable blood lead predictions for a population.

The above described SHEDS-IEUBK approach was only applied to children from birth up to 7 years of age, the age range limits of the IEUBK model. For simulation of 161 adults in NHEXAS (N=165), the Adult Lead Model (U.S. EPA, 2001) slope factor of 0.4 dL/day was applied to available intake. To convert intake to available intake for adults over 25 years of age, absorption factors of 12%, 12%, 20%, and 20% were applied for soil, dust, water, and diet, respectively. For individuals between 15 and 25 years of age absorption factors were linearly interpolated between adult values and IEUBK values used for children (30%, 30%, 50%, 50%) as per the guidance of Leggett et al. (1993).

S2. Summary of Key Model Input Values

One of the challenges of this work was identifying and compiling the available datasets from different studies and sampling times, not originally intended for this purpose, to develop probability exposure distributions and intake distributions for the various exposure pathways. Concentrations of lead in food, soil, and dust were derived from data provided by the U.S. Food and Drug Administration and the U.S. Department of Housing and Urban Development. Table S3 summarizes data and values used for key model inputs (that impacted the outputs) for the analyses.

More details on key model inputs are provided below. At current ambient conditions, maximum 3-month average airborne Pb concentrations are at or below 0.01 $\mu g/m^3$ (EPA, 2016) and contribute negligibly to predicted BLL. Nationally, average maternal BLL are also sufficiently low so as to not appreciably affect children’s predicted BLL beyond the first couple months of life.

Soil/Dust Ingestion Rate

The soil/dust ingestion rate for children is a key input to which model results are highly sensitive, and for which data are limited and uncertain, especially for children <2 years; for older ages, values are similar between Ozkaynak et al. 2011 and von Lindern et al. (2016) using different methodologies. This analysis used the approach in Ozkaynak et al. (2011) for modeling soil/dust ingestion distributions by age in years. As stated in the 2011 EPA Exposure Factor Handbook: "The advantages of this study include the fact that the SHEDS methodology can be applied to specific study populations of interest, a wide range of input parameters can be applied, and a full range of distributions can be generated." For 0-6-month-olds, analyses we assumed same soil/dust ingestion rate as 1-year-olds due to lack of data. It is important to note that there is uncertainty in this modeled age group due to lack of input data, and lack of NHANES BLL data to evaluate the model predictions for this age group.

Soil and Dust Pb Concentration

For soil Pb concentration, we initially fit an empirical distribution to data provided by Housing and Urban Development (HUD) from the 2005-2006 American Healthy Homes Survey (AHHS), a national probability sample, with a sample size of 942 and a mean of 169 ppm (summarized in HUD (2011); http://portal.hud.gov/hudportal/documents/huddoc?id=AHHS_Report.pdf)

and used the IEUBK default for dust Pb concentration as 70% of the soil Pb concentration.

In conducting the SHEDS-IEUBK analysis following peer consult, for both soil and dust Pb concentrations, we fit an empirical distribution to data provided by HUD from that study. The data were stratified and weighted by house age pre- and post-1950, and a correlation coefficient of 0.48 between dust and soil Pb concentrations was assigned in SHEDS based on the HUD/AHHS data and 0.2 for correlation between dust Pb and water Pb concentrations, from the NHEXAS Region 5 study (Clayton et al., 1999).

Food Pb Intake

For food Pb intake, this analysis used the Food and Drug Administration (FDA)'s Total Diet Study data 2007-2013, fitting an empirical distribution (using the published Xue et al., 2010 method for modeling non-detects) and FDA's file for mapping food items from TDS to NHANES in SHEDS-Multimedia (U.S. FDA, 2016). Three approaches were considered for treatment of non-detects, as shown in Table S8. How non-detects are handled is important especially for lower percentiles. We observed over-prediction with half LOD for all non-detects; under-prediction with zero for all non-detects; and good model evaluation (low relative error modeled vs. measured) using the Xue et al. (2010) "sens3" approach.

Bioavailability

For bioavailability, we assumed 30% for soil and dust; 50% for water and food based on IEUBK model defaults. A variety of factors are well recognized to affect the absorption of Pb in the gastrointestinal (GI) tract such as fasting, nutritional status, and the physicochemical nature of Pb in media as described in Chapter 4 of the IEUBK Guidance Manual (EPA, 1994). Recognizing that there can be considerable variability in bioavailability and concerns about the experimental design of some studies assessing bioavailability, the IEUBK Guidance Manual recommends a bioavailability default of 30% absolute absorption of Pb from soil and dust. Dietary Pb absorption is thought to be very high in infants and to decrease with age. The IEUBK Guidance

Manual recommends a bioavailability default of 50% absolute absorption of Pb from dietary sources recognizing that it may slightly overestimate dietary uptake in older children. The Guidance Manual also recommends a bioavailability default of 50% absolute absorption of Pb from water as plausible for children. After taking account of the bioavailability of Pb in these media, effects of Pb intake rates and age on saturable GI absorption of Pb are estimated in the IEUBK model using a non-linear regression model that is directly comparable to the Michaelis-Menten formula.

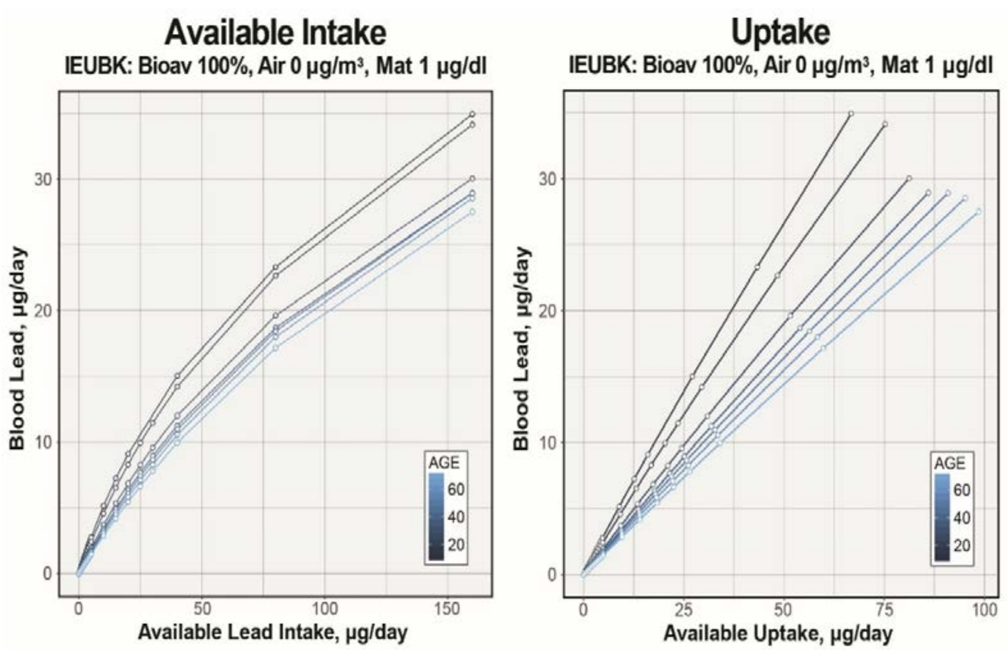
Drinking Water Consumption

Daily water consumption values by age (ml/day) were obtained from NHANES 2005-2011 data. Note we used NHANES data rather than EPA's Exposure Factors Handbook (U.S. EPA, 2011) Table 3-1 values for this input, because the SHEDS-Multimedia simulates drinking water exposures using diaries from NHANES that report the daily amount of water individuals in the study consumed. These data do not reflect consumption of bottled water.

Water Pb Concentration

A main goal of this analysis was to solve for drinking water Pb concentration that would keep the BLL below specified "targets," with known Pb exposure data for the other media and BLLs. However, for national-scale SHEDS-IEUBK model evaluation analyses for Pb, we used an empirical distribution from EPA's Office of Water data from Second Six-year Review National Compliance Monitoring Information Collection Request (ICR) Dataset; this "Six-Year Review 2 ICR Dataset" was collected through an Information Collection Request to all States and primacy entities to voluntarily submit their Safe Drinking Water Act (SDWA) compliance monitoring data collected between 1/1998 and 12/2005 for regulated contaminants (see USEPA, 2009). These data represent the national occurrence of regulated contaminants in public drinking water systems. They may not reflect water systems or homes with lead service lines. The average, 95th percentile and 99th percentile values from this data set are 0.89, 2.25 and 13.27 ug/L, respectively.

Figure S1. Age-specific relationships between available intake (μg/day) and blood lead (μg/dL)



Left Panel: IEUBK batch mode output. For each age (months), there is a deterministic non-linear relationship between available intake (μg/day) and blood lead (μg/dL). Right Panel: By accounting for saturable process in the GI, a linear relationship between uptake (mg/day) and blood lead (μg/dL) is observed.

Figure S2. SHEDS-IEUBK Predicted BLL Evaluation with 2009-2014 NHANES Data, for 2-Day Analysis (children 1 to <6 years)

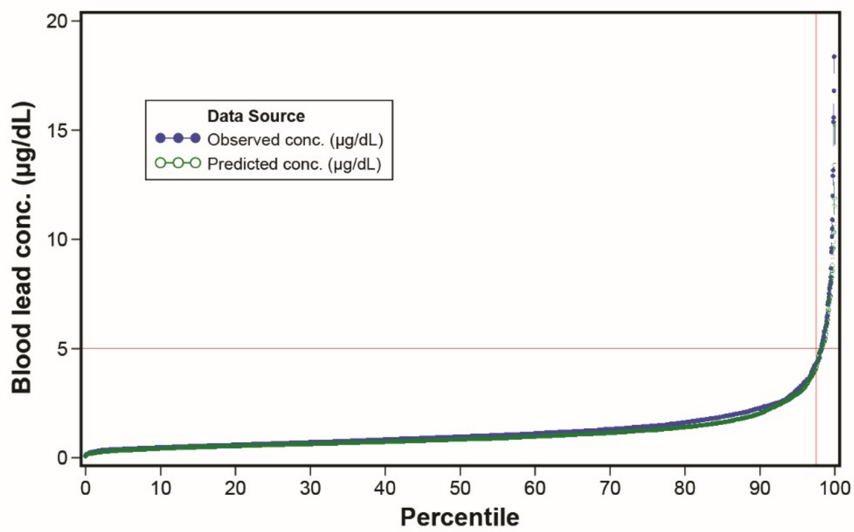


Figure S3. SHEDS-IEUBK Evaluation for different NHANES sampling times (2-day averaging time analyses), 1 to <6 year-olds

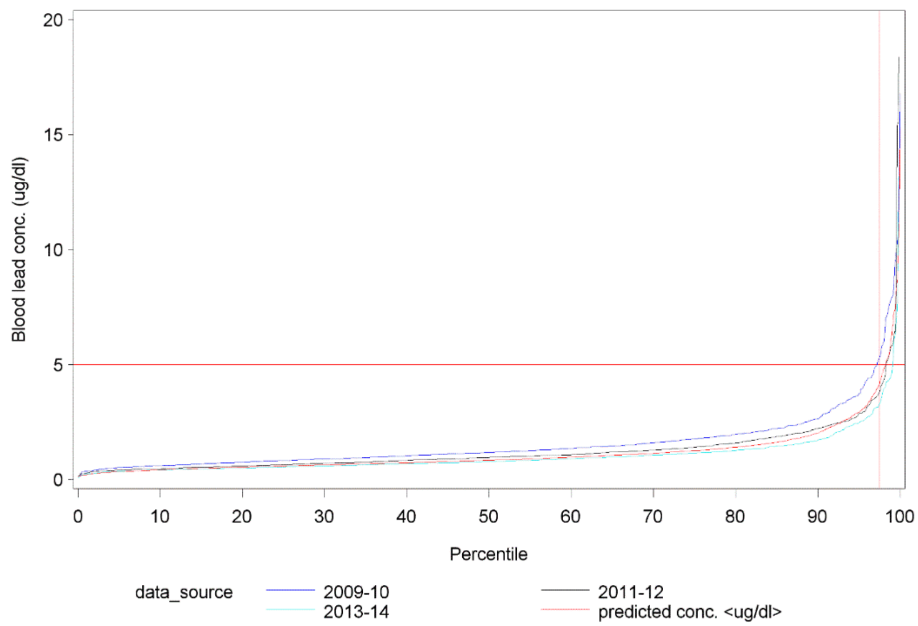


Figure S4. SHEDS-IEUBK Evaluation for different NHANES sampling periods 2009-2014 (30-day averaging time analyses), 1 to <6 year-olds

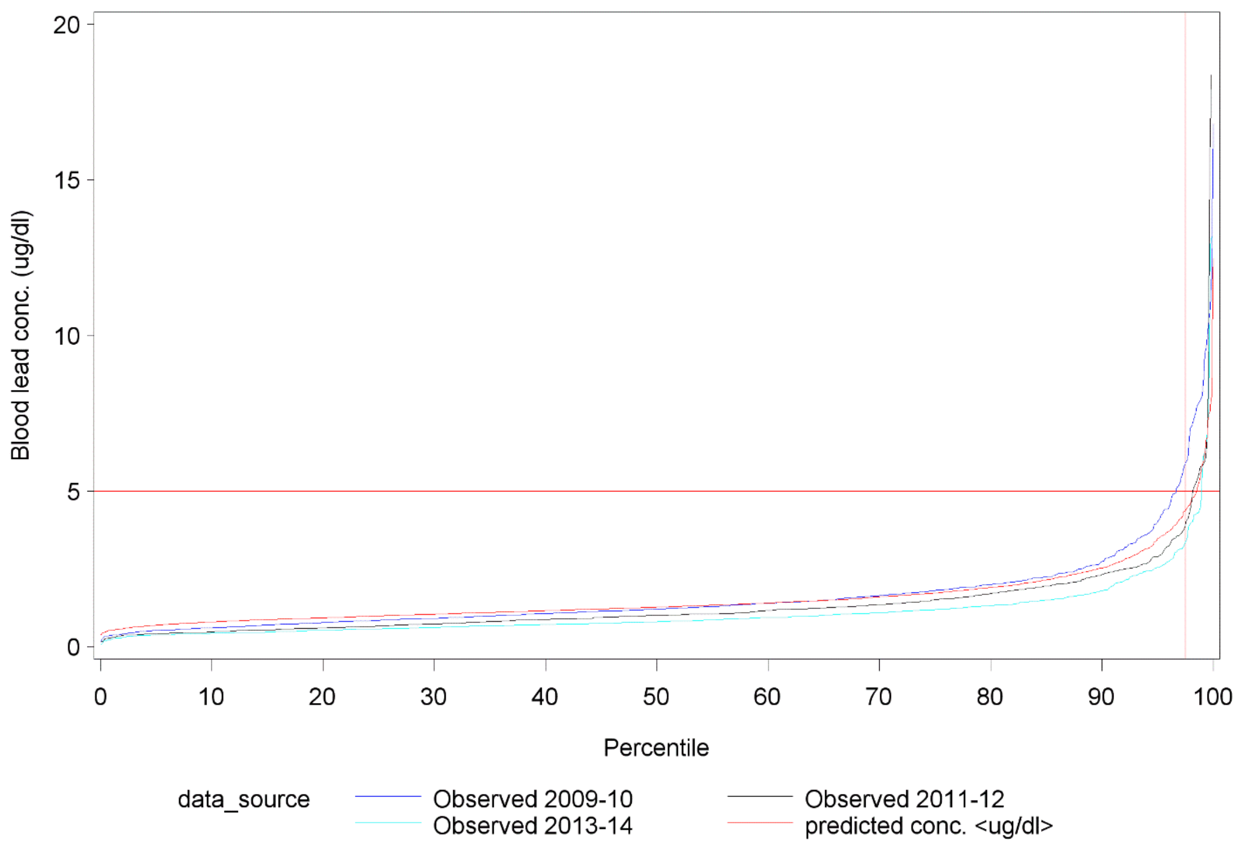
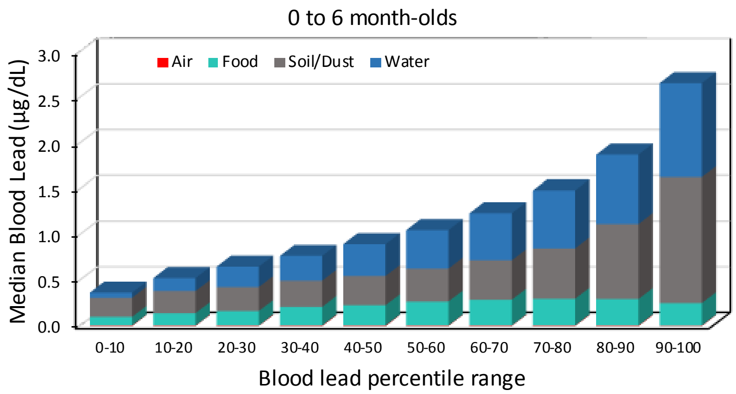
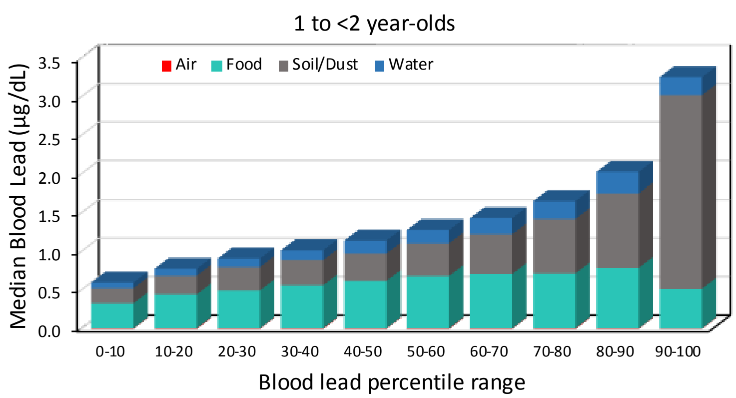


Figure S5. Estimated Relative Contribution to BLL by Exposure Pathway adjusted for bioavailability of each pathway for U.S. children (0 to 6 months, 1 to <2 year-olds, and 2 to <6 years) using available data (30-day averaging time analyses; BLL on y-axis)





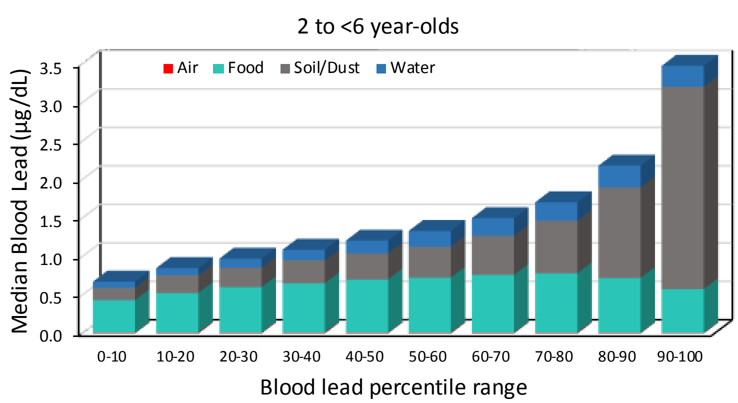


Figure S6. Percent Contribution by Pathway adjusted for bioavailability of each media for NHEXAS Region 5 Study

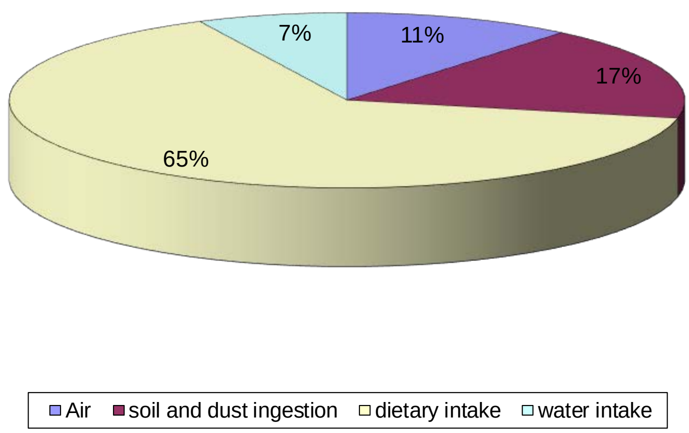


Figure S7. Impact of using von Lindern et al. (2016) Soil/Dust Ingestion Rate: SHEDS-IEUBK BLL estimates vs. NHANES years 2009-14; 1 to <2 year-olds

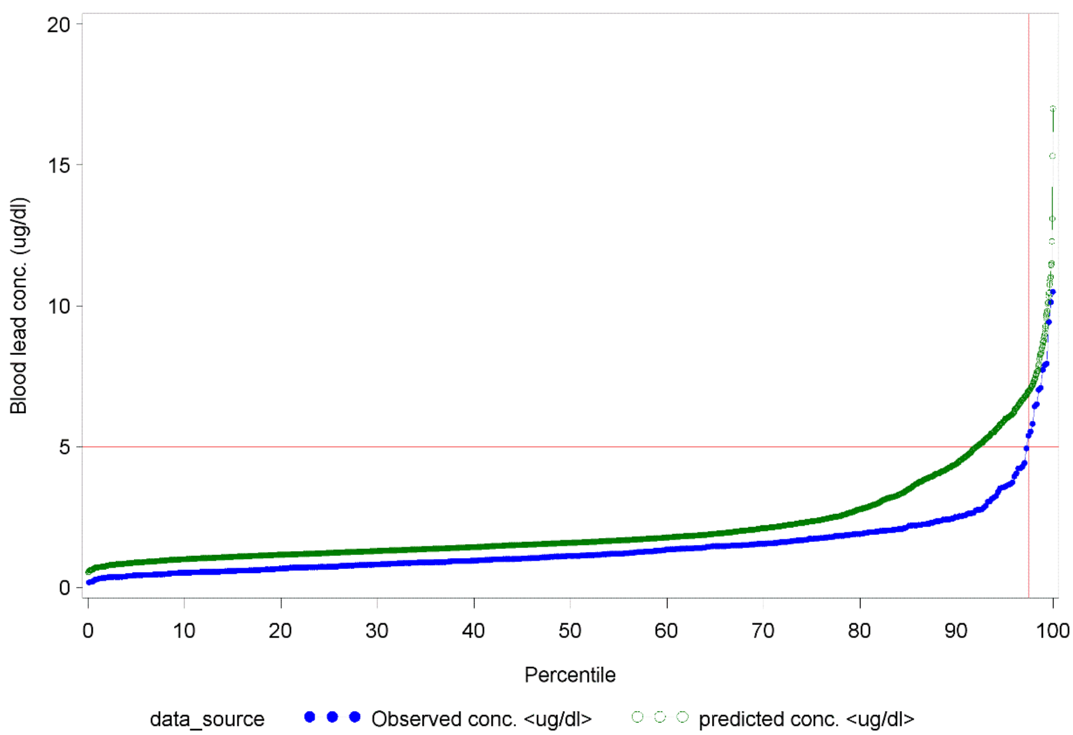


Table S1. Age-specific regressions for relationship between GI uptake (µg/day) and blood lead concentration (µg/dL)

IEUBK Age Interval (year)	*Age (months)*	β_0	β_1	β_2	$\beta 3$
0.5 - 1	*9*	*7.86E-03*	*5.47E-01*	*-0.001307607*	*6.01E-06*
1 - 2	*18*	*-3.11E-04*	*4.47E-01*	*-0.000637203*	*1.53E-06*
2 - 3	*30*	*1.23E-03*	*3.79E-01*	*-0.000429113*	*8.45E-07*
3 - 4	*42*	*6.58E-04*	*3.55E-01*	*-0.000370716*	*6.24E-07*
4 - 5	*54*	*6.36E-04*	*3.36E-01*	*-0.000337753*	*5.44E-07*
5 - 6	*66*	*1.65E-03*	*3.13E-01*	*-0.00027834*	*3.57E-07*
6 - 7	*78*	*1.32E-04*	*2.88E-01*	*-0.000230444*	*3.08E-07*
$R^2 > 0.995$					

Table S2. Comparison of SHEDS-IEUBK and IEUBK batch for a population of 8872 individuals with nominal blood values of 1-5 Pb µg/dL.

Method	n	mean	.05	.10	.25	.50	.75	.90	.95
				Age: 18, 30, 42, 54, 66, 78 months					
SHEDS-IEUBK	8872	1.557	0.941	0.970	1.037	1.202	1.546	2.395	3.369
IEUBK Batch	8872	1.546	0.94	0.97	1.03	1.20	1.54	2.38	3.34
Rel error	**0.4%**	0.7%	0.1%	0.0%	0.7%	0.2%	0.4%	0.6%	0.9%
				Age: 18 months					
SHEDS-IEUBK	1792	1.683	1.131	1.146	1.203	1.333	1.708	2.514	3.336
IEUBK Batch	1792	1.672	1.13	1.14	1.2	1.33	1.70	2.50	3.30
Rel error	**0.5%**	0.7%	0.1%	0.5%	0.3%	0.2%	0.5%	0.6%	1.1%
				Age: 78 months					
SHEDS-IEUBK	1306	1.348	0.8647	0.8764	0.9133	1.0237	1.3409	2.0390	2.9489
IEUBK Batch	1306	1.34	0.860	0.870	0.910	1.020	1.34	2.025	2.923
Rel error	**0.5%**	0.6%	0.5%	0.7%	0.4%	0.4%	0.1%	0.7%	0.9%

Table S3. Summary of Main SHEDS-IEUBK Inputs for Multimedia Pb Analysis

Variable	*Source*	*Values/Distribution Used*									
		Age (years)	*N*	*Mean*	*Std*	*50th*	*GM*	*GSD*	*75th*	*95th*	*99th*
Dietary Pb Intake (µg/day)	*Data from FDA Total Diet Study 2007-2013 (TDS) & FDA-CSFAN Data for Recipe Mapping; Method from Xue et al., 2010 EHP*	*0-6 months*	*1072*	*0.70*	*0.98*	*0.30*	*0.27*	*4.75*	*0.91*	*2.71*	*3.47*
		1 Year	*2226*	*2.58*	*1.84*	*2.17*	*2.00*	*2.16*	*3.41*	*5.83*	*7.63*
		2 Year	*1788*	*3.44*	*2.03*	*3.06*	*2.85*	*1.94*	*4.49*	*7.23*	*8.46*
		3 Year	*1160*	*3.54*	*2.06*	*3.18*	*2.98*	*1.89*	*4.63*	*7.26*	*8.43*
		4 Year	*1240*	*3.57*	*2.16*	*3.18*	*3.00*	*1.87*	*4.55*	*7.25*	*8.63*
		5 Year	*1066*	*3.85*	*2.18*	*3.43*	*3.31*	*1.77*	*4.83*	*7.86*	*9.52*
		6 Year	*1086*	*3.80*	*2.02*	*3.51*	*3.29*	*1.76*	*4.84*	*7.55*	*8.30*

		Media	*House Age*	*N*	*Mean*	*Std*	*Median*	*GM*	*GSD*	*Fitted Log Mean*	*Fitted Log Std*	*75th*	*95th*	*99th*
Soil and Dust Pb Concs. (ppm)	*Empirical Distribution from HUD AHHS 2005-2006 Data http://portal.hud.gov/hudportal/documents/huddoc?id=AHHS_Report.pdf*	*Dust*	*Before 1950*	*223*	*207.7*	*238.2*	*113.3*	*133.9*	*2.47*	*4.89*	*0.88*	*238.6*	*706.6*	*1108.9*
		Dust	*After 1950*	*908*	*79.0*	*77.2*	*64.5*	*61.3*	*2.00*	*4.12*	*0.63*	*87.1*	*195.3*	*353.1*
		Soil	*Before 1950*	*193*	*532.2*	*912.6*	*203.2*	*221.1*	*3.89*	*5.38*	*1.30*	*774.5*	*1841.3*	*5793.7*
		Soil	*After 1950*	*749*	*63.7*	*202.0*	*19.2*	*23.0*	*3.37*	*3.18*	*1.05*	*39.9*	*207.7*	*933.3*

		Age	*Soil/Dust*	*Mean*	*Std*	*50th*	*GM*	*GSD*	*95th*	*97.5th*	*99th*
Soil/Dust Ingestion (mg/day)	*Ozkaynak et al., 2011 Risk Analysis*	*1*	*mg_total*	*43.9*	*54.8*	*27.8*	*26.6*	*2.8*	*135*	*188*	*262*
		2	*mg_total*	*45.2*	*58.8*	*25.8*	*25.9*	*3.0*	*146*	*201*	*276*
		3	*mg_total*	*51.7*	*64.2*	*31.1*	*28.9*	*3.2*	*168*	*220*	*304*
		4	*mg_total*	*57.8*	*75.5*	*34.0*	*31.6*	*3.2*	*197*	*268*	*364*
		5	*mg_total*	*62.6*	*79.8*	*37.9*	*34.4*	*3.2*	*204*	*270*	*380*
		6	*mg_total*	*54.3*	*76.1*	*30.4*	*29.2*	*3.2*	*183*	*252*	*357*

		Age (years)	*N*	*Mean*	*Std*	*P50*	*GM*	*GSD*	*P75*	*P95*	*P99*
Water Consumption (ml/day)	*NHANES 2005-2012*	*0-6 months*	*1246*	*662*	*320*	*630*	*526*	*2.5*	*854*	*1216*	*1481*
		0	*2618*	*581*	*349*	*532*	*410*	*3.0*	*806*	*1172*	*1489*
		1	*1792*	*247*	*247*	*219*	*151*	*3.3*	*306*	*690*	*1148*
		2	*1948*	*300*	*312*	*251*	*176*	*3.4*	*360*	*909*	*1424*
		3	*1272*	*316*	*313*	*257*	*193*	*3.1*	*398*	*917*	*1640*
		4	*1358*	*320*	*333*	*261*	*197*	*3.2*	*404*	*874*	*1434*
		5	*1196*	*364*	*366*	*303*	*213*	*3.5*	*447*	*1037*	*1802*
		6	*1306*	*377*	*353*	*332*	*228*	*3.5*	*480*	*1067*	*1601*

Bioavailability	*IEUBK Default*	*30% for soil & dust; 50% for water & food*

Table S4. Pb Statistics from NHEXAS Region 5 Study (based on Clayton et al., 1999)

Medium	unit	n	mean	std	gm	gsd	50th	95th	97.5th	99th
beverage	ug/kg	160	1.69	2.16	1.08	2.74	1.20	4.03	7.85	11.70
beverage and food	ug/kg	156	4.60	7.09	3.44	1.90	3.31	11.39	14.42	27.03
beverage and food intake	ug/day	156	10.48	18.51	7.48	2.03	7.30	20.87	34.23	54.07
beverage intake	ug/day	160	2.61	3.52	1.63	2.77	1.66	7.77	9.41	13.73
blood	ug/dl	165	2.28	1.92	1.76	2.01	1.80	5.60	7.60	11.30
first draw water	ug/l	444	3.88	6.11	1.85	3.63	2.02	13.90	17.40	26.60
flush water	ug/l	443	1.00	2.58	0.32	4.49	0.32	4.30	6.36	9.82
food	ug/kg	159	10.63	17.40	7.85	1.91	7.20	24.00	29.50	91.20
food intake	ug/day	159	7.77	18.16	4.95	2.27	4.78	17.62	25.20	53.55
indoor air	ng/m3	213	15.9	37.4	6.6	3.7	6.8	56.1	114.6	248.1
indoor dust concentration	ug/g	244	469.7	2104.5	114.0	6.4	132.8	1176.0	2398.0	7547.0
indoor surface dust	ng/cm2	245	567.4	7318.2	5.6	8.7	5.9	118.8	421.5	7767.0
outdoor air	ng/m3	87	13.0	13.8	9.2	2.3	9.0	56.7	59.4	71.9
personal air	ng/m3	167	25.5	40.1	14.0	2.8	12.9	87.2	169.2	221.7
window sill dust concentration	ug/g	239	987	2721	208	8	201	3671	9104	18510
window sill dust surface	ng/cm2	239	1917	10436	21	13	14	9348	25860	42630

Table S5. Correlation Coefficients Inputs for Lead Exposure Assessment based on Clayton et al., 1999 and HUD data

Media	Dust	Soil	Water
Dust Pb	1	0.48	0.2
Soil Pb	0.48	1	0.2
Water Pb	0.2	0.2	1

Table S6. SHEDS-IEUBK Evaluation (National Scale, 2-day averaging time analysis)

SHEDS-IEUBK BLL evaluation with 2009-2014 NHANES BLL data*
(1-6 years old)

source	N	mean	Std	50th	GM	GSD	95th	97.5th	99th	% higher than 5 ug/dl
Observed	2897	1.30	1.47	0.96	1.01	1.90	3.14	4.32	6.51	1.83
Predicted	3530	1.15	1.12	0.85	0.90	1.91	2.94	4.14	6.26	1.73
relative error		12%		11%	11%	1%	7%	4%	4%	

* dietary pb intake from estimates by SHEDS-dietary with half LOD for non-detect**
** only fill half LOD for food item with any detected measurements, TDS-NHANES mapping from FDA emperical distributions are used
*** Original n=942 HUD and replacement of extreme values with 1200 ppm for soil lead concentration

Table S7. Prediction of Blood Lead Concentration (µg/dL) for NHEXAS Region 5 Study

data source	sample size	Mean	Std	GM	GSD	50th	75th	95th	97.5th	99th
Observed	165	2.28	1.92	1.76	2.01	1.80	2.80	5.60	7.60	11.30
Predicted	165	1.43	1.35	1.10	2.04	1.15	1.61	3.41	4.53	7.26
relative error		37%		37%		36%	42%	39%	40%	36%

Table S8. Sensitivity analyses on Dietary Pb Intake and Soil/Dust Ingestion factors (ages 1 to <6 years; NHANES 2009-2014)

Secenario	detail	outcome
Dietary 1	fill in zero for non-detects, 2007-2012 NHANES data	under-predict for <75th BLL percentile
Dietary 2	fill in half LOD for non-detects, 2007-2012 NHANES data	over-predicted for <75th BLL percentile
Dietary 3	fill in half LOD for non-detects with food item with any detects	fit well for <75th BLL percentile
Soil/dust ingestion 1	Scale soil and dust ingestion rate into 100 mg/day	over-predict
Soil/dust ingestion 2	Scale soil and dust ingestion rate into 80 mg/day	over-predict
Soil/dust ingestion 3	Use soil and dust ingestion rate from von Lindern et al. (2016)	over-predict

Table S9. Impact of Using Alternate Soil/Dust Ingestion Rate from von Lindern et al. 2016

SHEDS-Multimedia BLL Evaluation with 2009-2014 NHANES blood data*

(1 to <2 years old)

source	N	mean	Std	50th	GM	GSD	95th	97.5th	99th	% higher than 3 ug/dl
Observed	475	1.47	1.30	1.12	1.16	1.92	3.60	5.54	7.90	6.95
Predicted	3000	2.19	1.69	1.59	1.81	1.76	5.95	6.99	8.74	18.10
relative error		49%		42%	57%		65%	26%	11%	

* soil and dust ingestion rate from von Lindern et al. 2016 and adjustment of biological varibility

Table S10. Impact of Using Alternate Soil/Dust Ingestion Rate Assuming 80mg/day

Daily average household tap water pb conc (ppb) that could keep BLL below specified values

		97.5th percentile		95th percentile	
Age group	Exposure Scenario	3.5	5	3.5	5
0 to 7 years old	Aggregate	--	5	2	13
0 to 7 years old**	Aggregate	--	1	--	10

30 day correlated inputs IG, adding biological variance

** adjusted to 80 mg/day