SUPPORTING INFORMATION
(8 PAGES, 3 TABLES, 3 FIGURES)

Blood and hair manganese concentrations in pregnant women from the Infants' Environmental Health Study (ISA) in Costa Rica

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TABLE OF CONTENTS

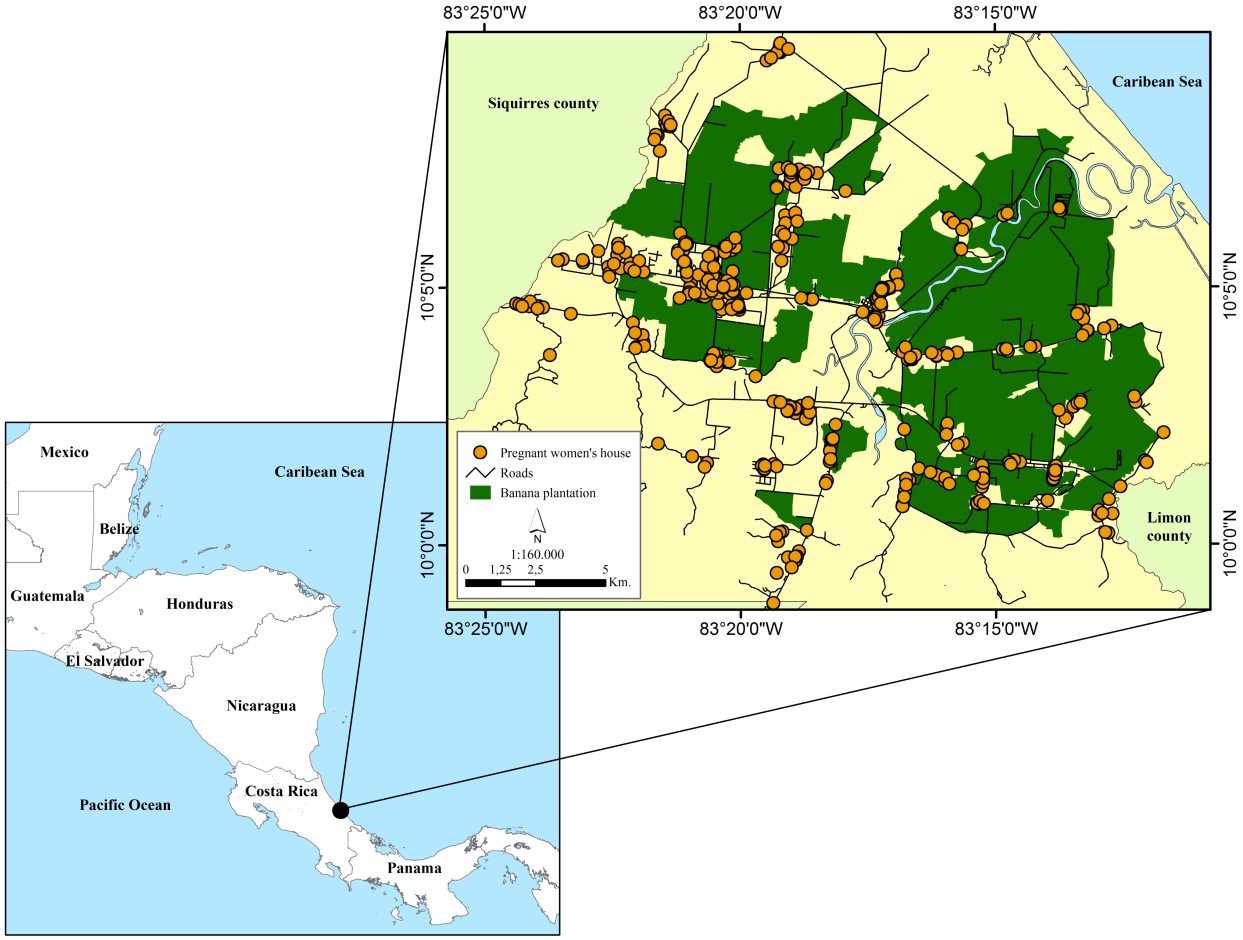

Figure S1. Map of prenatal residential locations and banana plantations in the Matina County, Costa Rica. Data source: Costa Rica Airborne Research and Technology Applications (CARTA) 2005 mission.

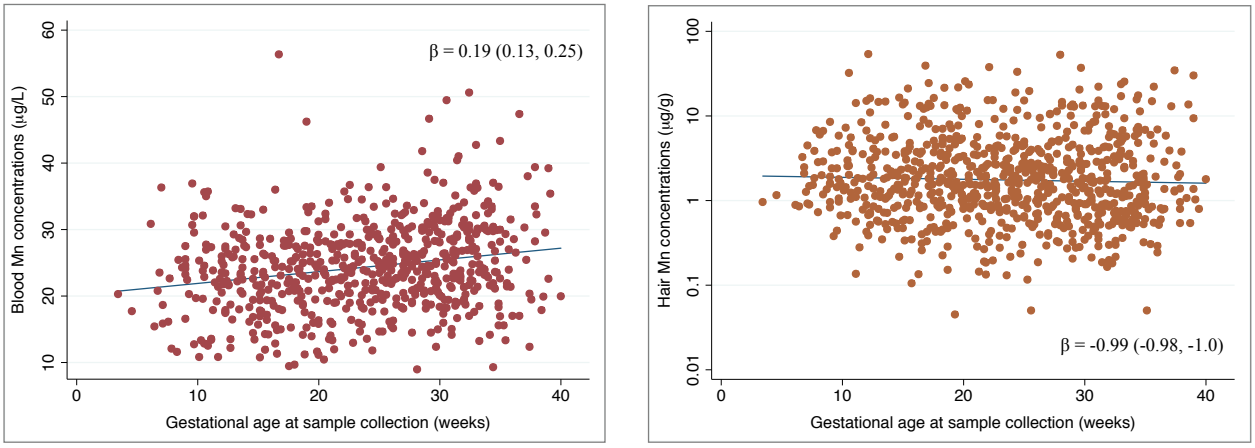

Figure S2. Distribution of (*A*) blood and (*B*) hair Mn concentrations (on the $\log_{10}$ scale) by gestational age at sample collection. Beta coefficients and 95% confidence intervals from unadjusted linear mixed-effects models.

Table S1. Final multivariate linear mixed-effects models for blood Mn concentrations (μg/L) in pregnant women from the ISA study.

Characteristic	**Model 1** (n = 664, k = 418)			**Model 2** (n = 487, k = 275)		
	β (95%CI)	***p*-value**	**Partial R^2**	**β (95%CI)**	***p*-value**	**Partial R^2**
Gestational age at each sample collection (per week)	0.2 (0.1, 0.2)	<0.001	0.04	0.2 (0.2, 0.3)	<0.001	0.04
Smoking during pregnancy						
Yes vs. no	-3.1 (-5.8, -0.3)	0.03	0.01	-3.3 (-6.4, -0.2)	0.04	0.01
Occupation at each visit during pregnancy						
Agriculture vs. none/not agriculture	-1.9 (-3.9, 0.1)	0.06	0.01	-2.1 (-4.5, 0.2)	0.08	0.01
Household members during pregnancy (per person)	0.4 (0.1, 0.6)	0.01	0.01	0.3 (0.0, 0.7)	0.04	0.01
Reported aerial spraying near home the day before each blood sample collection						
Yes vs. no	-1.0 (-2.1, 0.1)	0.07	0.01	-0.7 (-2.0, 0.5)	0.24	0.01
Wall and floor materials of the house	--					
One or both made of permeable and difficult-to-clean materials vs. both made of non-permeable and easy-to-clean materials				2.6 (1.3, 4.0)	<0.001	0.04
R^2 for model			0.08			0.14

Abbreviations: n, number of samples; k, number of women; CI, confidence interval; R^2, coefficient of determination.

Table S2. Final multivariate linear mixed-effects models for hair Mn concentrations (μg/g) in pregnant women from the ISA study.

Characteristic	**Model 1** (n = 800, k = 449)			**Model 2** (n = 259, k = 138)		
	% change[a] (95%CI)	***p*-value**	**Partial R^2**	**% change[a] (95%CI)**	***p*-value**	**Partial R^2**
Gestational age at each sample collection (per week)	-0.8 (-1.6, 0.0)	0.06	0.001	-1.4 (-2.8, 0.0)	0.05	0.001
Country of birth						
Other Central American countries vs. Costa Rica	29.6 (3.2, 62.8)	0.03	0.02	73.1 (8.8, 175.6)	0.02	0.02
Occupation before pregnancy						
Agriculture vs. none/not agriculture	25.1 (1.6, 54.0)	0.04	0.02	6.5 (-27.3, 56.1)	0.75	0.02
Household members during pregnancy (per person)	4.8 (0.4, 9.4)	0.03	0.01	3.9 (-3.5, 11.9)	0.31	0.01
Residential distance to banana plantations						
<50 vs. 50-<600 meters	42.1 (14.2, 76.9)	0.002	0.04	41.7 (-4.1, 109.6)	0.08	0.04
≥600 vs. 50-<600 meters	19.7 (-4.6, 50.2)	0.12		28.4 (-14.3, 92.4)	0.23	
Source of drinking water in the home						
Well vs. aqueduct	128.6 (78.9, 192.0)	<0.001	0.09	--		
Other source vs. aqueduct	37.3 (-7.6, 104.0)	0.12		--		
Reported aerial spraying near home the day of each hair sample collection						
Yes vs. no	23.9 (5.0, 46.2)	0.01	0.01	19.8 (-11.2, 61.7)	0.24	0.01
Drinking water Mn concentrations (per μg/L)[b]	--			17.5 (12.2, 22.8)	<0.001	0.22
R^2 for model			0.14			0.30

Abbreviations: n, number of samples; k, number of women; CI, confidence interval; R^2, coefficient of determination.

[a] Percent change in hair Mn concentrations associated with 1-unit increase (continuous variables) or with a category difference (categorical variables) in the predictor variable specified; % change = 100*(10^(beta coefficient)-1).

[b] Percent change in hair Mn concentrations associated with one μg/L increase in water Mn concentrations; % change = 100*(beta coefficient).

Table S3. Comparison of blood Mn concentrations (μg/L) in pregnant women by study site.

Author (year)	Location	Sample collection	n	Median	5th-95th percentile	Range	Matrix
Mora et al. (current study)	Matina County, Costa Rica	I trimester	96	23.2	12.2-35.0	10.8-36.9	Whole blood
		II trimester	328	23.7	13.5-33.4	9.4-56.3	Whole blood
		III trimester	240	25.3	15.6-38.9	8.9-50.6	Whole blood
Bradman et al. (unpublished)	California, US	II trimester	53	14.8	6.7-26.8	4.3-32.8	Whole blood
		Delivery	53	20.3	12.5-34.1	6.7-35.7	Whole blood
Callan et al. (2013)	Western Australia	III trimester	173	6.45	<0.1–27.7	<0.1–50.3	Whole blood
Guan et al. (2013)	Liaoning, China	Delivery	125	50.6	29.9-105.8		Whole blood
Yu et al. (2013)	Shanghai, China	Delivery	1377	2.8			Serum
Vigeh et al. (2013)	Tehran, Iran	I trimester	224	15.2[a]		6.5-36.4	Whole blood
		II trimester	224	15.1[a]		0.1-41.6	Whole blood
		III trimester	224	17.8[a]		0.4-34.7	Whole blood
Ajayi et al. (2012)	Ibadan, Nigeria	I and II trimester	34 (controls)	703.5[a]			Serum
Kopp et al. (2012)	Bochum, Germany	Delivery	50	17.0	8.0-32.3	6.4-38.4	Whole blood
Claus Henn et al. (2011)	Mexico City, Mexico	Delivery	332	17.1	8.7-32.8	4.2-66.2	Whole blood
Hansen et al. (2011)	Northern Norway	II trimester	211	11.3[a]		3.8–37.8	Whole blood
		Delivery	211	16.5[a]		6.6–43.1	Whole blood
Rudge et al. (2011)	Sao Paulo, Brazil	Delivery	155	16.7		7.0-39.7	Whole blood
Xu et al. (2011)	Shanghai, China	Delivery	142	58.7[a]		23.6-187.5	Whole blood
Abdelouahab et al. (2010)	Nancy and Poitiers, France	II trimester	160	10.0	3.0-23.5	3.0-29.0	Whole blood
Lin et al. (2010)	Taipei, Taiwan	Delivery	308	21.3			Whole blood
Afridi et al (2009)	Hyderabad, Pakistan	Delivery	115	46.9[a]			Whole blood
Ljung et al. (2009)	Matlab, Bangladesh	II trimester	408	22.0		10.0-53.0	Whole blood
Röllin et al. (2009)	South Africa	Delivery	96	16.7	8.9-26.3	7.9-63.5	Whole blood
Rudge et al. (2009)	South Africa	Delivery	62	16.8		8.7-63.5	Whole blood
Zota et al. (2009)	Oklahoma, US	Delivery	470	22.0	13.0-41.0		
Wang et al. (2008)	Shanghai, China	Delivery	130	54.3			
Vigeh et al. (2006)	Tehran, Iran	Delivery	365 (controls)	18.5		6.9-39.4	Whole blood
Yazbeck et al. (2006)	Paris, France	Delivery	224	21.4[b]	11.1-40.4		
Takser et al. (2004)	Quebec, Canada	I trimester	40	8.3	5.5-14.5	4.6-25.0	Whole blood
		II trimester	149	9.7	5.9-15.3	3.7-25.3	Whole blood
		III trimester	101	15.5	10.0-25.9	9.2-37.1	Whole blood
Anetor et al. (2003)	Ibadan, Nigeria	I trimester	10	7.4[a]			Serum
		II trimester	15	8.4[a]			Serum
		III trimester	15	9.9[a]			Serum
Takser et al. (2003)	Paris, France	Delivery	222	20.4[b]	11.1-40.4	6.3-151.2	Whole blood
Smargiassi et al. (2002)	Montreal, Canada	Delivery	160	23.0[a]	6.0-52.0		Whole blood
	Paris, France	Delivery	206	23.0[a]	12.0-40.0		Whole blood
Krachler et al (1999)	Maribor, Slovenia	Delivery	29	2.4		0.6-7.2	Serum
Spencer et al (1999)	Queensland, Australia	I trimester	34	7.9	4.9-11.5	3.8-20.1	Whole blood
		II trimester	34	9.2	5.9-13.3	4.9-21.5	Whole blood
		III trimester	34	12.2	7.6-18.7	7.3-23.2	Whole blood
Stoll et al. (1999)	Strasbourg, France	I trimester	340 (controls)	2.0[a]			Whole blood
Tholin et al. (1995)	Orebro, Sweden	I trimester	66	8.5	4.3-19.8		Whole blood
		II trimester	66	10.4	5.4-22.4		Whole blood
		III trimester	66	12.6	7.3-26.4		Whole blood
Sachdeva et al. (1993)	Punjab, India	I trimester	33 (controls)	7.0[a]			Serum
		III trimester	30 (controls)	8.0[a]			Serum
Wilson et al. (1991)	Belfast, Ireland	Delivery	56	4.2[a]			Plasma
Tsuchiya et al. (1984)	Nagoya, Japan	Delivery	102	31.0[a]		1.0-83.0	Whole blood
Hambidge et al. (1974)	Colorado, US	I trimester	20	1.5[a]			Plasma
		III trimester	20	2.0[a]			Plasma

[a] Geometric mean
[b] Arithmetic mean.

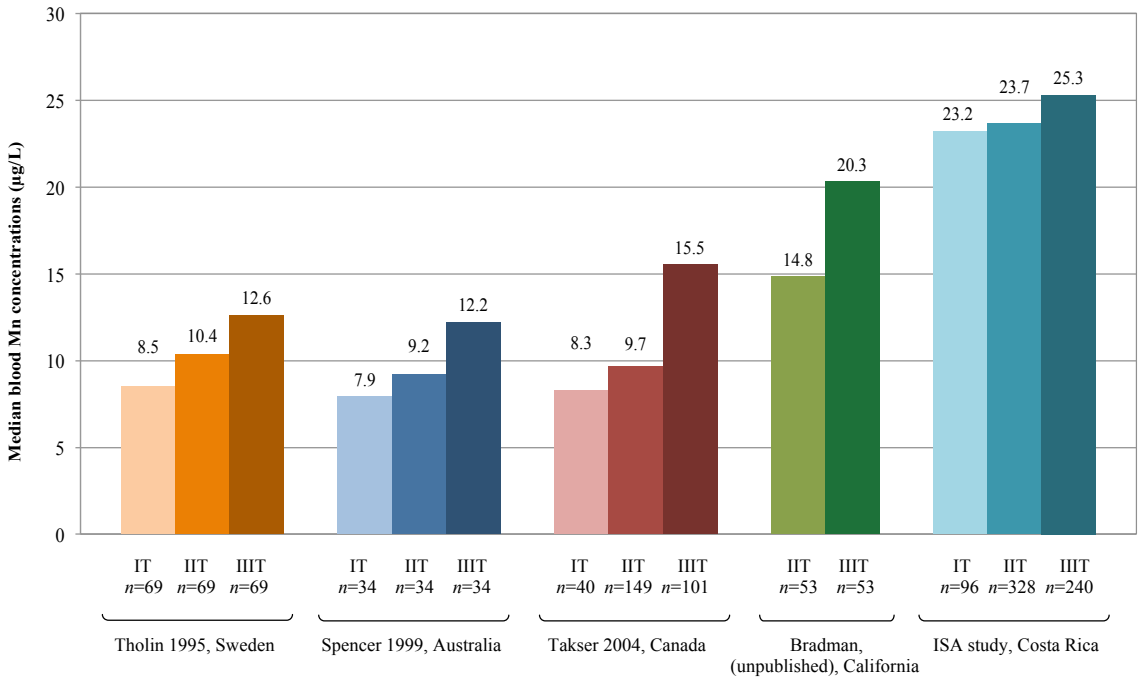

Figure S3. Variability in median blood Mn concentrations (µg/L) during pregnancy by study site. *Abbreviations*: *n*, number of blood samples; IT, first trimester; IIT, second trimester; IIIT, third trimester.