

**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 [ehp508@niehs.nih.gov](mailto:ehp508@niehs.nih.gov). Our staff will work with you to assess and meet your accessibility needs within 3 working days.

### **Supplemental Material**

#### **Prenatal Phthalates, Maternal Thyroid Function, and Risk of Attention-Deficit Hyperactivity Disorder in the Norwegian Mother and Child Cohort**

Stephanie M. Engel, Gro D. Villanger, Rachel C. Nethery, Cathrine Thomsen, Amrit K. Sakhi, Samantha S.M. Drover, Jane A. Hoppin, Pal Zeiner, Gun Peggy Knudsen, Ted Reichborn-Kjennerud, Amy H. Herring, and Heidi Aase

#### **Table of Contents**

**Table S1.** Associations between phthalates and ADHD with and without adjustment for year in a Nested Case-Control Study of Attention-deficit Hyperactivity Disorder in the Norwegian Mother and Child Cohort, 2003-2008.

**Table S2.** Sensitivity Analyses using alternate model specifications for associations between phthalates and ADHD in a Nested Case-Control Study of Attention-deficit Hyperactivity Disorder in the Norwegian Mother and Child Cohort, 2003-2008.

**Table S3.** Sensitivity Analyses using alternate model specifications for associations between phthalates and ADHD in a Nested Case-Control Study of Attention-deficit Hyperactivity Disorder in the Norwegian Mother and Child Cohort, 2003-2008.

**Table S4.** Sensitivity Analyses adjusting for urine collection month and year for associations between phthalates and ADHD in a Nested Case-Control Study of Attention-deficit Hyperactivity Disorder in the Norwegian Mother and Child Cohort, 2003-2008.

**Table S5.** Natural Direct Effect (NDE) and Natural Indirect Effect (NIE) Odds Ratios and 95% Confidence Intervals for Mediation of  $\sum$ DEHP by Thyroid Hormones and Preterm Delivery.

Table S1. Associations between phthalates and ADHD with and without adjustment for year in a Nested Case-Control Study of Attention-deficit Hyperactivity Disorder in the Norwegian Mother and Child Cohort, 2003-2008

Phthalate	With adjustment for year		Without adjustment for year	
	OR	95% CI	OR	95% CI
MEP				
Q1	1.00		1.00	
Q2	1.27	(0.67,2.20)	1.46	(0.83,2.42)
Q3	1.06	(0.55,1.89)	1.11	(0.61,1.86)
Q4	1.15	(0.61,1.97)	1.40	(0.78,2.33)
Q5	1.10	(0.57,1.94)	1.27	(0.71,2.07)
MiBP				
Q1	1.00		1.00	
Q2	0.92	(0.46,1.66)	0.88	(0.47,1.56)
Q3	1.10	(0.52,1.99)	0.87	(0.45,1.57)
Q4	1.21	(0.58,2.21)	0.81	(0.41,1.45)
Q5	0.70	(0.32,1.32)	0.45	(0.22,0.84)
MnBP				
Q1	1.00		1.00	
Q2	0.69	(0.34,1.30)	0.89	(0.44,1.59)
Q3	0.93	(0.43,1.81)	1.30	(0.64,2.30)
Q4	0.92	(0.40,1.94)	1.32	(0.61,2.55)
Q5	1.31	(0.55,2.75)	2.01	(0.90,3.96)
MBzP				
Q1	1.00		1.00	
Q2	0.78	(0.39,1.34)	0.75	(0.38,1.30)
Q3	0.72	(0.35,1.29)	0.85	(0.43,1.51)
Q4	1.00	(0.46,1.88)	1.09	(0.52,2.02)
Q5	0.88	(0.37,1.71)	1.06	(0.47,2.00)
$\Sigma$ DEHP				
Q1	1.00		1.00	
Q2	1.58	(0.80,2.77)	1.70	(0.87,2.92)
Q3	2.26	(1.12,4.02)	2.54	(1.32,4.42)
Q4	2.65	(1.34,4.70)	2.86	(1.45,5.00)
Q5	2.99	(1.47,5.49)	4.08	(2.07,7.10)
$\Sigma$ DiNP				
Q1	1.00		1.00	
Q2	1.07	(0.56,1.88)	0.88	(0.50,1.45)
Q3	1.22	(0.63,2.12)	0.75	(0.41,1.25)
Q4	1.03	(0.54,1.82)	0.57	(0.31,0.97)
Q5	0.88	(0.45,1.54)	0.45	(0.24,0.77)

Models adjusted for child sex, mother's age, mother's education level, mother's marital status, mother's smoking status, parity, maternal depression during pregnancy (with and without adjustment for year of birth)

Table S2. Sensitivity Analyses using alternate model specifications for associations between phthalates and ADHD in a Nested Case-Control Study of Attention-deficit Hyperactivity Disorder in the Norwegian Mother and Child Cohort, 2003-2008

Phthalate	Separate Models for each phthalate		Simultaneous Adjustment for all phthalates with specific gravity included as a covariate	
	OR	95% CI	OR	95% CI
MEP				
Q1	1.00		1.00	
Q2	1.27	(0.68,2.15)	0.66	(0.34,1.15)
Q3	1.12	(0.60,1.91)	1.31	(0.69,2.39)
Q4	1.27	(0.67,2.15)	0.70	(0.36,1.25)
Q5	1.19	(0.62,2.03)	1.18	(0.60,2.12)
MiBP				
Q1	1.00		1.00	
Q2	0.90	(0.46,1.57)	1.29	(0.63,2.40)
Q3	1.23	(0.66,2.13)	1.03	(0.47,2.02)
Q4	1.51	(0.79,2.57)	0.87	(0.36,1.69)
Q5	1.08	(0.55,1.86)	1.00	(0.41,2.14)
MnBP				
Q1	1.00		1.00	
Q2	0.68	(0.35,1.16)	0.82	(0.38,1.52)
Q3	1.07	(0.55,1.86)	0.67	(0.27,1.45)
Q4	1.09	(0.58,1.81)	1.57	(0.62,3.50)
Q5	1.58	(0.83,2.74)	1.23	(0.41,2.74)
MBzP				
Q1	1.00		1.00	
Q2	0.85	(0.44,1.48)	1.22	(0.61,2.23)
Q3	0.86	(0.44,1.50)	0.73	(0.32,1.48)
Q4	1.30	(0.68,2.22)	0.80	(0.32,1.69)
Q5	1.31	(0.69,2.27)	1.04	(0.38,2.33)
$\Sigma$ DEHP				
Q1	1.00		1.00	
Q2	1.44	(0.74,2.56)	1.97	(0.95,3.62)
Q3	1.92	(1.01,3.37)	1.68	(0.77,3.26)
Q4	2.40	(1.24,4.11)	3.80	(1.65,7.80)
Q5	2.73	(1.43,4.78)	3.35	(1.38,6.96)
$\Sigma$ DiNP				
Q1	1.00		1.00	
Q2	1.07	(0.60,1.79)	0.86	(0.43,1.47)
Q3	1.36	(0.73,2.03)	0.83	(0.42,1.48)
Q4	1.20	(0.64,2.00)	0.80	(0.37,1.50)
Q5	1.13	(0.60,1.97)	0.45	(0.20,0.89)

Models adjusted for batch, specific gravity, child sex, mother's age, mother's education level, mother's marital status, mother's smoking status, parity, maternal depression during pregnancy, birth year

Table S3. Sensitivity Analyses using alternate model specifications for associations between phthalates and ADHD in a Nested Case-Control Study of Attention-deficit Hyperactivity Disorder in the Norwegian Mother and Child Cohort, 2003-2008

Phthalate	Simultaneous adjustment for only HMW phthalates		Simultaneous Adjustment for only LMW phthalates	
	OR	95% CI	OR	95% CI
MEP				
Q1			1.00	
Q2			1.27	(0.70,2.16)
Q3			1.04	(0.56,1.79)
Q4			1.15	(0.63,1.98)
Q5			1.11	(0.60,1.92)
MiBP				
Q1			1.00	
Q2			0.89	(0.46,1.54)
Q3			1.13	(0.56,2.02)
Q4			1.25	(0.60,2.32)
Q5			0.79	(0.38,1.52)
MnBP				
Q1			1.00	
Q2			0.70	(0.36,1.25)
Q3			1.10	(0.55,2.01)
Q4			1.10	(0.53,2.02)
Q5			1.69	(0.80,3.16)
MBzP				
Q1	1.00			
Q2	0.71	(0.38,1.23)		
Q3	0.67	(0.35,1.18)		
Q4	0.93	(0.49,1.62)		
Q5	0.87	(0.43,1.56)		
ΣDEHP				
Q1	1.00			
Q2	1.55	(0.80,2.74)		
Q3	2.21	(1.12,3.98)		
Q4	2.64	(1.34,4.66)		
Q5	3.06	(1.51,5.57)		
ΣDiNP				
Q1	1.00			
Q2	1.06	(0.57,1.80)		
Q3	1.20	(0.64,2.06)		
Q4	1.02	(0.54,1.72)		
Q5	0.87	(0.45,1.52)		

Models adjusted for batch, specific gravity, child sex, mother's age, mother's education level, mother's marital status, mother's smoking status, parity, maternal depression during pregnancy, birth year

Table S4. Sensitivity Analyses adjusting for urine collection month and year for associations between phthalates and ADHD in a Nested Case-Control Study of Attention-deficit Hyperactivity Disorder in the Norwegian Mother and Child Cohort, 2003-2008

Phthalate	OR	95% CI
MEP		
Q1	1.00	
Q2	1.28	(0.67,2.17)
Q3	1.03	(0.54,1.76)
Q4	1.18	(0.65,2.00)
Q5	1.19	(0.62,2.06)
MiBP		
Q1	1.00	
Q2	0.95	(0.49,1.70)
Q3	1.25	(0.64,2.21)
Q4	1.22	(0.60,2.20)
Q5	0.69	(0.31,1.30)
MnBP		
Q1	1.00	
Q2	0.71	(0.34,1.31)
Q3	0.97	(0.45,1.86)
Q4	1.05	(0.47,2.09)
Q5	1.45	(0.62,3.01)
MBzP		
Q1	1.00	
Q2	0.78	(0.38,1.36)
Q3	0.74	(0.36,1.36)
Q4	0.96	(0.44,1.81)
Q5	0.87	(0.38,1.77)
$\Sigma$ DEHP		
Q1	1.00	
Q2	1.73	(0.87,3.07)
Q3	2.37	(1.19,4.22)
Q4	2.57	(1.30,4.67)
Q5	3.38	(1.61,6.08)
$\Sigma$ DiNP		
Q1	1.00	
Q2	1.05	(0.55,1.84)
Q3	1.25	(0.66,2.17)
Q4	0.95	(0.50,1.65)
Q5	0.90	(0.47,1.61)

Models adjusted for batch, specific gravity, child sex, mother's age, mother's education level, mother's marital status, mother's smoking status, parity, maternal depression during pregnancy, birth year

Table S5. Natural Direct Effect (NDE) and Natural Indirect Effect (NIE) Odds Ratios and 95% Confidence Intervals for Mediation of  $\Sigma$ DEHP by Thyroid Hormones and Preterm Delivery

Model Parameter	No Interaction				Interaction			
	NDE <sup>b</sup>		NIE		NDE <sup>b</sup>		NIE	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Low Thyroxine (T4) <sup>a</sup>	1.14	(0.78,1.66)	0.99	(0.93,1.04)	1.47	(0.87,2.50)	0.97	(0.85,1.10)
High Thyroxine (T4) <sup>a</sup>	2.15	(1.42, 3.26)	1.00	(0.99,1.01)	1.44	(1.11,1.87)	0.99	(0.96,1.03)

<sup>a</sup>Mediation models adjusted for iodine intake (dichotomized at 150), mother's age, mother's smoking status, parity, and year of birth and outcome models adjusted for child sex, mother's age, mother's education level, mother's marital status, mother's smoking status, parity, maternal depression during pregnancy, and year of birth.

<sup>b</sup>The NDE is conditional on values of the mediator model covariates. For the thyroid hormones, the NDEs are computed for the following covariate specifications: iodine deficient (less than or equal to 150), sample average maternal age, non-smoking mother, non-primiparous, and year of birth 2005. For preterm delivery, the NDEs are computed for the following covariate specifications: sample average maternal age, married mother, non-smoking mother, and year of birth 2005.