ASSOCIATION BETWEEN COMPLEX EXPOSURE TO CADMIUM AND MERCURY AND ATOPIC DERMATITIS IN ELEMENTARY SCHOOL STUDENTS: ANALYSIS USING DATA FROM THE KOREAN NATIONAL ENVIRONMENTAL HEALTH SURVEY (KONEHS) CYCLE 4

Kiook Baek

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PART 1

Participants Sampling, Urine Sampling and Transfer

For the fourth cycle of the baseline survey, a sample design was employed where schools were used as the primary sampling units. Stratification variables for the sample design included regional strata, which were divided into regions, cities, and counties as the first stratification. Further stratification within each regional stratum was based on the school. The population square root proportionate allocation method was applied to allocate samples within the city and county divisions of each institution, proportional to the square root of the number of children and adolescents in each stratum. Sample institutions were selected using systematic sampling proportional to the number of children and adolescents in each stratum, eventually selecting 58 elementary school sample institutions. The weights for children and adolescents were calculated by integrating design weights, nonresponse adjustment, and post-stratification adjustment. The most recent information for post-stratification came from the average of the 2018, 2019, and 2020 Population and Housing Census data. Design weights were defined as the inverse of the selection probabilities, and the sample institutions, as primary sampling units, were selected using the probability proportional to the measure of size method.

For the collection of biospecimens from children (infants, preschoolers, and elementary school students), only urine samples were collected. Parents of the survey participants collected urine samples the day before or the morning of the survey, stored them in a refrigerator, and filled out questionnaires on behalf of their children. On the survey day, a field survey team consisting of survey and sample transport personnel visited the sample childcare and educational institutions to collect the biospecimens and review the questionnaires completed by the parents. In the fourth cycle of KoNEHS, 736 elementary school students were recruited in 2020.

Urine samples were collected in sterilized specimen cups (B08-134-505, All-pak, IL, USA). Participants were instructed to collect midstream urine specimens while wearing disposable vinyl gloves. Immediately after collection, the samples were capped, blocked from light using aluminium foil, sealed in plastic bags, and refrigerated at 2–6 °C. Spot urine samples were transferred to the laboratory within 24 hours under cool conditions in an icebox and stored at −20 °C before analysis. During transportation, the position was tracked using a Global Positioning System (GPS) device, and the temperature was monitored in real-time. The transferred samples were divided into containers and stored frozen at −70 °C in polypropylene containers.

Analysis of Urinary Heavy Metals

For cadmium analysis, a cadmium standard solution of 1,000 mg/L in 2% HNO3 (SPEX Certiprep, USA) was utilized. The analysis was performed using a Perkin Elmer 900Z (Perkin Elmer, Germany). The primary standard solution (1 mg Cd/L) was prepared by adding 0.1 mL of the cadmium standard solution (1,000 mg/L) to 100 mL of a 1% HNO3 dilution solution. The final standard solutions (0.5, 1, 2, 4, 6, 8 µg Cd/L) were prepared by diluting aliquots of the primary standard solution (1 mg/L) with 1% HNO3 to a final volume of 100 mL.

For sample pretreatment, the frozen urine samples were thawed at room temperature for about 10 minutes. Using a micropipette, 0.1 mL of the supernatant was mixed with 0.3 mL of a diluent solution and 0.1 mL of distilled water, followed by thorough mixing. Similarly, control samples and reference materials (RMs) were prepared by pipetting 0.1 mL of each into 0.3 mL of the diluent solution and 0.1 mL of distilled water, then mixing thoroughly. The pretreated samples were then placed in tubes for GF-AAS analysis at a wavelength of 228.8 nm.

Urinary mercury levels were measured using a mercury analyser (Gold amalgamation direct mercury analyser, DMA-80, Milestones, Italy). The mercury standard solution (10 mg/L in 5% HNO3) from SPEX Certiprep was used as the standard material. The primary standard solution (0.25 mg Hg/L) was prepared by adding 2.5 mL of the mercury standard solution (10 mg/L) to 100 mL of distilled water, followed by gentle mixing. The final standard solutions (0.5, 1, 2.5, 5, 7.5, 10 µg Hg/L) were prepared by diluting aliquots of the primary standard solution (0.25 mg/L) with distilled water to a final volume of 100 mL. For sample pretreatment, the frozen urine samples were thawed in a 37 °C water bath and thoroughly mixed using a vortex mixer. Using a micropipette, 0.1 mL of the supernatant was dispensed into a sample boat for analysis. The samples were analysed at a wavelength of 253.7 nm.

Analysis of Urinary Cotinine

Cotinine levels were analysed using gas chromatography-mass spectrometry (GC-MS). An Elite-5MS or equivalent column (0.25 mm × 1 μm × 30 m) was used. The standard materials were 99% (±)-cotinine (C10H12N2O) (Sigma Aldrich, USA) and 98 atom % (±)-Cotinine-d3 (N-methyl-d3) (CDN isotope, CA).

PART 2

Confounder Selection

Confounders were selected based on their potential to influence both the exposure variable (heavy metals) and the outcome (atopic dermatitis). The variables sex, age, urinary cotinine, income, and body mass index (BMI) were identified as confounders that could potentially affect both the outcome and the independent variable. Sex was selected under the assumption that sex hormones influence both the metabolism of heavy metals (1) and the pathophysiology of atopic dermatitis (2). Age was considered because it is assumed that higher age correlates with prolonged exposure to heavy metals, leading to higher urinary concentrations, and because the prevalence of dermatitis varies with age (3). Since the outcome variable represents lifetime prevalence, age was deemed a necessary adjustment. Income was included as a proxy for socioeconomic status (SES) because previous studies have shown that SES can influence exposure to environmental pollutants such as heavy metals (4), and there is also a possible relationship between SES and atopic dermatitis, as proposed by the hygiene hypothesis, which suggests that frequent exposure to unsanitary conditions may reduce the risk of atopic dermatitis (5). Income was analysed in two categories: below 3 million KRW and above 3 million KRW. Respondents had the option to select "Do not respond" for their income within the survey items, and this was not treated as a missing value but rather considered a separate category for analysis. BMI, as an indicator of body fat (6), was included because fat has been reported to influence the development of atopic dermatitis, and there is a known association between BMI and atopic dermatitis (7). While heavy metals can affect fat metabolism, leading to obesity and fat accumulation, in this study, BMI was considered a confounder rather than a mediator, based on the hypothesis that more adipose tissue could lead to greater accumulation of heavy metals (8). Urinary cotinine, a marker of second-hand smoke exposure, was included because second-hand smoke can be a source of heavy metal exposure and is associated with the development of atopic dermatitis. The hypothesis that smoke itself has an impact on the prevalence of atopic dermatitis was also considered (9).

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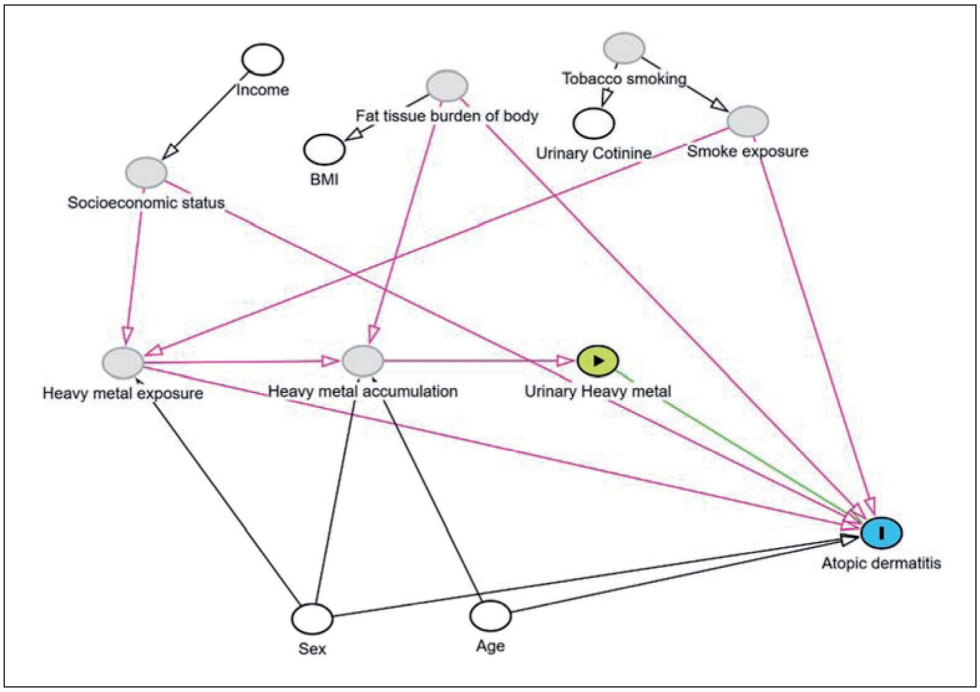

S Fig. 1. *Directed acyclic graph (DAG) for confounder selection.*

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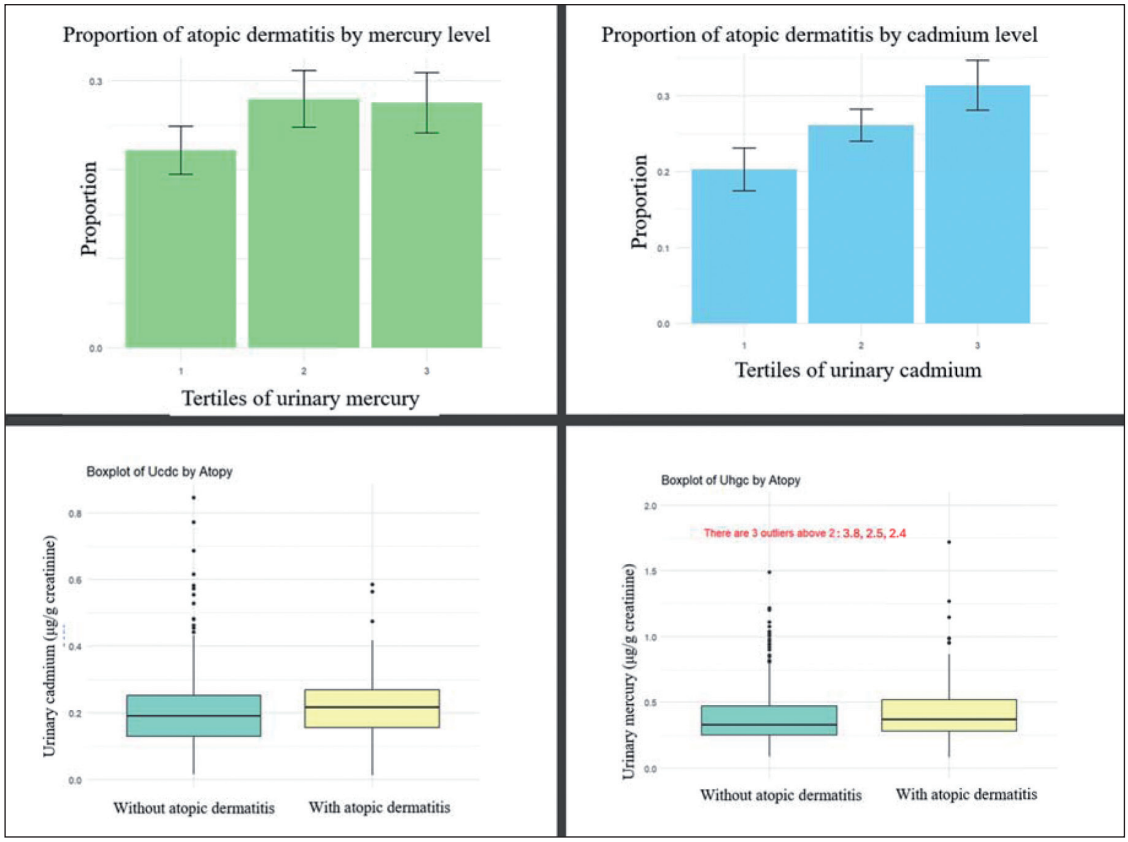
PART 3

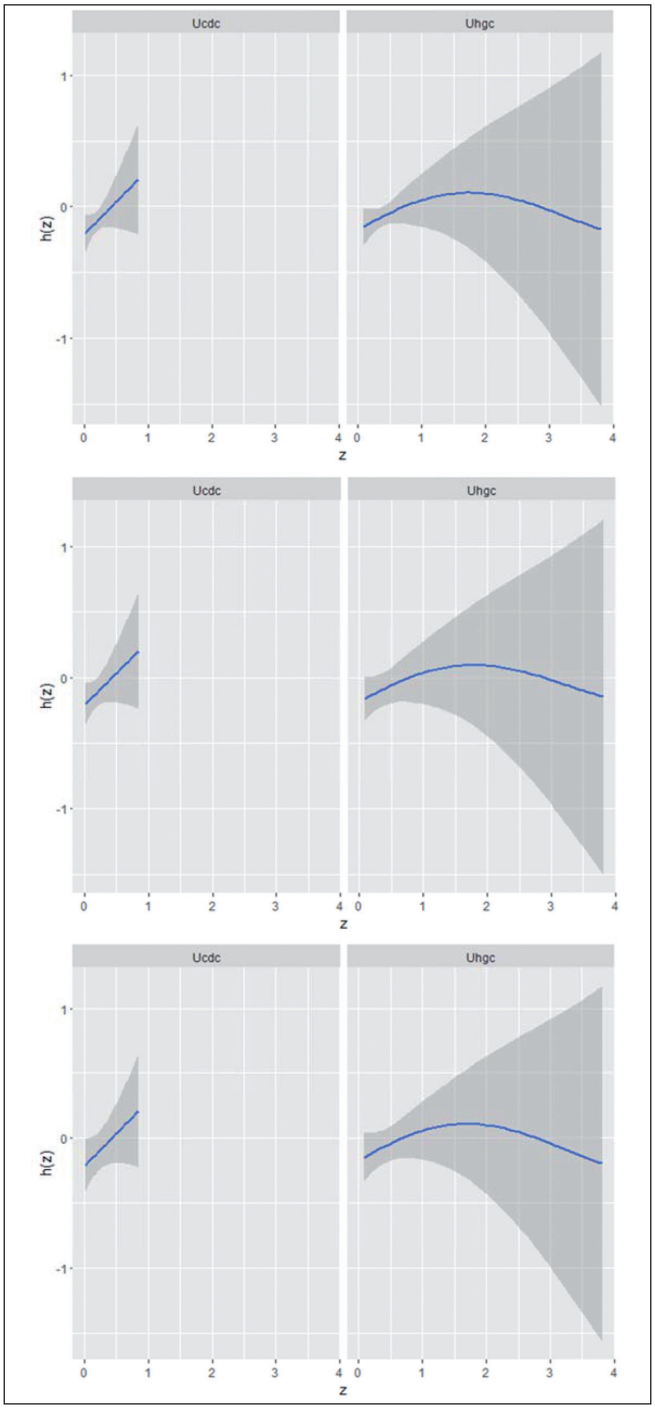


S Fig. 2. *Lifetime prevalence of atopic dermatitis according to tertiles of mercury and cadmium, and box plots of mercury and cadmium levels by atopic dermatitis status.*

PART 4

Bayesian Kernel Machine Regression Results of Urinary Cadmium, Mercury and Atopic Dermatitis

The increase in the risk of atopic dermatitis according to changes in the quantiles of each substance was analysed using Bayesian kernel machine regression. From top to bottom, S Fig. 3 shows the change in log (OR) with quantile changes while fixing the other substances at the 5th percentile, 50th percentile, and 95th percentile, respectively. The lack of significant differences among the three parts of S Fig. 3 indicates that the interaction between the two variables is not pronounced.



S Fig. 3. *Bayesian kernel machine regression results.*

PART 5

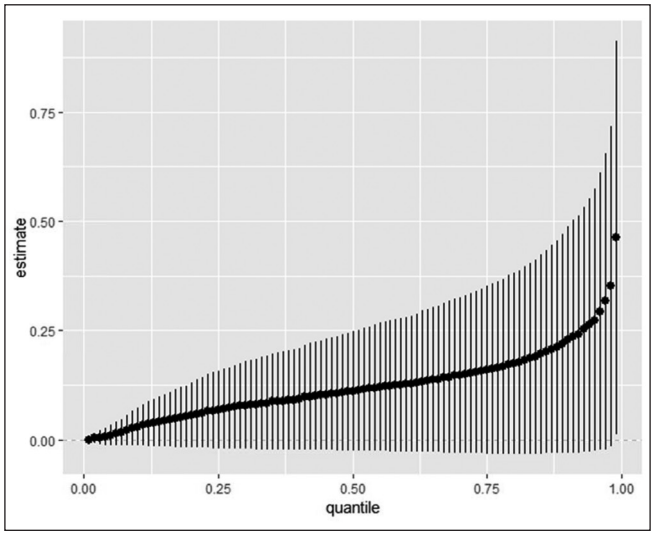
S Table 1. *Association between current symptoms of atopic dermatitis, current treatment of atopic dermatitis, and heavy metal exposure*

	Outcome	**Atopic dermatitis with symptom**		**Atopic dermatitis with treatment**	
	Exposure variables	**OR (95% CI)**	**p-value**	**OR (95% CI)**	**p-value**
OR for individual model per each metal (as category for each tertile)	Urinary cadmium				
	1st tertile	Reference		Reference	
	2nd tertile	1.3 (0.6–2.8)	0.508	1.14 (0.3–4.36)	0.849
	3rd tertile	2.39 (1.12–5.1)	0.030	1.45 (0.42–5.01)	0.562
	Urinary mercury				
	1st tertile	Reference		Reference	
	2nd tertile	1.26 (0.67–2.35)	0.475	1.14 (0.44–2.91)	0.792
	3rd tertile	1.02 (0.49–2.13)	0.958	1.11 (0.35–3.51)	0.854
OR for individual model per each metals (trend increase of tertile)	Urinary cadmium (trend per tertile increase)	1.01 (0.72–1.42)	0.957	1.05 (0.6–1.85)	0.856
	Urinary mercury (trend per tertile increase)	1.58 (1.08–2.31)	0.024	1.21 (0.66–2.22)	0.547
Within one model (as category for each tertile)	Urinary cadmium				
	1st tertile	Reference		Reference	
	2nd tertile	1.29 (0.6–2.76)	0.518	1.15 (0.31–4.29)	0.833
	3rd tertile	2.4 (1.13–5.09)	0.028	1.44 (0.42–5.01)	0.566
	Urinary mercury				
	1st tertile	Reference		Reference	
	2nd tertile	1.22 (0.65–2.29)	0.538	1.12 (0.44–2.84)	0.807
	3rd tertile	0.94 (0.46–1.92)	0.866	1.09 (0.36–3.37)	0.877
Within one model (trend increase of tertile)	Urinary mercury (trend per tertile increase)	0.98 (0.7–1.38)	0.913	1.05 (0.59–1.85)	0.874
	Urinary cadmium (trend per tertile increase)	1.58 (1.08–2.3)	0.023	1.21 (0.65–2.22)	0.552
WQS	Complex exposure (WQS)	1.75 (1.15–2.65)	0.002	0.66 (4.12–0.11)	0.123
		Weight for mercury 0.29 (0.03–0.67)		Weight for mercury 0.46 (0.00–1.00)	
		Weight for cadmium 0.71 (0.33–0.97)		Weight for cadmium 0.52 (0.00–1.00)	
QGC	Complex exposure (PSI)	1.75 (1.1–2.78)	0.019	−0.40 (−1.12–0.31)	0.367
		Weight for mercury 0.10		Weight for mercury 0.50	
		Weight for cadmium 0.9		Weight for cadmium 0.50	

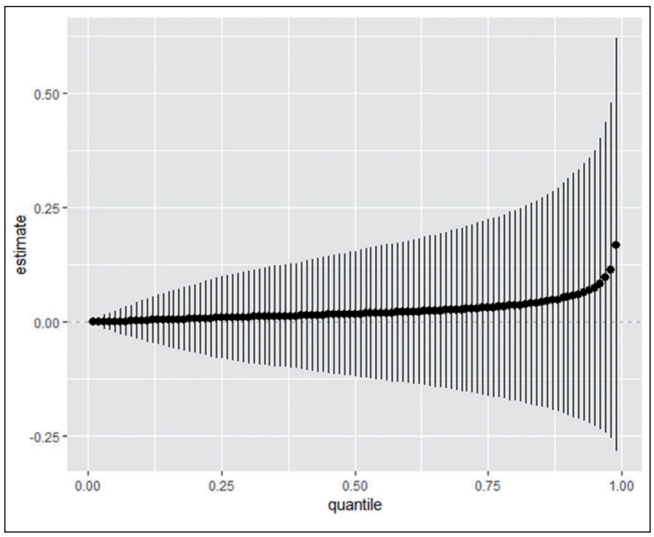
CI – confidence interval; OR – odds ratio; WQS – weighted quantile sum regression; QGC – quantile g-computation
The results of WQS and GQC represent the change in OR for each increase in tertile.

Results of Sensitivity Analysis Using BKMR

When the outcome variable was the presence of current symptoms of atopic dermatitis, the change in log (OR) with quantile changes in the complex exposure to mercury and cadmium was observed. Overall, a linear trend was noted; however, a significant difference was only observed between the 1st percentile and the 99th percentile (S Fig. 4a).



S Fig. 4a. *Results of sensitivity analysis.*



S Fig. 4b. *Results of sensitivity analysis.*

PART 6

Summary Statistics of All Environmental Pollutants by Atopic Dermatitis Status and Results of Quantile-based G-computation Adjusted for All Environmental Pollutants

The KoNEHS Cycle 4 survey investigated various environmental exposure markers in urine samples. The analysed substances included heavy metals such as mercury and cadmium, polycyclic aromatic hydrocarbons like 1-hydroxypyrene, 2-naphthol, 2-hydroxyfluorene, and 1-hydroxyphenanthrene, as well as phthalate metabolites including mono-2-ethyl-5-hydroxyhexyl phthalate, mono-2-ethyl-5-oxohexyl phthalate, mono-butyl phthalate, mono-2-ethyl-5-carboxypentyl phthalate, mono-benzyl phthalate, and mono-3-carboxypropyl phthalate. Additionally, bisphenols such as bisphenol A, bisphenol F, and bisphenol S were measured, along with personal care product-related chemicals like triclosan, methyl paraben, ethyl paraben, propyl paraben, butyl paraben, and benzophenone-3. The survey also assessed pesticide exposure through 3-phenoxybenzoic acid and smoking-related biomarkers such as cotinine, trans,trans-muconic acid, and benzyl mercapturic acid.

S Table 2. *Biological exposure values of pollutants by atopic dermatitis status*

Variable	Total	With atopic dermatitis (lifetime prevalence)	Without atopic dermatitis	p-value
BPS	0.15 (0.08, 0.29)	0.15 (0.08, 0.34)	0.14 (0.08, 0.28)	0.22
BPF	0.04 (0.02, 0.21)	0.04 (0.02, 0.27)	0.05 (0.02, 0.21)	0.81
OHP	0.08 (0.03, 0.15)	0.07 (0.03, 0.12)	0.08 (0.04, 0.16)	0.06
NAP	3.31 (1.67, 6.97)	2.93 (1.61, 6.97)	3.40 (1.70, 6.93)	0.48
OHFlu	0.35 (0.24, 0.50)	0.33 (0.25, 0.51)	0.35 (0.24, 0.50)	0.99
OHPhe	0.09 (0.03, 0.19)	0.10 (0.03, 0.18)	0.09 (0.03, 0.20)	0.73
MEHHP	21.32 (13.20, 33.20)	22.06 (15.16, 35.75)	20.64 (12.33, 32.35)	0.02
MEOHP	14.36 (8.90, 21.45)	15.24 (10.13, 23.53)	13.82 (8.29, 21.05)	0.02
MnBP	29.71 (19.58, 44.18)	32.75 (20.23, 48.05)	28.70 (19.27, 42.79)	0.12
MECPP	34.58 (21.91, 52.87)	35.54 (25.88, 56.13)	33.91 (21.10, 50.48)	0.06
MBzP	1.67 (0.67, 3.54)	2.17 (0.76, 4.87)	1.50 (0.65, 3.05)	0.00
MCPP	0.51 (0.33, 0.85)	0.54 (0.34, 0.92)	0.50 (0.32, 0.83)	0.15
MEP	4.53 (2.67, 9.86)	4.57 (3.02, 10.84)	4.49 (2.51, 9.79)	0.12
MMP	3.32 (2.18, 5.22)	3.31 (2.27, 5.01)	3.33 (2.16, 5.35)	0.71
BPA	1.51 (0.74, 3.06)	1.62 (0.79, 2.98)	1.46 (0.72, 3.06)	0.41
TCS	0.22 (0.10, 0.55)	0.28 (0.13, 0.67)	0.21 (0.09, 0.49)	0.00
MP	7.23 (3.46, 46.20)	8.61 (3.68, 88.02)	6.80 (3.41, 35.20)	0.12
EP	19.99 (3.00, 96.85)	23.18 (3.84, 96.85)	19.79 (2.81, 90.88)	0.64
PP	0.54 (0.18, 2.43)	0.67 (0.21, 3.98)	0.50 (0.17, 2.09)	0.05
BP	0.56 (0.29, 0.95)	0.56 (0.30, 0.92)	0.56 (0.28, 0.97)	0.74
BP_3	0.67 (0.28, 1.72)	0.71 (0.33, 1.59)	0.64 (0.27, 1.73)	0.65
tt_MA	61.98 (34.72, 104.65)	59.74 (37.08, 99.64)	61.98 (34.07, 106.85)	0.71
BMA	5.95 (4.04, 9.62)	6.93 (4.24, 11.55)	5.72 (3.99, 9.22)	0.01

OHP – 1-hydroxypyrene; NAP – 2-naphthol; OHFlu – 2-hydroxyfluorene; OHPhe – 1-hydroxyphenanthrene; MEHHP – mono-2-ethyl-5-hydroxyhexyl phthalate; MEOHP – mono-2-ethyl-5-oxohexyl phthalate; MnBP – mono-butyl phthalate; MECPP – mono-2-ethyl-5-carboxypentyl phthalate; MBzP – mono-benzyl phthalate; MCPP – mono-3-carboxypropyl phthalate; MEP – mono-ethyl phthalate; MMP – mono-methyl phthalate; BPA – bisphenol A; BPF – bisphenol F; BPS – bisphenol S; TCS – triclosan; MP – methyl paraben; EP – ethyl paraben; PP – propyl paraben; BP – butyl paraben; BP_3 – benzophenone-3; PBA – 3-phenoxybenzoic acid; COT – cotinine, tt_MA – trans,trans-muconic acid, BMA – benzyl mercapturic acid

Numbers are presented as median (25 percentile, 75 percentile).

S Table 3. *Frequency distribution of biological exposure values for all pollutants categorized into tertiles by atopic dermatitis status*

Variable	Tertile	Total			With atopic dermatitis (lifetime prevalence)			Without atopic dermatitis			p-value
		Raw n	Estimated n	Estimated %	Raw n	Estimated n	Estimated %	Raw n	Estimated n	Estimated %	
BPS	1st	256	915449.1	34.8	57	219392.8	31.5	199	696056.3	35.9	0.51
	2nd	238	917035.7	32.3	58	232140.0	32.0	180	684895.6	32.4	
	3rd	242	911038.2	32.9	66	258499.0	36.5	176	652539.2	31.7	
BPF	1st	247	915213.6	33.6	60	238670.4	33.1	187	676543.3	33.7	0.91
	2nd	243	916388.1	33.0	55	229203.9	30.4	188	687184.2	33.9	
	3rd	246	911921.3	33.4	66	242157.6	36.5	180	669763.7	32.4	
OHP	1st	239	918126.0	32.5	62	258301.9	34.3	177	659824.2	31.9	0.03
	2nd	244	912246.9	33.2	67	271742.9	37.0	177	640504.0	31.9	
	3rd	253	913150.1	34.4	52	179987.1	28.7	201	733163.0	36.2	
NAP	1st	249	915124.2	33.8	60	237485.6	33.1	189	677638.6	34.1	0.98
	2nd	247	918102.4	33.6	60	234553.1	33.1	187	683549.3	33.7	
	3rd	240	910296.4	32.6	61	237993.2	33.7	179	672303.2	32.3	
OHFlu	1st	258	915449.6	35.1	62	246654.9	34.3	196	668794.7	35.3	0.70
	2nd	240	915526.4	32.6	60	220969.4	33.1	180	694557.0	32.4	
	3rd	238	912547.0	32.3	59	242407.6	32.6	179	670139.4	32.3	
OHPhe	1st	238	915055.8	32.3	54	218753.8	29.8	184	696302.0	33.2	0.60
	2nd	253	916485.0	34.4	68	258223.4	37.6	185	658261.6	33.3	
	3rd	245	911982.3	33.3	59	233054.7	32.6	186	678927.6	33.5	
MEHHP	1st	249	915972.7	33.8	46	181874.7	25.4	203	734098.0	36.6	0.06
	2nd	247	915570.6	33.6	67	263530.2	37.0	180	652040.4	32.4	
	3rd	240	911979.7	32.6	68	264627.0	37.6	172	647352.6	31.0	
MEOHP	1st	252	918252.3	34.2	48	186711.1	26.5	204	731541.3	36.8	0.05
	2nd	241	912764.6	32.7	65	266026.2	35.9	176	646738.4	31.7	
	3rd	243	912506.0	33.0	68	257294.6	37.6	175	655211.5	31.5	
MnBP	1st	253	914893.7	34.4	57	218372.3	31.5	196	696521.4	35.3	0.59
	2nd	249	915493.1	33.8	60	233548.2	33.1	189	681944.9	34.1	
	3rd	234	913136.1	31.8	64	258111.3	35.4	170	655024.8	30.6	
MECPP	1st	252	917561.4	34.2	51	191359.2	28.2	201	726202.2	36.2	0.13
	2nd	242	915557.9	32.9	64	263042.4	35.4	178	652515.5	32.1	
	3rd	242	910403.7	32.9	66	255630.4	36.5	176	654773.4	31.7	
MBzP	1st	248	916588.2	33.7	51	203043.5	28.2%	197	713544.7	35.5	0.01
	2nd	240	914664.7	32.6	53	204083.4	29.3	187	710581.3	33.7	
	3rd	248	912270.1	33.7	77	302905.0	42.5	171	609365.1	30.8	
MCPP	1st	246	916146.8	33.4	53	215328.7	29.3	193	700818.1	34.8	0.24
	2nd	242	915282.2	32.9	55	221244.6	30.4	187	694037.5	33.7	
	3rd	248	912094.0	33.7	73	273458.6	40.3	175	638635.4	31.5	
MEP	1st	248	916525.4	33.7	57	207746.5	31.5	191	708778.9	34.4	0.28
	2nd	242	916192.1	32.9	60	244306.7	33.1	182	671885.4	32.8	
	3rd	246	910805.5	33.4	64	257978.7	35.4	182	652826.8	32.8	
MMP	1st	250	914899.3	34.0	58	223624.6	32.0	192	691274.7	34.6	0.51
	2nd	247	918180.1	33.6	69	267939.8	38.1	178	650240.4	32.1	
	3rd	239	910443.5	32.5	54	218467.5	29.8	185	691976.1	33.3	

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Variable	Tertile	Total			With atopic dermatitis (lifetime prevalence)			Without atopic dermatitis			p-value
		Raw n	Estimated n	Estimated %	Raw n	Estimated n	Estimated %	Raw n	Estimated n	Estimated %	
BPA	1st	250	920351.9	34.0	54	214808.6	29.8	196	705543.3	35.3	0.31
	2nd	240	909114.0	32.6	66	266476.6	36.5	174	642637.4	31.4	
	3rd	246	914057.0	33.4	61	228746.7	33.7	185	685310.4	33.3	
TCS	1st	245	918177.4	33.3	48	189733.0	26.5	197	728444.3	35.5	0.04
	2nd	253	914226.7	34.4	61	236131.4	33.7	192	678095.2	34.6	
	3rd	238	911119.0	32.3	72	284167.4	39.8	166	626951.5	29.9	
MP	1st	237	918520.7	32.2	54	217396.5	29.8	183	701124.1	33.0	0.53
	2nd	242	912488.3	32.9	59	232161.2	32.6	183	680327.0	33.0	
	3rd	257	912514.1	34.9	68	260474.1	37.6	189	652040.0	34.1	
EP	1st	256	917016.0	34.8	60	226111.9	33.1	196	690904.2	35.3	0.79
	2nd	243	916199.9	33.0	59	237507.5	32.6	184	678692.4	33.2	
	3rd	237	910307.0	32.2	62	246412.5	34.3	175	663894.6	31.5	
PP	1st	244	915723.6	33.2	51	200191.5	28.2	193	715532.2	34.8	0.24
	2nd	240	915815.2	32.6	61	243150.0	33.7	179	672665.2	32.3	
	3rd	252	911984.2	34.2	69	266690.4	38.1	183	645293.8	33.0	
BP	1st	241	917794.2	32.7	58	232499.7	32.0	183	685294.5	33.0	0.97
	2nd	245	916073.0	33.3	59	238679.4	32.6	186	677393.7	33.5	
	3rd	250	909655.8	34.0	64	238852.8	35.4	186	670803.0	33.5	
BP_3	1st	241	918718.8	32.7	53	214311.3	29.3	188	704407.5	33.9	0.55
	2nd	246	912102.1	33.4	66	260204.7	36.5	180	651897.4	32.4	
	3rd	249	912702.1	33.8	62	235515.9	34.3	187	677186.2	33.7	
tt_MA	1st	247	916569.1	33.6	60	232508.4	33.1	187	684060.6	33.7	0.67
	2nd	244	914569.9	33.2	63	255513.6	34.8	181	659056.4	32.6	
	3rd	245	912384.0	33.3	58	222009.9	32.0	187	690374.1	33.7	
BMA	1st	250	916726.6	34.0	49	196993.3	27.1	201	719733.2	36.2	0.14
	2nd	243	912430.2	33.0	56	229720.6	30.9	187	682709.6	33.7	
	3rd	243	914366.2	33.0	76	283317.9	42.0	167	631048.3	30.1	

Uhg – mercury; Ucd – cadmium; OHP – 1-hydroxypyrene; NAP – 2-naphthol; OHFlu – 2-hydroxyfluorene; OHPhe – 1-hydroxyphenanthrene; MEHHP – mono-2-ethyl-5-hydroxyhexyl phthalate; MEOHP – mono-2-ethyl-5-oxohexyl phthalate; MnBP – mono-butyl phthalate; MECPP – mono-2-ethyl-5-carboxypentyl phthalate; MBzP – mono-benzyl phthalate; MCPP – mono-3-carboxypropyl phthalate; MEP – mono-ethyl phthalate; MMP – mono-methyl phthalate; BPA – bisphenol A; BPF – bisphenol F; BPS – bisphenol S; TCS – triclosan; MP – methyl paraben; EP – ethyl paraben; PP – propyl paraben; BP – butyl paraben; BP_3 – benzophenone-3; PBA – 3-phenoxybenzoic acid; COT – cotinine, tt_MA – trans,trans-muconic acid; BMA – benzyl mercapturic acid
All urinary biological exposure indices concentrations are expressed in µg/g creatinine.

S Table 4. *Association between heavy metal complex exposure and atopic dermatitis in a fully adjusted model controlling for all pollutants and potential confounders*

		OR (95% CI)	p-value
QGC	Complex exposure	1.69 (1.24, 2.30)	0.001
	Weight for mercury 0.49		
	Weight for cadmium 0.51		

CI – confidence interval; OR – odds ratio; QGC – quantile g-computation
Adjusted for confounders and all biological exposure index presented previously.