**Supplementary materials**

**Pregnancy exposure to phenols and anthropometric measures in gestation and at birth in a cohort relying on repeated within-subject urine biospecimens**

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# Supplementary methods

## Study inclusion criteria

Inclusion criteria were 1) being pregnant (singleton pregnancy) by less than 19 gestational weeks at inclusion, 2) at least 18 years of age, 3) to read and speak French fluently, 4) to be affiliated to the French national social security system, and 5) to plan to deliver in one of the four maternity clinics of the area.

## Assessment of prenatal exposure to synthetic phenols

Ultra-performance liquid chromatography coupled to tandem mass spectrometry (UPLC-MS/MS) was used to measure urinary environmental phenols as described elsewhere.1 In brief, 200 µL of urine sample were mixed with internal standards and enzyme solution (beta-glucuronidase/ sulfatase in ammonium acetate buffer, pH 5.0) and incubated for 4h at 37°C. Next, the enzymatic reaction was stopped by addition of 40% formic acid. The samples were then centrifuged and 80µL of the supernatant was transferred into the UPLC-MS/MS system. For validation purposes, in-house pooled urine samples were analyzed along with the standard reference material provided by the National Institute of Standards and Technology (USA). Obtained inter- and intra-precisions were lower than 26% and accuracies ranged between 75 to 120%.

## Phenol concentrations standardization

All continuous exposures but triclosan that was not affected by urine processing and assay, were standardized using a two-step approach.2–4 Considered conditions were as follows: sample transport time from participant’s home to the biobank, individual samples thawing time at 4°C during the pooling procedure, and analytical batches. First, we estimated the associations between each biomarker concentration assessed in pools (ln-transformed) and the conditions mentioned above using linear regression adjusted for maternal age, education, pre-pregnancy body mass index, parity, date, season, and pregnancy trimester of sample collection, and specific gravity. We then used the measured biomarker concentrations and the estimated effects of processing/ assay conditions associated with the biomarker urine concentrations (p-value <0.2) to predict standardized concentrations, i.e., the concentrations that would have been observed if all samples had been processed under the same conditions and assayed in the same batch.

Categorized exposure (bisphenol S, butylparaben) concentrations were not standardized. Triclosan concentrations were not standardized either, as none of the considered conditions was associated with this phenol.

## Imputation of the missing data

Phenol concentration values below limit of detection (LOD) and between LOD and limit of quantification (LOQ) were singly imputed using *NADA*,5 and *msm*,6 R packages to implement the “fill-in” method,7,8 consisting of randomly drawing values below the LOD and between LOD and LOQ from the estimated distribution of the compound. Missing values for covariates were replaced by the median value for continuous variables (maternal height and gestational duration) and by mode for categorical variables (maternal education level, maternal active smoking, and child sex).

## Selection of the ultrasound measurements

For each woman we selected two ultrasound measurements (one for the second and one for the third pregnancy trimester). For women who had more than one ultrasound measurement assessed per trimester of pregnancy, we selected those ultrasound examinations that were performed at the gestational age closest to the median gestational age of women with only one ultrasound per trimester available.

## Coding of the adjustment variables

The coding of the potential confounders was as follows: maternal height (continuous), maternal pre-pregnancy weight (continuous), maternal age (continuous), maternal active smoking during second trimester of pregnancy above one cigarette per day (no, yes), maternal education level (below three years after high school, three-four years after high school, above four years after high school), gestational duration (continuous and quadratic term), child sex (female, male; except for models stratified by sex), and parity (zero, one, two children or more). While not formally accounting for urine dilution of individual samples, biomarker concentrations assessed in equal volume pools correlated well with those assessed in a pool of all urine samples collected over 24h or over a week.9 For this reason, our statistical analyses were not adjusted for marker of urine dilution, such as specific gravity.

## Maximum likelihood-based method to correct effect estimates

In studies with repeated assessments of exposure, standard regression calibration does not make the most efficient use of the information available due to its dependence on the ordering of the replicate measurements.10 Therefore, as an alternative way to account for exposure measurement error, we applied a standard random-intercept model to estimate the association between exposures and the outcome. We relied on bootstrap with 100 replications to calculate the variance of the estimated effects,11 and used the *mecor* R package.12 We relied on one to two urine pools per subject collected at trimesters 2 and 3 (the model is adapted to deal with unbalanced replicates). The applied algorithm allows for correction of the exposure-outcome associations for exposure measurement error by estimating the unobserved exposure $X\_{i}$ (real exposure measured without error) using $k\_{i}$ (one or two in our case) error-prone measurements ($W\_{i1}, …, W\_{ik\_{i}}$) of $X\_{i}$ and the predicted values of $X\_{i}$ in the regression model. The resulting estimated calibration function is $E(X\_{i}|Z\_{i}, \overbar{W}\_{i·})$, where $\overbar{W}\_{i·}$ is the mean of $k\_{i}$ repeated measurements.

# Supplementary results for sensitivity analyses

## Correction of the effect estimates using measurement error model

In general, effect estimates corrected by measurement error models may be closer to the real effect estimates than the uncorrected ones, however confidence intervals (CIs) should be interpreted with caution since usually they show larger variances than CIs of uncorrected effect estimates obtained in the pooling approach.13 Indeed, for exposures identified as associated with growth outcomes in our main analysis, the effect estimates corrected using the maximum likelihood-based method were generally further from zero compared to the main study, but the CIs widened notably (Supplementary Table 5).

## Non-standardized pregnancy phenol concentrations

In our main analysis, among the standardized biomarker concentrations, we detected associations only between averaged trimesters 2 and 3 concentrations of benzophenone-3 and third trimester ultrasound head circumference (β = 0.07, 95% CI: 0.01; 0.13) and between methylparaben and third trimester abdominal circumference (β = 0.06, 95% CI: 0.00; 0.12). These associations were almost identical when the non-standardized exposure concentrations were used (β = 0.06, 95% CI: 0.00; 0.12 and β = 0.06, 95% CI: 0.01; 0.12, respectively), Supplementary Table 6.

## Individuals with inverse dates of exposure and growth assessment

For the associations with third trimester outcomes, after filtering out of the individuals for whom data on pregnancy phenol exposure was collected after the ultrasound examination, the sample size decreased by more than 50%. Nevertheless, in most cases, the signs of effect estimates were preserved while the CIs widened notably (Supplementary Table 7). The associations between butylparaben and third trimester abdominal circumference observed in the main analysis were not retained.

# Supplementary Tables

## Supplementary Table 1: Distributions of the growth outcomes measured during pregnancy and at birth.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Outcome** | **Outcome period** | **Median GA** | **Mean (SD)a** | **N** |
| Abdominal circumference | Trimester 2 | 21.7 | 174 (10) | 433 |
| Biparietal diameter | 53 (3) | 435 |
| Femur length | 37 (2) | 435 |
| Head circumference | 191 (9) | 433 |
| Abdominal circumference | Trimester 3 | 32.4 | 286 (15) | 436 |
| Biparietal diameter | 82 (3) | 437 |
| Femur length | 62 (2) | 437 |
| Head circumference | 294 (11) | 434 |
| Birth length | Birth | 40.0 | 501 (23) | 470 |
| Birth weight | 3.3 (0.5) | 475 |
| Head circumference | 345 (14) | 466 |

 |

a All units are given in mm except for birth weight that is displayed in kg.

Abbreviations: GA: gestational age. SD: standard deviation.

## Supplementary Table 2: Adjusted associations between pregnancy phenol concentrations and standardized growth outcomes *in utero* (trimesters 2 and 3) and at birth.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Exposure** | **Out-come period** |  | **Head circumference** | **Abdominal circumference** | **Biparietal diameter** | **Femur Length** | **Weight (birth only)** | **Length (birth only)** |
|  | **β (95% CI)a** | **N** | **p-valueb** | **β (95% CI)a** | **N** | **p-valueb** | **β (95% CI)a** | **N** | **p-valueb** | **β (95% CI)a** | **N** | **p-valueb** | **β (95% CI)a** | **N** | **p-valueb** | **β (95% CI)a** | **N** | **p-valueb** |
| **BPA** | Trim. 2 |   |  0.02 (-0.07; 0.10) | 433 | 0.7 |  0.03 (-0.06; 0.12) | 433 | 0.5 |  0.01 (-0.08; 0.10) | 435 | 0.8 |  0.03 (-0.06; 0.12) | 435 | 0.5 |   |   |   |   |   |   |
| Trim. 3 |   | -0.07 (-0.19; 0.04) | 434 | 0.2 |  0.04 (-0.08; 0.15) | 436 | 0.5 | -0.06 (-0.18; 0.06) | 437 | 0.3 |  0.08 (-0.04; 0.19) | 437 | 0.2 |   |   |   |   |   |   |
| Birth |   | -0.02 (-0.13; 0.08)\* | 466 | 0.7 |   |   |   |   |   |   |   |   |   | -0.02 (-0.12; 0.08) | 475 | 0.7 |  0.03 (-0.06; 0.13)\* | 470 | 0.5 |
| **BPS** | Trim. 2 |  | reference |   |   | reference |   |   | reference |   |   | reference |   |   |   |   |   |   |   |   |
| LOD-LOQ | -0.08 (-0.43; 0.28) | 18 | 0.8 | -0.04 (-0.42; 0.34) | 18 | 0.9 | -0.15 (-0.52; 0.23) | 19 | 0.7 | -0.09 (-0.45; 0.26) | 19 | 0.9 |   |   |   |   |   |   |
| >LOQ |  0.04 (-0.14; 0.21) | 88 |   |  0.05 (-0.14; 0.24) | 88 |   | -0.04 (-0.23; 0.15) | 88 |   | -0.02 (-0.20; 0.16) | 88 |   |   |   |   |   |   |   |
|  |  | reference |   |   | reference |   |   | reference |   |   | reference |   |   |   |   |   |   |   |   |
| Trim. 3 | >LOD trim. 2 or 3 |  0.04 (-0.13; 0.22) | 149 | 0.9 |  0.02 (-0.16; 0.20) | 150 | 1 |  0.06 (-0.13; 0.24) | 150 | 0.6 |  0.20 ( 0.02; 0.37) | 150 | 0.08 |   |   |   |   |   |   |
| >LOD trim. 2 and 3 | -0.02 (-0.32; 0.27) | 37 |   | -0.03 (-0.34; 0.28) | 37 |   |  0.16 (-0.15; 0.47) | 38 |   |  0.11 (-0.18; 0.41) | 38 |   |   |   |   |   |   |   |
|  |  | reference |   |   |   |   |   |   |   |   |   |   |   | reference |   |   | reference |   |   |
| Birth | >LOD trim. 2 or 3 |  0.08 (-0.09; 0.24) | 161 | 0.6 |   |   |   |   |   |   |   |   |   |  0.09 (-0.06; 0.25) | 163 | 0.5 |  0.11 (-0.04; 0.26) | 162 | 0.4 |
| >LOD trim. 2 and 3 |  0.06 (-0.21; 0.34) | 41 |   |   |   |   |   |   |   |   |   |   | -0.02 (-0.28; 0.24) | 42 |   |  0.00 (-0.26; 0.25) | 41 |   |
| **Triclosan** | Trim. 2 |   | -0.02 (-0.06; 0.02) | 433 | 0.3 | -0.01 (-0.05; 0.03) | 433 | 0.7 |  0.00 (-0.04; 0.04) | 435 | 0.9 |  0.01 (-0.02; 0.05) | 435 | 0.5 |   |   |   |   |   |   |
| Trim. 3 |   | -0.01 (-0.05; 0.04) | 434 | 0.8 | -0.05 (-0.10; 0.00) | 436 | 0.04 |  0.01 (-0.04; 0.06) | 437 | 0.6 |  0.01 (-0.04; 0.05) | 437 | 0.8 |   |   |   |   |   |   |
| Birth |   | -0.02 (-0.06; 0.03) | 466 | 0.4 |   |   |   |   |   |   |   |   |   | -0.01 (-0.05; 0.03) | 475 | 0.6 |  0.01 (-0.04; 0.05) | 470 | 0.8 |
| **BP-3** | Trim. 2 |   | 0.02 (-0.03; 0.06)\* | 433 | 0.5 | 0.02 (-0.03; 0.07)\* | 433 | 0.5 | 0.02 (-0.03; 0.07)\* | 435 | 0.5 | 0.02 (-0.03; 0.07)\* | 435 | 0.4 |   |   |   |   |   |   |
| Trim. 3 |   | 0.07 ( 0.01; 0.13) | 434 | 0.03 | 0.03 (-0.03; 0.09)\* | 436 | 0.4 | 0.05 (-0.01; 0.12) | 437 | 0.1 | 0.03 (-0.03; 0.09) | 437 | 0.4 |   |   |   |   |   |   |
| Birth |   | 0.01 (-0.05; 0.07)\* | 466 | 0.8 |   |   |   |   |   |   |   |   |   | 0.01 (-0.04; 0.07) | 475 | 0.7 | 0.04 (-0.01; 0.09) | 470 | 0.1 |
| **Parabens** |  |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **BUPA** |  |  | reference |   |   | reference |   |   | reference |   |   | reference |   |   |   |   |   |   |   |   |
| Trim. 2 | LOD-LOQ |  0.03 (-0.19; 0.24) | 56 | 0.5 |  0.03 (-0.20; 0.25) | 56 | 0.4 |  0.09 (-0.14; 0.32) | 56 | 0.6 |  0.08 (-0.14; 0.29)\* | 56 | 0.6 |   |   |   |   |   |   |
| >LOQ | -0.13 (-0.36; 0.10) | 47 |   | -0.17 (-0.42; 0.07) | 47 |   | -0.08 (-0.33; 0.16)\* | 47 |   | -0.08 (-0.32; 0.15)\* | 47 |   |   |   |   |   |   |   |
|  |  | reference |   |   | reference |   |   | reference |   |   | reference |   |   |   |   |   |   |   |   |
| Trim. 3 | >LOD trim. 2 or 3 | -0.04 (-0.24; 0.15) | 102 | 0.9 | -0.25 (-0.45; -0.05) | 103 | 0.04 | -0.07 (-0.27; 0.14) | 103 | 0.8 | -0.01 (-0.21; 0.18) | 103 | 1 |   |   |   |   |   |   |
| >LOD trim. 2 and 3 | -0.04 (-0.31; 0.22) | 47 |   |  0.01 (-0.26; 0.28) | 47 |   | -0.04 (-0.32; 0.24) | 47 |   | -0.01 (-0.27; 0.26)\* | 47 |   |   |   |   |   |   |   |
|  |  | reference |   |   |   |   |   |   |   |   |   |   |   | reference |   |   | reference |   |   |
| Birth | >LOD trim. 2 or 3 | -0.07 (-0.25; 0.11) | 112 | 0.08 |   |   |   |   |   |   |   |   |   | -0.19 (-0.36; -0.02) | 114 | 0.08 | -0.11 (-0.28; 0.06) | 113 | 0.3 |
|  | >LOD trim. 2 and 3 | -0.27 (-0.51; -0.03) | 55 |   |   |   |   |   |   |   |   |   |   | -0.06 (-0.28; 0.17)\* | 55 |   |  0.06 (-0.16; 0.28) | 55 |   |
| **ETPA** | Trim. 2 |   | -0.02 (-0.06; 0.03)\* | 433 | 0.5 |  0.00 (-0.05; 0.05)\* | 433 | 1 |  0.00 (-0.05; 0.06) | 435 | 0.9 | -0.02 (-0.07; 0.03)\* | 435 | 0.4 |   |   |   |   |   |   |
| Trim. 3 |   |  0.00 (-0.07; 0.06) | 434 | 0.9 |  0.03 (-0.04; 0.09) | 436 | 0.5 |  0.00 (-0.06; 0.07) | 437 | 0.9 |  0.01 (-0.05; 0.08) | 437 | 0.7 |   |   |   |   |   |   |
| Birth |   | -0.03 (-0.09; 0.03)\* | 466 | 0.3 |   |   |   |   |   |   |   |   |   |  0.01 (-0.05; 0.07)\* | 475 | 0.7 |  0.00 (-0.05; 0.06) | 470 | 0.9 |
| **MEPA** | Trim. 2 |   | 0.00 (-0.05; 0.05) | 433 | 1 | 0.02 (-0.03; 0.08) | 433 | 0.4 | 0.01 (-0.04; 0.07) | 435 | 0.6 | 0.01 (-0.04; 0.05) | 435 | 0.8 |   |   |   |   |   |   |
| Trim. 3 |   | 0.04 (-0.02; 0.09) | 434 | 0.2 | 0.06 ( 0.00; 0.12) | 436 | 0.04 | 0.04 (-0.02; 0.10) | 437 | 0.2 | 0.05 (-0.01; 0.10) | 437 | 0.09 |   |   |   |   |   |   |
| Birth |   | 0.01 (-0.04; 0.06) | 466 | 0.6 |   |   |   |   |   |   |   |   |   | 0.04 (-0.01; 0.09) | 475 | 0.1 | 0.01 (-0.03; 0.06) | 470 | 0.6 |
| **PRPA** | Trim. 2 |   | -0.01 (-0.04; 0.01) | 433 | 0.4 | -0.01 (-0.04; 0.01) | 433 | 0.3 | -0.01 (-0.04; 0.02) | 435 | 0.5 | -0.01 (-0.03; 0.02) | 435 | 0.7 |   |   |   |   |   |   |
| Trim. 3 |   |  0.00 (-0.03; 0.03) | 434 | 1 |  0.00 (-0.03; 0.04) | 436 | 0.8 |  0.00 (-0.04; 0.03) | 437 | 0.9 |  0.00 (-0.03; 0.03) | 437 | 0.9 |   |   |   |   |   |   |
| Birth |   |  0.00 (-0.03; 0.03) | 466 | 0.8 |   |   |   |   |   |   |   |   |   | -0.02 (-0.04; 0.01) | 475 | 0.3 |  0.00 (-0.03; 0.02) | 470 | 0.8 |

Trimester 2 outcomes were related to trimester 2 exposures while trimester 3 and birth outcomes were related to trimesters 2 and 3 averaged exposures. Regression models were adjusted for maternal height, maternal pre-pregnancy weight, maternal age, maternal active smoking during trimester 2, maternal education level, gestational duration, child sex, and parity.

a For continuous phenol biomarker concentrations (BP-3, BPA, ETPA, MEPA, PRPA, triclosan), β regression estimates correspond to the change in standard deviation of the considered growth outcome associated with a 1-unit increase in standardized ln-transformed urinary phenol concentration. For categorically-coded exposures (BPS, BUPA) measured at trimester 2, β estimates correspond to the change, expressed in standard deviations, of the growth outcome associated with phenol biomarker concentrations between LOD and LOQ or >LOQ compared to <LOD concentrations (reference). For BPS and BUPA measured at trimester 3, β estimates correspond to the change in standard deviation of growth outcome associated with phenol biomarker concentrations >LOD at trimester 2 or 3 or at trimester 2 and 3 compared to <LOD concentrations at trimester 2 and 3 (reference). For the original units of growth measurements refer to the Supplementary Table 1.

b For categorically coded exposures (BPS, BUPA), p-values are given for Wald test testing the overall effect of exposure.

\* p-value <0.2 for interaction with child sex. Results for sex-stratified analysis are provided in the Supplementary Table 3.

Abbreviations: BP-3: benzphenone-3. BPA: bisphenol A. BPS: bisphenol S. BUPA: butylparaben. CI: confidence interval. ETPA: ethylparaben. LOD: limit of detection. LOQ: limit of quantification. MEPA: methylparaben. PRPA: propylparaben. Trim: trimester.

## Supplementary Table 3: Adjusted associations between pregnancy phenol concentrations and growth outcomes *in utero* (at trimesters 2 and 3) and at birth in a sex-stratified analysisa.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Expo-sure** | **Out-come period** | **Child sex** |  | **Head circumference** | **Abdominal circumference** | **Biparietal diameter** | **Femur Length** | **Weight (birth only)** | **Length (birth only)** |
|  | **β (95% CI)b** | **N** | **p-val.c** | **int. p-val.** | **β (95% CI)b** | **N** | **p-val.c** | **int. p-val.** | **β (95% CI)b** | **N** | **p-val.c** | **int. p-val.** | **β (95% CI)b** | **N** | **p-val.c** | **int. p-val.** | **β (95% CI)b** | **N** | **p-val.c** | **int. p-val.** | **β (95% CI)b** | **N** | **p-val.c** | **int. p-val.** |
| **BPA** | Birth | Female |   | -0.15 (-0.29; 0.00) | 216 | 0.05 | 0.02 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | -0.06 (-0.20; 0.08) | 217 | 0.4 | 0.06 |
| Male |   | 0.10 (-0.05; 0.25) | 250 | 0.2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0.14 (-0.01; 0.28) | 253 | 0.06 |
| **BP-3** | Trim. 2 | Female |   | -0.01 (-0.08; 0.05) | 198 | 0.8 | 0.1 | 0.00 (-0.07; 0.07) | 199 | 1 | 0.1 | -0.05 (-0.12; 0.02) | 200 | 0.2 | 0.002 | -0.01 (-0.08; 0.05) | 200 | 0.7 | 0.06 |  |  |  |  |  |  |  |  |
| Male |   | 0.05 (-0.02; 0.12) | 235 | 0.1 | 0.05 (-0.02; 0.13) | 234 | 0.1 | 0.10 ( 0.02; 0.17) | 235 | 0.01 | 0.06 (-0.01; 0.13) | 235 | 0.09 |  |  |  |  |  |  |  |  |
| Trim. 3 | Female |   |  |  |  |  | -0.01 (-0.10; 0.07) | 196 | 0.8 | 0.1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Male |   |  |  |  | 0.07 (-0.02; 0.16) | 240 | 0.1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Birth | Female |   | -0.03 (-0.12; 0.05) | 216 | 0.4 | 0.08 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Male |   | 0.05 (-0.03; 0.13) | 250 | 0.2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **BUPA** | Trim. 2 |   |  |  |  |  |  |  |  |  |  | reference |  |  |  | reference |  |  |  |  |  |  |  |  |  |  |  |
| Female | LOD-LOQ |  |  |  |  |  |  |  |  |  |  |  |  | -0.05 (-0.38; 0.29) | 23 | 0.4 | 0.2 |  |  |  |  |  |  |  |  |
| Male | LOD-LOQ |  |  |  |  |  |  |  |  |  |  |  | 0.25 (-0.04; 0.55) | 33 | 0.2 |  |  |  |  |  |  |  |  |
| Female | >LOQ |  |  |  |  |  |  |  |  | -0.27 (-0.61; 0.07) | 24 | 0.3 | 0.06 | -0.22 (-0.55; 0.11) | 24 | 0.4 | 0.1 |  |  |  |  |  |  |  |  |
| Male | >LOQ |  |  |  |  |  |  |  |  | 0.15 (-0.21; 0.51) | 23 | 0.3 | 0.11 (-0.23; 0.45) | 23 | 0.2 |  |  |  |  |  |  |  |  |
| Trim. 3 |   |  |  |  |  |  |  |  |  |  |  |  |  |  | reference |  |  |  |  |  |  |  |  |  |  |  |
| Female | >LOD trim. 2 and 3 |  |  |  |  |  |  |  |  |  |  |  |  | -0.28 (-0.64; 0.08) | 22 | 0.2 | 0.1 |  |  |  |  |  |  |  |  |
| Male | >LOD trim. 2 and 3 |  |  |  |  |  |  |  |  |  |  |  |  | 0.16 (-0.23; 0.54) | 25 | 0.7 |  |  |  |  |  |  |  |  |
| Birth |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | reference |  |  |  |  |  |  |  |
| Female | >LOD trim. 2 and 3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | -0.31 (-0.61; -0.01) | 28 | 0.05 | 0.04 |  |  |  |  |
| Male | >LOD trim. 2 and 3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0.19 (-0.15; 0.54) | 27 | 0.1 |  |  |  |  |
| **ETPA** | Trim. 2 | Female |   | -0.05 (-0.12; 0.03) | 198 | 0.2 | 0.1 | -0.05 (-0.13; 0.03) | 199 | 0.2 | 0.1 |  |  |  |  | -0.06 (-0.14; 0.01) | 200 | 0.1 | 0.07 |  |  |  |  |  |  |  |  |
| Male |   | 0.01 (-0.05; 0.08) | 235 | 0.7 | 0.03 (-0.03; 0.10) | 234 | 0.3 |  |  |  |  |  | 0.02 (-0.05; 0.08) | 235 | 0.6 |  |  |  |  |  |  |  |
| Birth  | Female |   | -0.07 (-0.15; 0.01) | 216 | 0.1 | 0.2 |  |  |  |  |  |  |  |  |  |  |  |  | -0.05 (-0.13; 0.02) | 220 | 0.1 | 0.05 |  |  |  |  |
| Male |   | 0.01 (-0.08; 0.09) | 250 | 0.9 |  |  |  |  |  |  |  |  |  |  |  |  | 0.06 (-0.02; 0.15) | 255 | 0.1 |  |  |  |  |

Trimester 2 outcomes were related to trimester 2 exposures while trimester 3 and birth outcomes were related to trimesters 2 and 3 averaged exposures. Regression models were adjusted for maternal height, maternal pre-pregnancy weight, maternal age, maternal active smoking during trimester 2, maternal education level, gestational duration, and parity. For BPS, MEPA, PRPA, and triclosan no interactions with child sex were detected.

a Only associations with p-values <0.2 for an interaction term between sex and phenol concentration in the main analysis are displayed in this table.

b For continuous phenol biomarker concentrations (BP-3, BPA, ETPA), β regression estimates correspond to the change in standard deviation of the considered growth outcome associated with a 1-unit increase in standardized ln-transformed urinary phenol concentration. For categorically-coded exposure (BUPA) measured at trimester 2, β estimates correspond to the change, expressed in standard deviations, of the growth outcome associated with phenol biomarker concentrations between LOD and LOQ or >LOQ compared to <LOD concentrations (reference). For BUPA measured at trimester 3, β estimates correspond to the change in standard deviation of growth outcome associated with phenol biomarker concentrations >LOD at trimester 2 or 3 or at trimester 2 and 3 compared to <LOD concentrations at trimester 2 and 3 (reference).

c For categorically coded exposure (BUPA), p-values are given for Wald test testing the overall effect of exposure.

Abbreviations: BP-3: benzophenone-3. BPA: bisphenol A. BPS: bisphenols S. BUPA: butylparaben. CI: confidence interval. ETPA: ethylparaben. int.: interaction. LOD: limit of detection. LOQ: limit of quantification. MEPA: methylparaben. PRPA: propylparaben. Trim.: trimester.

## Supplementary Table 4: Intraclass correlation coefficients (ICC) reported in previous studies assessing the variability of phenols in spot urine samples of pregnant womena, restricted to compounds assessed in the present study.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Reference** | Current studyb | 14 | 15 | 16 | 17 | 18 | 19,20 | 21,22 | 23 | 24 |
| **N of subjects** | 478 | 332 | 137 | 71 | 105 | 80 | 45 | 80 | 154 | 386 |
| **Phenol** |  |  |  |  |  |  |  |  |  |  |
| **Bisphenol A** | 0.16 (0.07, 0.25) | 0.11 | 0.12 | 0.14 | 0.24 (0.13, 0.40) | 0.31 (0.16, 0.47) | 0.04 (-0.07, 0.17) | Between-trimester: 0.07 (0.02, 0.25) | 0.24 (0.11, 0.43) | 0.16 |
| **Bisphenol S** | < 30% detection | - | - | - | - | - | - | - | - | 0.16 |
| **Benzophenone-3** | 0.66 (0.61, 0.71) | - | - | 0.70 | 0.62 (0.51, 0.71) | - | < 50% detection | - | 0.65 (0.55, 0.73) | 0.56 |
| **Triclosan** | 0.47 (0.39, 0.53) | - | - | 0.61 | 0.47 (0.35, 0.59) | - | 0.49 (0.31, 0.65) | Between-trimester: 0.50Within-day: 0.77–0.79 | 0.41 (0.29, 055) | 0.58 |
| **Butylparaben** | < 30% detection | - | - | 0.64 | 0.47 (0.35, 0.60) | - | 0.38 (0.23, 0.53) | - | 0.54 (0.43, 0.65) | - |
| **Ethylparaben** | 0.43 (0.36, 0.51) | - | - | 0.44 | - | - | - | - | 0.53 (0.25, 0.64) | - |
| **Methylparaben** | 0.38 (0.30, 0.46) | - | - | 0.61 | 0.39 (0.27, 0.53) | - | 0.24 (0.10, 0.40) | - | 0.38 (0.25, 0.52) | - |
| **Propylparaben** | 0.43 (0.35, 0.50) | - | - | 0.54 | 0.32 (0.20, 0.47) | - | 0.62 (0.49, 0.72) | - | 0.36 (0.24, 0.51) | - |
|   |  |  |  |  |  |  |  |  |  |  |
| ICC interpretation after,25: | poor < .40 | moderate .40-.59 | good .60-.74 | excellent > .75 |  |  |  |  |  |  |

a Only studies that collected ≥ three voids per subject during pregnancy and reported an ICC. ICCs were calculated considering creatinine-standardized,13-22 specific gravity-standardized,23 or standardized using two-step approach,2,3 (current study) phenol concentrations.

b The only study where sample pooling was applied.

## Supplementary Table 5: Sensitivity analysis. Adjusted regression with maximum likelihood-based method applied to correct effect estimates.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Exposurea** | **ICC** | **Outcome period** | **Head circumference** | **Abdominal circumference** | **Biparietal diameter** | **Femur Length** | **Weight (birth only)** | **Length (birth only)** |
| **β (95% CI)b** | **N** | **β (95% CI)b** | **N** | **β (95% CI)b** | **N** | **β (95% CI)b** | **N** | **β (95% CI)b** | **N** | **β (95% CI)b** | **N** |
| **BPA** | 0.16 | Trim. 2 |  0.16 (-0.14; 0.63) | 433 |  0.15 (-0.25; 0.60) | 433 |  0.09 (-0.20; 0.54) | 435 |  0.13 (-0.24; 0.64) | 435 |   |   |   |   |
| Trim. 3 | -0.27 (-0.88; 0.05) | 434 |  0.16 (-0.44; 0.63) | 436 | -0.25 (-1.13; 0.29) | 437 |  0.20 (-0.22; 0.74) | 437 |   |   |   |   |
| Birth | -0.11 (-0.57; 0.26) | 466 |   |   |   |   |   |   | -0.09 (-0.46; 0.34) | 475 |  0.10 (-0.26; 0.50) | 470 |
| **Triclosan** | 0.47 | Trim. 2 | -0.03 (-0.08; 0.01) | 433 | -0.04 (-0.12; 0.02) | 433 |  0.01 (-0.04; 0.07) | 435 |  0.03 (-0.01; 0.09) | 435 |   |   |   |   |
| Trim. 3 | -0.01 (-0.07; 0.06) | 434 | -0.08 (-0.17; -0.01) | 436 |  0.02 (-0.06; 0.11) | 437 |  0.01 (-0.07; 0.06) | 437 |   |   |   |   |
| Birth | -0.03 (-0.11; 0.04) | 466 |   |   |   |   |   |   | -0.02 (-0.08; 0.07) | 475 |  0.01 (-0.04; 0.07) | 470 |
| **BP-3** | 0.66 | Trim. 2 | 0.05 ( 0.00; 0.11) | 433 | 0.04 (-0.02; 0.11) | 433 | 0.04 (-0.02; 0.12) | 435 | 0.04 (-0.03; 0.09) | 435 |   |   |   |   |
| Trim. 3 | 0.09 ( 0.00; 0.15) | 434 | 0.04 (-0.06; 0.12) | 436 | 0.07 (-0.01; 0.14) | 437 | 0.04 (-0.05; 0.11) | 437 |   |   |   |   |
| Birth | 0.01 (-0.06; 0.08) | 466 |   |   |   |   |   |   | 0.02 (-0.04; 0.07) | 475 | 0.05 (-0.02; 0.11) | 470 |
| **ETPA** | 0.43 | Trim. 2 | -0.03 (-0.09; 0.05) | 433 |  0.00 (-0.09; 0.11) | 433 |  0.00 (-0.10; 0.10) | 435 | -0.03 (-0.11; 0.07) | 435 |   |   |   |   |
| Trim. 3 |  0.00 (-0.08; 0.12) | 434 |  0.04 (-0.06; 0.18) | 436 |  0.01 (-0.11; 0.12) | 437 |  0.03 (-0.09; 0.13) | 437 |   |   |   |   |
| Birth | -0.06 (-0.14; 0.04) | 466 |   |   |   |   |   |   |  0.01 (-0.08; 0.10) | 475 |  0.00 (-0.08; 0.10) | 470 |
| **MEPA** | 0.38 | Trim. 2 | 0.01 (-0.08; 0.15) | 433 | 0.09 (-0.01; 0.26) | 433 | 0.04 (-0.03; 0.19) | 435 | 0.05 (-0.02; 0.20) | 435 |   |   |   |   |
| Trim. 3 | 0.07 (-0.02; 0.15) | 434 | 0.11 ( 0.03; 0.23) | 436 | 0.08 (-0.01; 0.19) | 437 | 0.10 (-0.02; 0.22) | 437 |   |   |   |   |
| Birth | 0.02 (-0.06; 0.10) | 466 |   |   |   |   |   |   | 0.07 (-0.02; 0.16) | 475 | 0.03 (-0.07; 0.12) | 470 |
| **PRPA** | 0.43 | Trim. 2 | -0.02 (-0.06; 0.04) | 433 | -0.01 (-0.06; 0.05) | 433 |  0.01 (-0.04; 0.07) | 435 |  0.00 (-0.04; 0.06) | 435 |   |   |   |   |
| Trim. 3 |  0.00 (-0.05; 0.04) | 434 |  0.01 (-0.06; 0.05) | 436 | -0.01 (-0.07; 0.05) | 437 |  0.00 (-0.05; 0.06) | 437 |   |   |   |   |
| Birth |  0.01 (-0.04; 0.05) | 466 |   |   |   |   |   |   | -0.03 (-0.08; 0.02) | 475 | -0.01 (-0.04; 0.04) | 470 |

Regression models were adjusted for maternal height, maternal pre-pregnancy weight, maternal age, maternal active smoking during trimester 2, maternal education level, gestational duration, child sex, and parity.

a Regression estimates correction was not applied to the categorized phenol concentrations (BPS, BUPA).

b Maximum likelihood estimates for β are reported with 95% CIs calculated using bootstrap with 100 replications and correspond to a change in standard deviation of growth outcome associated with a 1-unit increase in standardized ln-transformed urinary phenol biomarker concentration.

Abbreviations: BP-3: benzophenone-3. BPA: bisphenol A. BPS: bisphenol S. BUPA: butylparaben. CI: confidence interval. ETPA: ethylparaben. ICC: intraclass correlation coefficient. MEPA: methylparaben. PRPA: propylparaben. Trim: trimester.

## Supplementary Table 6: Sensitivity analysis. Adjusted associations between non-standardized pregnancy phenol concentrations and growth outcomes *in utero* (at trimesters 2 and 3) and at birth.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Expo-surea** | **Outcome period** | **Head circumference** | **Abdominal circumference** | **Biparietal diameter** | **Femur Length** | **Weight (birth only)** | **Length (birth only)** |
| **β (95% CI)b** | **N** | **p-value** | **β (95% CI)b** | **N** | **p-value** | **β (95% CI)b** | **N** | **p-value** | **β (95% CI)b** | **N** | **p-value** | **β (95% CI)b** | **N** | **p-value** | **β (95% CI)b** | **N** | **p-value** |
| **BPA** | Trim. 2 |  0.03 (-0.06; 0.11) | 433 | 0.5 |  0.04 (-0.05; 0.12) | 433 | 0.4 |  0.01 (-0.07; 0.10) | 435 | 0.7 |  0.03 (-0.05; 0.12) | 435 | 0.5 |  |  |  |  |  |  |
| Trim. 3 | -0.08 (-0.19; 0.03) | 434 | 0.2 |  0.03 (-0.08; 0.15) | 436 | 0.6 | -0.06 (-0.18; 0.05) | 437 | 0.3 |  0.09 (-0.02; 0.20) | 437 | 0.1 |  |  |  |  |  |  |
| Birth | -0.04 (-0.15; 0.06) | 466 | 0.4 |  |  |  |  |  |  |  |  |  | -0.03 (-0.13; 0.07) | 475 | 0.5 |  0.02 (-0.08; 0.11) | 470 | 0.7 |
| **BP-3** | Trim. 2 | 0.01 (-0.03; 0.06) | 433 | 0.6 | 0.01 (-0.04; 0.06) | 433 | 0.7 | 0.01 (-0.04; 0.06) | 435 | 0.6 | 0.02 (-0.03; 0.06) | 435 | 0.5 |  |  |  |  |  |  |
| Trim. 3 | 0.06 ( 0.00; 0.12) | 434 | 0.04 | 0.03 (-0.03; 0.09) | 436 | 0.4 | 0.05 (-0.02; 0.11) | 437 | 0.2 | 0.03 (-0.03; 0.09) | 437 | 0.3 |  |  |  |  |  |  |
| Birth | 0.00 (-0.05; 0.06) | 466 | 0.9 |  |  |  |  |  |  |  |  |  | 0.02 (-0.04; 0.07) | 475 | 0.5 | 0.04 (-0.01; 0.09) | 470 | 0.1 |
| **ETPA** | Trim. 2 | -0.01 (-0.05; 0.04) | 433 | 0.8 |  0.01 (-0.04; 0.06) | 433 | 0.8 |  0.01 (-0.04; 0.06) | 435 | 0.7 | -0.02 (-0.07; 0.03) | 435 | 0.5 |  |  |  |  |  |  |
| Trim. 3 | -0.01 (-0.07; 0.06) | 434 | 0.9 |  0.02 (-0.05; 0.09) | 436 | 0.6 |  0.00 (-0.07; 0.06) | 437 | 0.9 |  0.02 (-0.05; 0.08) | 437 | 0.6 |  |  |  |  |  |  |
| Birth | -0.04 (-0.10; 0.02) | 466 | 0.2 |  |  |  |  |  |  |  |  |  |  0.00 (-0.05; 0.06) | 475 | 0.9 |  0.00 (-0.06; 0.05) | 470 | 1 |
| **MEPA** | Trim. 2 | 0.01 (-0.04; 0.05) | 433 | 0.8 | 0.03 (-0.02; 0.08) | 433 | 0.3 | 0.02 (-0.03; 0.07) | 435 | 0.5 | 0.00 (-0.05; 0.05) | 435 | 0.9 |  |  |  |  |  |  |
| Trim. 3 | 0.03 (-0.02; 0.09) | 434 | 0.2 | 0.06 ( 0.01; 0.12) | 436 | 0.03 | 0.04 (-0.02; 0.09) | 437 | 0.2 | 0.05 ( 0.00; 0.11) | 437 | 0.05 |  |  |  |  |  |  |
| Birth | 0.01 (-0.04; 0.06) | 466 | 0.7 |  |  |  |  |  |  |  |  |  | 0.04 (-0.01; 0.08) | 475 | 0.1 | 0.01 (-0.04; 0.06) | 470 | 0.7 |
| **PRPA** | Trim. 2 | -0.01 (-0.03; 0.02) | 433 | 0.6 | -0.01 (-0.04; 0.02) | 433 | 0.5 | -0.01 (-0.03; 0.02) | 435 | 0.6 | -0.01 (-0.03; 0.02) | 435 | 0.6 |  |  |  |  |  |  |
| Trim. 3 |  0.00 (-0.03; 0.04) | 434 | 0.8 |  0.01 (-0.02; 0.04) | 436 | 0.6 |  0.00 (-0.03; 0.03) | 437 | 1 |  0.01 (-0.03; 0.04) | 437 | 0.7 |  |  |  |  |  |  |
| Birth |  0.01 (-0.02; 0.04) | 466 | 0.7 |  |  |  |  |  |  |  |  |  | -0.01 (-0.04; 0.02) | 475 | 0.5 |  0.00 (-0.03; 0.03) | 470 | 0.9 |

Trimester 2 outcomes were related to trimester 2 exposures while trimester 3 and birth outcomes were related to trimesters 2 and 3 averaged exposures. Regression models were adjusted for maternal height, maternal pre-pregnancy weight, maternal age, maternal active smoking during trimester 2, maternal education level, gestational duration, child sex, and parity.

a Categorized exposure (BPS, BUPA) concentrations were not standardized; Triclosan concentrations were not standardized either as none of the considered conditions was associated with this phenol.

b β regression estimates are reported with 95% CIs and correspond to a change in standard deviation of growth outcome associated with a 1-unit increase in ln-transformed urinary phenol biomarker concentration.

Abbreviations: BP-3: benzophenone-3. BPA: bisphenol A. BPS: bisphenol S. BUPA: butylparaben. CI: confidence interval. ETPA: ethylparaben. MEPA: methylparaben. PRPA: propylparaben. Trim.: trimester.

## Supplementary Table 7: Sensitivity analysis. Adjusted associations between pregnancy phenol concentrations and growth outcomes *in utero* (at trimesters 2 and 3) and at birth after removal of individuals with inverse assessment of phenols and ultrasound data.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Exposure** | **Out-come period** |  | **Head circumference** | **Abdominal circumference** | **Biparietal diameter** | **Femur Length** | **Weight (birth only)** | **Length (birth only)** |
| **β (95% CI)a** | **N** | **p-valueb** | **β (95% CI)a** | **N** | **p-valueb** | **β (95% CI)a** | **N** | **p-valueb** | **β (95% CI)a** | **N** | **p-valueb** | **β (95% CI)a** | **N** | **p-valueb** | **β (95% CI)a** | **N** | **p-valueb** |
| **BPA** | Trim. 2 |  |  0.02 (-0.07; 0.10) | 430 | 0.7 |  0.03 (-0.06; 0.12) | 430 | 0.5 |  0.01 (-0.08; 0.10) | 432 | 0.9 |  0.03 (-0.06; 0.11) | 432 | 0.5 |   |   |   |   |   |   |
| Trim. 3 |  | -0.07 (-0.27; 0.12) | 171 | 0.5 | -0.01 (-0.22; 0.19) | 173 | 0.9 |  0.00 (-0.19; 0.20) | 173 | 1 |  0.13 (-0.06; 0.32) | 173 | 0.2 |   |   |   |   |   |   |
| Birth |  | -0.06 (-0.23; 0.10) | 209 | 0.5 |   |   |   |   |   |   |   |   |   |  0.02 (-0.14; 0.18) | 212 | 0.8 |  0.04 (-0.12; 0.19) | 210 | 0.6 |
| **BPS** | Trim. 2 |  | reference |   |   | reference |   |   | reference |   |   | reference |   |   |   |   |   |   |   |   |
| LOD-LOQ |  0.04 (-0.14; 0.22) | 87 | 0.8 |  0.04 (-0.15; 0.24) | 87 | 0.9 | -0.04 (-0.23; 0.15) | 87 | 0.7 | -0.01 (-0.19; 0.17) | 87 | 0.9 |   |   |   |   |   |   |
| >LOQ | -0.08 (-0.43; 0.28) | 18 |   | -0.04 (-0.42; 0.34) | 18 |   | -0.15 (-0.52; 0.22) | 19 |   | -0.09 (-0.45; 0.26) | 19 |   |   |   |   |   |   |   |
| Trim. 3 |  | reference |   |   | reference |   |   | reference |   |   | reference |   |   |   |   |   |   |   |   |
| >LOD at trim. 2 or 3 | -0.67 (-1.25; -0.09) | 11 | 0.07 | -0.24 (-0.85; 0.37) | 11 | 0.5 | -0.30 (-0.87; 0.28) | 11 | 0.5 | -0.06 (-0.63; 0.50) | 11 | 0.6 |   |   |   |   |   |   |
| >LOD at trim. 2 and 3 | -0.01 (-0.31; 0.28) | 57 |   | -0.14 (-0.45; 0.17) | 58 |   | -0.11 (-0.41; 0.18) | 58 |   |  0.14 (-0.15; 0.42) | 58 |   |   |   |   |   |   |   |
| Birth |  | reference |   |   |   |   |   |   |   |   |   |   |   | reference |   |   | reference |   |   |
| >LOD at trim. 2 or 3 | -0.02 (-0.51; 0.47) | 14 | 0.9 |   |   |   |   |   |   |   |   |   | -0.06 (-0.52; 0.39) | 15 | 0.9 | -0.06 (-0.51; 0.39) | 14 | 0.5 |
| >LOD at trim. 2 and 3 |  0.06 (-0.19; 0.30) | 72 |   |   |   |   |   |   |   |   |   |   |  0.03 (-0.21; 0.27) | 72 |   |  0.12 (-0.11; 0.35) | 72 |   |
| **Triclosan** | Trim. 2 |  | -0.02 (-0.06; 0.02) | 430 | 0.3 | -0.01 (-0.05; 0.03) | 430 | 0.7 |  0.00 (-0.04; 0.04) | 432 | 0.9 |  0.01 (-0.02; 0.05) | 432 | 0.5 |   |   |   |   |   |   |
| Trim. 3 |  | -0.05 (-0.12; 0.03) | 171 | 0.3 | -0.07 (-0.15; 0.01) | 173 | 0.09 | -0.05 (-0.13; 0.03) | 173 | 0.2 |  0.01 (-0.07; 0.08) | 173 | 0.9 |   |   |   |   |   |   |
| Birth |  | -0.05 (-0.12; 0.02) | 209 | 0.1 |   |   |   |   |   |   |   |   |   | -0.01 (-0.07; 0.06) | 212 | 0.9 |  0.01 (-0.06; 0.07) | 210 | 0.8 |
| **BP-3** | Trim. 2 |  |  0.02 (-0.03; 0.06) | 430 | 0.5 |  0.02 (-0.03; 0.07) | 430 | 0.4 |  0.02 (-0.03; 0.07) | 432 | 0.5 |  0.02 (-0.03; 0.07) | 432 | 0.5 |   |   |   |   |   |   |
| Trim. 3 |  |  0.07 (-0.03; 0.17) | 171 | 0.2 |  0.06 (-0.04; 0.17) | 173 | 0.2 |  0.05 (-0.05; 0.15) | 173 | 0.3 |  0.03 (-0.07; 0.13) | 173 | 0.5 |   |   |   |   |   |   |
| Birth |  | -0.03 (-0.12; 0.06) | 209 | 0.5 |   |   |   |   |   |   |   |   |   |  0.03 (-0.06; 0.11) | 212 | 0.5 |  0.06 (-0.02; 0.15) | 210 | 0.1 |
| **BUPA** | Trim. 2 |  | reference |   |   | reference |   |   | reference |   |   | reference |   |   |   |   |   |   |   |   |
| LOD-LOQ | -0.13 (-0.36; 0.10) | 47 | 0.5 | -0.17 (-0.41; 0.08) | 47 | 0.4 | -0.08 (-0.33; 0.16) | 47 | 0.6 | -0.08 (-0.32; 0.15) | 47 | 0.6 |   |   |   |   |   |   |
| >LOQ |  0.03 (-0.19; 0.24) | 56 |   |  0.03 (-0.20; 0.26) | 56 |   |  0.09 (-0.14; 0.32) | 56 |   |  0.08 (-0.14; 0.30) | 56 |   |   |   |   |   |   |   |
| Trim. 3 |  | reference |   |   | reference |   |   | reference |   |   | reference |   |   |   |   |   |   |   |   |
| >LOD at trim. 2 or 3 |  0.04 (-0.43; 0.52) | 16 | 1 |  0.21 (-0.29; 0.70) | 16 | 0.3 |  0.11 (-0.37; 0.58) | 16 | 0.8 | -0.16 (-0.62; 0.30) | 16 | 0.7 |   |   |   |   |   |   |
| >LOD at trim. 2 and 3 |  0.02 (-0.31; 0.34) | 44 |   | -0.20 (-0.54; 0.13) | 45 |   | -0.07 (-0.39; 0.25) | 45 |   | -0.10 (-0.41; 0.21) | 45 |   |   |   |   |   |   |   |
| Birth |  | reference |   |   |   |   |   |   |   |   |   |   |   | reference |   |   | reference |   |   |
| >LOD at trim. 2 or 3 | -0.52 (-0.89; -0.15) | 24 | 0.02 |   |   |   |   |   |   |   |   |   | -0.02 (-0.38; 0.33) | 24 | 0.2 |  0.16 (-0.19; 0.51) | 24 | 0.5 |
| >LOD at trim. 2 and 3 | -0.06 (-0.32; 0.21) | 56 |   |   |   |   |   |   |   |   |   |   | -0.25 (-0.51; 0.01) | 56 |   | -0.07 (-0.33; 0.18) | 56 |   |
| **ETPA** | Trim. 2 |  | -0.02 (-0.06; 0.03) | 430 | 0.5 |  0.00 (-0.05; 0.05) | 430 | 1 |  0.00 (-0.05; 0.06) | 432 | 0.9 | -0.02 (-0.07; 0.03) | 432 | 0.4 |   |   |   |   |   |   |
| Trim. 3 |  | -0.02 (-0.12; 0.08) | 171 | 0.7 |  0.06 (-0.05; 0.16) | 173 | 0.3 |  0.00 (-0.09; 0.10) | 173 | 0.9 | -0.02 (-0.11; 0.08) | 173 | 0.8 |   |   |   |   |   |   |
| Birth |  | -0.06 (-0.14; 0.03) | 209 | 0.2 |   |   |   |   |   |   |   |   |   |  0.00 (-0.08; 0.08) | 212 | 1 |  0.02 (-0.05; 0.10) | 210 | 0.5 |
| **MEPA** | Trim. 2 |  |  0.00 (-0.05; 0.05) | 430 | 1 |  0.02 (-0.03; 0.08) | 430 | 0.4 |  0.01 (-0.04; 0.07) | 432 | 0.6 |  0.00 (-0.05; 0.05) | 432 | 0.9 |   |   |   |   |   |   |
| Trim. 3 |  |  0.04 (-0.06; 0.14) | 171 | 0.4 |  0.08 (-0.02; 0.19) | 173 | 0.1 |  0.04 (-0.06; 0.14) | 173 | 0.4 |  0.00 (-0.10; 0.10) | 173 | 1 |   |   |   |   |   |   |
| Birth |  | -0.03 (-0.11; 0.06) | 209 | 0.5 |   |   |   |   |   |   |   |   |   |  0.06 (-0.02; 0.14) | 212 | 0.1 |  0.02 (-0.06; 0.10) | 210 | 0.7 |
| **PRPA** | Trim. 2 |  | -0.01 (-0.03; 0.02) | 430 | 0.5 | -0.01 (-0.04; 0.01) | 430 | 0.3 | -0.01 (-0.03; 0.02) | 432 | 0.6 |  0.00 (-0.03; 0.02) | 432 | 0.7 |   |   |   |   |   |   |
| Trim. 3 |  |  0.00 (-0.06; 0.06) | 171 | 1 |  0.04 (-0.02; 0.10) | 173 | 0.2 |  0.01 (-0.05; 0.06) | 173 | 0.9 | -0.01 (-0.07; 0.04) | 173 | 0.6 |   |   |   |   |   |   |
| Birth |  | -0.01 (-0.06; 0.03) | 209 | 0.6 |   |   |   |   |   |   |   |   |   |  0.02 (-0.03; 0.07) | 212 | 0.4 |  0.01 (-0.03; 0.06) | 210 | 0.6 |

Trimester 2 outcomes were related to trimester 2 exposures while trimester 3 and birth outcomes were related to trimesters 2 and 3 averaged exposures. Regression models were adjusted for maternal height, maternal pre-pregnancy weight, maternal age, maternal active smoking during trimester 2, maternal education level, gestational duration, child sex, and parity.

a For continuous phenol biomarker concentrations (BP-3, BPA, ETPA, MEPA, PRPA, triclosan), β regression estimates correspond to the change in standard deviation of the considered growth outcome associated with a 1-unit increase in standardized ln-transformed urinary phenol concentration. For categorically-coded exposures (BPS, BUPA) measured at trimester 2, β estimates correspond to the change, expressed in standard deviations, of the growth outcome associated with phenol biomarker concentrations between LOD and LOQ or >LOQ compared to <LOD concentrations (reference). For BPS and BUPA measured at trimester 3, β estimates correspond to the change in standard deviation of growth outcome associated with phenol biomarker concentrations >LOD at trimester 2 or 3 or at trimester 2 and 3 compared to <LOD concentrations at trimester 2 and 3 (reference).

b For categorically coded exposures (BPS, BUPA), p-values are given for Wald test testing the overall effect of exposure.

Abbreviations: BP-3: benzophenone-3. BPA: bisphenol A. BPS: bisphenol S. BUPA: butylparaben. CI: confidence interval. ETPA: ethylparaben. MEPA: methylparaben. PRPA: propylparaben. Trim.: trimester.

# Supplementary Figures



## Supplementary Figure 1: Study flow chart.

Abbreviations: BP-3: benzophenone-3. BPA: bisphenol A. BPS: bisphenol S. BUPA: butylparaben. ETPA: ethylparaben. gw: median gestational weeks. MEPA: methylparaben. PRPA: propylparaben. T2: second trimester. T3: third trimester. TCS: triclosan. US2: second trimester ultrasound. US3: third trimester ultrasound.

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