

Online Supplement

Supplemental Table 1. Linear range of the calibration curve for urinary phenols

Analyte	Linear range (ng/mL)
	LOD - Highest Standard*
Bisphenol A	0.2-100
Bisphenol F	0.2-100
Bisphenol S	0.1-100
Benzophenone-3	0.4-2000*
Triclosan	1.7-2000

LOD, limit of detection.

Supplemental Table 2. Alternative Healthy Eating Index for Pregnancy (AHEI-P) scoring method.

Component	Mean (SD) in original units	Criterion for minimum (0) ^a	Criterion for maximum (10) ^a	Score	
				Mean (SD)	Range
Vegetables, servings/d	1.3 (0.9)	0	≥5	2.8 (1.9)	0.3 - 10.0
Whole fruit, servings/d	1.7 (1.2)	0	≥4	3.8 (2.3)	0.2 - 10.0
Whole grains, g/d	1.7 (1.3)	0	75	5.3 (3.3)	0.2 - 10.0
Nuts and legumes, servings/d	1.0 (1.1)	0	≥1	6.0 (3.4)	0.2 - 10.0
Long-chain (<i>n</i> -3) fats (EPA + DHA), mg/d	89.2 (94.0)	0	250	3.7 (2.9)	0.0 - 10.0
PUFA, % of energy	8.3 (2.0)	≤2	≥10	7.7 (1.9)	2.5 - 10.0
Calcium, mg/d	757.7 (371.1)	0	≥1200	6.0 (2.4)	1.2 - 10.0
Folate, mcg/d	119.1 (92.6)	0	≥600	1.9 (1.4)	0.1 - 9.4
Iron, mg/d	11.1 (5.3)	0	≥27	4.0 (1.7)	0.9 - 10.0
Sugar-sweetened beverages, servings/d	0.5 (0.7)	≥1	0	7.0 (3.2)	0.0 - 10.0
Red/processed meat, servings/d	1.4 (1.2)	≥1.5	0	3.3 (3.0)	0.0 - 9.7
trans Fat, % of energy	2.9 (0.5)	≥4	≤0.5	2.9 (1.4)	0.0 - 7.3
Sodium, mg/d	2607.5 (1237.9)	Highest decile	Lowest decile	5.5 (2.9)	1.0 - 10.0
AHEI-P, total	-	-	-	60.1 (10.7)	31.0 - 87.6

AHEI-P, Alternate Healthy Eating Index for Pregnancy; SD, standard deviation.

^aIntermediate intakes were scored proportionately between 0 and 10.

Supplemental Table 3. Participant characteristics by Asians/Pacific Islanders race/ethnicity

	All (n=333)	Asians/Pacific Islanders (n=132)	Non-Asians/Pacific Islanders (n=201)	P-value*
Age, years, mean \pm SD	31.2 \pm 4.6	32.6 \pm 3.9	30.4 \pm 4.8	0.001
Race/ethnicity, n (%)				0.001
Asian/Pacific Islander	132 (39.6)	132 (100.0)	0	
Black	30 (9.0)	0	30 (14.9)	
Hispanic	111 (33.3)	0	111 (55.2)	
White	47 (14.1)	0	47 (23.4)	
Other	13 (3.9)	0	13 (6.5)	
Pre-pregnancy BMI, kg/m ² , mean \pm SD	27.8 \pm 7.0	24.5 \pm 4.2	30.0 \pm 7.6	0.001
Pre-pregnancy BMI, kg/m ² , n (%)				0.001
<24.9	139 (41.7)	83 (62.9)	56 (27.9)	
25.0-29.9	92 (27.6)	34 (25.8)	58 (28.9)	
\geq 30.0	102 (30.6)	15 (11.4)	87 (43.3)	
Education, n (%)				0.001
High school or less	37 (11.1)	5 (3.8)	32 (15.9)	
Some college	117 (35.1)	25 (18.9)	92 (45.8)	
College graduate or above	179 (53.8)	102 (77.3)	77 (38.3)	
Nulliparity, n (%)	138 (41.4)	65 (49.2)	73 (37.2)	0.030
AHEI-P, mean \pm SD	60.1 \pm 10.7	60.7 \pm 10.1	59.8 \pm 11.0	0.42
Moderate-to-vigorous physical activity, MET hours/week, mean \pm SD	10.9 \pm 15.0	7.6 \pm 10.1	13.1 \pm 17.2	<0.001
Daily use of canned food or beverage	110 (33.0)	33 (25.0)	77 (38.3)	0.013
Daily use of food or beverage in plastic wraps or containers	307 (92.2)	116 (87.9)	191 (95.0)	0.016

BMI, body mass index.

*Obtained by Student's t test for continuous variables or Pearson's χ^2 test for categorical variables.

Supplemental Table 4. Urinary phenol concentrations among all and by Asians/Pacific Islanders race/ethnicity*

	Detection frequency, %			Median (Interquartile Range)		
	A/PI (n=132)	Non-A/PI (n=201)	P- value [†]	A/PI (n=132)	Non-A/PI (n=201)	P-value [†]
Bisphenol A, ng/mL						
1st trimester	75.0	84.6	0.030	0.5 (0.3-0.9)	0.6 (0.3-1.1)	0.094
2nd trimester	62.3	77.0	0.008	0.4 (0.2-0.7)	0.5 (0.3-1.0)	0.037
Area under the curve [‡]	NA	NA	NA	105.7 (54.1-203.6)	127.1 (71.2-220.6)	0.030
Bisphenol F, ng/mL						
1st trimester	20.5	42.8	<0.001	<LOD	<LOD	NA
2nd trimester	18.4	41.8	<0.001	<LOD	<LOD	NA
Area under the curve [‡]	NA	NA	NA	§	§	NA
Bisphenol S, ng/mL						
1st trimester	76.5	89.1	0.002	0.4 (0.2-0.7)	0.6 (0.3-1.2)	<0.001
2nd trimester	73.7	90.9	<0.001	0.3 (0.1-1.1)	0.5 (0.3-1.2)	<0.001
Area under the curve [‡]	NA	NA	NA	90.4 (44.2-218.1)	140.8 (78.8-246.3)	0.005
Benzophenone-3, ng/mL						
1st trimester	99.2	99.0	0.82	42.3 (13.7-135.9)	69.2 (18.7-219.0)	0.067
2nd trimester	99.1	98.8	0.79	27.7 (11.3-99.4)	68.7 (18.3-206.8)	0.001
Area under the curve [‡]	NA	NA	NA	8992.7 (3083.6- 25339.2)	17595.2 (4696.3- 44637.4)	0.011
Triclosan, ng/mL						
1st trimester	68.9	70.2	0.81	3.7 (1.4-48.0)	3.2 (1.4-14.5)	0.66
2nd trimester	56.1	61.2	0.40	2.3 (1.2-17.2)	3.4 (1.2-16.7)	0.66
Area under the curve [‡]	NA	NA	NA	869.3 (278.8- 9539.0)	731.8 (330.4- 8421.4)	0.063

A/PI, Asian/Pacific Islander; NA, not applicable.

*Limit of detection (LOD) for BPA = 0.2 ng/mL, BPS = 0.1 ng/mL, BPF = 0.2 ng/mL, BP3 = 0.4 ng/mL, and triclosan = 1.7 ng/mL. Values below the LOD were imputed by LOD/ $\sqrt{2}$.

[†]Obtained by non-parametric Mann-Whitney test for continuous variables and Pearson's χ^2 test for categorical variables.

[‡]Calculated (in ng/mL \times day) using the formula: $M1 \times D1 + \frac{(M1+M2) \times (D2-D1)}{2} + M2 \times (197 - D2)$, where M1 and M2 were concentrations of urinary phenols at each time point, D1 and D2 were days of gestation at the two time points, respectively, and 197 was the maximum D2 based on the distribution in the entire PETALS cohort.

[§]Not calculated because the proportion of results below LOD was too high to provide a valid result.

Supplemental Table 5. Concentrations of urinary phenols among PETALS pregnant individuals in the first trimester (2015-2017) and women in the NHANES 2015-2016*

Phenols, ng/mL	PETALS Pregnant Individuals in 2015-2017 (n = 333)		U.S. Women in NHANES 2015-2016 [†]	
	Geometric Mean (95% CI)	50th Percentile (95% CI)	Geometric Mean (95% CI)	50th Percentile (95% CI)
Bisphenol A	0.569 (0.507-0.630)	0.500 (0.500-0.600)	1.02 (0.914-1.13)	1.00 (0.900-1.10)
Bisphenol F	‡	<LOD	‡	<LOD
Bisphenol S	0.497 (0.436-0.559)	0.500 (0.400-0.500)	0.436 (0.378-0.502)	0.400 (0.300-0.500)
Benzophenone-3	59.1 (47.5-70.7)	55.7 (40.4-70.9)	26.9 (20.8-34.7)	21.2 (18.6-27.0)
Triclosan	6.71 (5.12-8.30)	3.20 (2.60-3.90)	5.90 (4.75-7.31)	3.20 (2.60-4.00)

LOD, Limit of detection; NA, not available; NHANES, National Health and Nutrition Examination Survey; PETALS, Pregnancy Environment and Lifestyle Study.

*LOD for BPA = 0.2 ng/mL, BPS = 0.1 ng/mL, BPF = 0.2 ng/mL, BP3 = 0.4 ng/mL, and triclosan = 1.7 ng/mL. Values below the LOD were imputed by LOD/√2.

[†]Centers for Disease Control and Prevention National Center for Environmental Health. Fourth National Report on Human Exposure to Environmental Chemicals Updated Tables. 2021. https://www.cdc.gov/exposurereport/pdf/FourthReport_UpdatedTables_Volume2_Mar2021-508.pdf (accessed October 23 2021).

‡Not calculated because the proportion of results below LOD was too high to provide a valid result.

Supplemental Table 6. Sensitivity analysis: Adjusted odds ratio (95% CI) of gestational diabetes in association with urinary phenols during pregnancy with additional adjustment for dietary quality and physical activity during pregnancy among non-Asians/Pacific Islanders

	Multivariable model*	Multivariable model + dietary quality + physical activity†
Bisphenol A		
1st trimester, ng/mL		
T1 (IQR 0.1-0.4)	Reference	Reference
T2 (IQR 0.50-0.70)	1.07 (0.38-2.99)	0.74 (0.25,2.21)
T3 (IQR 1.1-2.1)	2.91 (1.05-8.02)	2.63 (0.93,7.41)
Per IQR increment	1.03 (0.97-1.09)	1.02 (0.96,1.09)
2nd trimester, ng/mL		
T1 (IQR 0.1-0.3)	Reference	Reference
T2 (IQR 0.4-0.6)	3.70 (1.00-13.6)	3.84 (1.02,14.4)
T3 (IQR 1.0-2.0)	2.96 (0.69-12.7)	2.96 (0.68,12.9)
Per IQR increment	0.98 (0.87-1.09)	0.97 (0.87,1.09)
Area under the curve, ng/mL × day		
T1 (IQR 33.3-65.9)	Reference	Reference
T2 (IQR 104.4-137.1)	1.50 (0.42-5.40)	1.59 (0.43,5.90)
T3 (IQR 208.1-379.2)	2.37 (0.69-8.17)	2.48 (0.71,8.70)
Per IQR increment	1.01 (0.92-1.10)	1.00 (0.92,1.10)
Bisphenol F‡		
1st trimester, ng/mL		
BPF not detected	Reference	Reference
BPF detected (range 0.3-31.9)	1.64 (0.71-3.82)	1.94 (0.80,4.74)
2nd trimester, ng/mL		
BPF not detected	Reference	Reference
BPF detected (range 0.3-48.6)	0.59 (0.22-1.57)	0.58 (0.22,1.55)
Bisphenol S		
1st trimester, ng/mL		
T1 (IQR 0.1-0.3)	Reference	Reference
T2 (IQR 0.4-0.6)	1.43 (0.48-4.27)	1.61 (0.52,4.93)
T3 (IQR 1.0-2.7)	4.60 (1.55-13.7)	4.54 (1.47,14.1)
Per IQR increment	0.94 (0.77-1.14)	0.93 (0.76,1.13)
2nd trimester, ng/mL		
T1 (IQR 0.1-0.3)	Reference	Reference
T2 (IQR 0.4-0.6)	1.60 (0.48-5.40)	1.69 (0.48,5.93)
T3 (IQR 1.2-2.0)	2.57 (0.72-9.19)	2.63 (0.72,9.57)
Per IQR increment	1.01 (0.80-1.28)	1.01 (0.79,1.28)
Area under the curve, ng/mL × day		
T1 (IQR 19.7-51.0)	Reference	Reference
T2 (IQR 78.8-111.2)	1.66 (0.35-7.86)	1.91 (0.37,9.92)
T3 (IQR 189.8-443.7)	8.21 (1.79-37.8)	9.40 (1.87,47.3)
Per IQR increment	0.90 (0.70-1.15)	0.89 (0.69,1.15)
Benzophenone-3		
1st trimester, ng/mL		

T1 (IQR 6.3-18.4)	Reference	Reference
T2 (IQR 39.3-80.3)	0.37 (0.13-1.07)	0.53 (0.16,1.75)
T3 (IQR 175.7-821.5)	0.75 (0.31-1.83)	1.50 (0.55,4.11)
Per IQR increment	1.00 (0.96-1.05)	1.00 (0.96,1.05)
2nd trimester, ng/mL		
T1 (IQR 5.6-15.6)	Reference	Reference
T2 (IQR 34.9-68.4)	0.50 (0.14-1.79)	0.78 (0.18,3.35)
T3 (IQR 129.1-652.4)	1.55 (0.50-4.81)	2.21 (0.60,8.11)
Per IQR increment	1.04 (0.91-1.20)	1.06 (0.92,1.23)
Area under the curve, ng/mL × day		
T1 (IQR 1468.4-3550.8)	Reference	Reference
T2 (IQR 8278.0-17595.2)	0.49 (0.16-1.55)	0.73 (0.20,2.59)
T3 (IQR 39200.2-154351.6)	0.74 (0.23-2.37)	1.07 (0.30,3.84)
Per IQR increment	1.00 (0.92-1.09)	1.01 (0.93,1.10)
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Triclosan		
1st trimester, ng/mL		
T1 (IQR 0.8-1.4)	Reference	Reference
T2 (IQR 2.4-3.9)	1.34 (0.45-3.99)	1.40 (0.39,5.02)
T3 (IQR 13.0-247.4)	2.88 (1.11-7.45)	3.06 (0.99,9.43)
Per IQR increment	1.02 (1.00-1.04)	1.02 (1.00,1.05)
2nd trimester, ng/mL		
T1 (IQR 0.6-1.1)	Reference	Reference
T2 (IQR 1.3-3.4)	2.05 (0.49-8.65)	1.89 (0.41,8.72)
T3 (IQR 11.4-236.5)	4.12 (1.01-16.9)	4.49 (0.83,24.3)
Per IQR increment	1.05 (1.00-1.11)	1.04 (0.99,1.09)
Area under the curve, ng/mL × day		
T1 (IQR 183.8-302.1)	Reference	Reference
T2 (IQR 505.4-998.8)	5.51 (1.04-29.2)	5.72 (0.93,35.0)
T3 (IQR 6517.7-54697.0)	5.68 (1.40-23.0)	5.89 (1.16,30.0)
Per IQR increment	1.14 (1.02-1.27)	1.14 (0.99,1.30)

IQR, interquartile range; T1, the first tertile; T2, the second tertile; T3, the third tertile.

*Adjusted for urinary creatinine levels, age, pre-pregnancy body mass index, and race/ethnicity (White, Black, Hispanic, and Other), which is identical to Model 2 in Table 3.

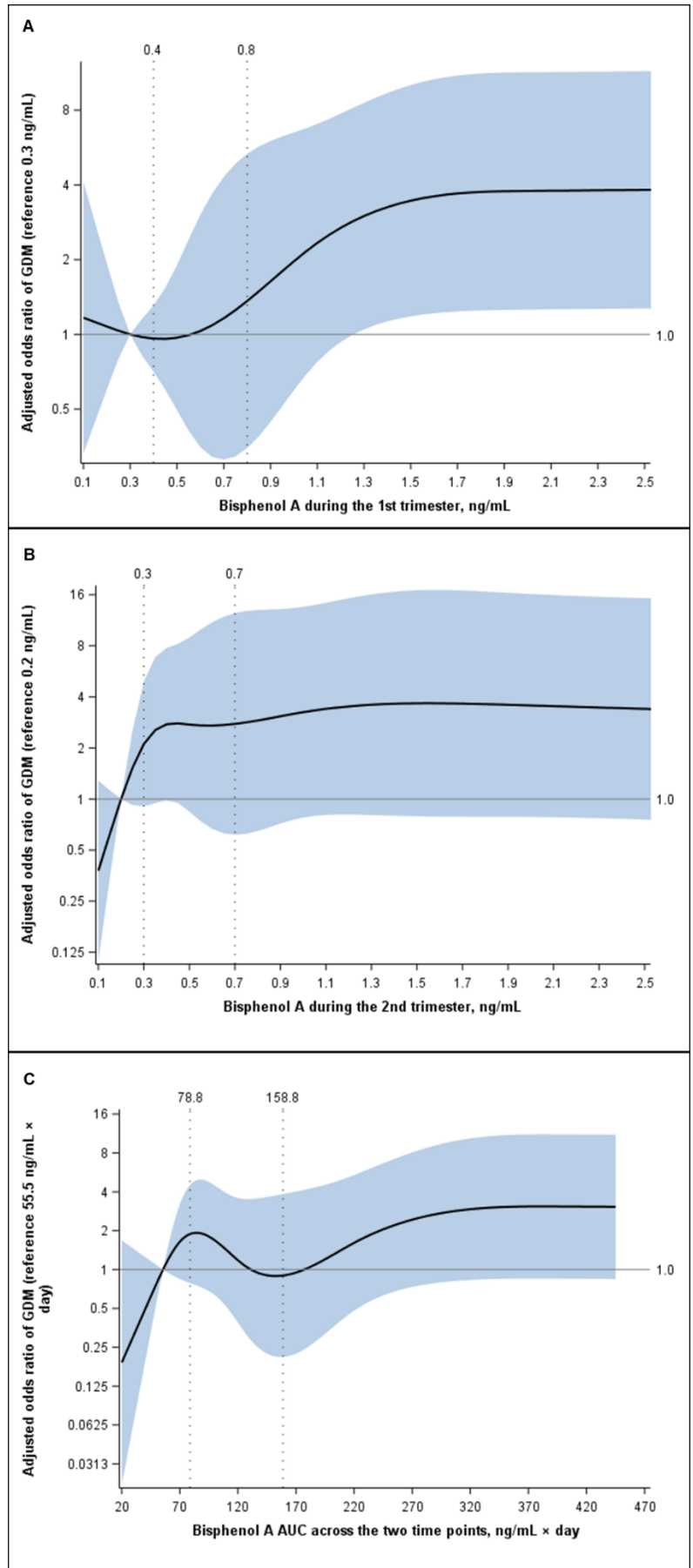
†Additionally adjusted for dietary quality as assessed by Alternate Health Eating Index for Pregnancy and physical activity (metabolic equivalent of tasks-hours per day) during pregnancy.

‡Bisphenol F was parameterized as detected vs. non-detected due to the relatively low detection frequency (see Table 2) and thus area under the curve was not calculated.

Supplemental Figure 1. Nonparametric cubic spline regression curves for the association of maternal urinary bisphenol A during (A) the first trimester, (B) the second trimester, and (C) across the two time points with risk of gestational diabetes among non-Asians/Pacific Islanders.

AUC, area under the curve; GDM, gestational diabetes.

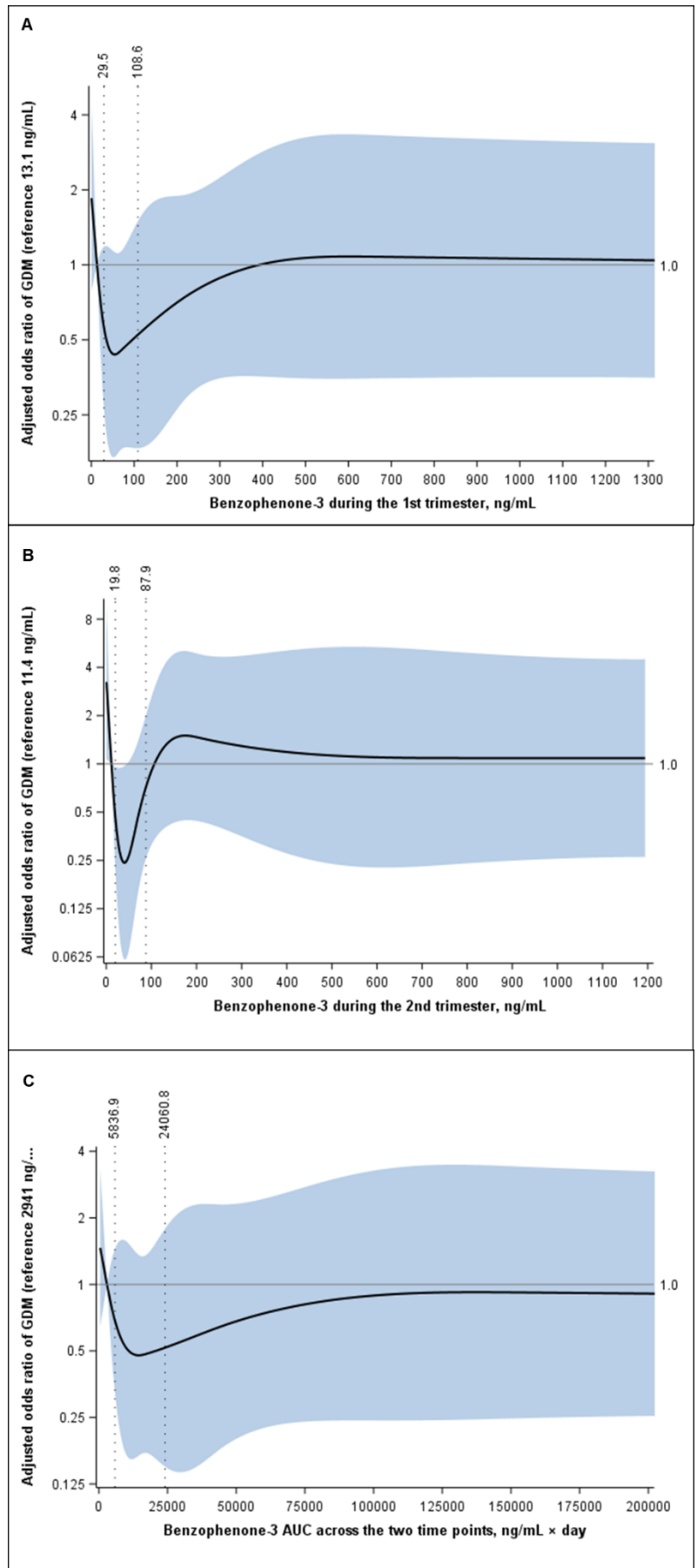
Solid black curve represents adjusted odds ratio and grey areas represent 95% confidence intervals. Point estimates were adjusted for urinary creatinine levels, age, pre-pregnancy body mass index, and race/ethnicity (White, Black, Hispanic, and Other). Reference value for each phenol is 20th percentile of phenol concentrations among non-GDM controls. Dotted vertical lines represent cutoff points of each tertile among non-GDM controls.



Supplemental Figure 2. Nonparametric cubic spline regression curves for the association of maternal urinary benzophenone-3 during (A) the first trimester, (B) the second trimester, and (C) across the two time points with risk of gestational diabetes among non-Asians/Pacific Islanders.

AUC, area under the curve; GDM, gestational diabetes.

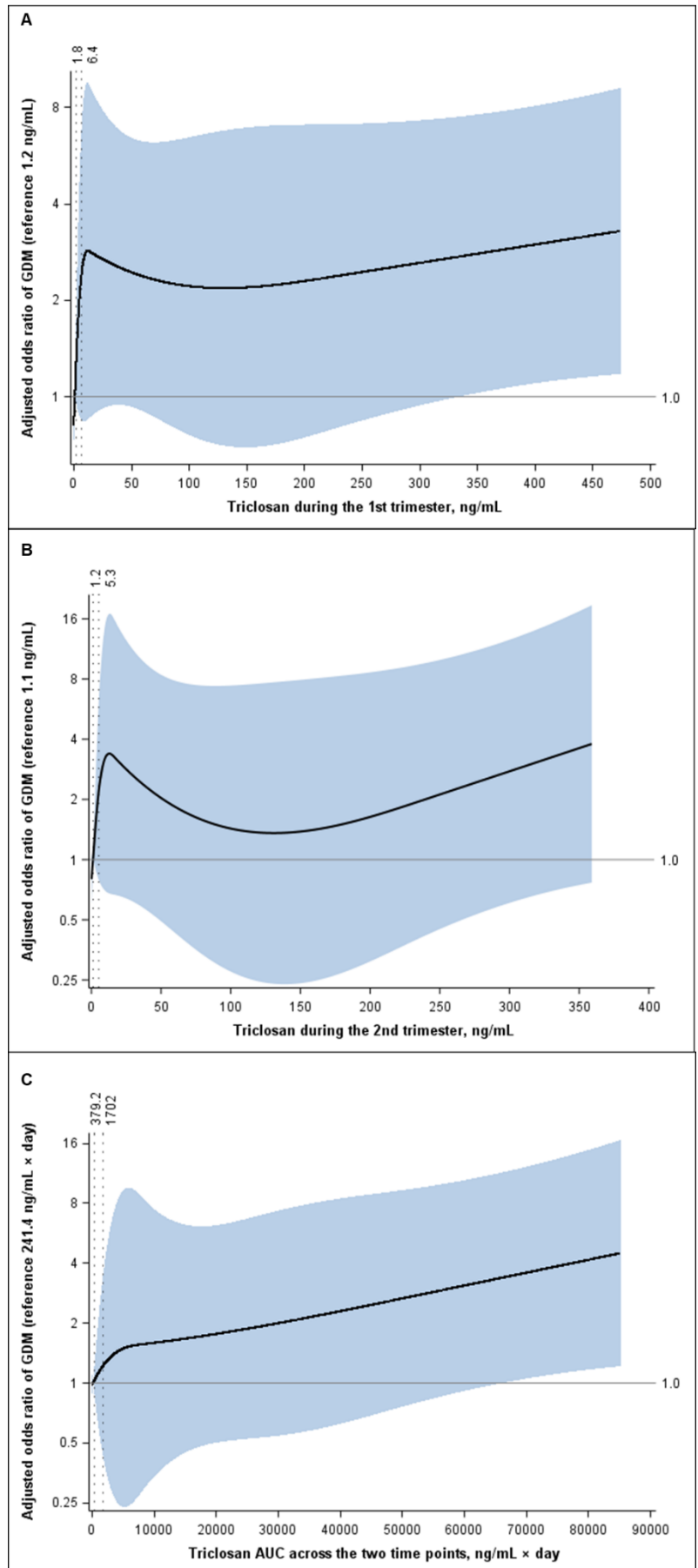
Solid black curve represents adjusted odds ratio and grey areas represent 95% confidence intervals. Point estimates were adjusted for urinary creatinine levels, age, pre-pregnancy body mass index, and race/ethnicity (White, Black, Hispanic, and Other). Reference value for each phenol is 20th percentile of phenol concentrations among non-GDM controls. Dotted vertical lines represent cutoff points of each tertile among non-GDM controls.



Supplemental Figure 3. Nonparametric cubic spline regression curves for the association of maternal urinary triclosan during (A) the first trimester, (B) the second trimester, and (C) across the two time points with risk of gestational diabetes among non-Asians/Pacific Islanders.

AUC, area under the curve; GDM, gestational diabetes.

Solid black curve represents adjusted odds ratio and grey areas represent 95% confidence intervals. Point estimates were adjusted for urinary creatinine levels, age, pre-pregnancy body mass index, and race/ethnicity (White, Black, Hispanic, and Other). Reference value for each phenol is 20th percentile of phenol concentrations among non-GDM controls. Dotted vertical lines represent cutoff points of each tertile among non-GDM controls.



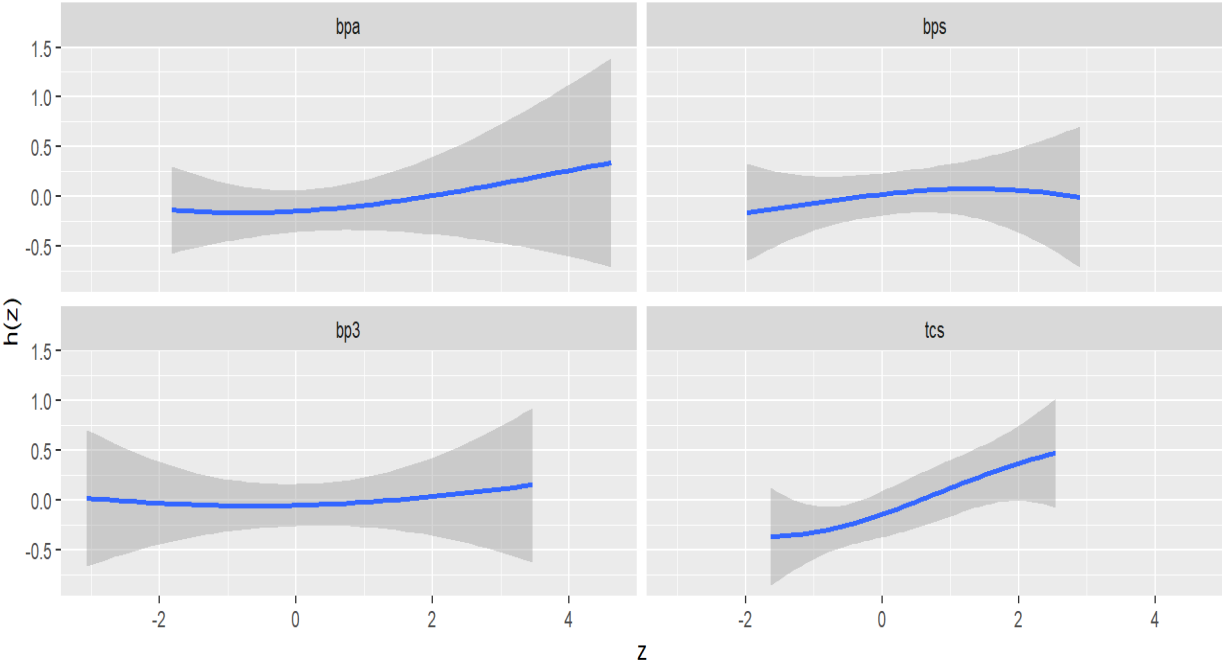
Supplemental Table 7. Posterior Inclusion Probabilities of each urinary phenol in Bayesian kernel machine regression models, overall and stratified by race/ethnicity.

Phenol	Overall			Among A/PI			Among non-A/PI		
	T1	T2	AUC	T1	T2	AUC	T1	T2	AUC
Bisphenol A	0.29	0.32	0.26	0.31	0.44	0.41	0.41	0.35	0.40
Benzophenone-3	0.20	0.35	0.29	0.32	0.46	0.35	0.42	0.33	0.64
Bisphenol S	0.24	0.57	0.31	0.31	0.57	0.36	0.36	0.39	0.45
Triclosan	0.47	0.48	0.54	0.29	0.45	0.35	0.82	0.74	0.89

A/PI, Asian/Pacific Islander; AUC, area under the curve across the first and second trimesters; T1, 1st trimester; T2, 2nd trimester.

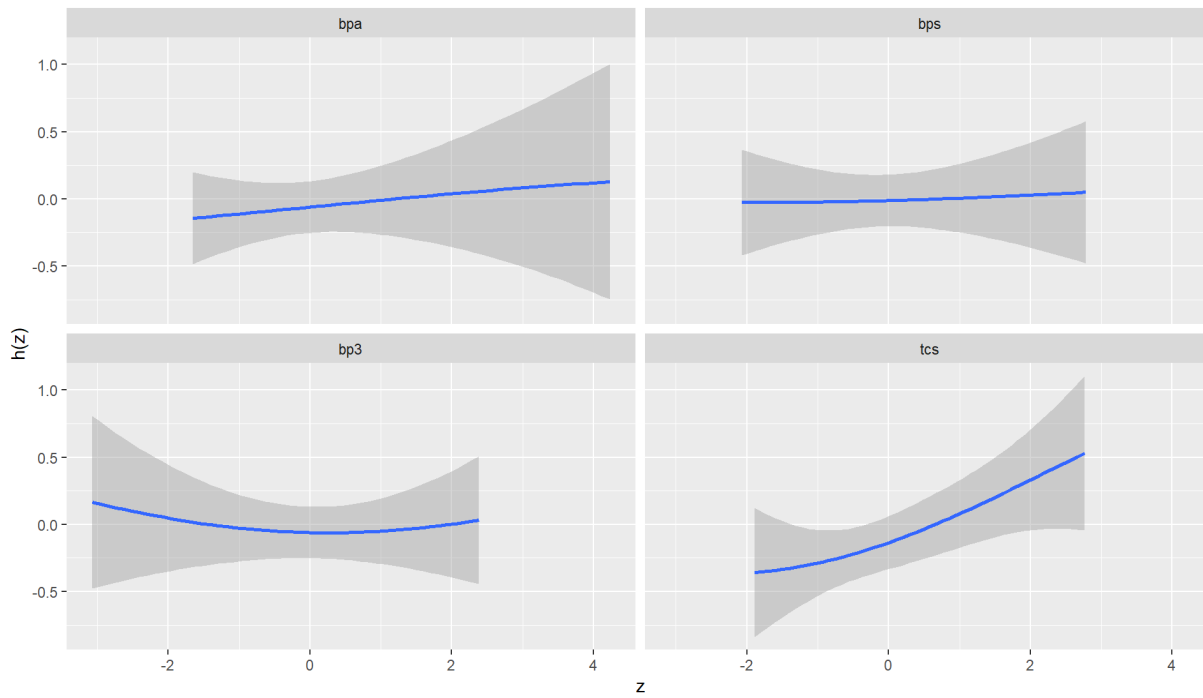
Supplemental Figure 4. Exposure response function for each phenol from Bayesian kernel machine regression model among non-Asians/Pacific Islanders in the first trimester.

BPA, bisphenol A; BPS, bisphenol S; BP3, benzophenone-3; TCS, triclosan.



Supplemental Figure 5. Exposure response function for each phenol from Bayesian kernel machine regression model among non-Asians/Pacific Islanders in the second trimester.

BPA, bisphenol A; BPS, bisphenol S; BP3, benzophenone-3; TCS, triclosan.



Supplemental Figure 6. Exposure response function for the area-under-the-curve value of each phenol from Bayesian kernel machine regression model among non-Asians/Pacific Islanders across the first and second trimesters.

BPA, bisphenol A; BPS, bisphenol S; BP3, benzophenone-3; TCS, triclosan.

