

## Supplementary Online Content

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**eTable 1.** Geometric Means (95% CIs) for Serum Concentrations of Specific Antibodies at Age 5 (Prebooster) and 7 Years by Tertile Groups of PFC Concentrations in Maternal Pregnancy Serum and 5-Year Serum

**eTable 2.** Estimated Percentage Differences (95% CIs) in Specific Antibody Concentrations at 5 Years Prebooster, 5 Years Postbooster, and 7 Years per 2-Fold Increase of the Concentrations of Total, Linear, and Branched PFOS Isomers in Maternal or 5-Year Serum

**eTable 3.** Estimated Percentage Differences (95% CIs) in Specific Antibody Concentrations at 5 Years Prebooster, 5 Years Postbooster, 7 Years, Before and After Adjustment for Year 5 Prebooster, per Doubling of PFC 5-Year or Maternal PFC Exposure, With Adjustment for Covariates and Milk-PCB and Serum-PCB at Age 5 Years

**eTable 4.** Odds Ratios (95% CIs) for Inadequate Antibody Concentrations at 5 Years Prebooster and 7 Years

This supplementary material has been provided by the authors to give readers additional information about their work.

**eTABLE 1.** Geometric Means (95% CIs) for Serum Concentrations of Specific Antibodies at Age 5 (Prebooster) and 7 Years by Tertile Groups of PFC Concentrations in Maternal Pregnancy Serum and 5-Year Serum<sup>a</sup>

	Age 5 by maternal PFC			Age 5 by 5-year PFC			Age 7 by 5-year PFC		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
<b>Tetanus</b>									
PFOS	0.22 (0.17; 0.28)	0.25 (0.20; 0.31)	0.22 (0.18; 0.28)	0.27 (0.21; 0.33)	0.24 (0.19; 0.30)	0.21 (0.17; 0.26)	2.26 (1.69; 3.02)	2.06 (1.53; 2.77)	1.68 (1.24; 2.27)
PFOA	0.25 (0.20; 0.32)	0.21 (0.17; 0.26)	0.23 (0.18; 0.29)	0.26 (0.20; 0.32)	0.24 (0.20; 0.30)	0.21 (0.17; 0.26)	2.37 (1.75; 3.20)	2.01 (1.53; 2.65)	1.68 (1.24; 2.28)
PFHxS	0.26 (0.21; 0.33)	0.18 (0.14; 0.23)	0.25 (0.20; 0.31)	0.27 (0.22; 0.33)	0.23 (0.18; 0.29)	0.21 (0.16; 0.26)	2.56 (1.91; 3.42)	2.03 (1.52; 2.70)	1.49 (1.11; 2.01)
PFNA	0.22 (0.18; 0.28)	0.21 (0.17; 0.27)	0.26 (0.21; 0.32)	0.24 (0.19; 0.30)	0.23 (0.19; 0.29)	0.23 (0.19; 0.29)	2.16 (1.62; 2.89)	2.03 (1.51; 2.73)	1.82 (1.36; 2.45)
PFDA	0.23 (0.18; 0.29)	0.24 (0.19; 0.30)	0.22 (0.18; 0.27)	0.25 (0.20; 0.31)	0.24 (0.19; 0.30)	0.22 (0.17; 0.27)	2.37 (1.78; 3.14)	1.93 (1.43; 2.59)	1.69 (1.25; 2.28)
<b>Diphtheria</b>									
PFOS	0.18 (0.14; 0.23)	0.15 (0.12; 0.19)	0.12 (0.09; 0.15)	0.16 (0.13; 0.21)	0.15 (0.12; 0.19)	0.13 (0.11; 0.17)	1.02 (0.78; 1.34)	0.90 (0.68; 1.19)	0.75 (0.57; 0.99)
PFOA	0.16 (0.12; 0.20)	0.12 (0.10; 0.16)	0.15 (0.12; 0.19)	0.16 (0.12; 0.20)	0.15 (0.12; 0.19)	0.14 (0.11; 0.18)	1.04 (0.79; 1.38)	0.85 (0.66; 1.10)	0.82 (0.62; 1.09)
PFHxS	0.15 (0.12; 0.19)	0.14 (0.11; 0.18)	0.14 (0.11; 0.18)	0.16 (0.12; 0.20)	0.13 (0.11; 0.17)	0.16 (0.12; 0.20)	0.99 (0.76; 1.31)	0.82 (0.62; 1.07)	0.88 (0.67; 1.16)

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**eTable 1 (Continued)**

PFNA	0.16 (0.12; 0.20)	0.14 (0.11; 0.18)	0.13 (0.11; 0.17)	0.16 (0.13; 0.21)	0.15 (0.11; 0.19)	0.14 (0.11; 0.17)	0.93 (0.71; 1.22)	0.94 (0.71; 1.24)	0.82 (0.62; 1.07)
PFDA	0.18 (0.14; 0.23)	0.15 (0.12; 0.19)	0.12 (0.09; 0.15)	0.16 (0.13; 0.21)	0.15 (0.12; 0.20)	0.13 (0.10; 0.17)	0.99 (0.76; 1.29)	0.89 (0.68; 1.18)	0.78 (0.59; 1.03)

<sup>a</sup>Estimates at age 5 are for a boy of mean age (4.95 years), at age 7 for a boy of mean age (7.5 years) and booster type 1 (tetanus and diphtheria only). Tertile groups for maternal PFC: PFOS (6.47+, 16.87+, 21.25+), PFOA (0.82+, 2.80+, 3.81+), PFHxS (0.62+, 2.91+, 7.33+), PFNA (0.12+, 0.51+, 0.70+) and PFDA age 5 (0.03+, 0.23+, 0.34+).

Tertile groups for PFOS age 5 (3.33+, 14.50+, 19.53+), PFOA age 5 (0.77+, 3.54+, 4.61+), PFHxS age 5 (0.02+, 0.50+, 0.76+), PFNA age 5 (0.39+, 0.81+, 1.13+) and PFDA age 5 (0.05+, 0.23+, 0.33+)

**eTable 2.** Estimated Percentage Differences (95% CIs) in Specific Antibody Concentrations at 5 Years Prebooster, 5 Years Postbooster, and 7 Years per 2-Fold Increase of the Concentrations of Total, Linear, and Branched PFOS Isomers in Maternal or 5-Year Serum<sup>a</sup>

	Maternal PFC				PFC at age 5 years			
	Pre year 5	Post year 5	Year 7	Year 7, Adjusted for Age 5 Results	Pre year 5	Post year 5	Year 7	Year 7, Adjusted for Age 5 Results
	% Change (95% CI)	% Change (95% CI)	% Change (95% CI)	% Change (95% CI)	% Change (95% CI)	% Change (95% CI)	% Change (95% CI)	% Change (95% CI)
<b>Tetanus</b>	<b>n=509</b>	<b>n=419</b>	<b>n= 424</b>	<b>n=380</b>	<b>n=537</b>	<b>n=440</b>	<b>n=408</b>	<b>n=401</b>
Total PFOS	-10.1 (-31.9;18.7)	-2.3 (-28.6;33.6)	35.3 (-3.9;90.6)	33.1 ( 1.5;74.6)	-11.9 (-30.0;10.9)	-28.5 (-45.5;-6.1)	-23.8 (-44.3; 4.2)	-11.4 (-30.5;12.8)
n-PFOS	-14.7 (-35.0;12.0)	-4.5 (-29.7;29.9)	36.1 (-2.7;90.6)	37.1 ( 5.1;78.9)	-11.7 (-29.0; 9.9)	-29.9 (-45.8;-9.2)	-19.3 (-39.7; 8.0)	-7.8 (-26.3;15.5)
br-PFOS	6.5 (-15.7;34.5)	2.8 (-21.7;34.9)	22.2 (-7.8;62.0)	11.2 (-11.0;38.8)	-10.4 (-28.3;12.0)	-22.0 (-40.0; 1.3)	-24.7 (-44.6; 2.5)	-13.1 (-31.5;10.3)
<b>Diphtheria</b>	<b>n=510</b>	<b>n=419</b>	<b>n= 424</b>	<b>n=382</b>	<b>n=537</b>	<b>n=440</b>	<b>n=408</b>	<b>n=403</b>
Total PFOS	-38.6 (-54.7;-16.9)	-20.6 (-37.5; 0.9)	-19.7 (-41.8;10.7)	-10.0 (-32.6;20.0)	-16.0 (-34.9; 8.3)	-15.5 (-31.5; 4.3)	-27.6 (-45.8;-3.3)	-20.6 (-38.2; 2.1)
n-PFOS	-42.6 (-57.3;-22.7)	-22.6 (-38.8;-2.2)	-22.9 (-43.8; 5.8)	-10.6 (-32.7;18.8)	-17.5 (-35.2; 5.1)	-16.1 (-31.3; 2.4)	-24.2 (-42.1;-0.8)	-16.4 (-33.8; 5.5)
br-PFOS	-16.8 (-35.6; 7.5)	-11.8 (-28.4; 8.7)	-5.7 (-27.7;22.9)	-5.8 (-25.3;18.9)	-8.1 (-28.2;17.7)	-10.9 (-27.3; 9.2)	-21.1 (-40.6; 4.9)	-18.3 (-36.1; 4.5)

<sup>a</sup>Covariate adjustments as in Table 3 (n-PFOS, linear; br-PFOS, branched isomers).

**eTable 3.** Estimated Percentage Differences (95% CIs) in Specific Antibody Concentrations at 5 Years Prebooster, 5 Years Postbooster, 7 Years, Before and After Adjustment for Year 5 Prebooster, per Doubling of PFC 5-Year or Maternal PFC Exposure, With Adjustment for Covariates and Milk-PCB and Serum-PCB at Age 5 Years<sup>a</sup>

	Maternal PFC				PFC at age 5 years			
	Pre year 5	Post year 5	Year 7	Year 7, Adjusted for Age 5 Results <sup>a</sup>	Pre year 5	Post year 5	Year 7	Year 7, Adjusted for Age 5 Results <sup>a</sup>
	% Change (95% CI)	% Change (95% CI)	% Change (95% CI)	% Change (95% CI)	% Change (95% CI)	% Change (95% CI)	% Change (95% CI)	% Change (95% CI)
<b>Tetanus</b>	<b>n=449</b>	<b>n=369</b>	<b>n=350</b>	<b>n=339</b>	<b>n=472</b>	<b>n=385</b>	<b>n=364</b>	<b>n=357</b>
PFOS	-7.66 (-32.7;26.6)	4.00 (-26.6;47.4)	26.67 (-13.8;86.1)	28.58 (-3.7;71.7)	-21.78 (-40.5; 2.8)	-33.21 (-51.4;-8.2)	-32.19 (-53.1;-1.9)	-10.66 (-32.7; 18.6)
PFOA	-12.17 (-30.9;11.7)	16.97 (-10.2;52.4)	11.46 (-15.7;47.4)	14.35 (-7.5; 41.4)	-24.63 (-42.4;-1.4)	-9.61 (-32.7;21.3)	-35.42 (-53.3;-10.7)	-20.03 (-37.8; 2.9)
PFHxS	-8.19 (-17.5; 2.1)	0.19 (-14.2;17.1)	-1.95 (-15.9;14.3)	9.53 (-2.5; 23.0)	-11.49 (-23.7; 2.7)	-19.78 (-31.7;-5.8)	-20.68 (-33.9;-4.8)	-12.26 (-23.7; 0.9)
PFNA	16.64 (-8.5;48.8)	-2.71 (-26.6;29.0)	15.89 (-14.6;57.2)	0.09 (-20.3; 25.8)	-10.42 (-27.7;11.0)	-21.43 (-38.7; 0.7)	-22.44 (-39.9; 0.0)	-15.04 (-29.9; 3.0)
PFDA	-3.60 (-22.2;19.5)	-3.45 (-24.5;23.4)	3.17 (-20.6;34.1)	3.96 (-14.5; 26.5)	-17.43 (-31.0;-1.2)	-21.64 (-36.0;-4.1)	-29.80 (-43.1;-13.4)	-17.83 (-30.0; -3.5)
<b>Diphtheria</b>	<b>n=450</b>	<b>n=369</b>	<b>n=350</b>	<b>N=341</b>	<b>n=473</b>	<b>n=385</b>	<b>n= 364</b>	<b>n=359</b>
PFOS	-28.72 (-49.6; 0.8)	-23.75 (-41.9; 0.1)	-24.76 (-48.5; 9.9)	-15.26 (-38.8;17.3)	-14.06 (-36.6;16.5)	-15.96 (-34.8; 8.3)	-38.01 (-56.3;-12.1)	-29.64 (-48.2; -4.4)
PFOA	-9.43 (-30.4;17.9)	-8.00 (-25.3;13.3)	-24.08 (-42.3;-0.2)	-18.46 (-35.6; 3.2)	-4.29 (-28.9;28.9)	0.27 (-20.8;26.9)	-23.08 (-43.6; 4.9)	-20.05 (-39.0; 4.8)
PFHxS	-8.78 (-18.9; 2.6)	-7.91 (-18.5; 4.0)	-8.83 (-21.6; 6.0)	-1.83 (-13.7; 11.7)	11.34 (-5.6;31.3)	-7.42 (-18.7; 5.4)	-11.74 (-25.8; 5.0)	-15.75 (-27.6; -1.9)
PFNA	-7.63 (-29.4;20.8)	-19.21 (-35.1; 0.6)	-15.99 (-37.8;13.5)	-15.31 (-34.3; 9.1)	-16.33 (-34.1; 6.2)	-15.17 (-30.3; 3.2)	-19.05 (-36.5; 3.1)	-16.81 (-32.6; 2.6)
PFDA	-19.35 (-36.3; 2.1)	-24.88 (-37.9;-9.2)	-10.03 (-30.5;16.5)	-4.73 (-23.5; 18.7)	-20.91 (-35.2;-3.5)	-8.68 (-22.2; 7.2)	-20.05 (-34.6;-2.2)	-13.58 (-27.5; 3.0)

<sup>a</sup>Covariate adjustments as in Table 3.

**eTABLE 4.** Odds Ratios (95% CIs) for Inadequate Antibody Concentrations at 5 Years Prebooster and 7 Years<sup>a</sup>

Exposure	Maternal PFC				PFC age 5 years			
	OR (95% CI) year 5	P	OR (95% CI) year 7	P	OR (95% CI) year 5	P	OR (95% CI) year 7	P
<b>Tetanus</b>	<b>n=509</b>		<b>n=424</b>		<b>n=509</b>		<b>n=386</b>	
PFOS	1.16 (0.71; 1.89)	0.5474	0.53 (0.16; 1.79)	0.3105	1.16 (0.77; 1.74)	0.4749	2.61 (0.77; 8.92)	0.1245
PFOA	1.21 (0.82; 1.78)	0.3400	0.73 (0.27; 1.95)	0.5312	1.38 (0.91; 2.10)	0.1313	4.20 (1.54; 11.44)	0.0065
PFHxS	1.05 (0.88; 1.25)	0.5708	1.35 (0.79; 2.31)	0.2721	1.11 (0.89; 1.39)	0.3349	1.78 (1.08; 2.93)	0.0334
PFNA	0.95 (0.68; 1.33)	0.7643	0.71 (0.28; 1.81)	0.4735	1.14 (0.82; 1.58)	0.4361	1.61 (0.73; 3.55)	0.2516
PFDA	1.06 (0.77; 1.46)	0.7032	0.82 (0.36; 1.86)	0.6347	1.23 (0.93; 1.64)	0.1501	1.64 (0.78; 3.47)	0.1915
<b>Diphtheria</b>	<b>n=510</b>		<b>n=424</b>		<b>n=510</b>		<b>n=386</b>	
PFOS	2.48 (1.55; 3.97)	0.0001	2.33 (0.88; 6.14)	0.0843	1.60 (1.10; 2.34)	0.0138	2.38 (0.89; 6.35)	0.0820
PFOA	1.44 (1.01; 2.06)	0.0445	2.11 (0.89; 4.99)	0.0802	1.19 (0.81; 1.73)	0.3725	3.27 (1.43; 7.51)	0.0057
PFHxS	1.12 (.96; 1.31)	0.1557	0.81 (0.52; 1.27)	0.3477	1.04 (0.85; 1.28)	0.6898	1.48 (0.96; 2.28)	0.0845
PFNA	1.43 (1.05; 1.97)	0.0236	1.17 (0.55; 2.49)	0.6756	1.38 (1.02; 1.86)	0.0364	1.81 (0.97; 3.39)	0.0714
PFDA	1.69 (1.25; 2.30)	0.0005	1.05 (0.53; 2.08)	0.8917	1.36 (1.04; 1.77)	0.0228	1.72 (0.95; 3.13)	0.0734

<sup>a</sup>Results are adjusted for age and sex at 5 years pre-booster, and age, sex and booster type at 7 years.