Environ Health Perspect

DOI: 10.1289/EHP2754

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. Our staff will work with you to assess and meet your accessibility needs within 3 working days.

Supplemental Material

Prenatal Exposure to Perfluoroalkyl Substances and IQ Scores at Age 5; a Study in the Danish National Birth Cohort

Zeyan Liew, Beate Ritz, Cathrine Carlsen Bach, Robert F. Asarnow, Bodil Hammer Bech, Ellen A. Nohr, Rossana Bossi, Tine Brink Henriksen, Eva Cecilie Bonefeld-Jørgensen, and Jørn Olsen

Table of Contents

Table S7. Adjusted difference of child IQ scores according to prenatal PFAS (per natural-log ng/ml increase), comparing models accounting for selection factors.

Table S8. Adjusted difference of child IQ scores at age five according to prenatal PFAS (per natural-log ng/ml increase), additionally adjusting for birth year.

Table S9. Adjusted difference of child IQ scores at age five according to prenatal PFAS (per natural-log ng/ml increase), excluding blood samples that were subjected to processing delay.

Reference

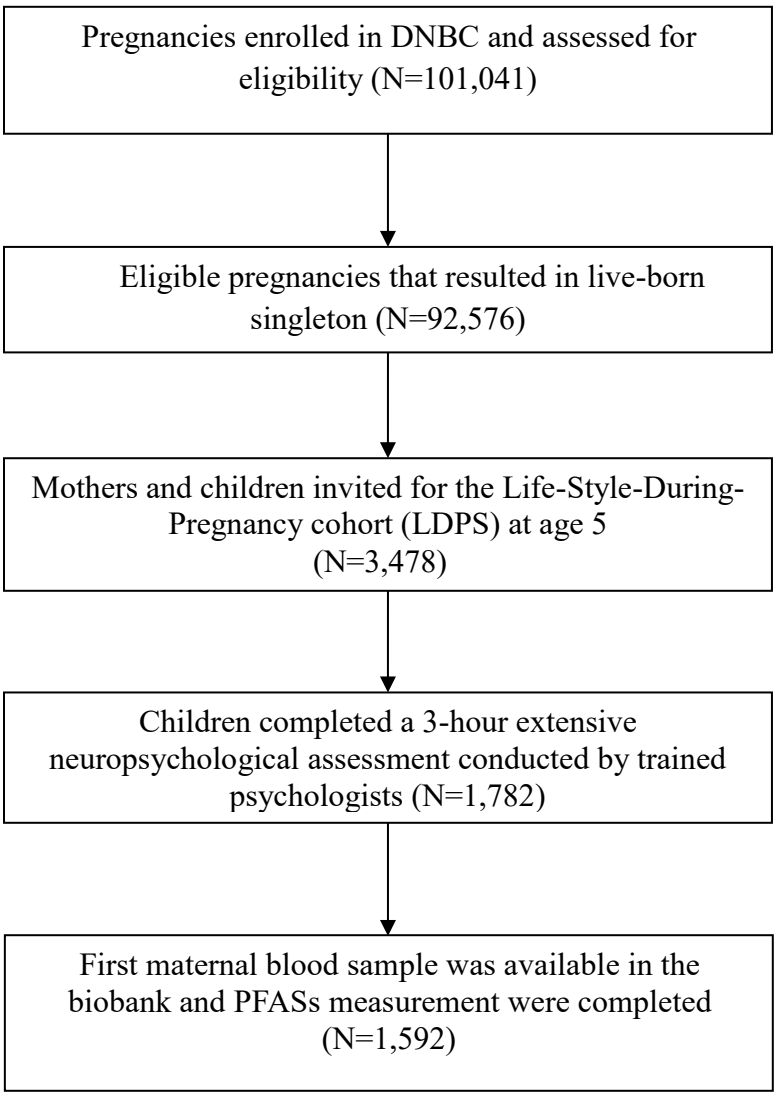

Figure S1. Selection of the LDPS study population from the DNBC

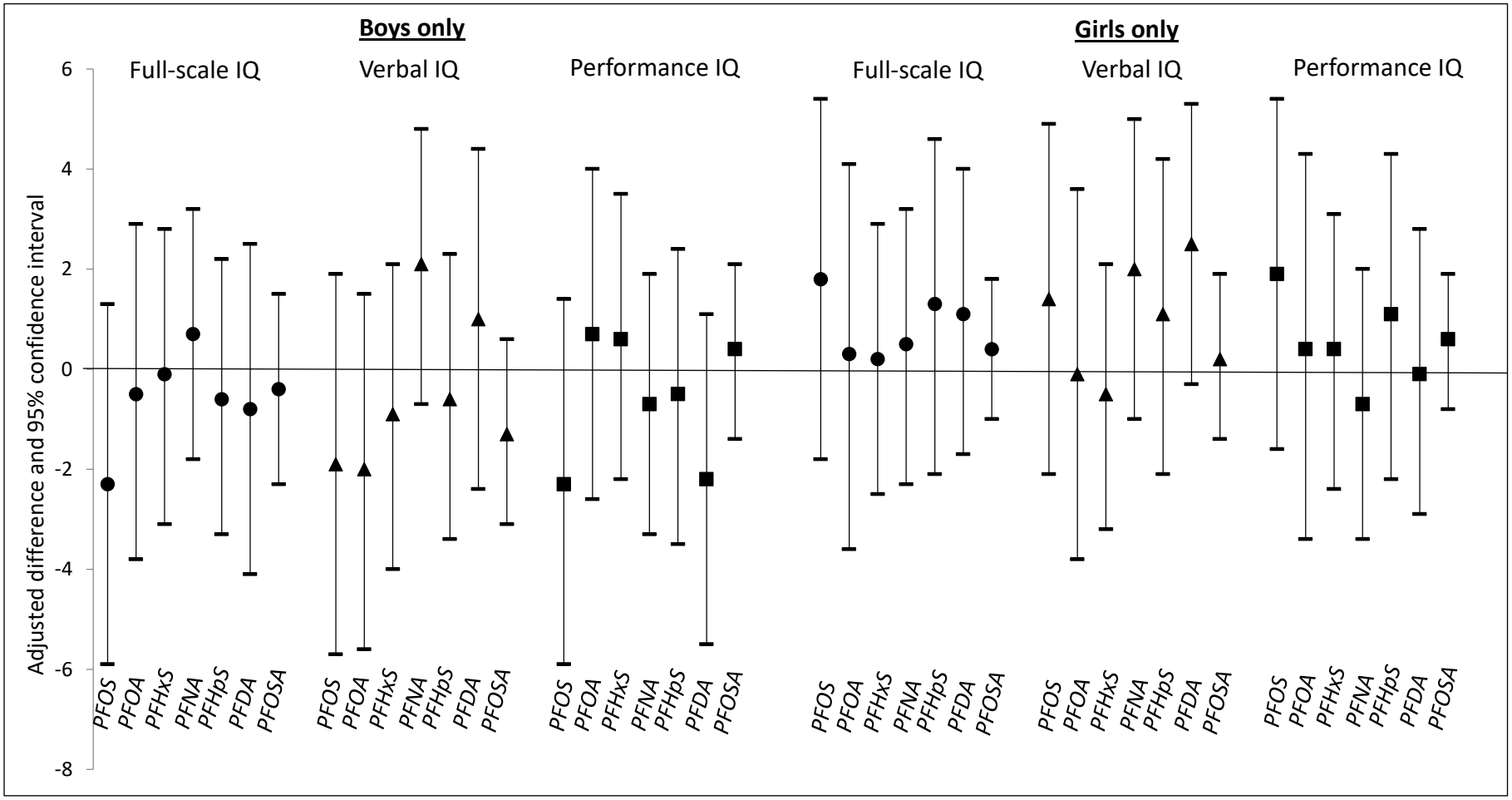

Figure S2. Adjusted difference in IQ scores in boys and girls at age five according to prenatal PFAS levels (per natural-log ng/ml increase). 831 boys and 761 girls were analyzed for each of the PFASs and outcome scores. Multivariable linear regression modeling was used to estimate the expected difference in IQ scores. Estimates are adjusted for maternal age at child birth, parity, maternal socio-economic status, maternal IQ, maternal smoking during pregnancy, maternal alcohol consumption during pregnancy, maternal pre-pregnancy BMI, and gestational week of blood draw. Abbreviations: IQ, intelligence quotient; PFAS, perfluoroalkyl substances; PFOS, perfluorooctane sulfonate; PFOA, perfluorooctanoic acid; PFHxS, perfluorohexan sulfonate; PFNA, perfluorononanoic acid; PFHpS, perfluoroheptane sulfonate; PFDA, perfluorodecanoic acid; PFOSA, perfluorooctanesulfonic acid.

Table S1 Comparison of the characteristics for those invited and those who participated in the LDPS-DNBC cohort

	Invited in the LDPS (N=3,478)	Participated in the LDPS (N=1,782)	Participated in the LDPS and PFASs measured (N=1,592)
	%	%	%
Child's sex			
Female	48.6	48.1	47.8
Male	51.3	51.8	52.2
Preterm birth (<37 weeks)	3.6	2.7	2.6
Low birth weights (<2500 gram)	2.7	2.1	2.2
Maternal age at delivery			
≤ 24	10.5	8.6	8.7
25-29	36.6	35.7	35.3
30-34	36.1	38.4	38.8
≥ 34	16.7	17.2	17.2
Parity			
0	48.1	50.9	50.3
≥1	49.2	49.1	49.7
Socio-economic status			
High	65.0	71.5	71.0
Medium	30.1	25.3	25.9
Low	4.2	2.7	2.7
Missing	0.7	0.5	0.4
Maternal alcohol consumption during pregnancy			
Never	49.7	47.7	47.5
1-4 glass(es) per week	39.6	41.1	41.1
more than 4 glasses per week	10.6	11.2	11.4
Maternal smoking during pregnancy			
No	66.6	68.4	68.9
Yes	33.3	31.6	31.1
Maternal pre-pregnancy body mass index (BMI)			
<18.5	4.0	3.6	3.8
18.5-24.9	66.6	69.2	68.7
25.0-29.9	19.5	18.0	18.3
≥30	8.2	7.1	7.3
Missing	1.7	2.1	1.9

Abbreviations: LDPS, Lifestyle during pregnancy study; DNBC, Danish National Birth Cohort.

Table S2 PFAS concentrations in the LDPS cohort compared with data from a previous DNBC sample and the U.S. NHANES data reported as median concentration (25^{th}-75^{th} percentiles) in ng/ml.

Study	PFOS	PFOA	PFHxS	PFNA
DNBC-LDPS study population	28.1 (21.6-35.8)	4.3 (3.2-5.5)	1.1 (0.8-1.4)	0.5 (0.4-0.6)
DNBC sample [a]	27.4 (20.4-35.6)	4.0 (3.0-5.4)	0.9 (0.7-1.2)	0.4 (0.3-0.6)
U.S. NHANES 1999-2000 [b]	27.9 (20.3-37.3)	5.2 (3.8-7.1)	1.8 (1.0-3.3)	0.3 (0.4-0.7)

[a] Liew et al. 2014. Sample comprised live-born singleton births.

[b] Calafat et al. 2007. PFASs concentrations reported for adults age 20-39.

Abbreviations: LDPS, Lifestyle during pregnancy study; DNBC, Danish National Birth Cohort; NHANES, The National Health and Nutrition Examination Survey; PFAS, perfluoroalkyl substances; PFOS, perfluorooctane sulfonate; PFOA, perfluorooctanoic acid; PFHxS, perfluorohexan sulfonate; PFNA, perfluorononanoic acid.

Table S3 Distributions of selected PFASs by study characteristics in the LDPS-DNBC cohort (N=1,592)

	N	Median and 25th-75th percentiles (ng/ml)			
		PFOS	PFOA	PFHxS	PFNA
Child's sex					
Female	761	27.9 (21.3-35.8)	4.3 (3.2-5.5)	1.1 (0.8-1.4)	0.5 (0.4-0.6)
Male	831	28.3 (22.0-35.8)	4.3 (3.1-5.5)	1.1 (0.8-1.3)	0.5 (0.4-0.6)
Parity					
0	801	30.2 (23.4-37.9)	5.0 (4.0-6.1)	1.2 (0.9-1.5)	0.5 (0.4-0.6)
1	511	26.0 (20.6-33.9)	3.5 (2.7-4.6)	0.9 (0.7-1.2)	0.5 (0.4-0.6)
>1	280	26.6 (21.1-33.4)	3.3 (2.5-4.3)	0.9 (0.6-1.2)	0.4 (0.4-0.5)
Maternal age at child birth (years)					
≤ 24	139	31.1 (23.2-39.9)	5.0 (4.0-6.0)	1.0 (0.8-1.4)	0.4 (0.4-0.6)
25-29	562	29.4 (22.5-37.3)	4.5 (3.4-5.8)	1.1 (0.8-1.4)	0.5 (0.4-0.6)
30-34	617	27.8 (21.9-34.8)	4.2 (3.0-5.3)	1.1 (0.8-1.4)	0.5 (0.4-0.6)
≥ 35	274	26.0 (19.5-32.6)	3.7 (2.7-4.8)	1.0 (0.7-1.3)	0.5 (0.4-0.6)
Socio-economic status (SES) [a]					
High	1131	27.7 (21.1-34.6)	4.3 (3.1-5.5)	1.1 (0.8-1.4)	0.5 (0.4-0.6)
Medium	412	29.2 (24.2-38.7)	4.3 (3.2-5.6)	1.0 (0.8-1.3)	0.5 (0.4-0.6)
Low	43	26.3 (20.0-39.7)	3.7 (2.7-5.1)	0.9 (0.7-1.2)	0.4 (0.4-0.5)
Maternal alcohol consumption during pregnancy					
Never	756	28.1 (21.5-36.0)	4.3 (3.2-5.5)	1.0 (0.7-1.4)	0.5 (0.4-0.6)
1-4 glass per week	655	28.6 (22.2-35.9)	4.3 (3.1-5.6)	1.1 (0.8-1.4)	0.5 (0.4-0.6)
more than 4 glasses per week	181	27.3 (20.8-35.1)	4.1 (3.1-5.3)	1.1 (0.8-1.3)	0.5 (0.4-0.6)
Maternal smoking during pregnancy					
No	1,097	28.6 (21.5-36.5)	4.3 (3.1-5.5)	1.1 (0.7-1.4)	0.5 (0.4-0.6)
Yes	495	27.3 (22.0-34.4)	4.3 (3.2-5.5)	1.1 (0.8-1.4)	0.5 (0.4-0.6)
Maternal pre-pregnancy body mass index (BMI) [a]					
<18.5	61	27.5 (19.2-32.9)	4.3 (2.7-5.7)	1.2 (0.8-1.4)	0.5 (0.4-0.6)
18.5-24.9	1,091	27.7 (21.2-34.7)	4.3 (3.1-5.5)	1.1 (0.8-1.4)	0.5 (0.4-0.6)
25.0-29.9	294	30.3 (23.8-38.6)	4.2 (3.2-5.5)	1.1 (0.8-1.4)	0.5 (0.4-0.6)
≥30	116	30.9 (23.3-41.2)	4.4 (3.3-5.6)	1.0 (0.8-1.3)	0.5 (0.4-0.6)
Maternal IQ [a]					
< 85	239	29.9 (23.8-38.4)	4.6 (3.3-5.6)	1.1 (0.8-1.4)	0.5 (0.4-0.6)
85-115	1083	28.3 (21.9-35.9)	4.3 (3.2-5.6)	1.1 (0.8-1.4)	0.5 (0.4-0.6)
> 115	261	25.1 (19.6-32.1)	3.9 (2.8-5.1)	1.0 (0.8-1.4)	0.5 (0.4-0.6)
Gestational week of blood draw [a]					
<8 weeks	664	28.1 (22.0-35.9)	4.5 (3.3-5.7)	1.1 (0.8-1.4)	0.5 (0.4-0.6)
≥8 weeks	793	28.7 (21.9-35.9)	4.2 (3.1-5.4)	1.1 (0.8-1.4)	0.5 (0.4-0.6)

[a] The missing values for maternal IQ, gestational week of blood draw, socio-economic status, and pre-pregnancy BMI are 0.4%, 8.5%, 0.01%, 1.9% respectively.

Abbreviations: LDPS, Lifestyle during pregnancy study; DNBC, Danish National Birth Cohort; PFAS, perfluoroalkyl substances; PFOS, perfluorooctane sulfonate; PFOA, perfluorooctanoic acid; PFHxS, perfluorohexan sulfonate; PFNA, perfluorononanoic acid.

Table S4. Adjusted difference of child IQ scores at age five according to prenatal PFAS (per natural-log ng/ml increase), stratified by parity

PFAS	Adjusted difference (β and 95% CI)					
	Full Scale IQ		Verbal IQ		Performance IQ	
	Nulliparous (N=801)	Parous (N=791)	Nulliparous (N=801)	Parous (N=791)	Nulliparous (N=801)	Parous (N=791)
Per 1 natural-log unit (ng/ml) increase						
PFOS	-0.6 (-4.4, 3.2)	-1.0 (-4.6, 2.5)	0.8 (-3.4, 5.0)	-1.4 (-4.9, 2.1)	-1.5 (-5.1, 2.1)	-0.4 (-4.2, 3.4)
PFOA	0.6 (-4.1, 5.3)	-1.0 (-4.0, 2.1)	1.0 (-4.1, 6.1)	-2.1 (-5.3, 1.0)	0.2 (-4.1, 4.5)	0.1 (-3.1, 3.3)
PFHxS	-0.3 (-4.2, 3.6)	-0.1 (-2.6, 2.3)	-0.5 (-4.1, 3.1)	-0.4 (-3.0, 2.1)	-0.4 (-4.1, 3.3)	0.2 (-2.3, 2.8)
PFNA	2.0 (-1.8, 5.8)	-0.3 (-3.3, 2.7)	5.8 (2.1, 9.6)	1.0 (-1.9, 4.0)	-1.3 (-5.2, 2.7)	-1.2 (-4.1, 1.8)
PFHpS	-0.2 (-3.5, 3.0)	-0.2 (-3.0, 2.6)	0.9 (-2.7, 4.5)	-0.4 (-3.1, 2.3)	-1.3 (-4.4, 1.8)	0.1 (-3.0, 3.1)
PFDA	-0.1 (-3.3, 3.1)	0.6 (-1.8, 3.1)	2.4 (-1.2, 5.9)	1.8 (-0.9, 4.4)	-1.9 (-5.0, 1.2)	-0.4 (-2.6, 1.8)
PFOSA	-0.4 (-1.5, 0.8)	-0.2 (-1.7, 1.4)	-0.7 (-2.1, 0.7)	-0.6 (-2.2, 1.0)	0.0 (-1.0, 1.0)	0.2 (-1.3, 1.7)

Note: Multivariable linear regression modeling was used to estimate the expected difference in IQ scores. Models were adjusted for maternal age at child birth, parity, maternal socio-economic status, maternal IQ, maternal smoking during pregnancy, maternal alcohol consumption during pregnancy, maternal pre-pregnancy BMI, and gestational week of blood draw. Abbreviations: CI, confidence interval; IQ, intelligence quotient; PFAS, perfluoroalkyl substances; PFOS, perfluorooctane sulfonate; PFOA, perfluorooctanoic acid; PFHxS, perfluorohexan sulfonate; PFNA, perfluorononanoic acid; PFHpS, perfluoroheptane sulfonate; PFDA, perfluorodecanoic acid; PFOSA, perfluorooctanesulfonic acid.

Table S5. Adjusted difference of child IQ scores at age five according to prenatal PFAS (per natural-log ng/ml increase), stratified by maternal socio-economic status (SES)

PFAS	Adjusted difference (β and 95% CI)					
	Full Scale IQ		Verbal IQ		Performance IQ	
	High SES	Medium/Low	High SES	Medium/Low	High SES	Medium/Low
Per 1 natural-log unit (ng/ml) increase						
PFOS	-1.1 (-4.0, 1.8)	0.0 (-5.1, 5.2)	-0.9 (-3.8, 2.0)	0.6 (-4.9, 6.1)	-0.9 (-4.0, 2.2)	-0.6 (-5.5, 4.3)
PFOA	0.2 (-2.7, 3.1)	-0.7 (-5.8, 4.4)	-0.8 (-3.8, 2.1)	-1.1 (-6.4, 4.1)	1.0 (-2.0, 4.0)	-0.6 (-5.3, 4.2)
PFHxS	0.5 (-1.7, 2.6)	-2.4 (-7.1, 2.3)	-0.1 (-2.4, 2.1)	-2.4 (-7.3, 2.4)	0.9 (-1.2, 3.1)	-2.2 (-6.5, 2.1)
PFNA	-1.2 (-3.7, 1.4)	2.8 (-0.4, 5.9)	0.7 (-1.9, 3.3)	5.4 (2.3, 8.5)	-2.2 (-5.1, 0.6)	0.2 (-3.0, 3.3)
PFHpS	-0.5 (-2.9, 1.9)	1.0 (-2.9, 4.8)	-0.1 (-2.4, 2.2)	0.4 (-3.9, 4.8)	-0.6 (-3.3, 2.0)	0.7 (-2.9, 4.3)
PFDA	-2.0 (-4.5, 0.5)	2.0 (-0.5, 4.6)	-0.1 (-2.9, 2.6)	3.4 (0.3, 6.5)	-2.9 (-5.4, -0.3)	0.3 (-1.8, 2.4)
PFOSA	-0.4 (-1.5, 0.7)	-0.1 (-1.8, 1.6)	-0.9 (-2.0, 0.3)	-0.3 (-2.3, 1.7)	0.0 (-1.1, 1.1)	0.1 (-1.3, 1.4)

Note: Multivariable linear regression modeling was used to estimate the expected difference in IQ scores. Models were adjusted for maternal age at child birth, parity, maternal socio-economic status, maternal IQ, maternal smoking during pregnancy, maternal alcohol consumption during pregnancy, maternal pre-pregnancy BMI, and gestational week of blood draw. Abbreviations: CI, confidence interval; IQ, intelligence quotient; PFAS, perfluoroalkyl substances; PFOS, perfluorooctane sulfonate; PFOA, perfluorooctanoic acid; PFHxS, perfluorohexan sulfonate; PFNA, perfluorononanoic acid; PFHpS, perfluoroheptane sulfonate; PFDA, perfluorodecanoic acid; PFOSA, perfluorooctanesulfonic acid.

Table S6 Mean differences in IQ scores in 1,592 children at age five according to prenatal PFAS level quartiles

PFAS quartiles (unit in ng/ml)	N	Full Scale IQ	Verbal IQ	Performance IQ
		Mean difference and 95% CI		
PFOS				
2.36 - 21.60	400	ref	ref	ref
21.61 - 28.10	399	-0.4 (-3.2, 2.5)	-1.0 (-3.9, 1.9)	0.6 (-2.3, 3.5)
28.11 - 35.80	398	1.1 (-1.8, 4.0)	-0.2 (-3.3, 2.9)	1.6 (-1.2, 4.5)
≥ 35.81	395	-0.5 (-3.5, 2.6)	-0.7 (-3.9, 2.4)	-0.1 (-3.1, 2.8)
p-trend		0.87	0.76	0.93
PFOA				
0.61 - 3.15	402	Ref	ref	ref
3.16 - 4.28	397	2.4 (-0.3, 5.1)	2.5 (-0.4, 5.4)	1.6 (-1.2, 4.3)
4.29 - 5.49	397	-0.2 (-3.2, 2.9)	-2.1 (-5.1, 1.0)	1.0 (-2.1, 4.1)
≥ 5.50	396	0.3 (-3.0, 3.6)	-0.6 (-3.9, 2.7)	0.5 (-2.8, 3.7)
p-trend		0.79	0.29	0.88
PFHxS				
<LLOQ - 0.76	398	ref	ref	ref
0.77- 1.07	410	-1.4 (-4.2, 1.5)	-1.1 (-4.2, 1.9)	-1.1 (-4.0, 1.8)
1.08 - 1.38	386	-0.3 (-3.1, 2.5)	-0.6 (-3.4, 2.1)	0.2 (-2.7, 3.2)
≥ 1.39	398	-1.7 (-5.0, 1.6)	-1.6 (-4.8, 1.7)	-1.4 (-4.6, 1.8)
p-trend		0.42	0.4	0.55
PFNA				
<LLOQ - 0.36	414	ref	ref	ref
0.37 - 0.46	412	1.2 (-1.6, 4.0)	1.2 (-1.7, 4.2)	0.7 (-2.1, 3.5)
0.47 - 0.57	381	3.0 (0.4, 5.6)	3.5 (0.8, 6.2)	1.9 (-0.9, 4.6)
≥ 0.58	385	-0.2 (-3.3, 2.9)	2.0 (-1.1, 5.0)	-1.7 (-4.8, 1.3)
p-trend		0.95	0.16	0.29
PFHpS				
<LLOQ - 0.27	413	ref	ref	ref
0.28 - 0.37	383	1.6 (-1.1, 4.3)	1.0 (-1.9, 3.9)	1.6 (-1.2, 4.3)
0.38 - 0.49	413	1.1 (-1.8, 4.0)	-0.7 (-3.7, 2.2)	1.8 (-1.2, 4.8)
≥ 0.50	383	-0.5 (-3.6, 2.6)	-0.2 (-3.4, 2.9)	-0.7 (-3.7, 2.3)
p-trend		0.58	0.69	0.52
PFDA				
<LLOQ - 0.14	523	ref	ref	ref
0.15 - 0.17	304	1.1 (-2.0, 4.1)	0.1 (-3.0, 3.3)	1.2 (-1.7, 4.2)
0.18 - 0.22	398	-0.3 (-3.2, 2.6)	1.0 (-1.9, 3.9)	-1.1 (-4.0, 1.8)
≥ 0.23	367	0.2 (-2.4, 2.8)	2.5 (-0.2, 5.1)	-1.7 (-4.4, 1.1)
p-trend		0.98	0.06	0.15
PFOSA				
<LLOQ - 1.38	398	ref	ref	ref
1.39 - 2.32	398	0.2 (-2.6, 3.0)	-0.6 (-3.5, 2.2)	1.2 (-1.7, 4.0)
2.33 - 4.16	399	0.1 (-2.7, 2.9)	-1.4 (-4.5, 1.7)	1.3 (-1.4, 3.9)
≥ 4.17	397	-0.7 (-3.8, 2.5)	-1.9 (-5.3, 1.4)	0.7 (-2.3, 3.8)
p-trend		0.62	0.25	0.83

Note: Multivariable linear regression modeling was used to estimate the mean difference in IQ scores. Models were adjusted for maternal age at child birth, parity, maternal socio-economic status, maternal IQ, maternal smoking during pregnancy, maternal alcohol consumption during pregnancy, maternal pre-pregnancy BMI, and gestational week of blood draw. P-trend was modeled based on the midpoint of each category. Abbreviations: CI, confidence interval; IQ, intelligence quotient; PFAS, perfluoroalkyl substances; PFOS, perfluorooctane sulfonate; PFOA, perfluorooctanoic acid; PFHxS, perfluorohexan sulfonate; PFNA, perfluorononanoic acid; PFHpS, perfluoroheptane sulfonate; PFDA, perfluorodecanoic acid; PFOSA, perfluorooctanesulfonic acid.

Table S7. Adjusted difference of child IQ scores according to prenatal PFAS (per natural-log ng/ml increase), comparing models accounting for selection factors

PFAS	Adjusted difference (β and 95% CI)					
	Full Scale IQ		Verbal IQ		Performance IQ	
	Model 1 [a]	Model 2 [b]	Model 1 [a]	Model 2 [b]	Model 1 [a]	Model 2 [b]
Per 1 natural-log unit (ng/ml) increase						
PFOS	-0.7 (-3.3, 1.9)	-1.0 (-3.7, 1.6)	-0.4 (-3.1, 2.2)	-0.9 (-3.5, 1.7)	-0.7 (-3.4, 1.9)	-0.9 (-3.6, 1.8)
PFOA	-0.1 (-2.7, 2.4)	-0.1 (-2.5, 2.3)	-1.1 (-3.7, 1.6)	-1.2 (-3.7, 1.3)	0.5 (-2.1, 3.0)	0.6 (-1.9, 3.1)
PFHxS	-0.1 (-2.1, 2.0)	0.2 (-1.8, 2.3)	-0.6 (-2.7, 1.5)	-0.2 (-2.3, 1.8)	0.3 (-1.7, 2.3)	0.5 (-1.5, 2.5)
PFNA	0.4 (-1.9, 2.8)	0.0 (-2.2, 2.2)	2.3 (0.1, 4.5)	1.8 (-0.3, 4.0)	-1.1 (-3.5, 1.3)	-1.3 (-3.6, 1.0)
PFHpS	-0.1 (-2.2, 2.0)	-0.2 (-2.4, 1.9)	0.0 (-2.0, 2.1)	-0.2 (-2.2, 1.9)	-0.2 (-2.4, 1.9)	-0.3 (-2.5, 2.0)
PFDA	0.3 (-1.7, 2.2)	-0.2 (-2.1, 1.6)	1.6 (-0.5, 3.8)	1.1 (-0.9, 3.2)	-0.9 (-2.7, 0.9)	-1.2 (-3.0, 0.5)
PFOSA	-0.2 (-1.2, 0.7)	-0.3 (-1.2, 0.6)	-0.5 (-1.6, 0.6)	-0.6 (-1.7, 0.4)	0.0 (-0.8, 0.9)	0.1 (-0.8, 0.9)

[a] Model 1: IPW accounted for the probabilities of sampling and selection in the LDPS

[b] Model 2: IPW accounted for probability of sampling according to each alcohol intake category at baseline only

Note: Multivariable linear regression modeling was used to estimate the expected difference in IQ scores. Models were adjusted for maternal age at child birth, parity, maternal socio-economic status, maternal IQ, maternal smoking during pregnancy, maternal alcohol consumption during pregnancy, maternal pre-pregnancy BMI, and gestational week of blood draw. Abbreviations: CI, confidence interval; IQ, intelligence quotient; PFAS, perfluoroalkyl substances; PFOS, perfluorooctane sulfonate; PFOA, perfluorooctanoic acid; PFHxS, perfluorohexan sulfonate; PFNA, perfluorononanoic acid; PFHpS, perfluoroheptane sulfonate; PFDA, perfluorodecanoic acid; PFOSA, perfluorooctanesulfonic acid.

Table S8. Adjusted difference of child IQ scores at age five according to prenatal PFAS (per natural-log ng/ml increase), additionally adjusting for birth year

PFAS	Adjusted difference (β and 95% CI)					
	Full Scale IQ		Verbal IQ		Performance IQ	
	Model 1 [a]	Model 2 [b]	Model 1 [a]	Model 2 [b]	Model 1 [a]	Model 2 [b]
Per 1 natural-log unit (ng/ml) increase						
PFOS	-0.9 (-3.5, 1.7)	-0.8 (-3.4, 1.8)	-0.3 (-3.0, 2.3)	-0.2 (-2.8, 2.4)	-1.1 (-3.8, 1.5)	-1.1 (-3.7, 1.5)
PFOA	-0.5 (-2.9, 2.0)	-0.5 (-3.0, 2.0)	-0.9 (-3.5, 1.7)	-0.8 (-3.5, 1.8)	-0.1 (-2.7, 2.4)	-0.3 (-2.8, 2.3)
PFHxS	-0.1 (-2.2, 1.9)	-0.1 (-2.2, 1.9)	-0.6 (-2.7, 1.6)	-0.5 (-2.6, 1.6)	0.1 (-1.9, 2.1)	0.1 (-1.9, 2.0)
PFNA	0.7 (-1.7, 3.2)	0.6 (-1.9, 3.1)	2.3 (-0.1, 4.6)	2.3 (-0.1, 4.6)	-0.6 (-3.0, 1.8)	-0.8 (-3.2, 1.7)
PFHpS	-0.2 (-2.2, 1.9)	-0.1 (-2.2, 2.0)	0.1 (-2.0, 2.2)	0.2 (-1.9, 2.3)	-0.4 (-2.6, 1.7)	-0.4 (-2.6, 1.8)
PFDA	0.5 (-1.5, 2.5)	0.5 (-1.6, 2.5)	1.6 (-0.7, 3.8)	1.6 (-0.6, 3.8)	-0.5 (-2.3, 1.3)	-0.6 (-2.4, 1.3)
PFOSA	-0.5 (-1.5, 0.4)	-0.5 (-1.5, 0.4)	-0.5 (-1.7, 0.7)	-0.5 (-1.6, 0.7)	-0.4 (-1.3, 0.4)	-0.4 (-1.2, 0.4)

[a] Model 1: adjusted for a continuous birth year variable in addition to the covariates listed below

[b] Model 2: adjusted for a categorical birth year variable in addition to the covariates listed below

Note: Multivariable linear regression modeling was used to estimate the expected difference in IQ scores. Models were adjusted for maternal age at child birth, parity, maternal socio-economic status, maternal IQ, maternal smoking during pregnancy, maternal alcohol consumption during pregnancy, maternal pre-pregnancy BMI, and gestational week of blood draw. Abbreviations: CI, confidence interval; IQ, intelligence quotient; PFAS, perfluoroalkyl substances; PFOS, perfluorooctane sulfonate; PFOA, perfluorooctanoic acid; PFHxS, perfluorohexan sulfonate; PFNA, perfluorononanoic acid; PFHpS, perfluoroheptane sulfonate; PFDA, perfluorodecanoic acid; PFOSA, perfluorooctanesulfonic acid.

Table S9. Adjusted difference of child IQ scores at age five according to prenatal PFAS (per natural-log ng/ml increase), excluding blood samples that were subjected to processing delay

PFAS	Adjusted difference (β and 95% CI)					
	Full Scale IQ		Verbal IQ		Performance IQ	
	Model 1 [a]	Model 2 [b]	Model 1 [a]	Model 2 [b]	Model 1 [a]	Model 2 [b]
Per 1 natural-log unit (ng/ml) increase						
PFOS	-0.7 (-3.3, 1.9)	-0.7 (-3.4, 1.9)	-0.4 (-3.1, 2.2)	-0.3 (-3.1, 2.5)	-0.7 (-3.4, 1.9)	-0.9 (-3.6, 1.8)
PFOA	-0.1 (-2.7, 2.4)	-0.1 (-2.7, 2.5)	-1.1 (-3.7, 1.6)	-0.9 (-3.7, 1.8)	0.5 (-2.1, 3.0)	0.5 (-2.1, 3.1)
PFHxS	-0.1 (-2.1, 2.0)	-0.2 (-2.4, 2.0)	-0.6 (-2.7, 1.5)	-0.8 (-3.1, 1.4)	0.3 (-1.7, 2.3)	0.2 (-1.9, 2.3)
PFNA	0.4 (-1.9, 2.8)	0.4 (-2.0, 2.9)	2.3 (0.1, 4.5)	2.5 (0.2, 4.8)	-1.1 (-3.5, 1.3)	-1.2 (-3.7, 1.3)
PFHpS	-0.1 (-2.2, 2.0)	-0.2 (-2.3, 2.0)	0.0 (-2.0, 2.1)	0.1 (-2.1, 2.3)	-0.2 (-2.4, 1.9)	-0.4 (-2.6, 1.8)
PFDA	0.3 (-1.7, 2.2)	0.2 (-1.8, 2.3)	1.6 (-0.5, 3.8)	1.7 (-0.5, 3.9)	-0.9 (-2.7, 0.9)	-1.0 (-2.9, 0.9)
PFOSA	-0.2 (-1.2, 0.7)	-0.5 (-1.6, 0.6)	-0.5 (-1.6, 0.6)	-0.9 (-2.0, 0.3)	0.0 (-0.8, 0.9)	0.0 (-1.0, 1.0)

[a] Model 1: Full cohort (N=1,592)

[b] Model 2: Excluded 101 samples that were subjected to processing delay (> 48 hours)

Note: Multivariable linear regression modeling was used to estimate the expected difference in IQ scores. Models were adjusted for maternal age at child birth, parity, maternal socio-economic status, maternal IQ, maternal smoking during pregnancy, maternal alcohol consumption during pregnancy, maternal pre-pregnancy BMI, and gestational week of blood draw. Abbreviations: CI, confidence interval; IQ, intelligence quotient; PFAS, perfluoroalkyl substances; PFOS, perfluorooctane sulfonate; PFOA, perfluorooctanoic acid; PFHxS, perfluorohexan sulfonate; PFNA, perfluorononanoic acid; PFHpS, perfluoroheptane sulfonate; PFDA, perfluorodecanoic acid; PFOSA, perfluorooctanesulfonic acid.

REFERENCE

Liew Z, Ritz B, Bonefeld-Jorgensen EC, Henriksen TB, Nohr EA, Bech BH, et al. 2014. Prenatal exposure to perfluoroalkyl substances and the risk of congenital cerebral palsy in children. Am J Epidemiol 180:574-581.

Calafat AM, Kuklenyik Z, Reidy JA, Caudill SP, Tully JS, Needham LL. 2007. Serum concentrations of 11 polyfluoroalkyl compounds in the U.S. Population: Data from the national health and nutrition examination survey (nhanes). Environ Sci Technol 41:2237-2242.