\<Supporting Information\>

Title: Isomer-Specific Serum Concentrations of Perfluorooctane Sulfonic Acid among U.S. Adults: Results from the National Health and Nutrition Examination Survey (NHANES) and the Study of Women's Health Across the Nation Multi-Pollutant Study (SWAN-MPS)

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Table S1. Survey-weighted serum concentrations of n- and sm-PFOS in U.S. adults: NHANES

2013–2018

	n	Weighted %	n-PFOS (ng/mL)		sm-PFOS (ng/mL)	
			GM (GSE)[a]	p-value	GM (GSE)	p-value
Total	3759	100	3.27 (1.03)		1.40 (1.03)	
Survey year						
2013-2014	1261	33	3.51 (1.05)	(ref.)	1.45 (1.06)	(ref.)
2015–2016	1292	34	3.20 (1.04)	0.16	1.45 (1.03)	0.97
2017–2018	1206	33	3.09 (1.05)	0.07	1.30 (1.05)	0.16
Race/ethnicity						
Non-Hispanic White	1396	66	3.34 (1.03)	(ref.)	1.55 (1.03)	(ref.)
Hispanic	958	15	2.53 (1.05)	<0.0001	1.15 (1.04)	<0.0001
Non-Hispanic Black	831	11	3.82 (1.07)	0.04	1.22 (1.05)	<0.0001
Non-Hispanic Asian	421	5	3.99 (1.07)	0.02	1.18 (1.05)	<0.0001
Other Race	153	4	3.01 (1.08)	0.21	1.29 (1.08)	0.02
Sex						
Male	1786	49	4.22 (1.03)	(ref.)	2.00 (1.04)	(ref.)
Female	1973	51	2.56 (1.03)	<0.0001	1.00 (1.03)	<0.0001
Age (years)						
20–29	645	19	2.58 (1.04)	(ref.)	0.96 (1.04)	(ref.)
30–39	684	19	2.46 (1.05)	0.26	0.99 (1.06)	0.89
40–49	665	18	3.02 (1.04)	0.003	1.30 (1.05)	<0.0001
50–59	655	20	3.76 (1.06)	<0.0001	1.67 (1.06)	<0.0001
60–69	714	16	4.44 (1.06)	<0.0001	2.14 (1.05)	<0.0001
70–79	396	8	5.07 (1.05)	<0.0001	2.48 (1.06)	<0.0001
Poverty-income ratio						
<1	781	14	2.85 (1.05)	(ref.)	1.08 (1.04)	(ref.)
1–<1.25	322	6	2.88 (1.07)	0.89	1.15 (1.08)	0.35
1.25–<2	680	15	2.90 (1.05)	0.79	1.18 (1.06)	0.14
2–<4	986	27	3.18 (1.04)	0.02	1.40 (1.04)	<0.0001
≥4	990	39	3.72 (1.03)	<0.0001	1.68 (1.03)	<0.0001
BMI[b] (kg/m^2)						
<25	1017	28	3.28 (1.04)	(ref.)	1.32 (1.04)	(ref.)
25–<30	1183	32	3.57 (1.04)	0.15	1.52 (1.04)	0.03
≥30	1559	41	3.03 (1.04)	0.08	1.36 (1.04)	0.47
Fish and shellfish consumption						
Tertile 1 (≤2/month)	1676	45	2.82 (1.04)	(ref.)	1.29 (1.04)	(ref.)
Tertile 2 (3–5/month)	907	24	3.40 (1.04)	0.0008	1.48 (1.05)	0.02
Tertile 3 (≥6/month)	1155	30	3.93 (1.04)	<0.0001	1.52 (1.03)	0.0007
Missing	21	0				
Tap water source						
Do not drink	833	16	3.24 (1.06)	(ref.)	1.25 (1.06)	(ref.)
Community supply	2480	70	3.22 (1.03)	0.95	1.42 (1.03)	0.05
Others	322	12	3.72 (1.05)	0.06	1.60 (1.05)	0.002
Missing	124	2				
eGFR[c]						
≤60 mL/min/1.73m^2	201	4	3.48 (1.13)	(ref.)	1.72 (1.13)	(ref.)
>60–90 mL/min/1.73m^2	1079	28	4.09 (1.04)	0.16	1.91 (1.04)	0.39
>90 mL/min/1.73m^2	2479	68	2.96 (1.03)	0.18	1.21 (1.03)	0.006
Parity (women only)						
0	1004	56	2.70 (1.04)	(ref.)	1.04 (1.04)	(ref.)

≥1	835	44	2.51 (1.04)	0.15	1.01 (1.04)	0.56
Last menstruation (women only)						
≤12 month	872	49	1.99 (1.04)	(ref.)	0.69 (1.04)	(ref.)
>12 month	967	51	3.38 (1.04)	<0.0001	1.50 (1.03)	<0.0001

[a]Geometric mean (GM) and geometric standard error (GSE). GSE was reported to show precision of the weighted estimates.

[b]Body mass index.

[c]Estimated glomerular filtration rate.

Table S2. Serum concentrations of n- and sm-PFOS in the SWAN-MPS population

	n (%)	n-PFOS (ng/mL)		sm-PFOS (ng/mL)	
		GM (GSD)[a]	p-value	GM (GSD)	p-value
Total	1303 (100)	17.93 (1.80)		7.26 (2.00)	
Site					
Los Angeles, CA	346 (27)	16.45 (1.68)	(ref.)	7.49 (1.89)	(ref.)
Oakland, CA	295 (23)	15.88 (1.66)	0.44	5.69 (2.02)	<0.0001
Southeast Michigan	228 (17)	22.83 (1.89)	<0.0001	8.56 (2.01)	0.02
Pittsburgh, PA	219 (17)	20.47 (1.94)	<0.0001	8.62 (2.07)	0.02
Boston, MA	215 (17)	16.44 (1.72)	0.99	6.82 (1.84)	0.11
Race/ethnicity					
White	659 (51)	17.45 (1.79)	(ref.)	7.93 (1.94)	(ref.)
Black	276 (21)	23.12 (1.91)	<0.0001	8.41 (2.07)	0.21
Chinese	169 (13)	15.35 (1.59)	0.009	4.46 (1.84)	<0.0001
Japanese	199 (15)	15.71 (1.63)	0.02	6.71 (1.83)	0.002
Age (years)					
>44–48	443 (34)	18.29 (1.83)	(ref.)	7.48 (2.14)	(ref.)
>48–52	603 (46)	17.97 (1.77)	0.74	7.26 (1.89)	0.50
>52–56	257 (20)	17.21 (1.81)	0.16	6.92 (2.00)	0.15
Education					
≤High school diploma	236 (18)	19.20 (1.87)	(ref.)	7.17 (2.09)	(ref.)
Some college	415 (32)	19.09 (1.82)	0.74	7.68 (2.00)	0.22
College	318 (24)	16.02 (1.77)	<0.0001	6.50 (2.07)	0.10
Postgraduate	334 (26)	17.58 (1.71)	0.11	7.60 (1.83)	0.32
Financial hardship					
Very hard	83 (6)	20.27 (1.82)	(ref.)	7.60 (1.90)	(ref.)
Somewhat hard	318 (24)	17.44 (1.77)	0.03	6.90 (2.01)	0.26
Not hard at all	902 (69)	17.90 (1.80)	0.05	7.36 (2.00)	0.69
BMI[b] (kg/m²)					
<25	555 (43)	16.21 (1.76)	(ref.)	6.25 (1.99)	(ref.)
25–<30	350 (27)	17.93 (1.80)	0.01	7.31 (1.97)	0.0007
≥30	398 (31)	20.63 (1.79)	<0.0001	8.89 (1.92)	<0.0001
Fish and shellfish consumption					
Tertile 1 (≤4.5/month)	466 (36)	18.51 (1.79)	(ref.)	7.97 (2.04)	(ref.)
Tertile 2 (>4.5–8.5/month)	417 (32)	17.72 (1.76)	0.37	7.22 (1.93)	0.03
Tertile 3 (>8.5/month)	420 (32)	17.50 (1.84)	0.21	6.59 (1.99)	<0.0001
Pizza consumption					
Never or <1/month	286 (22)	18.05 (1.87)	(ref.)	6.57 (2.18)	(ref.)
1/month	399 (31)	17.74 (1.82)	0.80	7.17 (1.91)	0.10
≥2/month	618 (47)	17.99 (1.75)	0.82	7.67 (1.95)	0.002
Salty snacks consumption					
Never or <1/month	228 (17)	15.97 (1.75)	(ref.)	5.57 (1.99)	(ref.)
1–2/month	187 (14)	17.47 (1.87)	0.09	6.55 (2.00)	0.01
≥1/week	888 (68)	18.57 (1.79)	<0.0001	7.95 (1.96)	<0.0001
French fries consumption					
Never or <1/month	368 (28)	16.74 (1.85)	(ref.)	6.43 (2.07)	(ref.)
1/month	283 (22)	18.59 (1.86)	0.03	7.36 (1.95)	0.01
≥2/month	652 (50)	18.34 (1.73)	0.01	7.73 (1.96)	<0.0001
Parity					

0	253 (19)	18.21 (1.80)	(ref.)	7.95 (1.99)	(ref.)
1–2	684 (52)	18.19 (1.79)	0.98	7.25 (2.01)	0.07
≥3	366 (28)	17.26 (1.81)	0.26	6.84 (1.96)	0.007
Menopausal status					
Pre-/early perimenopausal	844 (65)	17.20 (1.77)	(ref.)	6.88 (2.00)	(ref.)
Late peri-/natural postmenopausal	260 (20)	19.52 (1.76)	0.002	8.20 (1.91)	0.0003
Unknown (hormone therapy)	199 (15)	19.12 (1.91)	0.02	7.79 (2.03)	0.02

[a]Geometric mean (GM) and Geometric standard deviation (GSD).

[b]Body mass index.

Table S3. Association of characteristics with percentage of n-PFOS (% n-PFOS) in U.S. women aged 45–56 years participating in NHANES 2013-2018
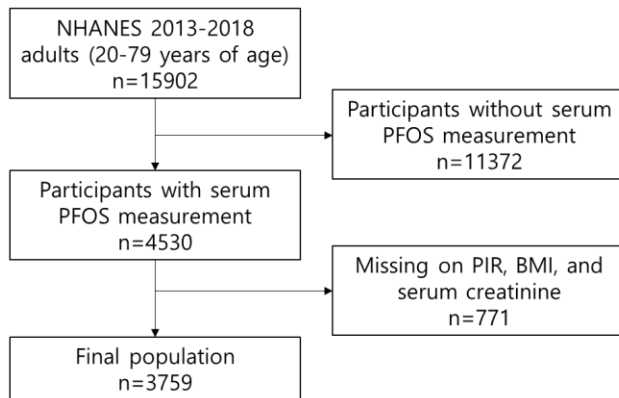
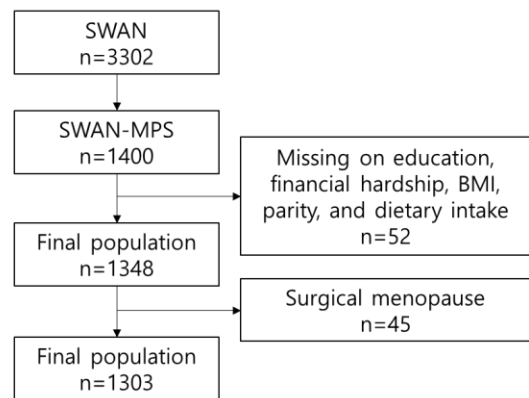|	n	Model 1[a]		Model 2[b]	
		β (95% CI)	p-value	β (95% CI)	p-value
Fish and shellfish consumption					
Continuous (80th vs. 20th)	430	2.1 (1.0, 3.2)	<0.0003	1.8 (0.8, 2.8)	0.001
Tertile 1 (≤2/month)	146	(ref.)		(ref.)	
Tertile 2 (3–5/month)	142	1.7 (-1.1, 4.5)	0.22	1.7 (-1.1, 4.5)	0.22
Tertile 3 (≥6/month)	142	4.1 (1.5, 6.7)	0.003	3.4 (1.0, 5.8)	0.007
Tap water source					
Do not drink	103	(ref.)		(ref.)	
Community supply	278	-0.4 (-2.9, 2.0)	0.71	0.0 (-2.4, 2.4)	0.99
Others	35	2.6 (-3.8, 9.0)	0.42	3.5 (-2.2, 9.3)	0.22
eGFR[c]					
Continuous (80th vs. 20th)	431	1.2 (-0.5, 2.9)	0.16	1.1 (-0.7, 2.8)	0.23
≤60 mL/min/1.73m^2	8	(ref.)		(ref.)	
>60–90 mL/min/1.73m^2	123	3.1 (-9.4, 15.6)	0.62	2.7 (-9.1, 14.5)	0.64
>90 mL/min/1.73m^2	300	4.0 (-8.1, 16.2)	0.50	3.5 (-8.0, 15.1)	0.54
Parity					
0	189	(ref.)		(ref.)	
≥1	223	-0.4 (-3.6, 2.7)	0.79	-0.3 (-3.4, 2.7)	0.83
Last menstruation					
≤12 month	157	(ref.)		(ref.)	
>12 month	255	-2.8 (-5.2, -0.4)	0.02	-3.2 (-5.6, -0.8)	0.01

[a]Adjusted for age and race/ethnicity.
[b]Additionally adjusted for poverty-income ratio and body mass index (BMI).
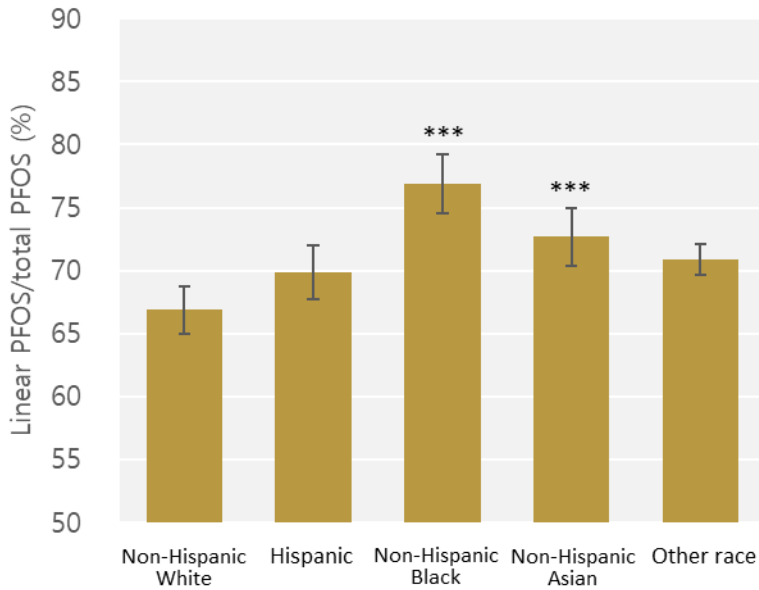[c]Estimated glomerular filtration rate.

(A) NHANES

(B) SWAN-MPS

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NHANES 2013-2018
adults (20-79 years of age)
n=15902
        │
        ├──────────────► Participants without serum
        │                PFOS measurement
        │                n=11372
        ▼
Participants with serum
PFOS measurement
n=4530
        │
        ├──────────────► Missing on PIR, BMI, and
        │                serum creatinine
        │                n=771
        ▼
Final population
n=3759
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SWAN
n=3302
     │
     ▼
SWAN-MPS
n=1400
     │
     ├──────────────► Missing on education,
     │                financial hardship, BMI,
     │                parity, and dietary intake
     │                n=52
     ▼
Final population
n=1348
     │
     ├──────────────► Surgical menopause
     │                n=45
     ▼
Final population
n=1303
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Figure S1. Selection of the (A) NHANES and (B) SWAN-MPS analytic samples.

Figure S2. Least squared means and standard errors of percentage of linear PFOS in U.S. women aged 45–56 years participating in NHANES 2013-2018 by site and race/ethnicity. The least squared means were adjusted for age, poverty-income ratio, BMI, fish and shellfish consumption, tap water source, and eGFR. Symbols above the bars indicate a statistical difference comparing with non-Hispanic White. $* p < 0.05$, $** p < 0.01$, $*** p < 0.001$.