

Supplemental Material for

“Association of Perfluoroalkyl Substance with Lung Function in the US Population”

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Supplemental Table S1. Association of PFASs Serum Concentration with FEV1 in NHANES 2011-2012 Participants Using Unadjusted, Age-adjusted, and Multivariable Adjusted Linear Regression (all models adjusted for survey weight).

FEV1		Male		Female	
		B (95% CI)	P value	B (95% CI)	P value
PFOA					
Unadjusted		Referent		Referent	
	2nd	105.19 (-238.52, 448.90)	0.53	-117.42 (-347.94, 113.10)	0.30
	3rd	-17.90 (-314.89, 279.09)	0.90	-19.79 (-250.68, 211.11)	0.86
	4th	115.42 (-186.31, 417.15)	0.43	-125.89 (-302.99, 51.21)	0.15
Age-adjusted		Referent		Referent	
	2nd	126.18 (-156.33, 408.69)	0.36	8.39 (-154.06, 170.84)	0.91
	3rd	50.04 (-196.60, 296.67)	0.67	102.50 (-43.15, 248.15)	0.16
	4th	252.85 (8.27, 497.44)	0.04	127.29 (1.11, 253.46)	0.05
Multivariable-adjusted		Referent		Referent	
	2nd	89.62 (-177.18, 356.42)	0.48	-66.16 (-232.69, 100.37)	0.41
	3rd	14.90 (-221.68, 251.47)	0.90	18.37 (-128.28, 165.02)	0.79
	4th	170.13 (-60.48, 400.73)	0.14	12.59 (-142.57, 167.75)	0.87
PFOS					
Unadjusted		Referent		Referent	
	2nd	272.46 (78.18, 466.74)	0.009	18.98 (-162.04, 199.99)	0.83
	3rd	206.73 (3.87, 409.58)	0.046	-59.19 (-290.44, 172.06)	0.60
	4th	19.52 (-190.19, 229.23)	0.85	-179.575 (-330.20, -28.94)	0.02
Age-adjusted		Referent		Referent	
	2nd	382.04 (171.43, 592.65)	0.001	65.69 (-103.41, 234.79)	0.42
	3rd	382.68 (133.91, 631.45)	0.005	86.04 (-83.43, 255.51)	0.30
	4th	342.02 (125.51, 558.53)	0.004	154.45 (-3.96, 312.86)	0.06
Multivariable-adjusted		Referent		Referent	
	2nd	356.25 (120.62, 591.88)	0.005	26.87 (-126.13, 179.88)	0.72
	3rd	355.75 (99.69, 611.80)	0.009	32.63 (-133.7, 198.99)	0.68
	4th	303.90 (89.92, 517.89)	0.008	132.49 (-27.29, 292.28)	0.10
PFNA					
Unadjusted		Referent		Referent	
	2nd	-145.10 (-326.71, 36.51)	0.11	-89.21 (-272.58, 94.17)	0.32
	3rd	-139.01 (-373.07, 95.04)	0.23	-44.27 (-254.68, 166.14)	0.66
	4th	-141.78 (-413.29, 129.73)	0.29	-153.93 (-330.34, 22.47)	0.08
Age-adjusted		Referent		Referent	
	2nd	-47.19 (-229.29, 134.91)	0.59	-28.35 (-214.88, 158.18)	0.75
	3rd	-41.27 (-295.25, 212.70)	0.74	74.34 (-97.35, 246.04)	0.37
	4th	-6.69 (-252.56, 239.18)	0.95	46.32 (-134.54, 227.18)	0.60
Multivariable-adjusted		Referent		Referent	
	2nd	-69.01 (-240.62, 102.60)	0.41	-25.62 (-204.14, 152.90)	0.77
	3rd	-26.81 (-227.21, 173.59)	0.78	74.73 (-97.75, 247.22)	0.37
	4th	12.07 (-193.83, 219.97)	0.90	47.91 (-131.26, 227.07)	0.58
PFHxS					
Unadjusted		Referent		Referent	
	2nd	79.73 (-186.68, 346.14)	0.54	123.42 (-31.12, 277.96)	0.11
	3rd	115.89 (-114.09, 345.87)	0.30	41.30 (-197.14, 279.75)	0.72
	4th	236.45 (-73.59, 546.49)	0.13	-21.12 (-217.18, 174.93)	0.82
Age-adjusted		Referent		Referent	
	2nd	85.34 (-204.17, 374.85)	0.54	132.66 (-10.24, 275.56)	0.07
	3rd	208.63 (-57.09, 474.36)	0.12	88.70 (-28.84, 206.24)	0.13
	4th	304.27 (38.58, 569.96)	0.03	106.97 (-67.17, 281.11)	0.21
Multivariable-adjusted		Referent		Referent	
	2nd	29.11 (-258.25, 316.49)	0.83	118.54 (-19.45, 256.52)	0.09
	3rd	167.37 (-104.11, 438.85)	0.21	29.4 (-114.20, 173.06)	0.67
	4th	215.99 (-50.01, 482.01)	0.10	31.02 (-146.78, 208.82)	0.71

*In all models, the reference category was the respective 1st PFAS quartile.

Variables adjusted: age, annual household income and race/ethnicity.

N = 1450

Supplemental Table S2. Association of PFASs Serum Concentration with FVC in NHANES 2011-2012 Participants Using Unadjusted, Age-adjusted, and Multivariable Adjusted Linear Regression (all models adjusted for survey weight).

		Male		Female	
		B (95% CI)	P value	B (95% CI)	P value
FVC					
PFOA					
Unadjusted		Referent		Referent	
	2nd	161.74 (-140.94, 464.42)	0.28	-22.29 (-241.11, 196.52)	0.83
	3rd	10.74 (-299.91, 321.39)	0.94	-9.80 (-257.52, 237.93)	0.93
	4th	222.73 (-100.03, 545.48)	0.16	-24.32 (-239.92, 191.27)	0.81
Age-adjusted		Referent		Referent	
	2nd	174.89 (-130.00, 479.78)	0.24	72.86 (-110.45, 256.16)	0.41
	3rd	53.31 (-235.15, 341.78)	0.70	82.69 (-110.84, 276.22)	0.38
	4th	308.85 (0.33, 617.37)	0.05	167.16 (-18.29, 352.62)	0.07
Multivariable-adjusted		Referent		Referent	
	2nd	116.06 (-170.20, 402.32)	0.40	-41.72 (-230.72, 147.27)	0.65
	3rd	-4.39 (-270.07, 261.28)	0.97	-51.87 (-233.32, 129.58)	0.55
	4th	164.60 (-128.41, 457.61)	0.25	-8.36 (-214.27, 197.54)	0.93
PFOS					
Unadjusted		Referent		Referent	
	2nd	388.37 (120.26, 656.47)	0.007	44.83 (-170.62, 260.27)	0.67
	3rd	325.96 (86.41, 565.51)	0.01	-5.96 (-239.94, 228.03)	0.96
	4th	185.52 (-77.12, 448.17)	0.15	-166.17 (-372.57, 40.23)	0.11
Age-adjusted		Referent		Referent	
	2nd	459.17 (164.07, 754.28)	0.004	78.72 (-149.61, 307.05)	0.48
	3rd	439.65 (151.01, 728.29)	0.005	99.42 (-109.15, 307.99)	0.33
	4th	393.91 (100.21, 687.61)	0.01	76.19 (-154.99, 307.38)	0.5
Multivariable-adjusted		Referent		Referent	
	2nd	412.95 (103.30, 722.60)	0.01	15.17 (-185.23, 215.57)	0.88
	3rd	381.33 (85.26, 677.40)	0.01	16.29 (-175.35, 207.94)	0.86
	4th	311.99 (15.47, 608.53)	0.04	43.93 (-177.57, 265.42)	0.68
PFNA					
Unadjusted		Referent		Referent	
	2nd	-83.71 (-258.39, 90.97)	0.33	-95.87 (-337.83, 146.08)	0.41
	3rd	-98.40 (-402.05, 205.26)	0.50	-17.64 (-307.16, 271.87)	0.90
	4th	-117.19 (-399.60, 165.22)	0.40	-180.45 (-409.39, 48.49)	0.11
Age-adjusted		Referent		Referent	
	2nd	-24.43 (-224.26, 175.39)	0.80	-51.32 (-304.20, 201.56)	0.67
	3rd	-39.22 (-361.98, 283.55)	0.81	69.19 (-205.85, 344.23)	0.60
	4th	-35.40 (-305.49, 234.69)	0.79	-33.85 (-271.94, 204.25)	0.77
Multivariable-adjusted		Referent		Referent	
	2nd	-62.61 (-247.17, 121.96)	0.48	-46.40 (-284.68, 191.89)	0.69
	3rd	-27.76 (-289.88, 234.36)	0.83	73.08 (-197.81, 343.97)	0.58
	4th	-7.57 (-219.71, 204.57)	0.94	-21.50 (-263.17, 220.13)	0.85
PFHxS					
Unadjusted		Referent		Referent	
	2nd	145.86 (-203.13, 494.86)	0.39	202.67 (15.12, 390.23)	0.04
	3rd	206.54 (-43.30, 456.38)	0.10	150.30 (-103.50, 404.10)	0.23
	4th	362.00 (45.19, 678.82)	0.03	49.94 (-204.56, 304.45)	0.68
Age-adjusted		Referent		Referent	
	2nd	149.37 (-217.40, 516.14)	0.40	209.54 (19.51, 399.56)	0.03
	3rd	264.45 (-24.91, 553.81)	0.07	185.51 (-3.97, 374.98)	0.05
	4th	404.34 (96.52, 712.17)	0.01	145.10 (-108.73, 398.92)	0.24
Multivariable-adjusted		Referent		Referent	
	2nd	45.02 (-306.17, 396.21)	0.79	188.51 (7.60, 369.42)	0.04
	3rd	170.75 (-138.62, 480.12)	0.26	87.18 (-128.04, 302.40)	0.40
	4th	231.36 (-68.31, 531.02)	0.12	20.40 (-226.05, 266.85)	0.86

*In all models, the reference category was the respective 1st PFAS quartile.

Variables adjusted: age, annual household income and race/ethnicity.

N = 1450

Supplemental Table S3. Association of PFASs serum concentration with FEV1/FVC in NHANES 2011-2012 participants using unadjusted, age-adjusted and multivariable adjusted linear regression (all models adjusted for survey weight).

FEV1/FVC		Male		Female	
		B (95% CI)	P value	B (95% CI)	P value
PFOA					
Unadjusted		Referent		Referent	
	2nd	-0.50 (-4.38, 3.38)	0.79	-3.06 (-5.67, -0.46)	0.02
	3rd	-0.24 (-3.29, 2.81)	0.87	-0.58 (-2.73, 1.58)	0.58
	4th	-1.17 (-4.09, 1.76)	0.41	-3.45 (-5.61, -1.30)	0.004
Age-adjusted		Referent		Referent	
	2nd	-0.26 (-2.74, 2.21)	0.83	-1.53 (-3.19, 0.14)	0.07
	3rd	0.53 (-2.08, 3.14)	0.67	0.92 (-0.64, 2.47)	0.23
	4th	0.38 (-1.61, 2.38)	0.69	-0.36 (-2.49, 1.77)	0.73
Multivariable-adjusted		Referent		Referent	
	2nd	-0.09 (-2.63, 2.46)	0.94	-0.99 (-2.76, 0.77)	0.25
	3rd	0.70 (-1.92, 3.33)	0.58	1.65 (0.20, 3.10)	0.03
	4th	0.98 (-1.16, 3.11)	0.35	0.43 (-1.65, 2.52)	0.67
PFOS					
Unadjusted		Referent		Referent	
	2nd	-0.80 (-3.25, 1.64)	0.50	-0.42 (-2.73, 1.90)	0.71
	3rd	-1.09 (-2.70, 0.53)	0.17	-1.88 (-4.57, 0.81)	0.16
	4th	-2.99 (-5.21, -0.77)	0.01	-1.45 (-2.96, 0.05)	0.06
Age-adjusted		Referent		Referent	
	2nd	0.39 (-1.70, 2.48)	0.70	0.19 (-1.17, 1.55)	0.77
	3rd	0.83 (-0.50, 2.15)	0.21	0.004 (-2.03, 2.03)	0.99
	4th	0.52 (-1.38, 2.42)	0.57	2.89 (1.30, 4.48)	0.001
Multivariable-adjusted		Referent		Referent	
	2nd	0.59 (-1.25, 2.44)	0.51	0.57 (-0.91, 2.05)	0.43
	3rd	1.22 (-0.12, 2.56)	0.07	0.41 (-1.61, 2.43)	0.67
	4th	1.06 (-1.01, 3.13)	0.30	3.01 (1.50, 4.51)	0.001
PFNA					
Unadjusted		Referent		Referent	
	2nd	-1.63 (-4.05, 0.79)	0.17	-0.34 (-2.19, 1.51)	0.70
	3rd	-1.17 (-3.48, 1.13)	0.30	-1.22 (-3.35, 0.91)	0.24
	4th	-0.77 (-2.88, 1.34)	0.45	-0.26 (-2.12, 1.61)	0.77
Age-adjusted		Referent		Referent	
	2nd	-0.49 (-2.29, 1.32)	0.58	0.44 (-0.88, 1.76)	0.49
	3rd	-0.03 (-2.11, 2.05)	0.98	0.30 (-1.44, 2.04)	0.72
	4th	0.81 (-0.93, 2.55)	0.34	2.31 (0.68, 3.95)	0.008
Multivariable-adjusted		Referent		Referent	
	2nd	-0.33 (-2.17, 1.52)	0.71	0.41 (-0.82, 1.63)	0.49
	3rd	0.08 (-2.06, 2.23)	0.94	0.21 (-1.39, 1.82)	0.78
	4th	0.71 (-1.24, 2.67)	0.45	2.05 (0.46, 3.64)	0.46
PFHxS					
Unadjusted		Referent		Referent	
	2nd	-0.80 (-2.83, 1.23)	0.42	-0.86 (-2.72, 1.00)	0.34
	3rd	-1.13 (-3.11, 0.85)	0.25	-2.63 (-5.42, 0.16)	0.06
	4th	-1.15 (-3.90, 1.59)	0.39	-1.94 (-4.08, 0.19)	0.07
Age-adjusted		Referent		Referent	
	2nd	-0.74 (-2.57, 1.10)	0.41	-0.74 (-2.12, 0.63)	0.27
	3rd	-0.08 (-1.70, 1.53)	0.91	-2.04 (-3.83, -0.25)	0.03
	4th	-0.39 (-2.60, 1.82)	0.71	-0.33 (-1.93, 1.27)	0.67
Multivariable-adjusted		Referent		Referent	
	2nd	-0.24 (-2.03, 1.55)	0.78	-0.66 (-1.99, 0.68)	0.31
	3rd	0.59 (-1.33, 2.50)	0.53	-1.44 (-3.25, 0.38)	0.11
	4th	0.57 (-2.08, 3.22)	0.67	0.41 (-1.18, 1.99)	0.60

*In all models, the reference category was the respective 1st PFAS quartile.

Variables adjusted: age, annual household income and race/ethnicity.

N = 1450