Associations between polycyclic aromatic hydrocarbon exposure and cognitive performance in older adults: a cross-sectional study from NHANES 2011-2014

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Table S1 Distribution of PAHs metabolites (N=772), NHANES, USA, 2011-2014.

PAH (μg/L)	Detection frequency	GM	Mean	Percentile 5th	25th	50th	75th	95th
1-NAP	99.74%	1.83	46.29	0.26	0.70	1.41	3.49	21.87
2-NAP	100.00%	3.41	6.74	0.56	1.48	3.42	7.41	21.82
3-FLUO	96.37%	0.07	0.16	0.01	0.03	0.06	0.13	0.66
2-FLUO	100.00%	0.17	0.35	0.03	0.08	0.15	0.31	1.25
1-PHEN	99.22%	0.10	0.16	0.02	0.06	0.10	0.18	0.46

Table S2 BKMR models of group inclusion and conditional inclusion for posterior inclusion probabilities (PIPs).

OH-PAHs	Group	IRT z-score		DRT z-score		AFT z-score		DSST z-score	
		groupPIP	condPIP	groupPIP	condPIP	groupPIP	condPIP	groupPIP	condPIP
1-NAP	1	0.177	1.000	0.115	1.000	0.5697	1.000	0.426	1.000
2-NAP	2	0.193	1.000	0.154	1.000	0.599	1.000	0.717	1.000
3-FLUO	3	0.633	0.224	0.723	0.322	0.703	0.500	0.545	0.621
2-FLUO	3	0.633	0.776	0.723	0.678	0.703	0.500	0.545	0.379
1-PHEN	4	0.272	1.000	0.113	1.000	0.601	1.000	0.355	1.000

Note: adjusting for age, gender, race, education, family PIR, physical activity, serum cotinine, alcohol drinking, stroke, diabetes, hypertension, BMI and urinary creatinine. IRT, Immediate Recall test; DRT, Delayed Recall test; AFT, Animal Fluency test; DSST, Digit Symbol Substitution test.

Table S3 The estimated differences and their 95% CIs of specific percentile

Percentile	IRT z-score		DRT z-score		AFT z-score		DSST z-score	
	Est	95% CI	Est	95% CI	Est	95% CI	Est	95% CI
25th	0.046	-0.016~0.107	**0.064**	**0.001~0.126**	0.004	-0.039~0.048	**0.057**	**0.000~0.114**
30th	0.035	-0.012~0.081	0.045	-0.002~0.092	0.003	-0.031~0.037	**0.045**	**0.003~0.088**
35th	0.022	-0.011~0.055	0.029	-0.005~0.063	0.003	-0.022~0.027	**0.035**	**0.005~0.065**
40th	0.009	-0.016~0.033	0.013	-0.012~0.038	0.002	-0.015~0.019	**0.028**	**0.005~0.051**
45th	0.004	-0.008~0.017	0.004	-0.009~0.017	0.001	-0.008~0.010	**0.012**	**0.001~0.023**
50th	0.000	0.000~0.000	0.000	0.000~0.000	0.000	0.000~0.000	0.000	0.000~0.000
55th	**-0.013**	**-0.025~-0.001**	-0.012	-0.024~0.001	0.000	-0.009~0.008	-0.009	-0.020~0.001
60th	-0.023	-0.049~0.003	-0.019	-0.046~0.007	-0.002	-0.021~0.018	**-0.026**	**-0.050~-0.003**
65th	-0.029	-0.066~0.008	-0.023	-0.061~0.014	-0.002	-0.031~0.026	**-0.039**	**-0.072~-0.006**
70th	-0.032	-0.083~0.018	-0.027	-0.078~0.025	-0.003	-0.041~0.034	**-0.056**	**-0.101~-0.010**
75th	-0.045	-0.112~0.022	-0.033	-0.101~0.035	-0.005	-0.054~0.045	**-0.075**	**-0.134~-0.016**

Note: adjusting for age, gender, race, education, family PIR, physical activity, serum cotinine, alcohol drinking, stroke, diabetes, hypertension, BMI and urinary creatinine. IRT, Immediate Recall test; DRT, Delayed Recall test; AFT, Animal Fluency test; DSST, Digit Symbol Substitution test.
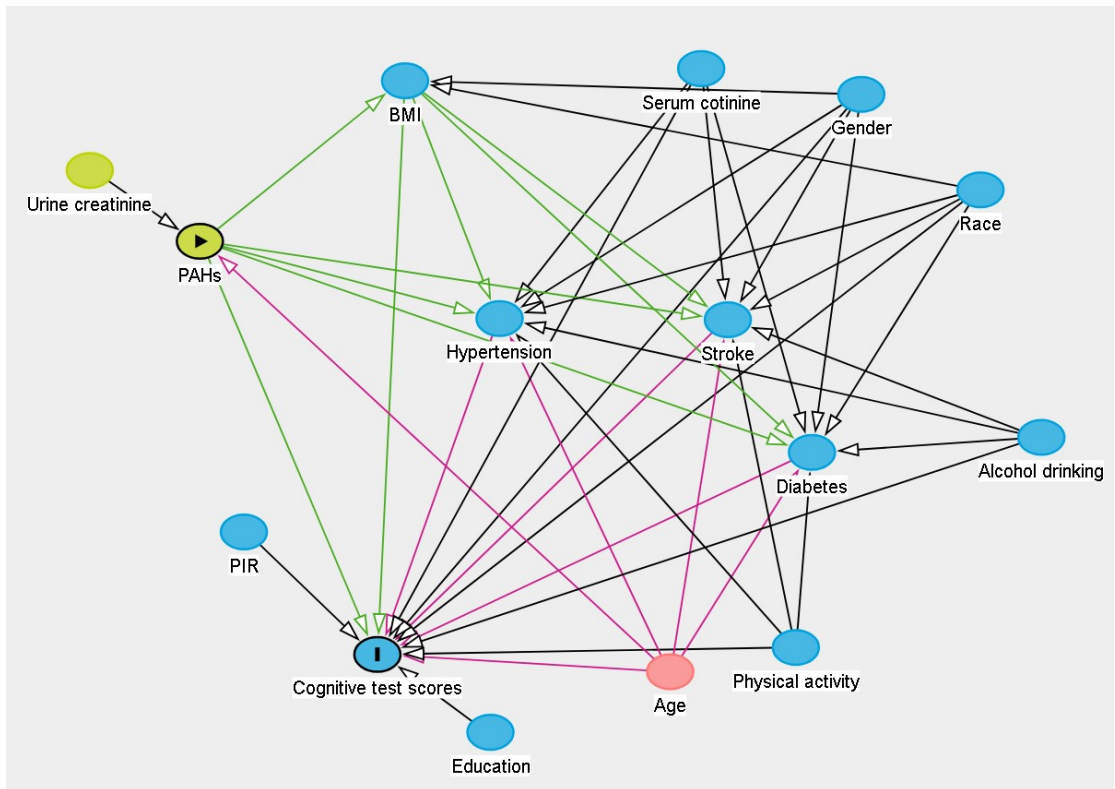
Fig S1. Directed acyclic graph of hypothesized associations between PAHs exposures and cognitive function.
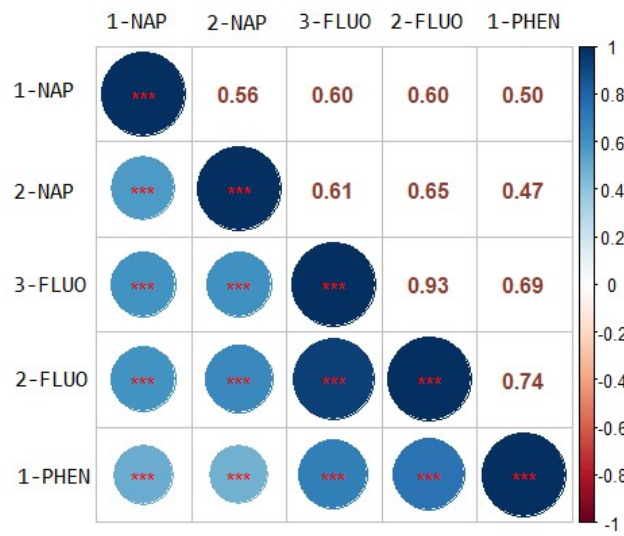
Fig.S2 Pearson correlation coefficients among 5 PAHs metabolites (N=772), NHANES, USA, 2011-2014. *, P < 0.05; **, P < 0.01; ***, P < 0.001.
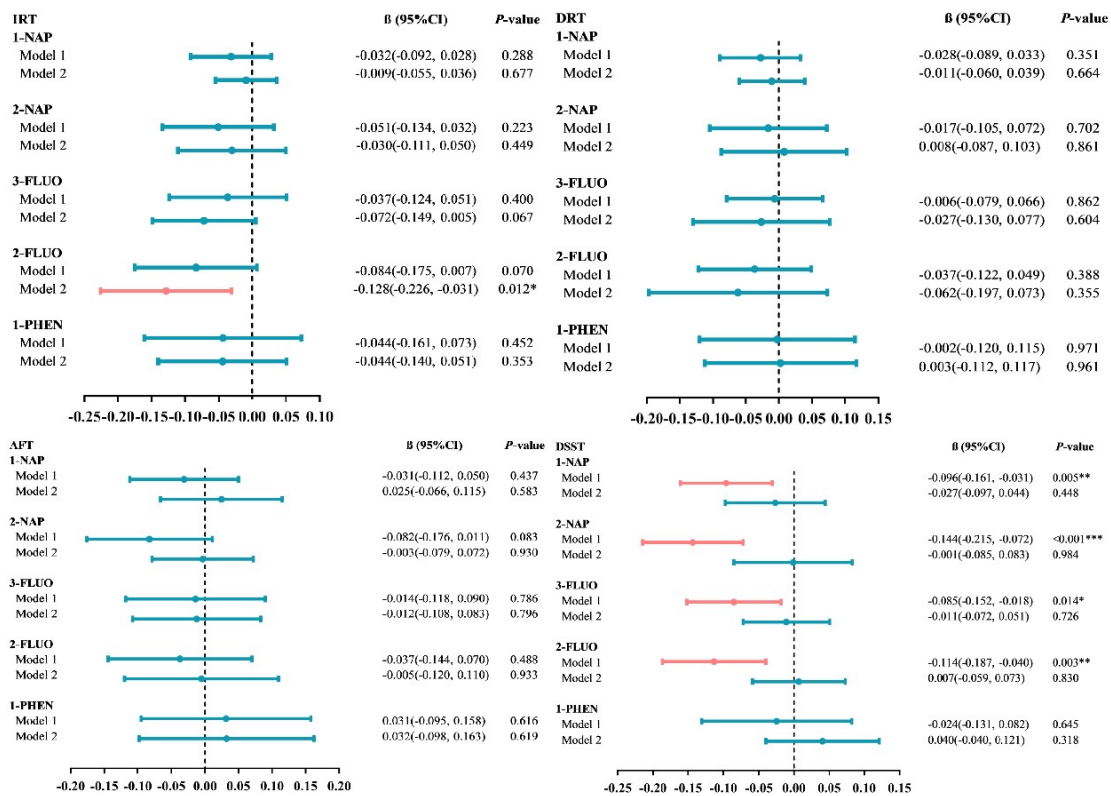
IRT

	ß (95%CI)	P-value
1-NAP		
Model 1	-0.032(-0.092, 0.028)	0.288
Model 2	-0.009(-0.055, 0.036)	0.677
2-NAP		
Model 1	-0.051(-0.134, 0.032)	0.223
Model 2	-0.030(-0.111, 0.050)	0.449
3-FLUO		
Model 1	-0.037(-0.124, 0.051)	0.400
Model 2	-0.072(-0.149, 0.005)	0.067
2-FLUO		
Model 1	-0.084(-0.175, 0.007)	0.070
Model 2	-0.128(-0.226, -0.031)	0.012*
1-PHEN		
Model 1	-0.044(-0.161, 0.073)	0.452
Model 2	-0.044(-0.140, 0.051)	0.353

-0.25 -0.20 -0.15 -0.10 -0.05 0.00 0.05 0.10

DRT

	ß (95%CI)	P-value
1-NAP		
Model 1	-0.028(-0.089, 0.033)	0.351
Model 2	-0.011(-0.060, 0.039)	0.664
2-NAP		
Model 1	-0.017(-0.105, 0.072)	0.702
Model 2	0.008(-0.087, 0.103)	0.861
3-FLUO		
Model 1	-0.006(-0.079, 0.066)	0.862
Model 2	-0.027(-0.130, 0.077)	0.604
2-FLUO		
Model 1	-0.037(-0.122, 0.049)	0.388
Model 2	-0.062(-0.197, 0.073)	0.355
1-PHEN		
Model 1	-0.002(-0.120, 0.115)	0.971
Model 2	0.003(-0.112, 0.117)	0.961

-0.20 -0.15 -0.10 -0.05 0.00 0.05 0.10 0.15

AFT

	ß (95%CI)	P-value
1-NAP		
Model 1	-0.031(-0.112, 0.050)	0.437
Model 2	0.025(-0.066, 0.115)	0.583
2-NAP		
Model 1	-0.082(-0.176, 0.011)	0.083
Model 2	-0.003(-0.079, 0.072)	0.930
3-FLUO		
Model 1	-0.014(-0.118, 0.090)	0.786
Model 2	-0.012(-0.108, 0.083)	0.796
2-FLUO		
Model 1	-0.037(-0.144, 0.070)	0.488
Model 2	-0.005(-0.120, 0.110)	0.933
1-PHEN		
Model 1	0.031(-0.095, 0.158)	0.616
Model 2	0.032(-0.098, 0.163)	0.619

-0.20 -0.15 -0.10 -0.05 0.00 0.05 0.10 0.15 0.20

DSST

	ß (95%CI)	P-value
1-NAP		
Model 1	-0.096(-0.161, -0.031)	0.005**
Model 2	-0.027(-0.097, 0.044)	0.448
2-NAP		
Model 1	-0.144(-0.215, -0.072)	<0.001***
Model 2	-0.001(-0.085, 0.083)	0.984
3-FLUO		
Model 1	-0.085(-0.152, -0.018)	0.014*
Model 2	-0.011(-0.072, 0.051)	0.726
2-FLUO		
Model 1	-0.114(-0.187, -0.040)	0.003**
Model 2	0.007(-0.059, 0.073)	0.830
1-PHEN		
Model 1	-0.024(-0.131, 0.082)	0.645
Model 2	0.040(-0.040, 0.121)	0.318

-0.25 -0.20 -0.15 -0.10 -0.05 0.00 0.05 0.10 0.15

Fig.S3 Association between weighted OH-PAHs and the z-score of IRT, DRT, AFT, DSST. Model 1: unadjusted model. Model 2: adjusted for age, gender, race, education, family PIR, physical activity, serum cotinine, alcohol drinking, stroke, diabetes, hypertension, BMI, and urinary creatinine. *, $P < 0.05$; **, $P < 0.01$; ***, $P < 0.001$.

IRT, Immediate Recall test; DRT, Delayed Recall test; AFT, Animal Fluency test; DSST, Digit Symbol Substitution test.