Table 1.

|  |  |  |
| --- | --- | --- |
| Variables | N | Weighted % or mean ± SE or  Median (IQR) |
| Age | 902 | 69.4 ± 0.3 |
| Survey years |  |  |
| 2011-2012 | 391 | 45.0 |
| 2013-2014 | 511 | 55.0 |
| Gender |  |  |
| Male | 443 | 45.8 |
| Female | 459 | 54.2 |
| Race |  |  |
| Hispanic | 171 | 6.7 |
| Non-Hispanic White | 432 | 80.7 |
| Non-Hispanic Black | 217 | 8.0 |
| Other | 82 | 4.6 |
| Education |  |  |
| Less than high school | 247 | 18.1 |
| High school or GED | 212 | 22.6 |
| Some college | 246 | 32.1 |
| College Graduate or above | 96 | 27.2 |
| Marital status |  |  |
| Married | 521 | 64.1 |
| Widowed | 184 | 18.0 |
| Others | 195 | 17.9 |
| Poverty income ratio |  |  |
| 0-1.99 | 364 | 27.9 |
| 2-3.99 | 223 | 28.9 |
| 4 or more | 225 | 34.2 |
| Missing | 90 | 9.0 |
| Alcohol |  |  |
| Yes | 609 | 73.6 |
| No | 274 | 26.4 |
| Smoking |  |  |
| Current | 118 | 10.6 |
| Former | 358 | 41.4 |
| Non-smoker | 425 | 48.0 |
| High blood pressure |  |  |
| Yes | 560 | 60.7 |
| No | 341 | 39.3 |
| High cholesterol level |  |  |
| Yes | 523 | 61.7 |
| No | 371 | 38.3 |
| Diabetes |  |  |
| Yes | 225 | 21.1 |
| No | 633 | 74.8 |
| Borderline | 44 | 4.1 |
| Coronary heart disease |  |  |
| Yes | 76 | 9.8 |
| No | 820 | 90.2 |
| Stroke |  |  |
| Yes | 52 | 4.4 |
| No | 848 | 95.6 |
| BMI (kg/m2) |  |  |
| <25 | 277 | 31.9 |
| 25-29.99 | 338 | 39.9 |
| ≥30 | 263 | 28.2 |
| Serum PFAS Concentrations (ng/mL) |  |  |
| PFOS | 902 | 9.3 (5.6-14.1) |
| PFOA | 902 | 2.7 (1.9-3.7) |
| PFHxS | 902 | 1.9 (1.1-2.9) |
| PFNA | 902 | 0.9 (0.7-1.4) |
| Cognitive Function Scores |  |  |
| Mean CERAD score trials recall | 902 | 6.5 ± 0.1 |
| CERAD score delayed recall | 902 | 6.3 ± 0.1 |
| Animal Fluency Score Total | 902 | 18.0 ± 0.3 |
| Digital Symbol Score | 902 | 52.3 ± 0.9 |

Table 2. Linear regression coefficients and 95% confidence intervals of PFAS and cognitive functions in old adults

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PFAS | Mean CERAD Score Trials Recall | CERAD Score Delayed Recall | Animal Fluency Score Total | Digital Symbol Score |
| Unadjusted |  |  |  |  |
| PFOS | **-0.12 (-0.22, -0.02)** | -0.15 (-0.33, 0.03) | -0.29 (-0.77, 0.19) | -1.44 (-2.90, 0.02) |
| PFOA | **0.24 (0.02, 0.46)** | **0.37 (0.01, 0.72)** | 0.59 (-0.38, 1.55) | 2.60 (-0.03, 5.22) |
| PFHxS | 0.08 (-0.11, 0.28) | 0.10 (-0.20, 0.40) | 0.11 (-0.45, 0.67) | 1.04 (-1.02, 3.09) |
| PFNA | 0.08 (-0.11, 0.28) | **0.33 (0.07, 0.60)** | 0.64 (-0.14, 1.42) | 1.70 (-0.07, 3.46) |
| Adjusted Model 1 |  |  |  |  |
| PFOS | -0.04 (-0.93, 0.84) | -0.03 (-0.22, 0.15) | -0.24 (-0.68, 0.20) | -0.44 (-1.67, 0.78) |
| PFOA | 0.18 (-0.01, 0.38) | 0.28 (-0.02, 0.59) | 0.28 (-0.54, 1.10) | 0.97 (-0.80, 2.74) |
| PFHxS | 0.10 (-0.04, 0.25) | 0.13 (-0.09, 0.35) | -0.11 (-0.53, 0.31) | 0.71 (-0.63, 2.04) |
| PFNA | **0.17 (0.01, 0.33)** | **0.25 (0.01, 0.49)** | 0.47 (-0.20, 1.13) | 0.23 (-1.24, 1.69) |
| Adjusted Model 2 |  |  |  |  |
| PFOS | -0.06 (-0.19, 0.07) | -0.04 (-0.23, 0.15) | -0.29 (-0.72, 0.14) | -0.56 (-1.79, 0.66) |
| PFOA | 0.16 (-0.02, 0.35) | 0.29 (-0.01, 0.59) | 0.20 (-0.61, 1.00) | 0.76 (-1.06, 2.58) |
| PFHxS | 0.09 (-0.06, 0.23) | 0.14 (-0.07, 0.35) | -0.13 (-0.57, 0.31) | 0.84 (-0.57, 2.25) |
| PFNA | 0.13 (-0.02, 0.29) | 0.23 (-0.01, 0.47) | 0.32 (-0.33, 0.97) | -0.01 (-1.39, 1.38) |

Model 1: Adjusted for gender, race, age, education, marital status, poverty income ratio, smoking, alcohol, and BMI

Model 2: Adjusted for all covariates in Model 1 plus high blood pressure, high cholesterol level, diabetes, coronary heart disease, and stroke

Table 3. Logistic regression odds ratios (ORs) and 95% confidence intervals of PFAS and cognitive functions in old adults

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PFAS | Low CERAD Score Trials Recall (< 5.3) | Low CERAD Score Delayed Recall (<5) | Low Animal Fluency Score Total (<13) | Low Digital Symbol Score (<34) |
| Percent | 16.6 | 19.4 | 15.7 | 13.6 |
| Unadjusted |  |  |  |  |
| PFOS | 1.09 (0.85, 1.39) | 1.17 (0.91, 1.51) | 0.90 (0.67, 1.22) | 0.89 (0.75, 1.07) |
| PFOA | **0.58 (0.43, 0.80)** | **0.65 (0.44, 0.96)** | **0.60 (0.43, 0.84)** | **0.56 (0.41, 0.78)** |
| PFHxS | 0.77 (0.57, 1.04) | 0.93 (0.64, 1.35) | 0.80 (0.60, 1.05) | **0.75 (0.57, 0.99)** |
| PFNA | **0.69 (0.53, 0.89)** | **0.67 (0.49, 0.92)** | 0.77 (0.56, 1.06) | **0.64 (0.51, 0.81)** |
| Adjusted Model 1 |  |  |  |  |
| PFOS | 0.99 (0.73, 1.34) | 1.08 (0.83, 1.41) | 0.90 (0.68, 1.19) | 0.82 (0.62, 1.08) |
| PFOA | **0.54 (0.36, 0.82)** | 0.67 (0.43, 1.05) | **0.70 (0.51, 0.96)** | 0.67 (0.42, 1.06) |
| PFHxS | **0.72 (0.52, 0.99)** | 0.91 (0.64, 1.30) | 0.86 (0.67, 1.09) | 0.84 (0.61, 1.16) |
| PFNA | **0.70 (0.50, 0.99)** | 0.71 (0.48, 1.05) | 0.85 (0.61, 1.19) | 0.72 (0.49, 1.05) |
| Adjusted Model 2 |  |  |  |  |
| PFOS | 1.02 (0.76, 1.37) | 1.09 (0.84, 1.41) | 0.92 (0.69, 1.23) | 0.85 (0.64, 1.12) |
| PFOA | **0.54 (0.36, 0.83)** | 0.67 (0.43, 1.03) | 0.73 (0.52, 1.01) | 0.68 (0.43, 1.08) |
| PFHxS | 0.74 (0.54, 1.02) | 0.92 (0.65, 1.29) | 0.88 (0.69, 1.13) | 0.84 (0.61, 1.14) |
| PFNA | 0.73 (0.52, 1.02) | 0.71 (0.49, 1.03) | 0.92 (0.64, 1.33) | 0.75 (0.51, 1.11) |

Model 1: Adjusted for gender, race, age, education, marital status, poverty income ratio, smoking, alcohol, and BMI

Model 2: Adjusted for all covariates in Model 1 plus high blood pressure, high cholesterol level, diabetes, coronary heart disease, and stroke

NHANES Participants

2011-2014

n = 19,931

n = 3,632

Age less than 60 years

n = 16,299

Incomplete cognitive tests

n = 698

n = 2,934

Without PFAS Data

n = 2,032

n = 902

Figure 1. Analytical sample from the NHANES 2011-2014 for PFAS and adult cognitive function analysis.