**Supplemental Material**

**The Impact of Repeated Organophosphorus Pesticide Exposure on Biomarkers and Neurobehavioral Outcomes among Adolescents**

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Supplement Table 1. Changes in urinary TCPy level across the four time points of study and relationship with different covariates

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Time effect | Significant time contrasts & p-values | | Job | | Time X job, F, p-valued | Education | |
|  | F, P-value | Difference of least square means b | p-value | β(SE)c | p-value | β±SE | p-value |
| Log TCPya  (ug/g creatinine) | 58.1,  < 0.001 | 1 - 2 = 0.9±0.1  2 - 3 = -0.9±0.1  3 - 4 = 0.9±0.1 | < 0.001  < 0.001  < 0.001 | -0.7±0.2 | < 0.001 | 8.7, 0.001 | -0.08± 0.03 | 0.003 |

a station was excluded from the model because its p-value was > 0.1

b (-ve) sign indicates a decrease when moving from a time point to the other, and vice versa

c (-ve) sign indicates non-applicators were lower than applicators

d Interaction term indicates that the difference between applicators and non-applicators was in Times 2 and 4

Supplement Table 2. Changes of cholinesterase activity across the four time points of study and relationship with different covariates

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Time effect | Significant time contrasts & p-values | | Job | | Time X job, F, p-value |
|  | F, P-value | Differences of least squared means b | p-value | β±SE | p-value |
| BChEa  (U/ml) | 17.0,  < 0.001 | 1 - 2 = -05 (0.1)  2 - 3 = 0.4 (0.1)  3 - 4 = -0.3 (0.1) | < 0.001  < 0.001  < 0.001 | -0.5 ± 0.1c | 0.005 | 6.4, 0.0005d |
| AChEa  (U/g Hgb) | 6.0,  < 0.001 | 1 - 2 = -0.9 (0.3)  2 - 3 = -0.1 (0.3)  3 - 4 = -0.4 (0.3) | 0.002  0.9  0.2 | - | - | - |

a Both station and years of education were excluded from the models because their p-value was > 0.1, for AChE, job and time\*job were excluded for the same reason

b (-ve) sign indicates a decrease from when moving from a time point to the other, and vice versa

c (-ve) sign indicates applicators were lower than applicators

d Interaction term indicates that the difference between applicators and non-applicators was in Times 2 and 4

Supplement Table 3. Least square means of different neurobehavioral measures at the four time points from the longitudinal analysis model

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Function | measure |  | May 2010  (Time 1) | July 2010  (Time 2) | May 2011  (Time 3) | July 2011  (Time 4) |
| Memory | BVRT | M±SE | 6.5±0.3 | 7.5±0.3 | 7.8±0.3 | 7.6±0.3 |
| N | 46 | 49 | 50 | 52 |
| Attention/  short memory | DST-F | M±SE | 4.6±0.2 | 5.2±0.2 | 4.9±0.2 | 4.8±0.2 |
| N | 65 | 58 | 40 | 44 |
| DST-R | M±SE | 4.2±0.2 | 4.3±0.2 | 4.3±0.2 | 4.2±0.2 |
| N | 56 | 54 | 40 | 34 |
| Sustained attention | CPT-Hit- Latency | M±SE | 326.0±10.8 | 351.5±10.9 | 324.0±11.9 | 339.8±11.7 |
| N | 66 | 65 | 46 | 51 |
| CPT-C-H-Fraction | M±SE | 0.78±0.03 | 0.78±0.03 | 0.70±0.03 | 0.78±0.03 |
| N | 66 | 65 | 50 | 51 |
| CPT D-Prime | M±SE | 2.0±0.2 | 2.7±0.2 | 2.5±0.2 | 2.8±0.2 |
| N | 66 | 65 | 46 | 51 |
| Motor speed/ coordination | TAP-Aver | M±SE | 86.6±1.7 | 90.4±1.7 | 94.1±1.9 | 95.1±1.9 |
| N | 64 | 65 | 50 | 51 |
| TAP-Alter | M±SE | 39.4±1.6 | 38.6±1.6 | 41.2±1.8 | 42.0±1.8 |
| N | 63 | 65 | 50 | 51 |
| Santana-Dom | M±SE | 42.4±1.5 | 51.6±1.0 | 53.2±1.5 | 57.1±1.0 |
| N | 46 | 49 | 50 | 52 |
| Santana Non-Dom | M±SE | 35.6±0.8 | 42.5±0.8 | 49.9±0.8 | 50.6±0.8 |
| N | 46 | 49 | 50 | 52 |
| Visual motor | SDT-LAT\* | M±SE | 2512.3±93.3 | 2056.9±117.2 | 1889.7±123.5 | 1848.5±96.9 |
| N | 59 | 22 | 35 | 38 |
| Trail A | M±SE | 50.9±1.6 | 34.4±1.6 | 30.0±1.6 | 26.6±1.6 |
| N | 46 | 49 | 50 | 52 |
| Trail B | M±SE | 94.2±3.2 | 64.2±3.1 | 55.4±3.1 | 48.1±3.1 |
| N | 46 | 49 | 50 | 52 |
| VMI | M±SE | 19.3±0.3 | 21.8±0.3 | 23.2±0.3 | 23.2±0.3 |
| N | 46 | 49 | 50 | 52 |
| Perception | Block Design | M±SE | 26.7±0.6 | 34.9±0.6 | 36.8±0.6 | 38.4±0.5 |
| N | 46 | 49 | 50 | 52 |
| Verbal abstraction | Similarities | M±SE | 14.1±0.5 | 19.1±0.5 | 18.9±0.5 | 19.8±0.5 |
| N | 46 | 49 | 50 | 52 |

\*Participants with numerous errors, indicating noncompliance with the test, were not included in the analysis.

\*\* BVRT; Benton Visual Retention Test, CPT-C-H-Fraction; Continuous Performance Test- Corrected Hit Fraction, CPT-D-Prime, Continuous Performance Test D-prime, CPT-Hit-Latency; Continuous Performance Test – Hit Latency, Digit Span Reverse Test, DST-F; Digit Span Forward Test, DST-R; Santana-Dom; Santana Dominant Hand, Santana non-Dom; Santana Non-Dominant Hand, SDT-LAT; Symbol Digit Latency, Trail A; TAP-Alter; Tapping alternating hands, TAP-Aver; Tapping Average of Right and Left Hand, Trail A; Trail Making A, Trail B; Trail Making B, VMI; Visual Motor Integration.

Supplement Table 4. Partial correlation between different neurobehavioral measures and both AChE and BChE controlling for urinary TCPy levels, years of education, time of testing, job status, and station

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | AChE  r (p-value) | | BChE  r (p-value) | |
| BVRT | 0.1 (0.3) | | -0.1 (0.5) | |
| DST-F | 0.2 (0.02) | | -0.02 (0.8) | |
| DST-R | 0.1 (0.3) | | -0.02 (0.9) | |
| CPT-C-H-Fraction | 0.1 (0.3) | | 0.1 (0.3) | |
| CPT-Hit-Latency | 0.02 (0.9) | | -0.2 (0.02) | |
| CPT-D-Prime | 0.1 (0.5) | | -0.1 (0.4) | |
| TAP-Aver | 0.1 (0.5) | | -0.1 (0.6) | |
| TAP-Alter | 0.04 (0.7) | | 0.04 (0.7) | |
| Santana-Dom | -0.1 (0.5) | | -0.2 (0.1) | |
| Santa Non-Dom | -0.04 (0.7) | | -0.2 (0.08) | |
| SDT-LAT | 0.02 (0.8) | | 0.04 (0.7) | |
| Trail A | 0.3 (0.001) | | 0.1 (0.3) | |
| Trail B | 0.1 (0.3) | | 0.01 (0.9) | |
| VMI | -0.2 (0.1) | | 0.1 (0.2) | |
| Block design | -0.1 (0.3) | | -0.1 (0.3) | |
| Similarities | 0.1 (0.4) | | -0.2 (0.04) | |

BVRT; Benton Visual Retention Test, CPT-C-H-Fraction; Continuous Performance Test- Corrected Hit Fraction, CPT-D-Prime, Continuous Performance Test D-prime, CPT-Hit-Latency; Continuous Performance Test – Hit Latency, Digit Span Reverse Test, DST-F; Digit Span Forward Test, DST-R; Santana-Dom; Santana Dominant Hand, Santana non-Dom; Santana Non-Dominant Hand, SDT-LAT; Symbol Digit Latency, Trail A; TAP-Alter; Tapping alternating hands, TAP-Aver; Tapping Average of Right and Left Hand, Trail A; Trail Making A, Trail B; Trail Making B, VMI; Visual Motor Integration.