

tions ranging from $r = -.13$ to $-.38$. These data suggest that chronic cocaine abuse may result in frontal perfusion anomalies and associated neuropsychiatric disturbance that may persist well into abstinence.

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K. LISDAHI, MEDINA, P.K. SHEAR, & J. SCHAFER. Memory Functioning In Polysubstance Dependent Women.

Numerous studies have demonstrated significant neuropsychological impairment, including verbal and visual memory, among polysubstance abusers. Unfortunately, the vast majority of studies on polysubstance abuse have utilized primarily male participants; therefore the specific neuropsychological effects of polysubstance abuse on women are relatively unknown. Further, there is strong evidence that sex differences exist in the effects of drug abuse on memory functioning, which suggests that results obtained primarily from men cannot necessarily be generalized to women. The goal of the present study is to examine the effects of polysubstance dependence on women's verbal and visual memory ability. Data were collected from 164 women (including 53 controls and 111 women who met current DSM-IV dependence on two or more drugs) who were similar in age, ethnic identification, education, levels of depression, and verbal ability. A series of multiple regressions were run to test whether group membership significantly predicted performance on the Benton Visual Retention Test and the California Verbal Learning Test after controlling for age, history of loss of consciousness, level of education, ethnic identification, and length of abstinence. The primary results indicated that the polysubstance dependent women had significantly poorer verbal learning and memory ability ($p < .006$) and discriminability ($p < .03$) compared to the controls, while no differences were found in visual memory ability. The results confirm that polysubstance dependence is associated with verbal learning and memory deficits among women.

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S. LEACH, M.W. HAUT, A. DUCATMAN, P. McCABE, B. LEVIN, & N. SCHNEIDERMAN. Effects of Solvent Exposure on Working Memory.

Solvents have been demonstrated to produce deficits with attention and processing, 2 key elements for working memory. The purpose of this study was to investigate the effects of chronic solvent exposure on working memory functions. Twenty subjects chronically exposed to solvents and 20 age and education matched, healthy controls served as the participants. Subjects with solvent exposure were otherwise healthy. Subjects were administered self-ordered pointing tasks for both verbal and visual information. The tasks increased in difficulty by varying amount of information to be processed and potential for organization. The results of this study demonstrated that subjects with a history of chronic exposure to solvents, relative to the controls, had increased error rates and failure to apply an organizational strategy, but no difference in working memory span. These results were independent of depressive symptomatology. These findings are consistent with deficits in executive functioning in patients with chronic solvent exposure.

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L. MORROW, B. NEEDLEMAN, K. METHENY, C. McFARLAND, & D. SANDSTROM. Cumulative Lead Exposure and Neuropsychological Function.

Lead continues to be a major occupational toxin. While blood lead levels (BLL) estimate recent exposure, they don't measure cumulative exposure or body burden. Bone lead concentration—measured with X-ray fluorescence (XRF)—is the best way to estimate cumulative lead exposure. The current study is a longitudinal follow-up of a group of workers with past and current occupational exposure to lead (average years at lead battery plants = 27.0), and nonexposed controls. Subjects were initially tested 20 years ago and little difference was found between the groups. At that time,

only BLL were taken. To date, we have reassessed 35 subjects on measures of neuropsychological function, and BLL and additionally collected XRF. Preliminary results show significantly higher BLL ($p < .001$) and XRF ($p < .05$) in exposed workers, as well as poorer performance on most neuropsychological measures, though only visual delayed memory and verbal delayed memory were significant ($p < .05$). Within the lead-exposed group, correlations were computed between lead measures and neuropsychological performance, controlling for age. Higher bone lead was associated with poorer performance on a number of measures—verbal learning, symbol-digit learning, digit symbol substitution, incidental recall, block design, visual memory, and delayed symbol-digit learning (r s ranged from $-.42$ to $-.75$). Correlations between BLL and neuropsychological test scores were less consistent but in the expected direction. These findings indicate that cumulative lead exposure, as indicated by higher concentrations of bone lead, is related to poorer neuropsychological function in occupationally exposed workers.

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B.C. SCHWEINSBURG, M.J. TAYLOR, O.M. ALHASSOON, A.D. DAGER, S.F. TAFERT, T.L. PATTERSON, & I. GRANT. Spectroscopy and Cognitive Functioning in Alcoholics with Withdrawal Seizures. Neuropsychological (NP) and MR imaging investigations have revealed that the brain may be sensitive to alcohol withdrawal seizures. However, the cellular correlates and NP consequences of withdrawal seizure-associated brain damage have not been well characterized in recovering alcoholic individuals. Proton magnetic resonance spectroscopy (MRS; PRESS, TE = 35 ms) and a comprehensive NP battery were used to compare brain metabolism and cognitive abilities in 10 recently detoxified alcoholics with a history of at least one withdrawal seizure (RDA-S; age = 39.8), 10 RDA with no history of alcohol-related seizures (RDA; age = 39.9), and 11 nonalcoholic controls (CON; age = 41.8). We predicted that RDA-S would display reductions in relative amounts of N-acetylaspartate (NAA), a marker of neuronal integrity, in frontal lobe gray matter (FGM) and frontal lobe white matter (FWM) when compared to the other groups. In addition, RDA-S were expected to have greater difficulties in NP domains of executive functioning and novel learning ability. The groups were equated on age, education, and an estimate of premonitory verbal functioning, and the alcoholic groups had similar drinking histories. Pairwise comparisons revealed RDA-S had significantly lower NAA/creatinine in FWM compared to RDA ($p = .05$) and CON ($p = .01$). The groups had comparable levels of NAA/creatinine in the FGM region of interest. RDA-S had greater difficulties on tests of novel learning compared to CON ($p = .001$) and RDA ($p = .07$), and the groups had similar performances on other measures of NP functioning. The results suggest that brain white matter axons and learning efficiency may be particularly sensitive to the effects of alcohol and withdrawal seizures.

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C.L. ARMSTRONG & J. CUNNINGHAM. Developmental Effects of Carbon Monoxide (CO) Poisoning.

Children are at high risk for carbon monoxide poisoning through fetal and post-natal exposure to maternal cigarette smoking, and through other vectors (as a motor vehicle passenger, a resident of a home with combustible fuel heat, exposure to chemical fumes). Children are at particular risk because of their small size and reduced pulmonary transport of CO due to immaturity. An earlier study at Children's Hospital of Philadelphia showed that half of the children admitted to the Emergency Room for flu-like symptoms and some means of exposure also had elevated carboxyhemoglobin levels. This paper reviews the animal and human studies of CO exposure and effects on behavior, in order to understand when CO exposure is most damaging, and what are the related risk factors. Integration of studies of outcome from exposure at different developmental phases, in both small animals and humans, provides evidence for both the timing and physiological mechanisms of the damaging effects upon the brain. The developmental phase of exposure appears to be a critical determinant of



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Number of pages: 2
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