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Multiple Exposures, Multiple Effects

Heredia, Costa Rica

We-O-10 PRENATAL EXPOSURE OF P,P'DDE AND INFANT NEURODEVELOPMENT AT 24 MONTHS OF AGE. PRELIMINARY REPORT

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Background and aims: p,p'-DDE (DDE) is an antiandrogenic compound, which has shown adverse effects on early infant neurodevelopment; however the persistence of its long-term effect is controversial. The objective of this study was to evaluate the effect of prenatal DDE exposure on infant neurodevelopment at 24 mo, according to the sex of the child.

Methods: As part of a perinatal cohort study conducted in Morelos, Mexico, we assessed the first 166 infants (58.4% male) with the Bayley Scales of Infant Neurodevelopment (BSID-II) at 24 mo of age. Maternal DDE levels (ng/ml) were measured during each trimester of pregnancy. The HOME Scale and family composition were considered as potential confounders.

Results: A marginal negative effect of DDE exposure at the third trimester of pregnancy on infant neurodevelopment at 24 mo of age was detected among male infants (β=-1.8; p=0.07) but not among females (β=1.6; p=0.20).

Discussion and conclusions: Our results suggest that due to its antiandrogenic activity, the effect of DDE exposure on infant neurodevelopment is modified by gender. A further analysis will include a larger sample size of this population.

We-O-11 DDT AND NEURODEVELOPMENT IN A MEXICAN-AMERICAN COHORT: THE CHAMACOS STUDY

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Background and aims: Dichlorodiphenyltrichloroethane (DDT) is a pesticide which has been used to control insects as vectors of disease and in agriculture. Considered a Persistent Organic Pollutant (POP), DDT breaks down slowly in soil (2- to 15-year half-life) and bioaccumulates in plants and in fatty tissues of animals. DDT was banned in the U.S. in 1972 and was phased out in Mexico, where it was banned in 2000, but it continues to be used in many malaria-endemic areas of the world. .In spite of substantial evidence in animals, there are few studies on neurotoxicity of DDE in humans and even fewer of DDE. The purpose of the present study is to investigate the relationship of /in utero/ exposure to DDT/DDE on the neurodevelopment of children from primarily Mexican farmworker families living in the Salinas Valley, California, enrolled in the CHAMACOS study.

Methods: CHAMACOS (Center for the Health Assessment of Mothers and Children of Salinas) is a longitudinal birth cohort study of the effects of pesticides and other environmental exposures on the health of pregnant women and their children. 601 women were enrolled, and 538 were followed to delivery. We include in this study singletons who had /in utero/ exposure measured in blood taken at 26-weeks gestation (n=394) or delivery (n=34), and a valid neurodevelopmental assessment at 6 (n=330), 12 (n=329), or 24 (n=309) months. p,p-DDT, p,p-DDE, and o,p-DDT were measured in serum by gas chromatography high-resolution mass spectrometry at 10,000 resolution.

Results: p,p-DDT and p,p-DDE were detected in 100%, and o,p-DDT in 95.8% of samples. Geometric mean and 95% confidence intervals (CI) for lipid-adjusted values (excluding outliers) were: p,p-DDT = 19.7 (16.7, 23.2); p,p-DDE = 1360.9 (1201.4, 1541.6); and o,p-DDT = 1.6 (1.4, 1.8.Mean standardized (mean=100, SD=15) scores for the Bayley mental development index (MDI) and psychomotor development index (PDI) were, respectively, 95.7 ± 7.4 and 96.6 ± 10.7 at 6, 100.9 ± 9.0 and 106.8 ± 12.3 at 12, and 86 4 ± 11.7 and 98.0 ± 10.6 at 24 months.We found an approximately 2-point decrease in Psychomotor Developmental Index scores with each 10-fold increase in p,p'-DDT levels at 6 and 12 months (but not 24 months) and p,p'-DDE levels at 6 months only. We found no association with mental development at 6 months but a 2- to 3-point decrease in Mental Developmental Index scores for p,p'-DDT and o,p'-DDT at 12 and 24 months, corresponding to 7- to 10-point decreases across the exposure range. Even when mothers had substantial exposure, breastfeeding was usually associated positively with Bayley
scale scores. We will also present the results of follow-up of these same children at 42 and 60 months. Prenatal exposure to DDT, and to a lesser extent DDE, was associated with neurodevelopmental delays during childhood, although breastfeeding was found to be beneficial even among women with high levels of exposure. Results of multivariate analysis will be presented.

Discussion and conclusions: In summary, we find evidence for an association between DDT and neurodevelopment. Countries considering the use of DDT should weigh its benefit in eradicating malaria against the negative associations found on DDT and human neurodevelopment as well as other health outcomes.

MINISYMPOSIUM: NEUROBEHAVIORAL IMPACT OF OCCUPATIONAL AND ENVIRONMENTAL EXPOSURE TO MANGANESE

We-O-12 NEUROPSYCHOLOGICAL EFFECTS OF MANGANESE EXPOSURE ON CHILDREN LIVING IN COMMUNITIES NEAR TO PROCESSING PLANTS IN MEXICO

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Background and aims: Mexico has one of the largest deposits of manganese (Mn) in the world. Around 200,000 inhabitants live in this zone. Mn deposits have been exploited for the past 60 years. A previous study showed significant effects of Mn exposure on neuromotor performance in the adult exposed population. The present project uses an ecosystem health approach that includes community participation, environmental pathway characterization and exposure and neuropsychological outcomes analyses too evaluate the association between Mn exposure and neuropsychological effects in children

Methods: We selected 100 boys and girls from the elementary schools (age 8 to 11years old), 100 more children living outside the manganese basin, with similar age and socioeconomic conditions, were selected as non-exposed control group. Biomarkers of Mn exposure were assessed (total blood Mn and hair Mn). A battery to assess cognitive, motor and neuropsychiatric disorders was applied.

Results: Mean Blood Mn concentrations were significantly higher in exposed children (10.04 mcg/L versus 8.3 mcg/L $p<0.05$). Mean Mn air concentrations were 0.1 mcg/m3 and 0.03 mcg/m3 for each of the communities. Mean hair concentration in the exposed population was 14.4 mcg/g and 0.73 mcg/g in the non-exposed Regression models showed that hair Mn was inversely and significantly associated with verbal IQ using the WISC test, after adjusting by mother's education and gender. Coef = -0.283 (CI -0.507, -0.060). Similar trend was found in the performance IQ but this was not significant. Neuromotor tests are still being evaluated.

Discussion and conclusions: Cognitive effects from Mn exposure in children could include impairment of verbal processes, although further and more detailed analyses must be done to confirm this hypothesis.

We-O-13 OCCUPATIONAL EXPOSURE TO MANGANESE IN FERROALLOY INDUSTRY: NEUROBEHAVIORAL EFFECTS IN A WORKERS' COHORT

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Background and aims: A cohort of workers from ferroalloy industry has been examined for 20 years in order to evaluate chronic neurobehavioral effects due to manganese (Mn) exposure. Neuromotor and cognitive functions were examined in exposed and controls to assess cross-sectional and longitudinal comparison of the results.

Methods: Biological monitoring included Mn in blood (MnB), plasma (MnP), urine (MnU) and lead (Pb) in blood (PbB). Several neuro-behavioral and neurophysiological tests were administered: postural evaluation, tremor, four tests from the computerized Swedish Performance Evaluation System, Pursuing Aiming, five subtests of the Luria Nebraska Motor Battery, Raven Progressive Matrices, Trail Making Test, Mood Scale, Brief Symptoms Inventory, and a neuropsychological symptoms questionnaire. Personal habits including food intake, working, residential and clinical histories were collected.

Results: A group of 43 exposed male workers (mean age 42,3 years)
and 40 male controls (mean age 45,7 years) were examined. Biological monitoring data showed significantly higher values of Mn and Pb in exposed compared to control subjects: MnB (GM) = 12,21 µg/L in exposed and 6,78 µg/L in controls ($p<0,0001$); MnP (GM) = 1,52 µg/L in exposed and 0,74 µg/L in controls ($p<0,0001$); MnU (GM) = 0,31 µg/L in exposed and 0,16 µg/L in controls ($p=0,0022$).

Neuropsychological examination showed differences in Raven Progressive Matrices and Pursuit Aiming, higher tremor values and differences in postural evaluation between exposed and controls. Longitudinal evaluation showed a tendency toward slight progressive impairment of tremor parameters among the exposed compared to controls.

Discussion and conclusions: Long-term occupational exposure to Mn causes impairment of motor function and coordination. Tremor becomes more evident as a function of cumulative exposure and after prolonged exposure periods.

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