

Science Spotlight

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Childhood Blood Lead Levels Linked to ADHD Symptoms

By Sara Mishamandani

Blood lead levels are associated with hyperactive and impulsive behaviors, two symptoms of attention deficient hyperactivity disorder (ADHD), according to a recent NIEHS-funded collaborative [study](#) of children in Mexico. Researchers from the U.S. and Canada collaborated with the [Instituto Nacional de Perinatología](#) in Mexico City to initiate this study.

An increasing trend of emotional and behavioral disorders in early childhood has been observed in the last 10 years, with ADHD now having an estimated worldwide prevalence of about five percent. The new study suggests that lead exposure is linked to the hyperactive and impulsive subtype of ADHD.

“Our findings also encourage additional explorations on the associations between lead exposure and other behavioral problems related to hyperactivity or impulsivity,” said Siying Huang, Ph.D., lead author on the study and postdoctoral research fellow at the University of Toronto. “This is just the beginning to understand how lead may affect behavior problems in children, such as delinquent behavior and violence.”

In ADHD, genetic inheritance is thought to play a major role in inattentiveness behaviors, but the same has not been shown for hyperactive or impulsive behaviors associated with the disorder. The new findings did not show an association between elevated blood lead levels and inattentiveness.

How Low is Low Enough?

The U.S. Centers for Disease Control and Prevention now uses a reference level of 5 micrograms per deciliter to classify children as having blood lead levels that require further investigation. Until recently, children were identified as having a “level of concern” if their blood had 10 or more micrograms of lead per deciliter.

In this study, the average blood lead level was 3.4 micrograms per deciliter. Blood lead levels below 5 micrograms per deciliter were associated with hyperactive and impulsive behaviors in children, adding to the evidence of neurodevelopmental effects from lead at low levels of exposure.

“This really triggers the question of whether there is really a safe level of lead in the blood,” said Huang. “In a lot of developing countries, lead contamination is still high and may pose a severe neurodevelopmental risk for children.”

An Ongoing Cohort and Multinational Collaboration



Researchers administered the Conners' Rating Scales-Revised behavioral assessment to mothers to evaluate their children's ADHD-symptoms. They then collected blood samples from the children to compare blood lead levels with ADHD symptoms.

(Photo courtesy of the ELEMENT cohort team)

The study population consists of two birth cohorts of mothers and their children enrolled in 1997 and 2001 in Mexico City. They are part of the larger Early Life Exposure in Mexico to Environmental Toxicants ([ELEMENT](#)) cohorts initiated in 1994 by a group of Harvard T.H. Chan School of Public Health researchers led by Howard Hu, Ph.D., and Karen Peterson, Ph.D., through an NIEHS Superfund Research Program grant. The original studies are still ongoing and have expanded to include mixed-metal exposures and other environmental modifiers.

“The uniqueness of the ELEMENT cohort is that it has varied exposures and health outcomes data over a long period of time. Most mothers entered the study during pregnancy, and the oldest children are now in their twenties,” said Huang. “The cohorts also have archived biological samples from mothers during pregnancy and cord blood from their children, making the cohort very valuable to investigate questions related to developmental origins of health and disease.”

Researchers from the University of Toronto, University of Michigan, and Icahn Mount Sinai School of Medicine as well as other U.S. collaborators work with the Instituto Nacional de Perinatología in Mexico City on ELEMENT cohort studies. A team in Mexico also collects data for the study, and the Mexican Social Security Institute assists in collecting perinatal data.



Collaborators in Mexico (shown here) work with cohort participants and collect data.
(Photo courtesy of the ELEMENT cohort team)