



# Mercury & Neurodevelopment

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## NEURODEVELOPMENTAL DISORDERS ON THE RISE

The number of neurodevelopmental disorders (NDD) is increasing in children. The Centers for Disease Control and Prevention (CDC) reports 1 in 88 American children, aged 8 years, is now affected by an Autism Spectrum Disorder (ASD), increased from 1 in 150 in surveillance year 2002 (CDC 1). CDC data and statistics reports that approximately 11% of children 4-17 years of age were diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) as of 2011, revealing an increase in diagnosis from 9.5% in 2007 and 7.3% in 2003 (CDC 2). Another CDC study "Trends in the Prevalence of Developmental Disabilities in U.S. Children, 1997-2008" revealed 7.66% of U.S. children had a learning disability during that time period, with a 5.5% increase in learning disabilities between the periods 1997-1999 and 2006-2008 (CDC 3). Further statistics from the CDC reveal that, for U.S. children aged 12-17 years in 2010, 9.3% had a learning disability. The rate of increase for this age group from previous years was not available (CDC 4).

## BACKGROUND

Mercury is a potent neurotoxin. It is ranked third on the 2011 Agency for Toxic Substances and Disease Registry (ATSDR) priority list of 275 hazardous substances (Chen). Mercury concentrates in fetal blood as it crosses the placenta (Miodovnik). Neurotoxin effects may be increased by synergistic action when mercury combines with other common environmental toxins (such as lead, manganese, PCBs, pesticides, etc.) often present in the bodies of children (Sexton, Miodovnik).



*Image courtesy of Arlington, VA Department of Human Services*

Embryonic and early childhood are critical times for the development of brain architecture, including the areas of brain limbic system, connecting with amygdala circuitry, critical to emotional stability and social thinking, in addition to other areas affecting intelligence, language, sensory modulation, motor and visual perception skills. Mercury disrupts brain development by inhibiting critical neuronal and glial cell division (National Scientific Council on the Developing Child), global disruption of neuronal migration (Miodovnik) and by disruption of the endocrine system.

## CURRENT EVIDENCE OF MERCURY'S NEUROTOXICITY

Research is revealing serious neurodevelopmental effects associated with embryonic exposure to mercury and other neurotoxins. A recent study reported higher levels of autism occurring in geographical areas where ambient air contains higher levels of mercury, associated spatially with point sources of mercury emission such as coal-fired power plants and cement kilns (Blanchard, et al). Another study reported an association between the occurrence of autism (diagnosed before the ninth birthday) and estimated concentrations of heavy metals (including mercury) in ambient air from U.S. government records near time of birth (Windham, et al). Boucher, Jacobson, et al reported an association of prenatal exposure to methylmercury, measured by cord blood, with higher symptom scores for attention problems and disruptive behaviors consistent with ADHD, for a cohort of children of average age 11.3 years. Cheuk and Wong reported a significant difference in blood mercury levels in children of average age 7.06 years, with higher levels associated with the diagnosis of ADHD, compared to the control group without ADHD. The mercury source was presumed to be fish consumption. Karagas, et al reviewed original research studies correlating low dose mercury exposure measured in hair, blood or umbilical cord blood with varied outcomes. They described studies documenting neurodevelopmental effects such as smaller cerebellar volume, poorer visual recognition, IQ decline, decreased vocabulary, decreased visual motor ability, decreased general cognition, memory and verbal skills. Low birth weight was also associated with mercury exposure. The American College of Obstetricians and Gynecologists and the American Society for Reproductive Medicine stated, "the evidence that links exposure to toxic environmental agents and adverse reproductive and developmental health outcomes is sufficiently robust" (ACOG).

## SOURCES OF MERCURY

Mercury is typically released as inorganic mercury into the atmosphere from the burning or transportation of coal, other industrial emissions and gold mining operations, finding its way into oceans, lakes and rivers where it is changed by microorganisms into organic methylmercury, an even more toxic substance. Methylmercury bioaccumulates in the aquatic food chain and is most typically ingested when people eat fish, especially larger predatory fish such as swordfish and tuna, but the amount of mercury in all fish varies by region. People are also exposed to mercury in ambient air. We know that mercury enters and accumulates in the human body; its biomarkers can be measured in blood, hair and umbilical cord blood in newborns (Sexton, Cheuk, Karagas). A study led by the U.S. Environmental Protection Agency found that Northeastern and West Coast women have the highest concentration of blood mercury levels in the U.S., with one in five exceeding levels considered safe for fetuses, presumably from eating more fish in coastal regions (Mahaffey).



*Coal-fired power plant in Cheshire, Ohio from  
[www.flickr.com/photos/dshea/2089737103](http://www.flickr.com/photos/dshea/2089737103)*

## WHAT YOU CAN DO

- If you are a woman of childbearing age, you can take precautions, even before pregnancy, by avoiding sources of neurotoxins, such as fish high in mercury content. For more information visit the following page: [www.fda.gov/Food/FoodbornellnessContaminants/Metals/ucm115644.htm](http://www.fda.gov/Food/FoodbornellnessContaminants/Metals/ucm115644.htm)
- If you are a fisherman/woman, you can check your local fish advisories for the current health report of your typical catch. For more information visit the following pages: [public.health.oregon.gov/newsadvisories/pages/recreationaladvisories.aspx](http://public.health.oregon.gov/newsadvisories/pages/recreationaladvisories.aspx)  
[www.doh.wa.gov/CommunityandEnvironment/Food/Fish/MercuryAdvisories.aspx](http://www.doh.wa.gov/CommunityandEnvironment/Food/Fish/MercuryAdvisories.aspx)
- If you are interested in further action, consider working to change permitted levels of mercury and other industrial toxic environmental emissions.



Image courtesy of Province of Alberta, Canada

## RESOURCES THAT INFORMED THIS FACTSHEET

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