Impact of Environmental Chemicals on Children’s Learning and Behavior

This focus sheet is to inform policy makers, government agencies, and disease prevention programs about the potential contribution of environmental chemicals to children’s learning and behavior problems.

Learning and Behavior Problems are Common in Children

Conditions that make it difficult for children to learn, communicate, or behave properly are widespread and increasing in the U.S.\textsuperscript{1,2} These conditions include learning disabilities, attention deficit [hyperactivity] disorder (ADD/ADHD), autism spectrum disorders, and intellectual disability.

The burden of these conditions for families and society includes financial costs related to special education, medical treatment, law enforcement, and the social and emotional toll on the children and caregivers.

Risk Factors for Children

Early life experiences are critical in determining whether a child’s brain architecture will provide a strong or weak foundation for all future learning, behavior, and health. Prolonged family stress, absence of a stimulating learning environment, and lack of supportive caregivers in early childhood are well known to impede healthy brain development in children.\textsuperscript{4} Other factors such as poor nutrition, fetal exposure to infectious agents, and exposure to toxic chemicals such as lead and mercury can directly impair brain and neurological development in children.\textsuperscript{4,5} Some disorders, such as Down Syndrome, are clearly linked to genetic abnormalities. Other conditions, like autism and ADHD, appear to result from a complex interaction between genes and the environment.\textsuperscript{4}

A child’s brain and nervous system develop over a long period – from the first trimester in pregnancy through adolescence. At certain times during this development, environmental chemicals can permanently change the architecture and function of the developing brain.\textsuperscript{4} The National Academy of Sciences suggests that generally a small percentage (about 3%) of developmental disorders may be caused solely by a toxic environmental exposure and another 25% results from a combination of genetic and environmental factors.\textsuperscript{7}

Cost of Early Life Exposure to Environmental Chemicals

New York researchers estimated the cost of environmental chemical contribution to several childhood learning and behavioral impairments.\textsuperscript{8} They estimated the cost of intellectual disabilities from lead poisoning and prenatal methyl mercury exposure, and the costs of a fraction of autism, ADD/ADHD, and intellectual disability that was reasonably attributable to environmental chemicals. Costs considered were primarily health care costs and lost economic productivity over the child’s lifetime. They estimated $74.3 billion in annual U.S. costs were attributable to environmental chemicals.

Lowered intelligence from early childhood exposure to lead exposure alone was estimated to result in about $675 million per year in income lost to those affected in Washington State.\textsuperscript{9}
Environmental chemicals that have been associated with impairment of the developing brain are found in consumer products and a child’s environment (for example, in air, food, water, house dust, and soil).

Environmental chemicals known to interfere with normal brain development\(^\text{1}\) include:

- Lead.
- Methyl mercury.
- Tobacco smoke (contains multiple chemicals).
- Polychlorinated biphenyls (PCBs).
- Manganese.
- Organophosphate insecticides.

Environmental chemicals suspected to interfere with normal brain development\(^\text{6}\) include:

- Arsenic.
- Bisphenol A.
- Polybrominated diphenyl ethers (PBDEs).
- Phthalates.

Summary

Inability to learn, communicate, and relate positively to others creates a huge burden on children, their families, our school system, and all of society. Prevention efforts that reduce neurotoxic chemicals in the environment and consumer products will help protect children from harm and conserve our health care and educational resources.

For More Information

- Autism, Washington State Department of Health: www.doh.wa.gov/YouandYourFamily/illnessandDisease/Autism.aspx
- Attention-Deficit / Hyperactivity Disorder (ADHD), CDC: www.cdc.gov/ncbddd/adhd/facts.html

References