AAMR

Collaborative on Health and the Environment (LDDI)

Institute for Children's Environmental Health

LINKING ENVIRONMENTAL EXPOSURES WITH PSYCHOLOGICAL DISORDERS

Linking Environmental Exposures with Psychological Disorders

Fact Sheet

The role of neurotoxicants in the etiology of psychological disorders is increasingly being recognized. A considerable body of research shows that neurotoxic exposures may be associated with deficits in IQ, learning, memory, and attention as well as behavioral changes. Less well-developed but emerging data reveal that exposure to environmental agents with neurotoxic effects may result in a spectrum of psychological disturbances, such as anxiety, depression, conduct disorders and schizophrenia. Most studies and clinical reports focus on high-dose exposures that would only be encountered by accident or perhaps in an occupational setting. There are even fewer studies of the impacts of low-dose and chronic exposure to neurotoxic agents and study results are often mixed. In short, new research suggests that psychological disorders can be influenced by environmental agents though the data are limited in many, but not all cases.

Below is a brief compilation of the small body of research that has found associations between environmental toxicants and mental health disorders. Studies finding no association are not included. Study design limitations have been noted in most cases to help provide perspective. In addition, readers should use a note of caution when extrapolating the effects seen in animal studies to the effects on humans.

Anxiety Disorder

Mercury

- A small study of 16 chemical workers conducted five years after their exposure to neurotoxic levels of organic mercury concluded that mercury may contribute to **anxiety, depression and phobic avoidance**. These workers were exposed to very high levels of mercury for a considerable time. (Powell 2000)
- Another small study of 13 men acutely exposed to inorganic mercury vapor found associations with **depression, anxiety and social withdrawal**. (Haut et.al. 2000)

Pesticides

- A four-year study of 761 residents of Colorado farms using herbicides and insecticides noted that "neurological effects resulting from a pesticide poisoning may **decrease concentration and cause irritability**…" (Beseler and Stallones, Oct 2003)
- A Brazilian study of 37 workers chronically exposed to low levels of the organophosphate pesticides chlorpyrifos and acephate showed almost half of the workers had psychiatric

diagnoses, including generalized **anxiety disorder, panic disorder and social anxiety**. (Salvi 2003)

- An animal study in which rats were given doses of 1.0, 3.0 and 7.0 mg/kg of cyhalothrin, a synthetic pyrethroid insecticide, showed evidence that it induces **anxiety-like symptoms**, with the effect being dose-related. (Righi 2003)
- Results of an animal study at Washington State University indicated that repeated exposure to low levels of lindane may produce persistent changes in **anxiety-related neural** circuitry. Animals pre-treated with lindane continued to show evidence of fear in the presence of an odor weeks after the fear-provoking stimulus previously associated with the odor was discontinued. (Cloutier 2006)

Conduct Disorder

Lead

- A study of 301 public-school boys associated lead exposure with an increased risk for **antisocial and delinquent behavior**. Teachers of 11-year-old boys with high bone lead levels reported increased **social and attention problems, delinquent behavior and anxious/depressed** symptoms. Parents and teachers of boys with high bone lead levels judged them to be more **aggressive and antisocial** than boys with low lead levels. ("High lead" classification refers to those boys with blood lead levels above the median; "Low lead" are those with levels below the median) (Needleman Feb96)
- A study of 195 subjects compared prenatal and postnatal blood lead levels with parental and self-report of delinquent behaviors. The researchers found that prenatal blood lead exposure greater than 10 micrograms per deciliter is associated with an increase of more than 2.3 delinquent acts compared with study subjects with less than or equal to blood lead levels of 5 micrograms per deciliter or less. Significantly higher rates of delinquent behavior is associated with a categorical blood lead level measured prenatally and at 78 months of age, although not by average childhood blood lead level. (Dietrich et al. 2001)

Depression

Lead

- A cross-sectional study on low-level lead exposure concluded that lead can contribute to **depression and anxiety**. It further supports the idea that lead exposure can play a role in psychiatric problems including general stress on the central nervous system (Rhodes et. al. 2003)
- In a prospective study of lead neurotoxicity, exposed foundry workers with blood lead levels over 40 micrograms per deciliter showed increased rates of **depression, confusion, anger, fatigue and tension**. (Baker et. al. 1983)

Organophosphates

- **Depression, along with anxiety, irritability and restlessness** represent the most prominent emotional symptoms from acute and moderate organophosphate poisonings. (Mearns 1994); (Metcalf & Holmes 1969)
- Long-term psychological effects of long-term low-level exposure to organophosphates have not been adequately studied. Some studies have found adverse psychological effects but not all. (Mearns 1994)
- One study by Salvi showed a significant decrease in **depressive mood disorder** among agricultural workers when they stopped using organophosphate pesticides. (Salvi 2003)

- Another study showed that **depression** was 5 times as likely when individuals reported pesticide poisoning in a population of farm workers. (Stallones 2002)

Solvents

- Occupational exposure to organic solvents has been associated with increased psychiatric symptoms, particularly **depression.** (Hakkola 1994); (Linz et al.1986); (Morrow, Kamis, & Hodgson 1993); (Struwe, Mindus, & Jonsson 1980).

Schizophrenia

Lead Exposure

- One study has found that lead exposure during pregnancy may be associated with **schizophrenia** later in life. The study results showed that elevated lead exposure (greater than 15 micrograms per deciliter) during gestation increased the odds of developing schizophrenia later in life by two and half times. (Opler 2004)
- Another study has found that low levels of lead exposure can overstimulate an enzyme in the brain that is implicated in **bipolar disorder** and **schizophrenia.** This over-stimulation of this enzyme Protein Kinase C contributes to a subset of symptoms involving the dysregulation of thought affect, and behavior, which are features of many neuropsychiatric disorders. (Birnbaum 2004). This suggests that gene-environment interactions may be important and that lead may some greater impact for people who are genetically predisposed.

Environmental Toxicant Exposures that Have Been Associated with Psychological Disorders in Research Studies*

Disorder/ Exposure	Anxiety Disorder	Conduct Disorder	Depression	Schizophrenia
Lead	XX	XX	XX	XX
Mercury	XX		XX	
Organophosphates	XX		XX	
Solvents	XX		XX	

*This chart summarizes the information described above showing possible associations between environmental toxicants and adverse mental health outcomes. Please note that these associations are based on a small body of emerging research and are not necessarily conclusive suggesting further studies are needed to substantiate these findings.

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