

Children's Environmental Health

Definition: Children's environmental health focuses on environmental exposures and health problems unique to children. Infants and children often face higher exposures to chemicals and pathogenic organisms than adults. Exposures can occur in the womb to chemicals that cross the placenta. Infants and children can encounter hazards in many places including the home, child care facilities, schools, and outdoors. Fetuses, infants, and children are especially sensitive to environmental exposures as their bodies grow and develop because their protective systems are not complete. Both acute and chronic health effects can result from environmental exposures.

Summary

The developing fetus, infants, and children have increased vulnerability to hazards in the environment. Their immune, nervous, and respiratory system defenses are not complete, and the rapidly growing tissues of all infants and children's systems are more susceptible to environmental assaults. Exposures to the fetus, especially during critical times of growth and development, can disrupt normal growth and function. Exposures among pregnant women are of concern because some chemicals readily cross the placenta to reach the fetus. Breast milk can be a potential source of exposure to nursing infants for some persistent chemicals.

Infants and children can have higher exposures to chemicals compared to adults. They eat more food, drink more water, and breathe more air for their size compared to adults. Unique behaviors of infants and children may also put them at increased risk from contaminants in the environment.

Introduction

Children experience most of the same kinds of environmental exposures adults do but may respond differently for a variety of reasons. Children often have greater exposures than adults due to their unique behaviors, smaller body size, and higher metabolic rate.^{1,2} Children are at increased risk to suffer health impacts from these exposures because their bodies are still developing and their defenses are not complete.

Children's bodies grow rapidly and exposures that kill or damage cells can interfere with normal growth and development. Exposures in the womb during critical periods of organ

development can result in irreversible impacts. For example, exposure to high levels of methylmercury in the womb can cause permanent damage to the brain and central nervous system. Exposures to lead and methylmercury during infancy and early childhood can have more harmful effects on the brain compared to exposures later in life when development is complete. The blood-brain barrier, which prevents the transfer of certain chemicals from reaching the central nervous system in adults, is not complete in fetuses, infants, and young children. The developing intestinal tract of infants and children allows more absorption of some chemicals compared to that of adults. For example, children one to two years old absorb 50% of ingested lead compared to adults who absorb only about 10%. Infants and children also have different abilities to metabolize and eliminate environmental chemicals, which can result in greater exposures as well as health effects. For example, infants do not metabolize caffeine until about six months of age.³

Infants and children have behaviors that put them at risk of higher exposures to environmental chemicals. Babies and young children naturally put toys and other non-food objects in their mouths, which can increase their exposures to contaminants from these items. Children also crawl on the floor and play in the dirt, activities that may put them at risk for exposures from these areas.

Children eat more food relative to their body weight than adults and tend to eat a lesser variety of foods than adults. Children eat more milk products and certain fruits and vegetables, which can result in higher dietary intake of contaminants present in such foods.

Children breathe more air per unit of body weight than adults because of their higher metabolic rate and higher activity levels. This can put them at increased risk of health impacts from both indoor and outdoor air pollution.² In addition, their breathing

space is different than adults, exposing them to chemicals closer to the ground.

Both acute (one-time, usually high concentration) and chronic (continuous or episodic exposure, usually to lower concentrations over a long period) environmental exposures can have effects on children's health. High-level acute exposures can result in damage to developing systems as can long-term low-level exposures to chemicals that build-up in the body.

Many chronic childhood health problems such as asthma, certain cancers, low birth weight, and neurobehavioral problems are linked to environmental exposures. For children, two of the most important acute environmental health risks are ingestion poisonings and respiratory and other health problems that result from exposures to air pollution. Important chronic exposures covered in this chapter are ongoing and mostly low-level exposures to pesticide residues, lead, and persistent chemicals found in the environment including methylmercury and polychlorinated biphenyls (PCBs). While there are other environmental health risks facing children, these are some of the important risks for which there are data specific to Washington State.

Description of Potential Indicators

While there are numerous environmental exposures that may affect pregnant women, infants, and children in Washington, there are relatively few useful sources of good data to document exposure levels, related health impacts, and trends.

The indicators presented below, and described in more detail later in this chapter, focus on known and suspected sources of environmental exposures for which there are some data. Since there are few human health data for many environmental exposures, we have to rely on indicators to understand many environmental health risks.

Hazard indicators. The amount of canned tuna containing mercury above a level of concern consumed by pregnant women presents a potential hazard to them and their fetuses. The proportion of Washington women of childbearing age and young children who frequently eat fish with high mercury levels is also used as an indicator of exposure.

The use of products that contain harmful ingredients such as pesticides, cleaning products, and solvents can present potential hazards for children. In general, there are few data on the use of these types of products in settings where infants and children are present.

Exposure indicators. Biological samples such as blood or urine can be analyzed for harmful chemicals or their breakdown products. Blood lead testing is used to identify children with harmful exposures to lead. A blood lead level of 10 µg/dl of blood indicates an elevated lead exposure, according to the U.S. Centers for Disease Control and Prevention (CDC).

The CDC periodically tests biological samples collected from a cross-section of the U.S. population, including children, for a variety of environmental chemicals such as pesticides, metals, and persistent environmental pollutants.⁴ These data provide information on how much people of all ages in the general population are exposed to various environmental chemicals and whether these exposures change over time. While some states have initiated similar state-based programs, there is no similar population-based testing program for people living in Washington State.

An exposure indicator for acute poisonings is the number of children who are reported to the Washington Poison Center (WAPC) with concerns about exposures.

Protective indicators. The proportion of school buses with refitted exhaust equipment to reduce diesel emission exposure to child riders represents a protective indicator. The proportion of new mothers who report receiving information from their health care providers during prenatal care visits about the potential hazards of mercury in fish is also used as a protective indicator.

Health outcome indicators. The number of children with pesticide-related illnesses is a health outcome indicator. The proportion of children hospitalized with poisoning-related illnesses can be used as a health outcome indicator.

Key Children's Environmental Health Issues

Chronic Health Conditions

Children's exposures to environmental chemicals may cause or contribute to chronic diseases such as asthma, cancer, and neurobehavioral problems. Linking specific health conditions to specific

exposures is difficult because past exposures are difficult to identify and measure, the time between exposure and the onset of disease can be long, many diseases can have a variety of causes, and health impacts may be subtle and difficult to identify.

Asthma. Asthma is relatively common among children in Washington State. On the 2003-2005 [Behavioral Risk Factor Surveillance System](#) (BRFSS) survey, about 16% ($\pm 1\%$) of respondents with children in the household reported that at least one child had ever been diagnosed with asthma, and about 11% ($\pm 1\%$) reported at least one child who currently had asthma.

Several indoor and outdoor factors can cause asthma in children or trigger childhood asthma attacks.⁵ Higher outdoor air pollution levels are associated with respiratory symptoms in children and adverse birth outcomes such as low birth weight, preterm birth, and decreased lung growth.⁶ There are also many factors in the indoor environment that can cause asthma or trigger attacks. These factors can be even more important than outdoor pollutants as the concentrations of indoor pollutants are often higher than outdoor levels. Furthermore, children spend the majority of their time indoors. Allergens and irritants such as mold, dust mite, cat dander, household chemical odors, and environmental tobacco smoke are associated with asthma.^{7,8} (See chapter on [Asthma](#) for more information about asthma in Washington.)

Cancer. A few environmental exposures are known to increase the risk of cancer among children, but the causes of most childhood cancers are still unknown. Known risk factors include ionizing radiation and prenatal diagnostic x-rays. Environmental exposures suspected to cause childhood cancers include pesticides, arsenic, asbestos, chlorination byproducts, motor vehicle exhaust, and environmental tobacco smoke.^{9,10,11}

Neurobehavioral problems. Many environmental chemicals can adversely affect normal brain development resulting in impacts on behavior, learning ability, and memory and lower IQ.¹² The health impacts of some of these such as lead, methylmercury, PCBs, some solvents and certain pesticides have been observed in human populations.¹² The evidence for neurobehavioral effects for many other chemicals mainly comes from laboratory animal studies that suggest risks to infants and

children.¹³ Early lifetime exposure to these chemicals can have potentially long-term effects. Additionally, there is concern that infants and children exposed to multiple chemicals with similar impacts can be at much higher risks for developmental delays. Environmental exposures to chemicals that affect normal brain development have been suggested as a factor in the rising prevalence of certain developmental delays, behavioral disorders, and disabilities seen in children such as attention deficit hyperactivity disorder and autism, but research to support these links is incomplete.¹⁴

Poisonings

Poisonings are a leading cause of injury and death among children and adolescents. Almost any medicine or chemical can cause serious injury if a child eats or breathes a sufficient amount; for some compounds, only a very small dose can lead to serious health effects. Household cleaning and personal care products; painting and automotive products; over-the-counter, prescription, and illegal drugs; pesticides; and poisonous plants can cause poisoning in children and adolescents.

The WAPC provides emergency information to the public and health care providers about potentially hazardous exposures. In 2006, 52% of the 67,174 calls to the WAPC about potential poisonings were for children younger than six years old. Forty-six percent of these calls were for poisoning from medications. The main reasons for other calls include cosmetics and personal care products (13%), household cleaners (9%), plants (6%), desiccants (3%), pesticides (2%), and paints (1%). Nationally, about half of all calls to poison control centers in 2005 were for children younger than six.¹⁵

During 2003–2005, acute poisonings were the second leading cause of injury hospitalization for Washington children 0–17 years old.¹⁶ Poisoning deaths among children younger than five have declined dramatically since 1970 due in part to the widespread use of child-resistant packaging, the development of poison control centers, the use of Ipecac to induce vomiting as a way to immediately reduce the effects of a poison, and better medical care for treatment of ingestions.¹⁷ During 2000–2005, there were 26 poisoning deaths among 0–14 year-olds and 26 poisoning deaths among 15–17 year-olds. Among teens 15–17 years old, the majority of poisoning deaths were unintentional (62%), followed by suicides (31%). The majority of non-fatal poisoning hospitalizations among this age

group were suicide attempts due to drug overdoses (57%).¹⁶

Key Children's Environmental Exposures

Pesticide Exposures

Children can be exposed to pesticides via accidental exposure to pesticides stored around the home, pesticide residues on foods, airborne pesticides from nearby applications, pesticide residue left on treated carpets or other household surfaces, in soil, in drinking water, or brought home on parents' work clothes.

During 2001–2005, about 2% of calls received by the WAPC were related to pesticide exposures. In 2005, the WAPC received 2,430 pesticide exposure calls. Thirty-six percent were related to a possible pesticide exposure to a child younger than six, and 11% of the calls were for children 6–19 years old. In about 10% of these calls the child reportedly had some symptom related to the exposure, but most often, symptoms were minor and did not require referral to a health care provider.

The Washington State Department of Health investigates reports of acute illness related to pesticide exposure. Data collected from the investigations are used to identify public health problems and develop strategies for preventing illness. For example, the investigation of a previously healthy ten-month old baby that was found unresponsive in a home where an excess of insecticide foggers was applied instigated efforts to raise awareness among WAPC specialists of the potential risks associated with fogger exposures and collaboration with the Washington State Department of Agriculture to improve product labels.¹⁸

Data from the department's Pesticide Illness Monitoring System show that reports of acute pesticide illness among children younger than 18 years old have remained fairly constant since 2002, at about 22 per year.¹⁹

Washington children living in agricultural areas and who have parents that apply pesticides have higher exposures to pesticides than other children.²⁰ Children living in agricultural communities have higher levels of organophosphate pesticide metabolites in their urine during periods of crop spraying. Exposure levels were four times higher during peak

spraying times. Studies in Washington also show that children of pesticide applicators have higher pesticide exposures than children of farm workers or children living in an urban area (Seattle).²⁰ Nonetheless, in Seattle children, studies show that exposure varies based on the diet. When the diet changed from conventional to organic, exposure decreased.²¹

Evidence for the association between low levels of pesticides in urine and deficits in neurobehavioral performance is growing among both adults and children. Washington farm workers, including pesticide applicators, are mostly Hispanic and tend to live in rural areas of the state, where their children may be at greatest risk of chronic, low-dose exposures to pesticides.^{22,23,24}

Secondhand Smoke

Maternal exposure to secondhand smoke, also called environmental tobacco smoke, during pregnancy has been linked to low birth weight. During infancy, exposure to secondhand smoke increases the risk of sudden infant death syndrome. Children exposed to secondhand smoke have more respiratory problems (including acute respiratory illness and asthma) and middle ear infections. Evidence also suggests causal links between secondhand smoke exposure and spontaneous abortion, adverse effects on cognitive development and behavior among children, and decreased lung function in children.²⁵ (See chapter on [Indoor Air Quality](#) for more information about secondhand smoke and exposures in Washington.)

Diesel Exhaust from School Buses

Each day approximately 10,000 school buses are used to transport nearly 500,000 Washington children to school. Most school buses have diesel engines. These engines emit air pollutants that can cause asthma, trigger asthma attacks, and affect the development of children's lungs, possibly leading to permanent lung damage. Diesel exhaust is also suspected to cause lung cancer.²⁶

Children may be exposed to diesel exhaust when they are lined-up waiting to board the buses. Diesel exhaust can also enter the main cabin of the bus and expose children.

Under the Washington State Clean Bus Program that was created in 2003, diesel buses in the state are being retrofitted to reduce both tailpipe and crankcase emissions. These retrofits significantly reduce levels of exhaust inside the buses.

Unfortunately, many buses older than 20 years cannot be effectively retrofitted. These buses produce 10 to 100 times more air pollution than buses built more recently. Replacing these older buses with newer, cleaner buses is the only way to significantly lower emissions from this source.

As of 2006, of the 6,000 public and private buses that are eligible for retrofitting, 5,000 (83%) of them have been retrofitted under the Clean Bus Program. The goal is to retrofit the remaining 1,000 school buses by 2008.²⁷ One thousand older buses cannot be retrofitted; the Washington State Department of Ecology is recommending that these buses be replaced.

Chemicals in Fish

Some chemicals released in the environment can build-up in fish to levels that are potentially harmful to people who eat fish. Chemicals found in fish can come from local industrial wastes that pollute nearby water bodies used for fishing or can be the result of air emissions released from distant industries; such emissions can be blown long distances before they are deposited onto a lake or ocean. Contamination of the ocean leads to the contamination of fish that are caught both recreationally and commercially and sold in retail stores. Contamination of rivers and lakes can lead to elevated levels of contaminants in sport-caught fish. Chemicals that accumulate in fish are commonly referred to as persistent and bioaccumulative chemicals and include mercury, PCBs, and some pesticides such as DDT.

To protect people who eat fish, health departments develop fish consumption advisories when fish contain harmful levels of chemicals. Health departments issue fish advisories for local waterways (e.g., lakes and rivers) and for fish sold in stores. Fish advisories provide information to the public on which fish to avoid, which fish should be eaten in limited amounts, which fish are safe to eat, and how people can prepare and cook fish to reduce levels of contaminants.

Most existing fish consumption advisories, in Washington and nationally, are directed at women who are or may become pregnant, nursing women, and young children. This is because the developing fetus, infants, and children are the most sensitive to the toxic effects of many of the contaminants found in fish.

Health departments are careful about advising people to reduce fish in their diets because of the health benefits gained from eating fish. These health benefits include improved cognitive development among infants whose mothers ate fish during pregnancy and reduced risk of heart disease among adults.^{28,29} The Department of Health encourages people to eat fish as part of a healthy diet but to choose fish with lower levels of contaminants.³⁰

Mercury. Mercury is a naturally occurring element that is released into the environment as a result of combustion of fossil fuel (e.g. coal), other industrial discharge, and from improper disposal of mercury-containing products such as thermostats, electrical switches, silver dental fillings, and fluorescent bulbs.

Microorganisms in lakes and other water bodies convert mercury into methyl mercury. Methyl mercury tends to build-up in fish, concentrating as it moves up the aquatic food chain. Older, predatory fish (such as bass, large tuna, and king mackerel) have the highest methyl mercury levels. Mercury builds-up in the muscle tissue; cutting off the skin and fat of fish and cooking does not decrease mercury levels.

Studies of poisoning events in Japan and Iraq show that exposure to high levels of methyl mercury in fish causes severe neurological damage to children exposed in the womb. Chronic low-level exposures to levels of methyl mercury commonly found in local and store-bought fish may result in subtle neurological problems such as lowering of IQ and decreased attention.³¹

Fish consumption is the main source of methyl mercury exposure among the general public.³¹ The CDC estimates that 8% of women of childbearing age in the United States exceed the U.S. Environmental Protection Agency's (EPA)-recommended maximum intake of mercury based on mercury measured in blood samples from the general public.³²

Since 2000, the Department of Health has issued four fish advisories for methyl mercury for certain fish in local water bodies in Washington (Lake Roosevelt, Lake Whatcom, Puget Sound, and a statewide advisory for bass).

The department has also issued a mercury advisory for several types of fish sold in stores (shark, swordfish, tilefish, king mackerel, tuna steaks, and canned tuna). This advisory is based on results of national and state fish testing. Canned white tuna, also labeled as albacore tuna, contains an average of three times as much mercury as canned light tuna. Based on these testing results, the department

recommends that women who are or who may become pregnant, nursing women, and young children limit their intake of canned white tuna to one serving per week. The EPA and the U.S. Food and Drug Administration (FDA) have issued a national advisory for mercury in some of the same types of commercial fish, but it does not include canned tuna.³³

In 2004, 52% ($\pm 2\%$) of women who had recently given birth reported on the [Pregnancy Risk Assessment Monitoring System](#) (PRAMS) survey that their health care providers had given them information about how eating fish containing high levels of mercury could affect their babies. The percent of women who reported getting this information from their health care providers increased to 61% ($\pm 2\%$) in 2005 and to 69% ($\pm 2\%$) in 2006.

PCBs. PCBs are a group of chemicals that were used widely in products such as electrical coolants and lubricants for transformers. The EPA banned PCBs in 1977 because of health concerns, but these chemicals persist in the environment and continue to be found in fish. Currently the public's main source of exposure to PCBs is from eating fish.³⁴ Children exposed to PCBs in the womb are at risk for learning and behavior problems later in life. PCBs can also affect the immune system.³⁵

Since 2000, the Washington State Department of Health has issued five fish advisories for PCBs—for certain fish in the Spokane River, the Walla Walla River, the Wenatchee River, the lower Columbia River, and in Puget Sound. Because PCBs build-up in the fatty tissues of fish, people can reduce exposures by cleaning off the skin and fat of fish and by cooking fish so that fat can drain away.

High Fish-consuming Populations. Several populations within Washington State have been identified as high consumers of fish and shellfish. They include recreational anglers, Native American tribes, and Asian and Pacific Islanders.^{36,37,38,39,40,41,42} Information about fish consumption patterns among these groups comes mainly from surveys of adults. Due to their high consumption rates compared to the general public, these groups can have greater exposures to contaminants found in fish.

Year 2010 Goals. The national *Healthy People 2010* goal is to reduce the potential human exposure to persistent chemicals by decreasing fish contaminant levels so that no more than

13.8% of river miles and no more than 29.6% of lake acreage are under advisories about potential human exposure to persistent chemicals in sport fish. In 2005 and 2006, 100% of Washington's river miles and lake acres were under advisory for mercury, and so it is unlikely that Washington will meet this goal.⁴³ The statewide advisory for all rivers and lakes in Washington due to risk of mercury contaminants in fish may reflect global mercury emissions.

Lead Exposures and Blood Lead Levels

Lead is a known cause of many different health problems in children including learning disabilities and mental retardation.⁴⁴ Everyone has some exposure to lead, and no safe level of exposure has been identified to date.⁴⁵ The level of lead in blood is commonly used to evaluate a child's exposure. In 1991, the CDC set a blood lead "level of concern" of 10 micrograms per deciliter (10 $\mu\text{g}/\text{dL}$) to identify children who should be further evaluated.⁴⁶ Since then, several studies have reported that blood lead levels below 10 $\mu\text{g}/\text{dL}$ cause subtle neurological effects such as decreased learning ability.⁴⁷ Still, an "elevated blood lead level" or "lead poisoning" commonly refers to a blood lead concentration greater than 10 $\mu\text{g}/\text{dL}$, and that definition is used here.

At relatively low levels of exposure (blood lead levels up to 20 $\mu\text{g}/\text{dL}$), lead has been associated with decreased learning ability, poor school performance, inappropriate behavior, and decreased growth.⁴⁴ Frank anemia, nephropathy, and encephalopathy can occur at higher blood lead concentrations (greater than 70 $\mu\text{g}/\text{dL}$), but such levels are rarely seen in Washington.

Children can be exposed to lead from many common household products, and small exposures add up. Paint, ethnic remedies, jewelry, ceramic dishware, Mexican candy, vinyl products, ammunition, and fishing weights may contain lead and have all been associated with cases of lead poisoning nationally.⁴⁴

The largest exposure source for most children is thought to be lead-based paint in older dwellings.⁴⁸ House paint used until the mid-1950s could contain up to 50% lead by weight, when manufacturers voluntarily reduced lead content to less than 1%. In 1978, federal law limited the amount of lead in house paint to 0.06%. Nationwide, there is an association between childhood lead poisoning and housing age. Results of a study conducted by the Washington State Department of Community, Trade, and Economic Development suggest that lead-

based paint in old houses is the most important source of lead exposure in Washington.⁴⁹

According to the 2000 [census](#), about 700,000 (or about 29% of the total) housing units in Washington were built before 1960, when the amount of lead in paint was highest. Another 700,000 housing units were built between 1960 and 1978, when lead content of paint was lower (but can still cause lead poisoning, especially when dust is produced during home renovation and repainting). The condition of painted surfaces in an old house is an important predictor of the potential hazard to children living in the house. Peeling and chipping paint are greater hazards to children than paint in good condition.

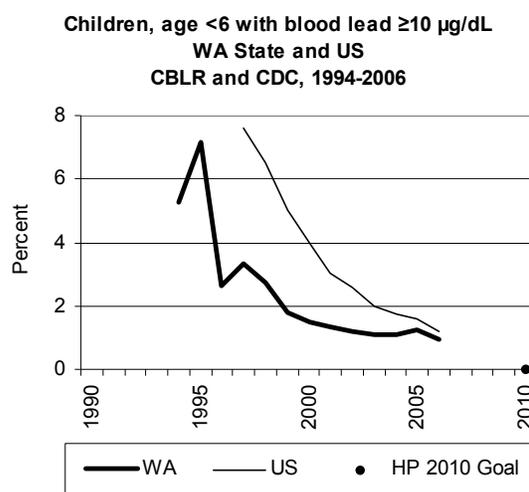
Some traditional Mexican folk remedies (most notably Azarcón and Greta used to treat certain types of gastrointestinal illness) consist of various forms of lead oxide. Although these remedies are not commonly available in Washington, some families bring them from Mexico, and some children are given the remedies during trips to Mexico. Several cases of lead poisoning from these substances have occurred in Washington.

Testing children for lead ensures that poisoned children are identified and provides an opportunity for intervention to prevent further exposure. All blood lead tests performed in Washington are reported to the Department of Health, which maintains the Childhood Blood Lead Registry (CBLR) of the results of all children tested. About 1% of tested children have an elevated blood lead level, but only about 5% of Washington children (about 5,400 children a year) ever receive a test. Childhood blood lead testing rates in Washington, in terms of both number and percentage of children tested, are among the lowest in the United States. Because of the low test rate and because it is unclear how children are chosen for testing, the available results may overestimate or underestimate the true rate of lead poisoning in Washington.

Time Trends. Data from the CBLR show that, of the children tested before their sixth birthday, the percentage with elevated blood lead levels decreased from 7.2% in 1995 to 1.3% in 2001 and then leveled off through 2006. Blood lead levels from 5.0 to 9.9 µg/dL indicate that a child has had some lead exposure, though the exposure does not meet the definition of “lead poisoning.” The percentage of children tested

before their sixth birthday who had blood lead levels in this range decreased steadily from 17.5% in 1994 to 4.4% in 2005. Due to laboratory detection methods, it is difficult to estimate the proportion of children with blood lead levels from 2 to 5 µg/dL (see Technical Note).

It is difficult to compare Washington state results with those seen nationally because of differences in how they are calculated. But the national percentage of children with elevated blood lead levels has declined every year since 1997. The results in the following graph exclude tests performed in the military’s medical system, which were inconsistently reported to the registry during the years depicted.



Year 2010 Goals. The national *Healthy People 2010* goal is to eliminate childhood lead poisoning. The prevalence of lead poisoning in children younger than six in Washington has remained at 1.1% to 1.3% since 2001. Washington does not appear to be approaching the goal.

Geographic Variation. There is no clear, broad geographic pattern to childhood lead poisoning in Washington State. This is likely due, in part, to the limited test data available. The counties with the highest and lowest rates of lead poisoning have had few children tested and have unreliable rates.

Age. Children are usually at the highest risk of lead poisoning when they are one or two years old. At those ages, they have the highest amount of hand-to-mouth activity and the greatest propensity to eat things they should not, like paint chips. Among children tested in Washington, those who are three or four years old are nearly as likely to have elevated blood lead levels as one- and two-year-old children. Fewer older children are tested, however,

and it is likely that they are selected because their health care providers feel they are at high risk for lead poisoning.

Race, Ethnicity, and Poverty. A statewide survey conducted in 1999 found a higher prevalence of lead poisoning among children of Hispanic origin in central Washington than among other children in the state. CBLR data from before 1999 show a higher prevalence of lead poisoning in clinics that served Hispanic populations. Since 1999, the rates of lead poisoning for children of Hispanic origin were not much different from those of other children. Nationwide, Blacks, Hispanics, children on Medicaid, children living in poverty, recent immigrants, and adopted children from some countries have been found to have high rates of lead poisoning. CBLR reports on childhood lead poisoning reflect a disproportionate number of children adopted from China and other Asian countries who have elevated blood lead levels.

Intervention Strategies

Each environmental exposure has specific intervention strategies to reduce exposure. But they all involve three basic activities: reducing the levels of contaminants in the environment where children live; improving recognition and treatment of environmentally related health problems; and educating people to change behaviors that lead to exposures.

Reduce levels of contaminants in children's environments. Ultimately reducing exposures will require reductions in the levels of contaminants in the environment. But for many persistent chemicals, such reductions take decades. Interventions designed to reduce exposure include:

- Improving regulation of chemicals in products to account for children's exposures and susceptibilities and promoting the use of less toxic alternatives in products commonly used by children
- Identifying and remediating places where children spend time that present hazardous exposures
- Promoting building practices and land use planning that reduces childhood exposures to environmental contaminants
- Improving regulations to control emissions of chemicals including persistent bioaccumulative toxic (PBT) chemicals.

Improve recognition and treatment of environmentally related health problems in children. Interventions include:

- Improving medical training in taking environmental exposure histories and in diagnosis and treatment of environmentally related illnesses
- Increasing testing of chemicals for developmental effects and improving toxicity study protocols to account for susceptible stages of development⁵⁰
- Assessing children's exposure through the use of biomonitoring data
- Expanding testing of childhood blood lead levels. Current federal policy recommends universal blood lead screening for Medicaid-eligible children and immigrant/refugee populations.

Change behaviors through education. For many exposures, educating parents and other care givers about environmental hazards can lead to changes in behaviors to help reduce children's exposures to environmental contaminants. Such efforts should involve health care providers and educators as well as parents themselves. These include:

- Selecting a variety of fish with lower levels of mercury and PCBs
- In older homes, repairing and remodeling using lead safe practices
- Washing children's hands, especially after playing outside
- Among Hispanic populations, avoiding use of pottery with lead-based paints and eliminating consumption of imported candies and traditional medicines that contain lead
- For workers who are exposed to hazardous chemicals at work, washing and removing clothing before going home to reduce the chance of "take-home" exposures
- Promoting healthy home practices to use less toxic pest control methods and low toxicity cleaning products, to control mold and moisture, and to ensure appropriate ventilation to reduce the build-up of contaminants such as carbon monoxide or wood-burning fumes and soot
- Promote smoking cessation programs and healthy home practices, such as not smoking inside, that reduce or eliminate exposure to secondhand smoke in the home.

See Related Chapters: [Asthma](#), [Indoor Air Quality](#), [Outdoor \(Ambient\) Air Quality](#), [Pesticide-Related Illness and Injury](#), [Other Issues in Environmental Health](#), [Poisoning](#), [Drug Abuse and Dependence](#)

Data Sources (For additional detail, see [Appendix B](#))

Childhood Blood Lead Registry (CBLR), Washington State Department of Health

National Center for Health Statistics, U.S. Centers for Disease Control and Prevention, State and Local Area Integrated Telephone Survey—National Survey of Early Childhood Health

Washington Poison Center (WAPC): Data on poisoning calls for children, 2006

Pesticide Illness Monitoring Database: Washington State Department of Health, Office of Environmental Health Assessments

Diesel school bus retrofit data: Washington State Department of Ecology, Air Quality Program, 2007

Behavioral Risk Factor Surveillance System (BRFSS): Washington State Department of Health and the CDC, 2002, 2004 and 2005

Retail fish testing: Washington State Department of Health, Office of Environmental Health Assessment, 2003 and 2005

Pregnancy Risk Assessment Monitoring System (PRAMS), Washington State Department of Health, Office of Maternal and Child Health Assessment, 2004, 2005, and 2006

For More Information

Washington Department of Health Childhood Lead Poisoning Prevention:
<http://www.doh.wa.gov/ehp/Lead/default.htm>: (800) 909-9898.

National Lead Information Center: (800) 424-LEAD

Washington Poison Center: <http://www.wapc.org/>

Technical Notes

The WAPC refers some pesticide exposures to the Department of Health for follow-up. Therefore, there is some overlap between pesticide exposures reported as part of the WAPC data and pesticide illnesses reported to the Department of Health.

Blood lead laboratory methods: Most laboratory methods measure blood lead levels within a 2 µg/dL margin of error. Many laboratories use analytic methods with detection limits of 3.3 µg/dL. Estimates of the proportion of children with blood lead levels from 2 to 5 µg/dL can be difficult to interpret because of these limitations.

The Department of Health's level of concern for mercury in fish is 100 ppb. The department's fish advisory for mercury is based on statewide testing of canned tuna. Recommendations for tuna

consumption are based on a serving size of one six-ounce can of tuna.

Department of Health 2003 tuna testing: mean total mercury in canned light or chunk light tuna=127 ppb (parts per billion or 1 ug/kg; N=58). Mean total mercury in canned white tuna (labeled as solid white or albacore) tuna=364 ppb (N=62).

Mean total mercury for other store-bought fish (DOH, 2005): Chinook salmon=71 ppb (N=17), cod=114 ppb (N=33), flounder=147 ppb (N=18), halibut=215 ppb (N=30), Pollack=15 ppb (N=24) and red snapper=221 ppb (N=27). Detection limit=5 ppb.

The Department of Health's level of concern for total PCBs in fish is 50-100 ppb. This range reflects some differences in marine and fresh water species, accounts for background levels in some areas, and includes reduction in levels from cleaning and cooking fish.

Mean total PCBs in store-bought fish (DOH, 2005): canned white (albacore) tuna=<detection limit (N=20), catfish=2.3 ppb (N=24), cod=<detection limit (N=33), flounder=0.6 ppb (N=19), halibut=10 ppb (N=29), canned light tuna=1.6 ppb (N=20), pollack=<detection limit (N=23), red snapper=12 ppb (N=27), Chinook salmon=25 ppb (N=17). Detection limit=2 to 4 ppb.

Endnotes

¹ U.S. Environmental Protection Agency. (2005, December). *Children's Health and the Environment in North America: A First Report on Available Indicators and Measures*. Washington, DC: U.S. Environmental Protection Agency.

² Etzel, R. A., & Balk, S. J. (Eds.). (2003). *Pediatric Environmental Health* (2nd ed.). Elk Grove Village, IL: American Academy of Pediatrics.

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