ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Your Child's Environmental Health

How the Body Works: Differences Between Adults and Children

Children are more likely to become ill from contaminants than adults are. One reason for this is that their bodies function differently than adults' bodies do. These differences can lead to an increased exposure to contaminants in their environment.

How children's bodies respond to environmental exposures changes as they grow. Some of the differences between children and adults include the following:

- On a pound-for-pound basis, children breathe more air, drink more water, and eat more food than adults.

  An infant breathes more than two times faster than an adult. During the first years of life, the young child's lungs are growing and developing quickly. Because children breathe faster than adults, they can be exposed to more air pollution.

  In the first 6 months of life, infants drink seven times more water pound for pound than adults. Because children drink more water, the possibility of their exposure to contaminants in drinking water increases.

  Children from 1 to 5 years of age eat three to four times more food per pound of body weight than adults. This increases their exposure to pesticides, herbicides, and contaminants found in fish.

- Because infants and toddlers have a limited diet, they can have more exposure to contaminants unique to specific foods. For example, children eat about 15 times more apples and apple products per unit of body weight than adults do. This can put them at a higher risk for pesticide exposure if the apples were not properly washed before they were processed.

- If children do not get enough calcium or iron, their bodies can absorb more lead if they are exposed to it.

- Some toxicants penetrate children's skin more easily than adults' skin. Compared with adults, children also have more skin surface area with which to absorb toxicants.

- Children play and act differently than adults do: very young children have more contact with ground surfaces than adults. Children also engage in more hand-to-mouth activity. Some children might eat dirt, which is an activity called pica. Pica behavior can increase exposure to toxicants found in soil (for example, lead).

- Children's bodies are changing and growing.

- Children's bodies might be less able to break down and remove certain toxic substances compared with adults' bodies.

As children grow older, these physical differences disappear and their exposure risk comes more from their behavior rather than how their bodies function.

For more information, contact your health care provider or local health department, or log on to www.atsdr.cdc.gov.

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What Puts Young Children at Risk?

Normal childhood behavior or activities can sometimes place children at a higher risk for exposure to hazardous substances. Children may play in mud, splash in creeks, crawl on the floor, and roll in dirt. All of these activities can lead to exposure to toxic substances present in their environment.

Toddlers and infants are often at greater risk than older children for exposure to certain contaminants.

- Their height makes them more likely to breathe dust and heavy vapors that are close to the ground.
- Because infants and toddlers are often placed on the ground, they can have more exposure to pesticides, residue from pest sprays, and chemicals such as mercury and cleaning solutions, which are heavier than air.
- With their newly acquired abilities to run, climb, and perform other mobile activities, the young child's environment expands and so can the risk for environmental exposure.
- With their intense curiosity and need to explore and try new things, young children frequently put things into their mouths. Sometimes they might even eat dirt. This can increase their exposure to lead, polychlorinated biphenyls (PCBs), arsenic, and other contaminants.
- Copper-arsenic treated wood used for landscaping, decks, and some playground equipment presents an exposure through the soil. Children playing in, under, or around these items can absorb arsenic through the skin or from eating dirt near the treated wood.
- Young children often lack the abilities and skills to recognize hazardous substances.
- Children might not wash their hands after playing, which increases their risk for exposure to contaminants in soil.
- Children's bodies might be less able to break down and remove certain toxic substances.

Other things that can influence a child's exposure to and absorption of environmental toxicants include

- where they play and live,
- their physical stature, and
- how mobile they are.

Take-Home Contamination

Children of all ages can be exposed to contamination by industrial chemicals through take-home contamination. Parents and caregivers can bring contaminants home from work on their clothes, shoes, hair, and skin. Contamination can occur if these adults wear their work clothes home or if the work clothes are washed with the rest of the family's clothes. Depending on the job the worker has, he may want to shower at work before going home. It is a good idea to wash the worker's clothes separately from those of the rest of the family. Some workers are required by OSHA (Occupational Safety and Health Administration) to have their clothes laundered at work.. Adults can also change from their work clothes to street clothes and shoes at work.

Contaminants and exposures of concern for young children are lead, pica tendencies (excessive eating of dirt), and take-home contamination from parents and caregivers.

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Your Child's Environmental Health
Environmental Exposure During Your Pregnancy and Your Child's Infancy

During Your Pregnancy

Exposure of the unborn child is of special concern because its organs and body systems are developing as the mother's pregnancy advances.

A fetus' major organs begin forming in the early weeks of its mother's pregnancy. During this time, the mother's health, nutrition, and avoidance of harmful substances are important. Mothers-to-be should make healthy choices for themselves, which is the best way to protect their unborn children. Anything the mother eats, breathes, drinks, or touches might potentially affect her baby's development, especially during the stage of pregnancy when the baby's organs and systems are forming.

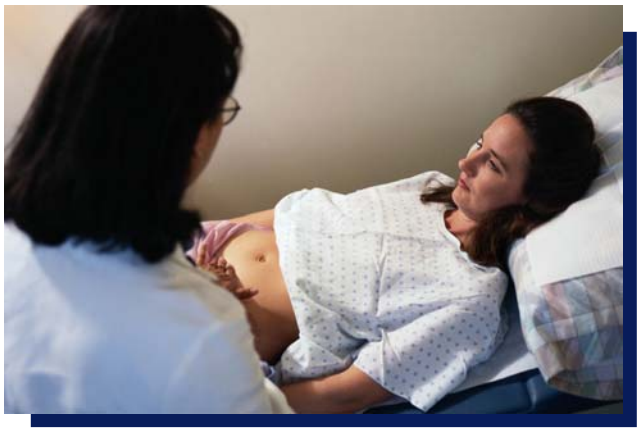
Whether a chemical affects development of a fetus depends on

- when maternal exposure occurs,
- what the chemical is,
- whether it is absorbed or stored in the mother's body,
- how much is absorbed,
- how it enters the mother's body,
- how the body changes and disposes of it, and
- if the chemical is excreted in breast milk.

The most sensitive time of fetal development is the first 3 months of pregnancy (the first trimester). Except for size, the heart, arms, and legs are fully developed by the end of this time.

The palate and ears will fully develop in the second trimester (4th, 5th, and 6th months).

The most critical period of the brain and central nervous system's development is completed by the end of the third trimester. However, portions of the brain and central nervous system continue to develop through puberty. The brain, more than any other



organ, remains sensitive to the effects of hazardous chemical exposure throughout a person's life. The eyes, teeth, and external genitalia also finish developing in the last 3 months of pregnancy.

Following are some principal organs and the period during pregnancy when they are most sensitive to contaminants:

- Kidneys: weeks 5–8
- Stomach: weeks 4–7
- Heart: weeks 4–7
- Brain and central nervous system: weeks 2–6
- Lungs: weeks 4–8
- Hands and arms: days 32–56
- Face and eyes–days 28–48.

These time frames can vary with exposure to specific chemicals.

Newborns to Toddlers (1 to 2 Years Old)

Toddlers and infants are at greater risk for exposure to contaminants.

- Their height makes them more likely to breathe dust and heavy vapors that are close to the ground.

- Because infants and toddlers are often placed on the ground, they can have more exposure to pesticides, residue from pest sprays, and chemicals such as mercury and cleaning solutions, which are heavier than air.
- With their intense curiosity and need to explore and try new things, young children at this age might still put things into their mouths. Sometimes they might even eat dirt. This can increase their exposure to lead, polychlorinated biphenyls (PCBs), arsenic, and other contaminants.
- If the food or liquid they eat or drink is contaminated, infants and toddlers receive more of it relative to their size than adults do. For example, infants drink 5 ounces of formula per kilogram of body weight, which is equal to thirty 12-ounce cans of soda a day for an adult male.

Contaminants and exposures of concern during pregnancy and infancy are lead, take-home contamination, and nitrates. Nitrates, found in some well water, can interact with hemoglobin in the bloodstream and create oxygen deficiencies in the body in very young infants. Without enough oxygen, the body turns blue or slate-gray and the infant has trouble breathing.

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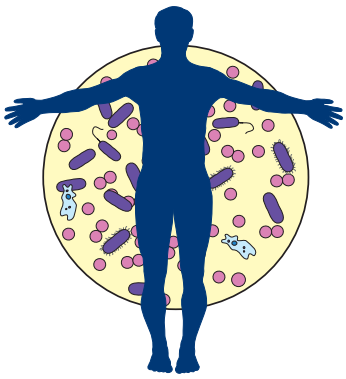
Your Child's Environmental Health
Exposure Routes in Elementary-School and Middle-School Children

School-aged children spend increasingly more time in school and at after-school activities. These activities away from home can add to the risk for environmental exposure.

Indoor air pollution can be a factor at schools and other places where children meet and play.



Outdoor pollution can be the source of exposure for children in this age group because they often play in areas unknown to their parents. Examples of such sources are

- pollutants resulting from hazardous waste sites,
- leaking underground storage tanks,
- local industrial sites, and
- air pollution.

Children in this age group are adventurous and often play in areas where they know no one will find them. Hazardous waste sites that are not clearly marked or fenced off might seem enticing to children.

Children playing soccer, baseball, and other outdoor activities during a poor air-quality day could inhale more of the polluted air than a child who is sitting in the park reading. Children actively playing outdoors are

estimated to have three times the breathing rate of those children watching the game. Be aware of air pollution warnings, which can suggest that children not play outdoors.

Behavioral risk factors in this age group include cigarette smoking and illegal drug use. Of particular concern in this age group is "sniffing" or inhaling glue, solvents, correction fluids, and dry-erase markers. Besides the effects of the chemicals themselves, children might go to unauthorized areas so they are not discovered using the chemicals.

Contaminants and exposures of concern for this age group are pesticides, hazardous waste areas, and lead.

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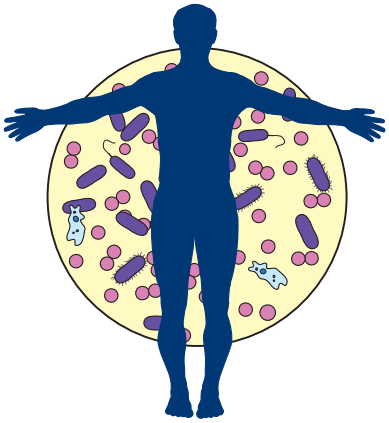
Your Child's Environmental Health

Adolescent Exposure Routes

Teenagers can especially be at risk for environmental exposures. Although their physical strength and stamina are at a peak, adolescents are still learning to use their reasoning skills and often fail to consider cause and effect (particularly delayed effects). Therefore, teens might place themselves in situations that have greater exposure risks than would adults.



Contaminants and exposures of concern for this age group are occupational exposures, illegal drugs, and hazardous waste areas.

Teens tend to take jobs that have higher risks without concern for their health. For example, they might have an increased exposure to gasoline because they take on tasks such as lawn mowing, become involved with cars, and work at filling stations. They might also work or enter vocational schools where they are exposed to workplace hazards.

Other exposures can be from hobbies and school activities, such as arts and crafts or chemistry.

During the teenage years, new tissues develop, particularly in the reproductive and endocrine systems. These tissues have special vulnerabilities to chemical exposures.

Adolescent behavior leads to new categories of potential exposures. Risk-taking behaviors might result in exploring off-limit industrial waste sites or abandoned buildings or experimenting with drugs and alcohol.

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Your Child's Environmental Health

How to Protect Your Children: Prevent and Reduce Their Exposure

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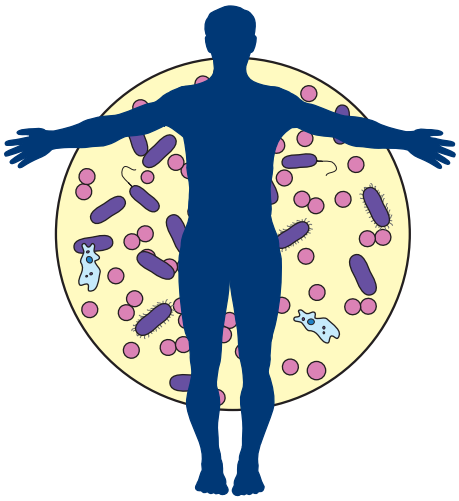
The Body's Protective Barriers

Three main protective barriers separate the child's inner environment (the body) from the outer environment (where he or she lives). These barriers are

- the skin, which protects your children from contaminants outside the body;
- the gastrointestinal (GI) tract, which protects your children from contaminants that they eat or drink; and
- the lungs, which protect your children from contaminants they breathe.



These protective barriers can be open to attack. Toxicants can penetrate the inner body by dissolving the protective covering of the skin. They can also enter the body through the pores of the skin and through any cuts or scrapes.

The GI tract, the largest of the three barriers, is vulnerable to toxicants and combinations of toxicants that are soluble and easily absorbed into the body.

The lungs are the most fragile and susceptible of the three principal barriers. The body's methods of protecting the lungs vary.

Nasal hairs filter dirt and pollutants as children breathe. The nasal passages and upper respiratory tract have many sharp turns, so particles in the air do not travel through. Particles that enter the nasal passage are also trapped in mucus, which is moved upward by small hairs (cilia), so that the trapped particles are swallowed or expelled. Coughing rids the large airways of contaminants. The cilia may be damaged by second-hand smoke.

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Keeping Your Child Safe

Parents can take actions to reduce their children's exposure to harmful chemicals. One of the first things is to look at your home to determine how safe it is. Here are a few actions you can take to reduce your child's exposure to chemicals.

- Before having your house sprayed for pests, talk to the company you hire about what chemicals they will be using and the possible health effects of those chemicals.
- If you are spraying your house yourself, read the labels of the chemicals you will use. The labels tell you how to safely use the chemicals.
- Store all chemicals, including household cleaning solutions, out of children's reach and in their original packages.
- If you live in an older building, check to see whether it has lead-based paint. Check with your local health department for more information.
- If lead-based paint has chipped, repaint over it with new, nonlead-based paint. If you are renovating your own home, get advice from your local health department on how to renovate safely.
- If you are renovating, find out whether the insulation you will remove has asbestos in it. If the insulation contains asbestos, you should hire a company trained in handling asbestos to remove it for you.
- While renovating, keep dust down by vacuuming or using a damp mop the area so that dust is not floating around in the air. The dust might contain substances that are dangerous for your children to breathe.
- If anyone in your family plays, sleeps, or spends time in your basement, you ought to have a radon detector. Your county or state health department can provide you with more information on radon, and assist with testing.
- Be aware of indoor air pollutants such as dust, vapors from your furnace or stove, mold, cigarette smoke, and fumes from cleaning solutions. Try to keep these pollutants at a minimum.
- If you use a fireplace, wood stove, space heater, or any gas appliances, you ought to have a carbon monoxide detector.
- Be aware of what is in your neighborhood. Teach your children not to play in old dumps, industrial sites, and polluted creeks and ponds.
- Everyone in the family should wash their hands after playing outside or working in the soil.
- If you get your water from a well, contact your local health department for a list of pollutants found in your area. Have the well tested for the major pollutants. If you use well water for infant formula, the water should be checked for nitrates.
- Most importantly, be aware of your environment and those where your family works, plays, and lives.

Over

- When using insect repellent, apply sparingly on exposed skin. Avoid applying repellent to your child's hands, eyes, and mouth. Do not use it on children under 2 years of age. Remember to bathe your child to remove the repellent from the skin.
- Don't let your children play near copper-arsenic treated wood decks, landscape materials or play equipment.
- Never use Bar-B-Q equipment indoors.
- Prescription drugs pose the biggest chemical threat to children. Keep purses, pill boxes, etc. where children can not get into them.

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