Pediatricians are fully aware of the major environmental causes of observable childhood morbidity and mortality (Table 1). It is also important for pediatricians to be aware of the variety of parental concerns regarding exposures to environmental chemicals. During their training and practice, one of their tasks is to counsel and educate parents on how to reduce or prevent the more common environmental risks (Table 1), but they have to be knowledgeable about the presence of environmental chemical and physical toxicants and the emerging literature on potential effects of low-level exposures of these agents to answer patients’ questions and provide reassurance or warnings about the valid risks of some of these toxicants. This article focuses on areas of counseling for which the pediatrician can feel assured that we have sufficient information so that attention to these issues and concerns will improve child health. Some of the material in this article can be found in more detail in the excellent Handbook of Pediatric Environmental Health.1 We have also used a format for categorizing children’s environmental risks in various age categories that was used by Napier2 in Chapter 13 of Juberg’s text on environmental chemicals.2

There has been some very good news concerning population exposures to environmental toxicants published by the Centers for Disease Control and Prevention (CDC) in 2003.3 The report indicated that there has been “encouraging signs that levels of lead, pesticides, and other chemicals in the body generally have declined over the past decade or so.”3 The report included 27 substances that included lead, mercury, cadmium, other metals, metabolites of organophosphorous pesticides, cotinine, phthalates, polycyclic aromatic hydrocarbons, dioxins, furans, coplanar polychlorinated biphenyls, noncoplanar polychlorinated biphenyls, phytoestrogens, selected organophosphate pesticides, carbamate pesticides, herbicides, pest repellants, and disinfectants. The cotinine levels that represent exposure to tobacco smoke and “pesticides,” however, are higher in children than in adults and in children from lower socioeconomic backgrounds. Richard Jackson, the head of the CDC branch supervising these studies and a pediatrician, summarized the status of the risk of these potential toxicants as follows: “For most of the chemicals in the report, well-established guidelines are not available.”3

IMPORTANT HEALTH AND SAFETY ISSUES DURING THE FIRST YEAR OF LIFE: COUNSELING FAMILIES ON HOW TO PREVENT THESE TRAGEDIES

1. Sudden infant death syndrome (SIDS). The pediatrician knows the factors that are associated with an increased risk of SIDS, which includes the proper position (sleeping on the back), room temperature, and clothing when the infant is sleeping as well as having a nonsmoking environment.

2. Trauma from falls. Pediatricians counsel parents that serious injury can occur from falls from strollers, from walkers, down the stairs, off the bed, out of the crib, or against sharp-cornered furniture. The infant is especially susceptible to head injuries.

3. Injuries or death as a passenger in automobiles. Pediatricians counsel parents about proper car seats and their installation. One does not hold an infant in one’s arms anywhere in the automobile, and never is the infant positioned in the front seat because of the serious risk to the infant if an air bag is activated. The yearly death toll of children as passengers is approximately 1700, and 170 000 are injured in automobile accidents.

4. Burns from heated items or hot water. The kitchen is a dangerous place in the home. Burns occur from food cooking on the stove, from spills, from hot water from the faucet, from items in the microwave oven and the toaster, and from hot items pulled off the table. The bathroom is also a dangerous place if the thermostat is set too high on the hot water heater.

5. Burns from fires. The sources of fire in the home are from adults smoking tobacco, sometimes accompanied by alcohol ingestion, somnolence and ignition by a dropped cigarette, children playing with matches, poor house wiring, worn out appliance wiring, defective heating systems, and

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ABBREVIATIONS. CDC, Centers for Disease Control and Prevention; SIDS, sudden infant death syndrome; AAP, American Academy of Pediatrics; MPE, maximum permissible exposure.
11. Vaccination schedule as recommended by the American Academy of Pediatrics (AAP). The small percentage of families who refuse to vaccinate their children not only are jeopardizing the health of their children but frequently attempt to proselytize their neighbors and friends to accept this dangerous viewpoint. This is an important challenge for pediatricians and family physicians. Failure to obtain proper vaccinations can result in serious illness and major disruption and guilt in these families.

12. Electrocuton. Electric outlets that are uncovered should be blocked with plastic plug inserts. Frayed or brittle electric cords to lamps and appliances should be replaced. Biting these electric cords can result in electric shock and electric burns that can be life-threatening.

13. Secondhand smoke. Parents who smoke at home or in their car in the presence of their children create an atmosphere that increases the risk for SIDS, hospitalization for respiratory infection, asthma, and other upper respiratory problems. See the article “Prenatal and Postnatal Environmental Tobacco Smoke Exposure and Children’s Health” in this supplement. Parents who smoke not only harm their children’s health but also serve as their role models. Children of parents who smoke are more likely to smoke as adults and adopt other addictive habits. These facts have to be told directly and effectively to parents.

14. Lead poisoning. Although access to lead-containing materials is limited during the first 6 months of life, as the child begins to crawl, stand, and put things into his or her mouth, the opportunity for lead poisoning is present. Fortunately, because of the lead abatement program initiated in the United States 30 years ago, the opportunities for the “old time” lead poisoning have diminished. In the 1950s and 1960s in the cities of the northeastern United States, children with blood lead levels >60 µg/dL were admitted to the hospital with encephalopathy, increased intracranial pressure, severe hypertension, anemia, lead lines in the long bones, abnormal porphyrin metabolism, basophilic stippling of the red blood cells, and iron deficiency anemia. Children with blood lead levels <40 µg/dL had lessor effects, and there was a decrease in intellect that was linearly related to the lead exposure. The CDC established a threshold exposure for intellectual reduction at 10 µg/dL in 1991. This was an unusual decision by the CDC, because there was no suggestion for the maximum permissible exposure (MPE) other than the 10 µg/dL, so this was the first time in the history of environmental toxicology that the MPE and the threshold exposure were the same. Ordinarily, the MPE is some fraction of the threshold exposure, eg, anywhere from 1/10th to 1/1000th the threshold exposure. The CDC recently reported some optimistic news about the lead levels in children in the United States: during 1991–1994, 4.4% of children exceeded the 10 µg/dL threshold level. In the current report, the CDC indicated that this has fallen to 2.2%. In addition, the mean blood lead levels have fallen from 2.7 µg/dL to 2.2 µg/dL. Unfortunately, third-world countries have children with much higher lead levels, and few of these countries have eliminated lead from their gasoline. Recent data, as described in the article “Lead” in this supplement, also suggest that even levels <10 µg/dL may result in decreases in cognitive functioning. Pediatricians still have to be concerned about old homes that contain lead-based paint, plaster and putty, old toys, cribs, and imported pottery that may contain lead.

15. Sunburn. Infants should have minimal exposure to the direct rays of the sun by using covered carriages and hats. Their skin is thin or more readily burns with excessive sun exposure. It is probably better to avoid the sun rather than depend on sunscreens during the first year.
16. Food poisoning. Bacterial contamination of food products may occur at the commercial site of preparation. In the home, protection can be provided by adequate cooking of the food, handwashing, and thorough washing of the food preparation surfaces and food utensils before and after preparation. Food poisoning can also occur at celebrations because of poor food storage before the event or because the food is outside in warm or sunny weather. It is regretful that many of the groups that criticize the food industry for distributing food products that are contaminated with *Escherichia coli*, salmonella, and other pathogens oppose the radiation of foods, which would prevent most of these infections and decrease the cost of food preparation and storage.

17. Child care. Most child care facilities provide quality, compassionate care. However, children who attend child care facilities have higher incidences of bacterial and viral infections. The quality of personnel at child care facilities varies, as does the quality of handwashing procedures, food sanitation, and diaper changing areas and compliance for administering medications. Children are at greater risk for various types of child abuse.

**IMPORTANT HEALTH AND SAFETY ISSUES FROM AGES 1 TO 4: COUNSELING FAMILIES ON HOW TO PREVENT THESE TRAGEDIES**

1. Accidental injury and death. This is an age when proper caution is not a consistent part of a child’s behavior. Taking chances by darting into the street, crossing unattended, and playing in the street all are activities that can result in tragedy; 35% of pedestrian accidents involve children. Children of this age should never cross the street without adult supervision. Each year in the United States, approximately 1800 children aged 19 and younger are killed and 50,000 are injured in pedestrian–motor vehicle collisions. Children have to be taught that the street is a dangerous place, again and again.

2. Falls. Falls are still very common in children 1 to 4 years of age and are the fifth leading cause of accidental death for children of this age. Falls from second-story windows, stairs, trees, garage roofs, and ladders result from the risk-taking behavior of this group of children and the absence of adult supervision and training.

3. Automobile passenger injuries and death. The use of age-appropriate car seats placed properly in the rear seat of the automobile is essential. There is no reason to have a child this age in the front seat as a passenger. A child also should not be allowed to travel in the truck bed of a pickup truck or in the enclosed compartment in the rear of a truck. Nearly 60% of accidents to pedestrians under age 5 happen in their own driveway when a family member backs over them.

4. Burns. Refer to the infant section with regard to burns. In addition, children this age should not have access to matches, cigarette lighters, prop-
IMPORTANT HEALTH AND SAFETY ISSUES FROM AGES 5 TO 9: COUNSELING FAMILIES ON HOW TO PREVENT THESE TRAGEDIES

Injuries remain the leading cause of death in this age group. In fact, more school-aged children die from injuries than from all other diseases combined.

1. Pedestrian injuries. Pedestrian injuries remain the most common cause of death from trauma for children aged 5 to 9 in the United States. Help children to understand the following street-smart rules. Most parents consider a child this age to be able to cross the street without supervision, which is a mistake with some children in this age group. Children this age need constant reminders of the safety procedures to follow when crossing a street. It may not be safe to cross when the light is green. Drivers may not see you and may not stop. Impulsive children or those who are taking some psychopharmacologic medications may need supervision when crossing the street.

2. Falls. See section on 1- to 4-year-olds. In this age group, it is common for families to purchase bunk beds. The risk of falls from bunk beds is increased if the bed is not equipped with a side rail in the upper bunk.

3. Automobile injuries. See previous age group sections.

4. Drowning and swimming accidents. See section on 1- to 4-year-olds. In addition, children aged 5 to 9 are more mobile and are able to travel to streams and other bodies of water that are not safe and where supervision is not available. They may also venture into these waters without knowing the depth and without being able to swim. Children who swim unsupervised may not leave the water in an electrical storm.

5. Bicycle injuries. See section on 1- to 4-year-olds. Children in grades 1 through 6 are at the greatest risk for bicycle injuries. Each year, approximately 400 children younger than 15 years are killed in the United States while riding bicycles, and almost 400,000 require emergency department treatment. Bicycle helmets reduce the risk of head injury by 85% and brain injury by nearly 90%. Despite this, helmets are used by a small percentage of child bicyclists. Proper equipment and riding in safe locations and at safe times (not at dusk or night time) will help to reduce bicycle-related risks.

6. Sports injuries. An estimated 65,000 children need hospital emergency department treatment each year for skateboard injuries, with 7 of every 10 such injuries incurred by children younger than 15 years. Football is 1 of the most dangerous athletic activities, causing some 57 injuries for every 100 players. Proper supervision and equipment dramatically reduce the risks in football and other contact sports such as hockey and lacrosse. Boxing carries such a high risk of brain injury that experts advise parents and young people not to participate. Equipment that should be used to reduce injuries includes shoulder pads, helmets, kneepads, tear-away bases, mouth protection bite plates, and appropriate gloves.

7. Burns. See previous age group sections.

8. Secondhand smoke. See infant section.

9. Choking and strangulation. See previous age group sections.

10. Poisoning. See previous age group sections.

11. Lead poisoning. See previous age group sections.

12. Guns. See infant section. Death and injury to children occur daily from accidental, self-inflicted, and intentional shootings, as well as by drive-by shootings. Forty million American homes have firearms. Children in this age group may be more aware of the location of guns in the home and also be allowed to view television with violence-based plots in which guns play a major role. The most sensible method to stop the maiming and killing of children from guns is to restrict the use of handguns to law enforcement officers. Even these individuals who have been trained in gun safety have tragedies in their homes resulting in death of and injury to children.

13. Food poisoning. See previous age group sections.

14. Vaccinate according to the AAP guidelines.

15. Electrocution. See infant and 1- to 4-year-old sections. In addition, older children who play and go to school unattended can come in contact with downed power lines and may have access to high-voltage transformers, both of which can lead to lethal injuries and burns. Similarly, lightning can be dangerous and children have to be taught what to do and what not to do when a thunder and lightning storm approaches.

IMPORTANT HEALTH AND SAFETY ISSUES FROM AGES 10 TO 18: COUNSELING FAMILIES ON HOW TO PREVENT THESE TRAGEDIES

As children grow into adolescence, they spend more time away from home and therefore parental supervision. Peer pressure is in competition with parental supervision. Peers can be a positive influence or a negative influence. This is the age of perceived invincibility and risk taking. This is the time to be able to say “no” to requests or activities that may jeopardize health and safety.

1. Automobile injuries. See previous age group sections. Automobile accidents are a major cause of mortality and serious injury. Reckless driving, impulsive behavior, showing off, or driving while intoxicated all pose specific risks. Not only do teenagers have higher accident rates, but the incidence increases proportionally with the number of teenage passengers in the car. Instruct teens not to “park” with their dates with cars running. This remains a common cause of carbon monoxide poisoning.

2. Burns. See infant section.

3. Poisoning. See infant section. In addition, teenagers become involved with illegal drugs that may result in overdoses that lead to illness or death.
4. Drowning and other swimming accidents. Older children may overestimate their stamina, endurance, and capability to swim long distances or in rough water. Children should always swim with another swimmer. If they do not know the depth of water, then they should be encouraged to jump feet first to avoid hitting their head on a shallow bottom. Horseplay on docks or boats should be discouraged. When boating, everyone always should wear lifejackets, and no one should undertake manning a boat that they have not been trained to use.

5. Sports injuries. See 5- to 9-year-old section.

6. Bicycle injuries. See 5- to 9-year-old section.

7. Guns. See 1- to 4-year-old and 5- to 9-year-old sections.

8. Injury from power tools and farm equipment. Farming is the most dangerous occupation in America, and children and adolescents make up a significant part of the farming workforce. Of the machine-related deaths of children on farms, tractors account for half of the fatalities. Power tools and gardening equipment are also responsible for many injuries. Nearly 10,000 children aged 15 and younger are hurt by lawn mowers each year. If children work on a farm, then clear use and safety instructions should be provided. They should know which equipment is off-limits until appropriate age. Lawn and garden equipment should be stored properly, making them inaccessible to children. Children younger than 12 years should not be allowed to operate walk-behind mowers, and children younger than 14 should not be allowed to operate ride-on mowers.

9. Fires. Children and teenagers who sleep above the living quarters are vulnerable to the smoke inhalation produced by fires that start on the first floor by a parent who is watching television, falls asleep.

10. Smoking. Parents who smoke are more likely to have children who smoke. Smoking is a great temptation for youths who wish to be cool. Unfortunately, children and even adults fail to understand the addictive nature of cigarettes and the disastrous illness consequences of smoking. Most adult smokers who have a difficult time quitting picked up the habit as teens.

11. Illicit drug use. Parents have to pay attention to their teenager’s behavior and activities. Changes in behavior, friends, sleep habits, grades in school, personality, and reactions may be signs of drug abuse. Missing money or valuable items from the house may not be the result of an intruder but rather a teenager. Alcohol is the prototype drug of abuse. Unfortunately, it is legal, and it therefore reflects the hypocrisy in our society about illicit drugs. Cigarettes are in the same category. Both are highly addictive. Drinking and driving is a killer for the teenager, passengers, and other drivers who may be involved in an accident with the drunken teenager.

12. Sexually transmitted diseases. Sexually transmitted disease can be life-threatening, cause infertility or sterility, and increase the risk of cervical cancer. Monitoring the sexual activity of a teenager is a difficult task. Discussions of sex, abstinence, and fidelity in marriage have to begin at an early age, and the parents have to set an example. Children must be taught that infection with human immunodeficiency virus may be a death sentence.

13. Pregnancy. From the ages of 15 to 19, the most common reason for hospitalization is pregnancy. Condoms and birth control pills are not 100% effective as contraceptives. Many of these pregnancies are single-mother pregnancies. Children having children represents a tragedy for many of these families.


15. Suicide. Depression is a common problem among teenagers. Frequently, the family and the teenager deny the presence of depression and the severity of the symptoms. Signs of depression overlap with the signs of drug abuse: change in sleep habits, loss of appetite, lowering of school grades, loss of weight or gain in weight, change in study habits, nonsocial behavior, and suicidal thoughts that are verbal or written. These behaviors may be ignored by parents, friends, and teachers. Suicide completers have a higher incidence of having both a gun and alcohol available. Tragically, suicide is 1 of the leading causes of death in teenage years.


17. Electrocution. Besides the warnings listed for the younger children, teenagers may have access to fuse boxes and power tools.

GENERIC PROBLEMS FOR ALL AGES

1. Obesity. The problem of obesity can begin in infancy, childhood, or adolescence. At the beginning of the 21st century, we are in the midst of a national epidemic of obesity. The cause of this epidemic is many-fold. In children, it is the combination of watching hours of television and eating food from fast food restaurants with a large number of calories. Snacks are available row after row on the supermarket shelves, consisting of fried chips, cookies, and candies. Portions served at home and in restaurants are oversized and establish very bad eating habits. Families need to develop a healthy eating program, which consists of fresh fruits and vegetable and no more than 30% fat in the diet, but the key is to limit the total number of calories to what is required. An exercise program should be developed for every family member and for a family with an obesity problem. The family should be made to realize that obesity is a major cause for weight-bearing joint replacement, cardiovascular disease, stroke, hypertension, pulmonary decompensation, and diabetes. Pediatricians should be the first line of defense against this epidemic and should be persistent in their effort to get the family to commit
TABLE 1. Leading Causes of Death for Different Age Groups

<table>
<thead>
<tr>
<th>Age</th>
<th>Top 5 Causes of Death</th>
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<tbody>
<tr>
<td>0–12 mo</td>
<td>1. SIDS</td>
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<td></td>
<td>2. Congenital anomalies</td>
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<tr>
<td></td>
<td>3. Preventable injuries</td>
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<td>4. Pneumonia/influenza</td>
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<td></td>
<td>5. Septicemia</td>
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<tr>
<td>1–4 y</td>
<td>1. Accidental deaths*</td>
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<tr>
<td></td>
<td>2. Congenital anomalies</td>
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<tr>
<td></td>
<td>3. Cancer</td>
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<td></td>
<td>4. Homicide</td>
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<td></td>
<td>5. Congenital heart disease</td>
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<tr>
<td>5–9 y</td>
<td>1. Accidental deaths*</td>
</tr>
<tr>
<td></td>
<td>2. Cancer</td>
</tr>
<tr>
<td></td>
<td>3. Congenital anomalies</td>
</tr>
<tr>
<td></td>
<td>4. Congenital heart disease</td>
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<tr>
<td></td>
<td>5. Congenital anomalies</td>
</tr>
<tr>
<td>10–14 y</td>
<td>1. Accidental deaths*</td>
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<td>2. Cancer</td>
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<td>3. Homicide</td>
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<td>4. Suicide</td>
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<td></td>
<td>5. Congenital anomalies</td>
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<td>15–19 y</td>
<td>1. Accidental deaths*</td>
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<td>4. Cancer</td>
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<td></td>
<td>5. Congenital anomalies</td>
</tr>
</tbody>
</table>

Source: National Association of Children’s Hospitals and Related Institutions, Alexandria, VA.
* Automobiles, pedestrian, fall, burns, and drowning.

1. Exercise program should be part of every family’s activities.

2. Osteoporosis. A significant proportion of adult women and some men have a low bone density, which makes them prone to fracture of the hip and spine in later years. Adequate intake of calcium and vitamin D should be a life-long habit. If adequate calcium and vitamin D are not part of the diet, then the diet should be supplemented with calcium and vitamin D. The third component to prevent osteoporosis is weight-bearing exercise. An exercise program should be part of every family’s activities.

PARENTAL CONCERNS THAT NEED TO BE ADDRESSED

The news media and Internet are the sources of information that may be anxiety provoking to parents. The pediatrician has the responsibility to be knowledgeable about some of these concerns and should be able to provide answers if there are adequate data that allow a definitive conclusion. Many toxicants are obviously deleterious at high exposures. The question that is difficult to answer with regard to many chemical agents is whether they have reproductive, neurobehavioral, or oncogenic effects at low exposures. Environmental chemicals expose infants, children, and adolescents as well as adults to low levels of these agents. Confusion arises when MPFs are exceeded or when the data that were used to establish the MPEs were incomplete or flawed. If the no-observable-adverse-effect level were 1 to 3 orders of magnitude higher than the MPE, then scientists would be of the opinion that an exposure slightly above the MPE has no toxicologic significance.

RESEARCH IS STILL ONGOING

The week that the manuscripts for this supplement were being submitted to Pediatrics, 4 letters to the editor and responses appeared in The Lancet. The authors of these letters disagree on whether there are deleterious effects from low-level mercury exposure.

1. Mercury in dental amalgams. The studies to determine the mercury levels associated with amalgams are still being evaluated. When the studies are completed, the information should be immediately made available to pediatricians.
2. Mercury in edible fish. Although we have an MPE that has been established, we do not have the various no-observable-adverse-effect levels for various neurotoxic and developmental effects of mercury.

RESEARCH INDICATES NO MEASURABLE INCREASED RISKS

1. Pesticide residues on fruits and vegetables that are washed before ingestion
2. Commercially prepared infant foods in the United States
3. Food additives approved by the Food and Drug Administration
4. Hormones in milk
5. Electromagnetic radiation from high-voltage power lines or electrical appliances in the home
6. Populations that live near nuclear power plants that are functioning normally
7. Fluoride poisoning from drinking water with added fluoride
8. Cancer risk from chlorinated drinking water
9. Adverse effects from microwave ovens or cellular phones

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The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://pediatrics.aappublications.org/content/113/Supplement_3/1167