Physical Environment and Safety

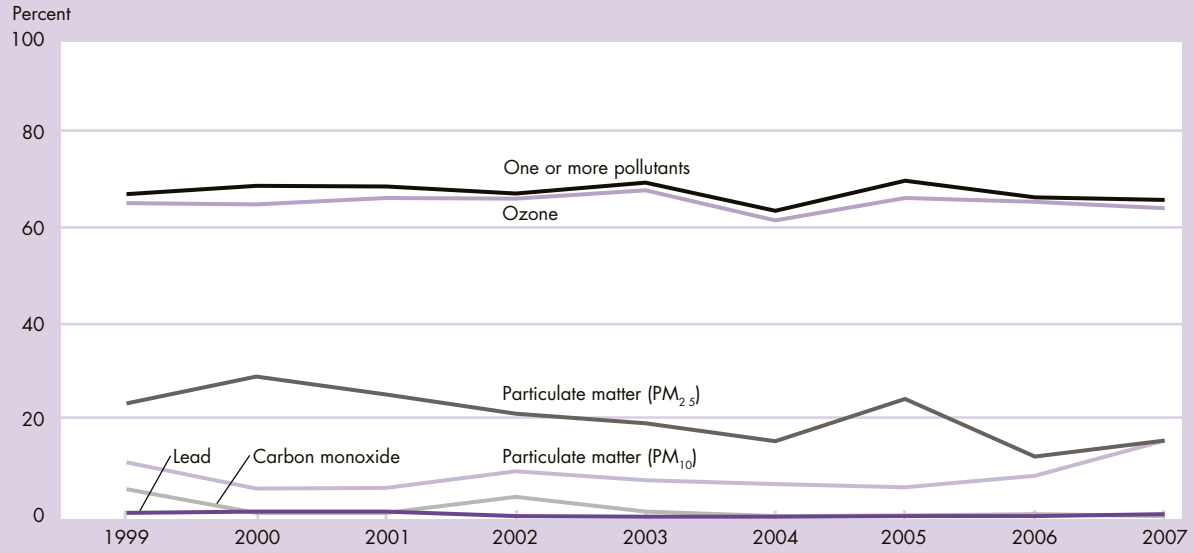
The physical environment in which children live plays a role in their health, development, and safety. This section presents indicators on how environmental conditions such as outdoor and indoor air quality, drinking water quality, and exposure to lead may affect children. In addition, indicators of housing problems, youth victims of serious violent crimes, and child and adolescent injury and mortality are presented.

Outdoor and Indoor Air Quality

The environment in which children live plays an important role in their health and development. Children may be more vulnerable than adults to the adverse effects of environmental contaminants in air, food, drinking water, and other sources because their bodies are still developing. In addition, children have increased potential for exposure to pollutants because they eat, drink, and breathe more, in proportion to the size of their bodies, than adults. One important measure of children's environmental health is the percentage of children living in areas in which air pollution levels are higher than the allowable levels of the Primary National Ambient Air Quality Standards.[49] These standards, established by the U.S. Environmental Protection Agency under the Clean Air Act, are designed to protect public health, including the health of susceptible populations such as children and individuals with asthma. Ozone, particulate matter, sulfur dioxide, and nitrogen dioxide are air pollutants associated with increased asthma episodes and other respiratory illnesses.[50–53] Lead can affect the development of the central nervous system in young children,[54] and exposure to carbon monoxide can reduce the capacity of blood to carry oxygen.[55]

Indicator PHY1.A

Percentage of children ages 0–17 living in counties in which levels of one or more air pollutants were above allowable levels, 1999–2007



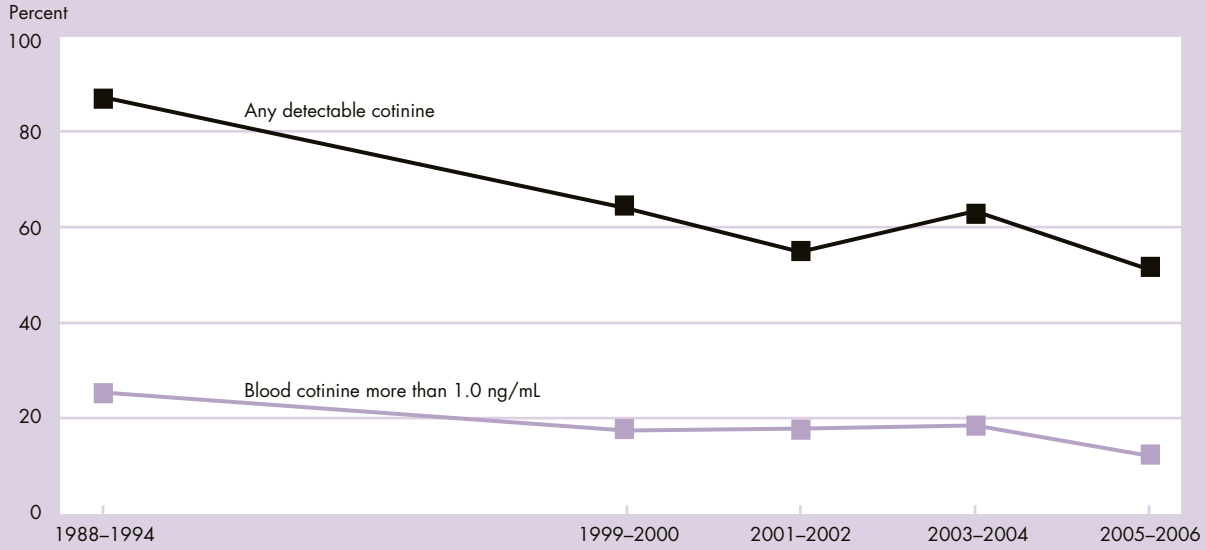
NOTE: The U.S. Environmental Protection Agency has set national air quality standards for six principal pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), and sulfur dioxide (SO_2). Nitrogen dioxide and sulfur dioxide are not included in the graph because all areas meet the Primary National Ambient Air Quality Standards for these pollutants. This analysis incorporates a new Primary National Ambient Air Quality Standard for ozone that was promulgated in 2008.

SOURCE: U.S. Environmental Protection Agency, Office of Air and Radiation, Air Quality System.

- In 2007, 66 percent of children lived in counties in which one or more air pollutants were above allowable levels.
- Ozone is the pollutant that is most often above the allowable levels as defined by the Primary National Ambient Air Quality Standards. Ozone, as well as particulate matter, can cause respiratory problems and aggravate respiratory diseases, such as asthma, in children.[50,52,53] These problems can lead to increased emergency room visits and hospitalizations.[56–59] In 2007, 64 percent of children lived in counties in which ozone concentrations were above allowable levels.
- In 2007, approximately 16 percent of children lived in counties where levels of fine particulate matter ($PM_{2.5}$) were above the annual allowable standard, compared with 24 percent in 1999. The term "particulate matter" (PM) includes both solid particles and liquid droplets found in air.[53] Airborne particles measuring less than 10 micrometers in diameter (PM_{10}) pose a health concern because they can be inhaled into and accumulate in the respiratory system. Particles less than 2.5 micrometers in diameter ($PM_{2.5}$) are referred to as "fine" particles and are believed to pose the largest health risks because they can lodge deeply in the lungs.

Children who are exposed to environmental tobacco smoke, also known as secondhand smoke, have an increased probability of experiencing such adverse health effects as infections of the lower respiratory tract, bronchitis, pneumonia, middle ear disease, sudden infant death syndrome (SIDS), and respiratory symptoms.[60] Secondhand smoke can also play a role in the development and exacerbation of asthma.[60] The U.S. Surgeon General has determined that there is no risk-free level of exposure to secondhand smoke.[60] Cotinine, a breakdown product of nicotine, is a marker for recent (previous 1–2 days) exposure to secondhand smoke.

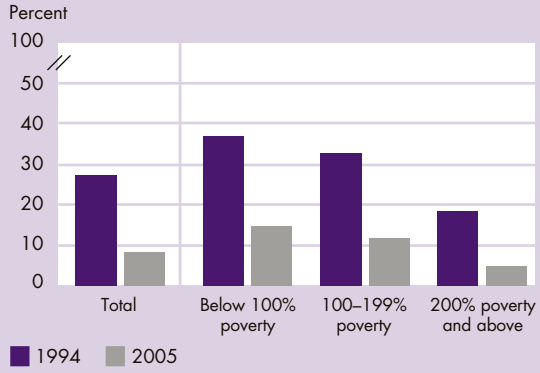
Indicator PHY1.B **Percentage of children ages 4–11 with specified blood cotinine levels, selected years 1988–2006**



NOTE: "Any detectable cotinine" indicates blood cotinine levels at or above 0.05 nanograms per milliliter (ng/mL), the detectable level of cotinine in the blood in 1988–1994. Cotinine levels are reported for nonsmoking children only. The average (geometric mean) blood cotinine level in children living in homes where someone smoked was 1.0 ng/mL in 1988–1994.

SOURCE: National Center for Health Statistics, National Health and Nutrition Examination Survey.

Indicator PHY1.C **Percentage of children ages 0–6 living in homes where someone smoked regularly by poverty status, 1994 and 2005**



SOURCE: National Center for Health Statistics, National Health Interview Survey.

- The percentage of children ages 4–11 with detectable blood cotinine levels decreased from 88 percent in 1988–1994 to 51 percent in 2005–2006. In 2005–2006, 12 percent had blood cotinine levels more than 1.0 nanograms per milliliter (ng/mL), down from 26 percent in 1988–1994.
- In 2005, the percentage of children ages 0–6 living in homes where someone smoked regularly was 8 percent, compared with 27 percent in 1994.[61] Children living below the poverty level and Black, non-Hispanic children were more likely than their peers to be living in homes where someone smoked regularly.

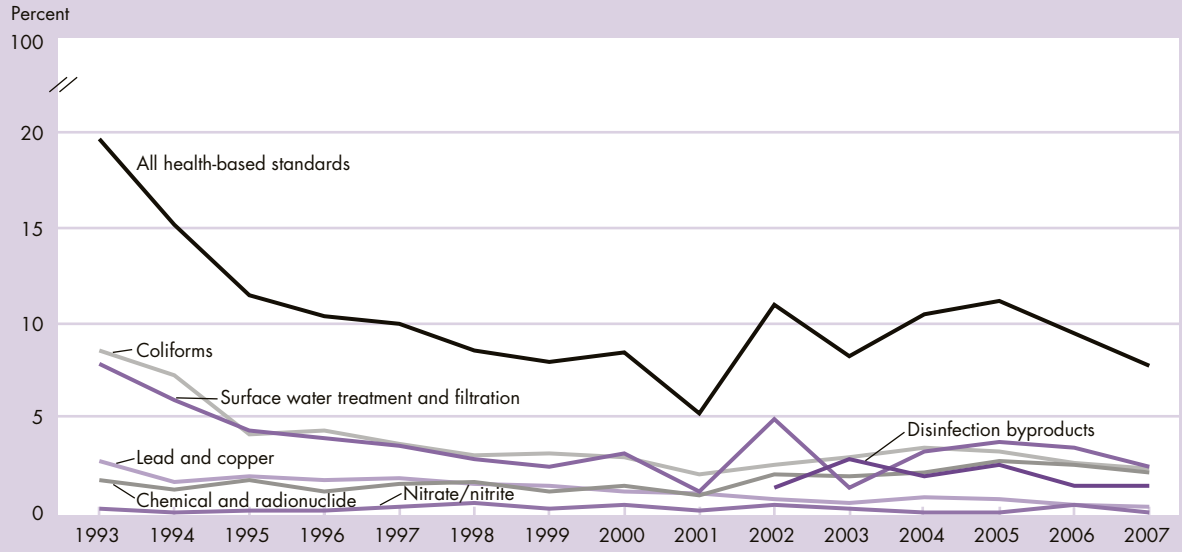
Bullets contain references to data that can be found in Tables PHY1.A–PHY1.C on pages 133–134. Endnotes begin on page 73.

Drinking Water Quality

Contaminants in surface and ground waters that serve as sources of drinking water may be quite varied and may cause a range of diseases in children, including acute diseases such as gastrointestinal illness, developmental effects such as learning disorders, and serious long-term illnesses such as cancer.[62] The U.S. Environmental Protection Agency (EPA) sets drinking water standards designed to protect people against adverse health effects. These standards currently include Maximum Contaminant Levels (MCLs) and treatment technique requirements for over 90 chemical, radiological, and microbiological contaminants.[63] One way to gain insight into children's potential exposure to drinking water contaminants is to look at community water system compliance with these standards. EPA's drinking water regulations require public water systems, including community water systems, to monitor for compliance with Federal health-based standards and treat their water if needed to meet standards. About 15 percent of the population receives drinking water from private water systems that are not required to monitor and report the quality of drinking water.[64]

Indicator PHY2

Percentage of children served by community water systems that did not meet all applicable health-based drinking water standards, 1993–2007



NOTE: A new standard for disinfection byproducts was implemented beginning in 2002 for larger drinking water systems and in 2004 for smaller systems. Revisions to the standard for surface water treatment took effect in 2002. A revised standard for radionuclides went into effect in 2003. A revised standard for arsenic (included in the chemical and radionuclide category) went into effect in 2006. No other revisions to the standards have taken effect during the period of trend data (beginning with 1993). Data have been revised since previous publication in *America's Children*. Values for years prior to 2007 have been recalculated based on updated data in the Safe Drinking Water Information System.

SOURCE: U.S. Environmental Protection Agency, Office of Water, Safe Drinking Water Information System.

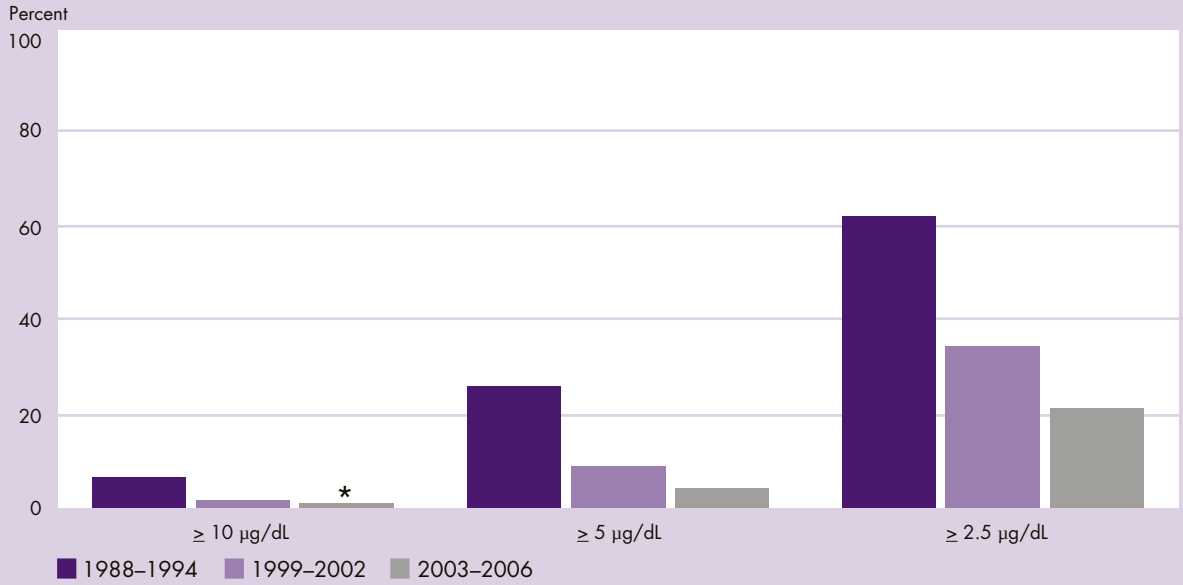
- The percentage of children served by community drinking water systems that did not meet all applicable health-based standards declined from 20 percent in 1993 to about 8 percent in 1999. Since 1999, this percentage has fluctuated between 5 and 12 percent and was 8 percent in 2007.
- Coliforms indicate the potential presence of harmful bacteria associated with infectious illnesses. The percentage of children served by community drinking water systems that did not meet the health-based standard for coliforms was about 9 percent in 1993 and about 2 percent in 2007.
- EPA adopted a new standard for disinfection byproducts in 2001. Disinfection byproducts are formed when drinking water disinfectants react with naturally-occurring organic matter in water. In 2007, about 1 percent of all children served by community water systems were served by systems that had violations of the disinfection byproducts standard. Exposure to disinfection byproducts may lead to cancer and have developmental effects.[65]

Bullets contain references to data that can be found in Table PHY2 on page 135. Endnotes begin on page 73.

Lead in the Blood of Children

Lead is a major environmental health hazard for young children. Childhood exposure to lead contributes to learning problems and behavioral problems.[66–69] A blood lead level of 10 micrograms per deciliter (µg/dL) or greater is considered elevated, but adverse health effects can occur at much lower concentrations.[70,71] A child with a 10 µg/dL blood lead level will experience, on average, a decrease in IQ of 6 points.[72] Lead exposures have declined since the 1970s, due largely to the removal of lead from gasoline and fewer homes with lead-based paint. However, 25 percent of U.S. homes have significant lead-based paint hazards, such as high lead levels in dust and soil, which may contribute to childhood exposure.[73] Children ages 1–5 years are particularly vulnerable because they frequently engage in hand-to-mouth behavior.

Indicator PHY3.A **Percentage of children ages 1–5 with specified blood lead levels, selected years 1988–2006**



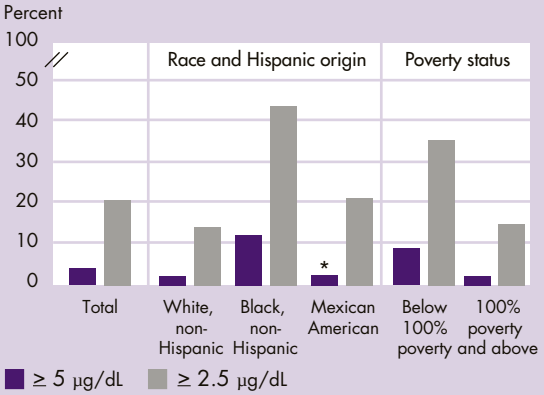
* Estimate is unstable (relative standard error is greater than 30 percent but less than 40 percent).

SOURCE: National Center for Health Statistics, National Health and Nutrition Examination Survey.

- Children's blood lead levels in 2003–2006 were lower than in 1988–1994.
- In 2003–2006 about 21 percent of children ages 1–5 had blood lead levels greater than 2.5 µg/dL, and 4 percent had levels greater than 5 µg/dL. The estimate of children with levels greater than 10 µg/dL is a low percentage, and the available sample is too small to provide a statistically reliable estimate.
- About 12 percent of Black, non-Hispanic children and 2 percent of White, non-Hispanic children had blood lead levels at or above 5 µg/dL in 2003–2006.
- Children living in poverty generally had greater blood lead levels than children in families with incomes at or above the poverty line.
- The median blood lead concentration for children ages 1–5 dropped from about 14 µg/dL in 1976–1980 to about 2 µg/dL in 2003–2006.[74]

Bullets contain references to data that can be found in Tables PHY3.A and PHY3.B on page 136. Endnotes begin on page 73.

Indicator PHY3.B **Percentage of children ages 1–5 with specified blood lead levels by race and Hispanic origin[75] and poverty status, 2003–2006**



* Relative standard error is between 30 and 40 percent.

NOTE: Data for percentage of children with blood lead above 10 µg/dL are not shown because estimates by race and Hispanic origin and by poverty status are considered unreliable.

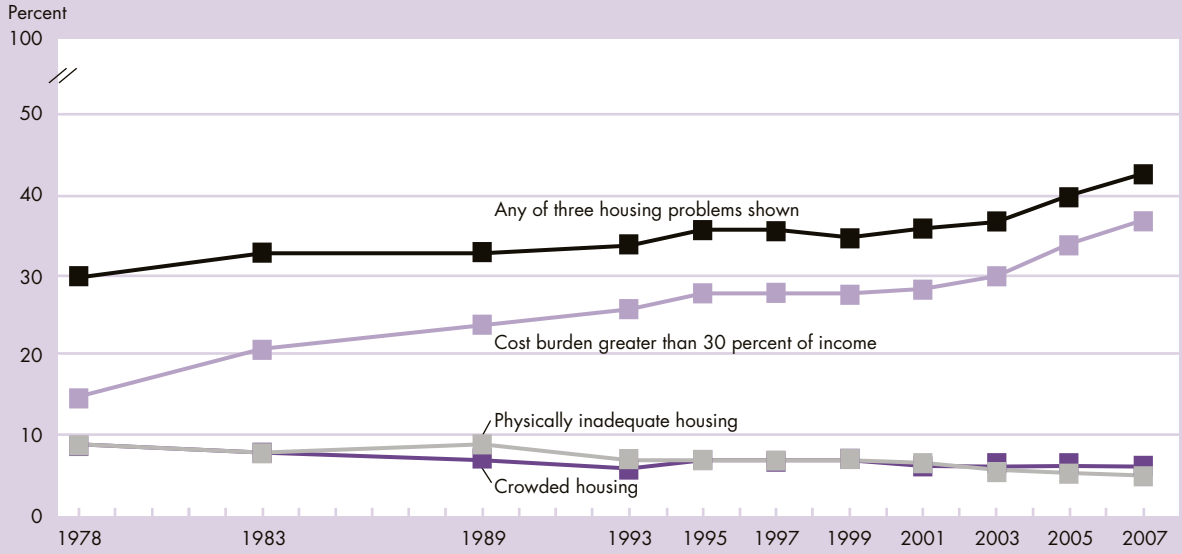
SOURCE: National Center for Health Statistics, National Health and Nutrition Examination Survey.

Housing Problems

Inadequate, crowded, or costly housing can pose serious problems to children's physical, psychological, and material well-being.[76] Housing cost burdens, especially at high levels, are a risk factor for negative child outcomes, including homelessness, overcrowding, poor nutrition, frequent moving, and lack of supervision while parents are at work.[77] The percentage of households with children that report that they are living in physically inadequate,[78] crowded, or costly housing provides an estimate of the percentage of children whose well-being may be affected by their family's housing.

Indicator PHY4

Percentage of households with children ages 0–17 that reported housing problems by type of problem, selected years 1978–2007



NOTE: Data are available for 1978, 1983, 1989, and biennially since 1993. All data are weighted using the decennial Census that preceded the date of their collection.

SOURCE: U.S. Census Bureau and U.S. Department of Housing and Urban Development, American Housing Survey. Tabulated by U.S. Department of Housing and Urban Development.

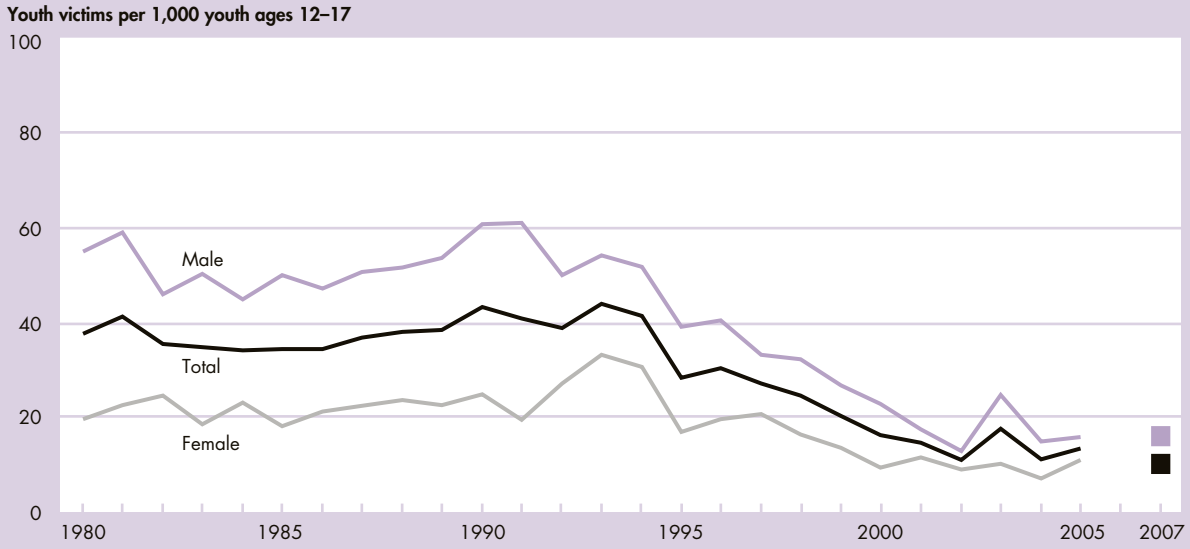
- In 2007, 43 percent of U.S. households (both owners and renters) with children had one or more of three housing problems: physically inadequate housing, crowded housing, or cost burden resulting from housing that costs more than 30 percent of household income.[79] In comparison, 40 percent of households with children had a housing problem in 2005. This percentage has increased over the long term from 30 percent in 1978.
- Physically inadequate housing, defined as housing with severe or moderate physical problems, continues to decrease. In 2007, 5 percent of households with children had physically inadequate housing, compared with 9 percent in 1978.
- Crowded housing, in which there is more than one person per room, remained stable at 6 percent of households with children in 2007, following reductions in crowded housing observed through 1993.
- Improvements in housing conditions, however, have been accompanied by rising housing costs. Between 1978 and 2007, the incidence of cost burdens among households with children more than doubled, from 15 percent to 37 percent. The proportion with severe cost burdens, paying more than half of their income for housing, rose from 6 percent to 16 percent over the same period.
- Households that receive no rental assistance and have severe cost burdens or physical problems are defined as having severe housing problems.[80] The percentage of households with children facing severe housing problems increased from 14 percent in 2005 to 15 percent in 2007.
- Severe housing problems are especially prevalent among very-low-income renters.[81] The incidence of severe problems among very-low-income renters with children changed from 36 percent to 35 percent between 2005 and 2007.

Bullets contain references to data that can be found in Table PHY4 on page 137. Endnotes begin on page 73.

Youth Victims of Serious Violent Crimes

Violence impacts the lives of young people who experience, witness, or feel threatened by it. In addition to the direct physical harm suffered by victims of serious violence, such violence can adversely affect young victims' mental health and development and increase the likelihood that they themselves will commit acts of serious violence.[82,83] Youth ages 12–17 were more than twice as likely as adults to be victims of serious violent crimes.[84]

Indicator PHY5 **Rate of serious violent crime victimization of youth ages 12–17 by gender, selected years 1980–2005 and 2007**



NOTE: Serious violent crimes include aggravated assault, rape, robbery (stealing by force or threat of violence), and homicide. Because of changes, data prior to 1992 are adjusted to make them comparable with data collected under the redesigned methodology. Data from 2006 are not included because, due to changes in methodology, 2006 crime victimization rates are not comparable to other years and cannot be used for yearly trend comparisons. See *Criminal Victimization, 2006,* http://www.ojp.usdoj.gov/bjs/abstract/cv06.htm. Reporting standards were not met for the 2007 estimate for females.

SOURCE: Bureau of Justice Statistics, National Crime Victimization Survey and Federal Bureau of Investigation, Uniform Crime Reporting Program, Supplementary Homicide Reports.

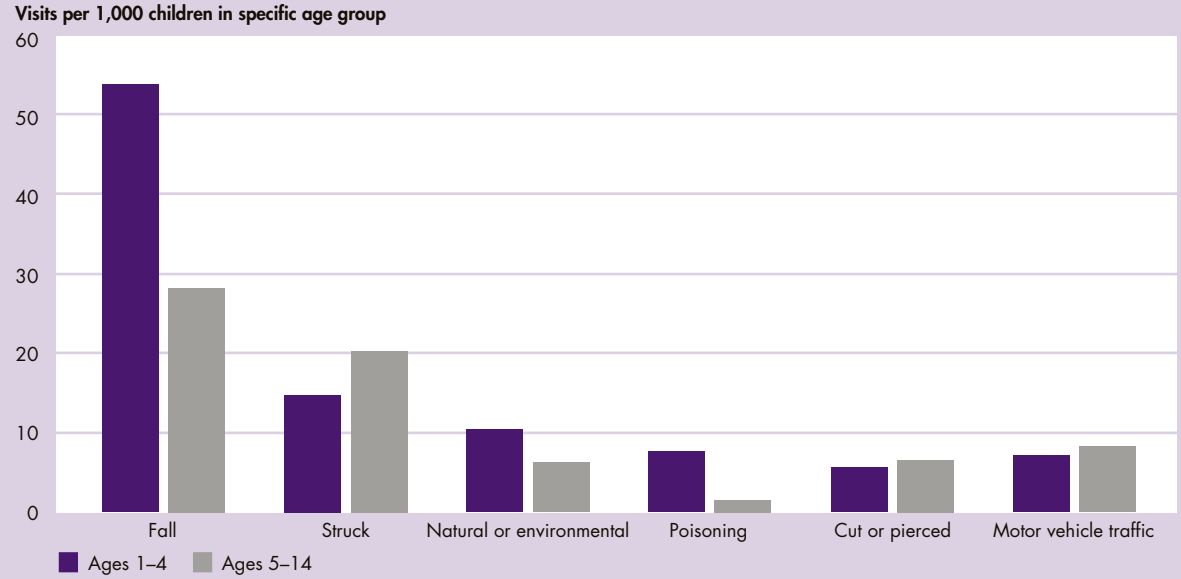
- In 2007, the rate at which youth were victims of serious violent crimes was 10 crimes per 1,000 youth ages 12–17. A total of 248,900 such crimes occurred in 2007.
- Serious violent crime involving youth victims stayed about the same in 2005 and 2007. However, rates are still significantly lower than their peak in 1993. In 1993, the serious violent crime victimization rate was 44 per 1,000 youth, compared to the 2007 rate of 10 per 1,000 youth.
- In 2007, White, non-Hispanic youth were as likely as Hispanic youth to be victims of a serious violent crime.
- Older youth (ages 15–17) were as likely to be victims of a serious violent crime as younger youth (ages 12–14) were in 2007.

Bullets contain references to data that can be found in Table PHY5 on page 138. Endnotes begin on page 73.

Child Injury and Mortality

Although injury death rates have declined over the past two decades, unintentional injuries remain the leading cause of death for children ages 1–4 and ages 5–14. In addition, nonfatal injuries continue to be important causes of child morbidity, disability, and reduced quality of life.[85] In 2000, the total lifetime costs (medical expenses and productivity losses) of injuries among children ages 0–14 were estimated to be over $50 billion.[86] For every fatal injury among children ages 1–14, there are 33 hospitalizations and 1,350 emergency department visits for injuries.[87] The leading causes of injury differ for children and adolescents (see PHY7.A).

Indicator PHY6.A **Emergency department visit rates for children ages 1–4 and 5–14 by leading causes of injury visits, 2005–2006**



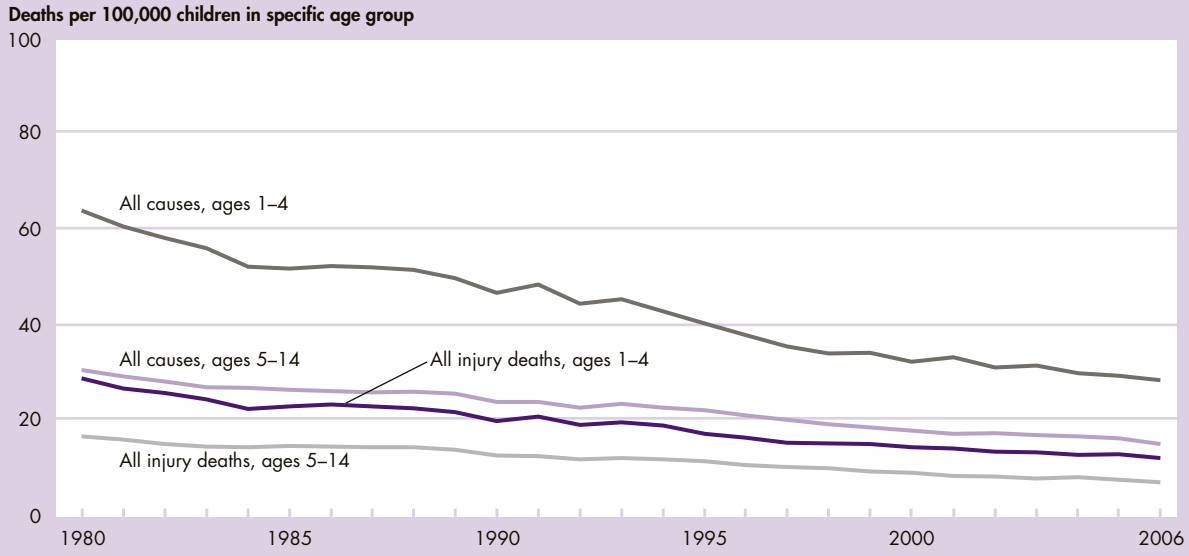
NOTE: Visits are the initial visit to the emergency department for the injury. Among causes of injury, "struck" denotes being struck by or against an object or person, "natural or environmental" denotes injuries caused by natural or environmental factors such as insect or animal bites, and "cut or pierced" denotes injuries caused by cutting or piercing from instruments or objects.

SOURCE: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey.

- Among children ages 1–14, falls and being struck by or against an object or person are the two leading causes of initial injury-related emergency department visits. In 2005–2006, there were 54 annual emergency department visits for falls per 1,000 children ages 1–4, whereas the rate was 28 visits per 1,000 children ages 5–14. Falls accounted for 38 percent of initial injury visits for children ages 1–4 and 27 percent of initial injury visits for children ages 5–14.[88]
- Younger children frequently strike furniture after running, tripping, or falling, whereas older children are often struck as a result of play or sports. Emergency department visit rates for being struck by or against an object or person were 15 emergency department visits per 1,000 for children ages 1–4 and 20 emergency department visits per 1,000 for children ages 5–14. Among children ages 1–4, 24 percent of the emergency department visits resulting from being struck by or against an object or person were related to striking furniture. Among children ages 5–14, 28 percent of the emergency department visits resulting from being struck by or against an object or person were sports related.[88]
- Emergency department visit rates for injuries caused by natural and environmental factors, poisonings, cutting or piercing from instruments or objects, and motor vehicle traffic crashes ranged between 6–10 visits per 1,000 children for children ages 1–4 and ranged between 2–8 visits per 1,000 children for children ages 5–14.
- Emergency department visit rates for poisoning were higher among children ages 1–4 (8 per 1,000) than among children ages 5–14 (2 per 1,000).
- For children ages 1–4 and 5–14, 2 percent of injury-related emergency department visits resulted in hospitalizations, although the percentage varied by cause.[88]

Indicator PHY6.B

Death rates among children ages 1–4 and 5–14 by all causes and all injury causes, 1980–2006

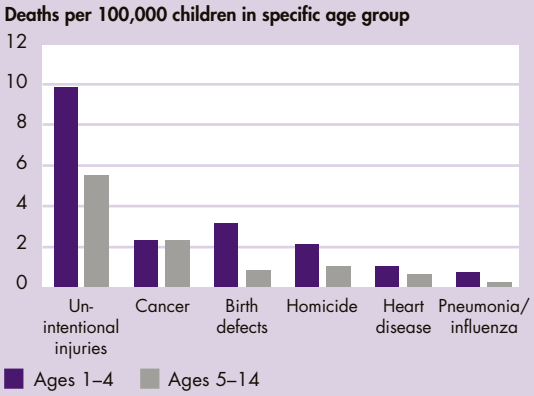


SOURCE: National Center for Health Statistics, National Vital Statistics System.

- In 2006, the death rate for children ages 1–4 was 28 per 100,000 children and for children ages 5–14 was 15 per 100,000 children. Between 1980 and 2006, the death rate declined by half or more for both age groups.
- Among both younger and older children, Black children had the highest death rates in 2006, at 43 per 100,000 children ages 1–4 and 21 per 100,000 children ages 5–14. Asian or Pacific Islander children had the lowest death rates.
- Among children ages 1–4 and 5–14, unintentional injuries (accidents) were the leading cause of death: 10 deaths per 100,000 children ages 1–4 and 6 deaths per 100,000 children ages 5–14. For children ages 1–4, the next most frequent causes of death were birth defects (3 per 100,000 children) and cancer and homicide (2 per 100,000 each). Among children ages 5–14, the next most frequent causes of death were cancer (2 per 100,000) and homicide and birth defects (1 per 100,000 children each).
- In 2006, the injury death rate was 12 per 100,000 for children ages 1–4 and 7 per 100,000 for children ages 5–14.
- Between 1980 and 2006, motor vehicle traffic and drowning death rates declined by one-half or more among children ages 1–4.
- Among children ages 10–14, homicide and suicide were the third and fourth leading causes of death (1.2 and 1.0 deaths per 100,000, respectively), after unintentional injuries and cancer.[89]

Indicator PHY6.C

Death rates among children ages 1–4 and 5–14 by cause of death, 2006



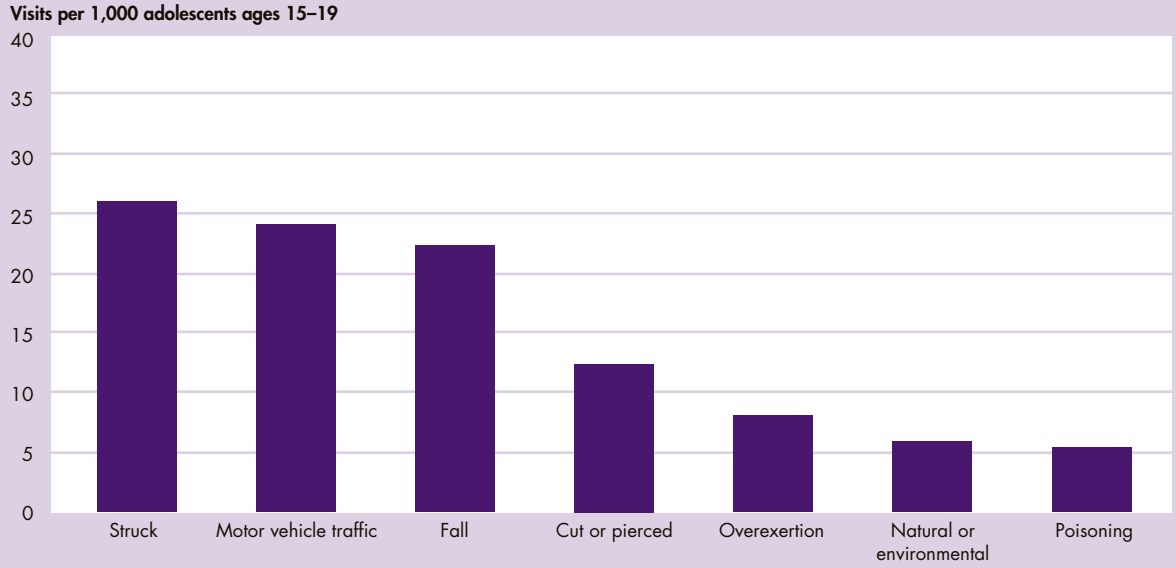
SOURCE: National Center for Health Statistics, National Vital Statistics System.

Bullets contain references to data that can be found in Tables PHY6.A–PHY6.B on pages 139–141. Endnotes begin on page 73.

Adolescent Injury and Mortality

Injury accounts for close to 80 percent of adolescent deaths. Compared with younger children, adolescents ages 15–19 have much higher mortality rates overall and from injuries. Adolescents are much more likely to die from injuries sustained from motor vehicle traffic crashes and firearms than are younger children.[90] The leading causes of nonfatal injuries in adolescents also differ from those in younger children. For example, the leading cause of adolescent nonfatal injury is being struck by or against an object or person, whereas for younger children, the leading cause of nonfatal injury is falls (see PHY6.A). In addition, nonfatal injuries for adolescents more often result from violence, sports-related activities, or motor vehicle traffic crashes. For each fatal injury among adolescents, there are 11 hospitalizations and nearly 300 emergency department visits for injuries.[87]

Indicator PHY7.A **Emergency department visit rates for adolescents ages 15–19 by leading causes of injury visits, 2005–2006**



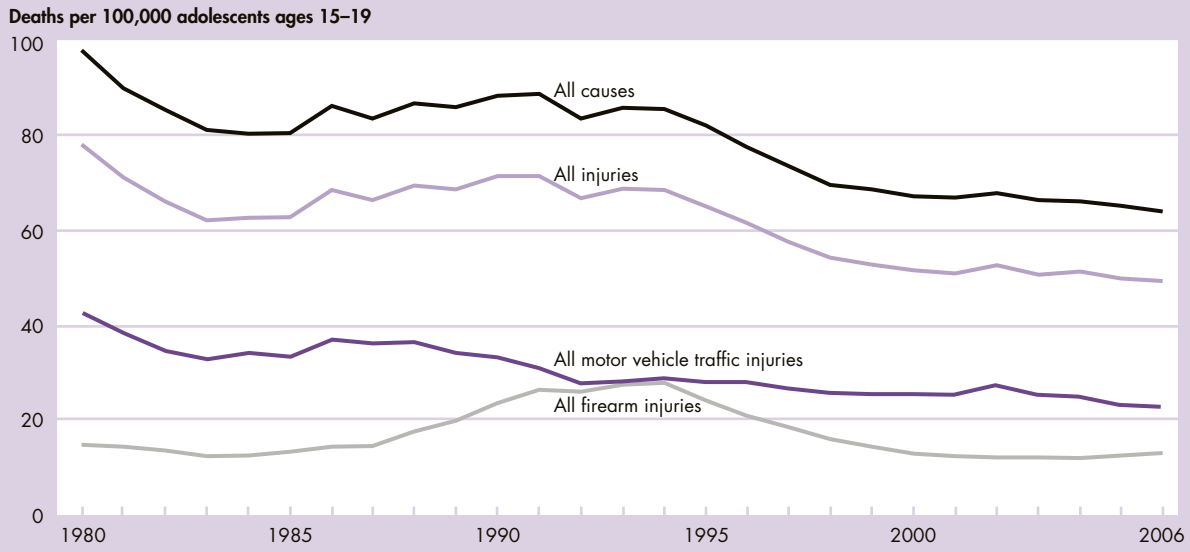
NOTE: Visits are the initial visit to the emergency department for the injury. Among causes of injury, "struck" denotes being struck by or against an object or person, "cut or pierced" denotes injuries caused by cutting or piercing from instruments or objects, "overexertion" denotes excessive physical exercise or strenuous movements in recreational or other activities, and "natural or environmental" denotes injuries caused by natural or environmental factors such as insect or animal bites.

SOURCE: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey.

- In 2005–2006, the leading causes of initial injury-related emergency department visits among adolescents ages 15–19 were being struck by or against an object or person (26 visits per 1,000), motor vehicle traffic crashes (24 visits per 1,000), and falls (22 visits per 1,000), altogether accounting for about half of all injury-related emergency department visits for this age group.
- Injury emergency department visits for adolescents being struck by or against an object or person were most often the result of a sports-related activity (33 percent) or an assault (26 percent).[88]
- Injuries caused by cutting or piercing from instruments or objects, overexertion from excessive physical exercise or strenuous movements in recreational or other activities, natural or environmental factors, and poisonings were also among the leading causes of injury-related emergency department visits among adolescents ages 15–19, ranging from 5–12 visits per 1,000 adolescents.
- For adolescents ages 15–19, 3 percent of injury-related emergency department visits resulted in hospitalizations.[88]

Indicator PHY7.B

Death rates among adolescents ages 15–19 by all causes and all injury causes and selected mechanisms of injury, 1980–2006



SOURCE: National Center for Health Statistics, National Vital Statistics System.

- In 2006, the death rate for adolescents ages 15–19 was 64 per 100,000. Nearly 80 percent of adolescent deaths occurred from injuries (50 per 100,000). Both the total and injury death rates have declined substantially since 1980, despite a period of increase from 1986 to 1991.
- Motor vehicle traffic and firearm injuries accounted for 71 percent of adolescent injury deaths in 2006. The motor vehicle traffic death rate declined since 1980. The firearm death rate was steady from 1980 to 1987, increased from 1987 to 1994, and declined by more than half since 1994. In 2006, the firearm death rate was 13 per 100,000 adolescents, an increase from 2005.
- Injury deaths can also be reported by intent. Unintentional injury accounts for more than 60 percent of all injury deaths among adolescents. In 2006, this rate was 31 deaths per 100,000 adolescents ages 15–19, unchanged from 2005.
- For intentional injuries, there were 11 homicides per 100,000 adolescents ages 15–19 in 2006, an increase from 2005. In 2006, there were 9 firearm homicides per 100,000, an increase from 2005. There were 7 suicide deaths per 100,000 adolescents ages 15–19 in 2006, unchanged from 2005.

Bullets contain references to data that can be found in Tables PHY7.A and PHY7.B on pages 142–145. Endnotes begin on page 73.

Indicators Needed

Physical Environment and Safety

A broader set of indicators than those presented in this section is needed to fully understand and monitor children's physical environment and safety. Additional indicators are needed on:

- *Body burden measurements.* Children are exposed to many different contaminants in the environment. Measures of contaminants in air, water, land and food provide indirect indications of children's potential exposure to these contaminants. Both environmental and body burden measurements (i.e., levels of contaminants in blood and urine) are needed to characterize children's exposures. Increasing efforts are under way to assess exposures through body burden measurements and to develop children's indicators based on these measurements.
- *Environmental quality.* Although this report provides indicators for contaminants in both outdoor and indoor air, regular sources of national data are needed to assess indoor air contaminants other than environmental tobacco smoke (e.g., pesticides) that are commonly encountered in homes, schools, and day care settings. Data are needed to more thoroughly characterize children's potential exposure to drinking water contaminants. Indicators are also needed for food and soil contaminants and for cumulative exposures to multiple environmental contaminants that children encounter daily.
- *Exposure to violence.* Although this report provides indicators for direct crime victimization, child maltreatment, and child and adolescent injury and mortality, regular sources of national data are needed to assess children's exposure to violence, including witnessing violence in the home, school, and community. Research suggests that witnessing violence can have detrimental effects similar to being a direct victim of violence. Additional work is needed to develop a national indicator for exposure to violence.