safety standards for them. Knowing the shape of a dose-response curve is crucial if one is using it to predict responses at doses below those that have been tested. Because so many novel synthetic chemicals exist in very low concentrations over wide areas, many scientists suspect that we may have underestimated the dangers of compounds that exert impacts at low concentrations.

Scientists first noted endocrine-disrupting effects decades ago, but the idea that synthetic chemicals might be altering the hormones of animals was not widely appreciated until the 1996 publication of the book *Our Stolen Future*, by Theo Colburn, Dianne Dumanoski, and J.P. Myers. Like *Silent Spring*, this book integrated scientific work from various fields and presented a unified view of the hazards posed by endocrine-disrupting chemicals.

Today, thousands of studies have linked hundreds of substances to effects on reproduction, development, immune function, brain and nervous system function, and other hormone-driven processes. Evidence is strongest so far in nonhuman animals, but many studies suggest impacts on humans. Some researchers argue that the sharp rise in breast cancer rates (one in eight U.S. women today develops breast cancer) may be due to hormone disruption, because an excess of estrogen appears to feed tumor development in older women. Other scientists attribute male reproductive problems to elevated BPA exposure. For example, studies found that workers in Chinese factories that manufactured BPA had elevated rates of erectile dysfunction and reduced sperm counts when compared to workers in factories manufacturing other products.

Much of the research into hormone disruption has brought about strident debate. This is partly because scientific uncertainty is inherent in any developing field. Another reason is that negative findings about chemicals pose an economic threat to the manufacturers of those chemicals, who stand to lose many millions of dollars in revenue if their products were to be banned or restricted in the United States.

Risk Assessment and Risk Management

Policy decisions on whether to ban chemicals or restrict their use generally follow years of rigorous testing for toxicity. Likewise, strategies for combating disease and other health threats are based on extensive scientific research. However, policy and management decisions also incorporate economics and ethics—and all too often the decision-making process is heavily influenced by pressure from powerful corporate and political interests. The steps between the collection and interpretation of scientific data and the formulation of policy involve assessing and managing risk.

We express risk in terms of probability

Exposure to an environmental health threat does not invariably produce a given consequence. Rather, it causes some probability of harm, a statistical chance that damage will result. To understand a health threat, a scientist must know more than just its identity and strength. He or she must also know the chance that one will encounter it, the frequency with which one may encounter it, the amount of substance or degree of threat to which one is exposed, and one's sensitivity to the threat. Such factors help determine the overall risk posed.

Risk can be measured in terms of *probability*, a quantitative description of the likelihood of a certain outcome. The probability that some harmful outcome (for instance, injury, death, environmental damage, or economic loss) will result from a given action, event, or substance expresses the overall risk posed by a particular threat.

Our perception of risk may not match reality

Every action we take and every decision we make involves some element of **risk,** some (generally small) probability that things will go wrong. We typically try to behave in ways that minimize risk, but our perceptions of risk do not always match statistical reality (**FIGURE 10.10**). People often worry unduly about small risks yet readily engage in activities that pose higher risks. For instance, most of us perceive flying in an airplane as a riskier activity than driving a car, but, statistically speaking, plane travel is much safer. Psychologists argue that this disconnect occurs because we feel more at risk when we are not controlling a situation and safer when we are "at the wheel"—regardless of the actual risk involved.

This psychology may help account for people's anxiety over exposure to bisphenol A, nuclear power, toxic waste, and

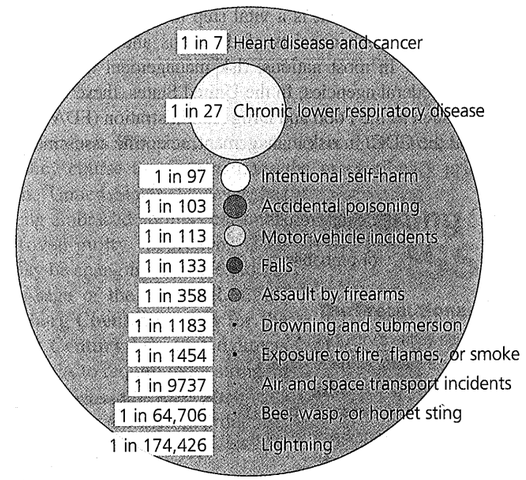

FIGURE 10.10 Our perceptions of risk do not always match the reality of risk. Listed here are several leading causes of death in the United States, along with a measure of the risk each poses. The larger the area of the circle in the figure, the greater the risk of dying from that cause. *Data are for 2013, from* Injury Facts, 2016. *Itasca, IL: National Safety Council.*

DATA People tend to view car travel as being safer than airplane travel, but a person is how many times more likely to die from a car accident than from an airplane crash?

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