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Savannah River Ecology Laboratory
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6. What is Risk?

Concepts

- Risk is a probability – that can be mitigated or increased based on choices and behaviors.
- Risk is all around us – and we make choices about those risks.
- Scientists and policymakers study perceived hazards to make decisions about regulations to reduce perceived hazards.

Skills: critical thinking, decision-making, observation

Materials

- Poster board and markers
- handouts

Time Consideration: Preparation 10-15 minutes, one 40-minute period

Objectives

- Participants will assess personal vs. societal risks.

Key terms: risk, risk assessment, personal risk, societal risk

Preparation

In this lesson, the activities are interspersed with the background information. The activities can be shortened or lengthened

Lesson & Activities

Whether or not you realize it, we are constantly evaluating and making decisions about risk in our lives. There are two different types of risks that we can evaluate, personal risk and societal risk. Personal risks are those that an individual can be exposed to on a daily basis, like driving a vehicle, drinking alcohol, and eating specific foods. Societal risks pertain to those risks that affect large groups of people, communities, and nations, such as levels of risk associated with how much of a contaminant an industry can emit, how we educate our children, and what businesses are permitted in our communities.

To evaluate risks from potential hazards, as an individual or as a society, we perform risk assessments. The probability, or chance, of a potential hazard resulting in a particular outcome is what we attempt to predict in a risk assessment. For example, a risk assessment of the potential harm that can come to human health as a result of interacting with a particular chemical is designed to provide us with the probability that the chemical will harm us given varying levels of ingestion, inhalation, or physical contact with the chemical. Scientists use both quantitative data and qualitative data in risk assessments. Personal risk is often evaluated based on qualitative information based on our own past experiences, such as the risk of being stung if we catch a wasp in our hand or the risk of being bitten if we pet an unfamiliar dog. . Because we often use qualitative information to assess personal risk, our values can often influence how we manage the risks that we encounter. For example, choosing to ride a bike versus driving a vehicle to work because of concern over climate change can increase the risk of our being hit by a vehicle on the road in exchange for a reduced risk of polluting the environment.

Alternatively, Experts typically use scientific data and often design studies specifically to evaluate risks, making efforts to reduce bias or to remove the effect of personal values. For instance, a recent study evaluated how experts and the public viewed the risk of chemicals and found that the public viewed chemicals as harmful or safe regardless of the dose or exposure to the chemical, while experts typically took into account these factors before making conclusions about the risk of the chemical(1).

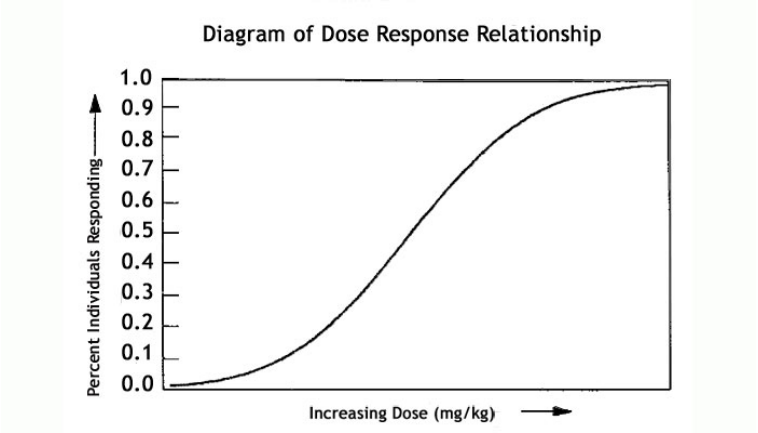
Our perception of risk reflects the attitude we have towards particular hazards and what we, personally and as a society, perceive as acceptable. Unfortunately, because risk is often assessed based on our perception and values rather than on scientific fact, information conveyed by the mass media often plays a huge role in setting the agenda of which risks are evaluated, both by the public and by policymakers. Interactions with family and friend can also play a significant role in our perception of specific risks due to the value we place on the information received from these sources. These two factors, mass media and family/social groups can sometimes increase of decrease our perception of risk, even when scientific evidence may suggest a different perception would be more appropriate. Misperceptions of risk often result from a variety of factors including: lack of knowledge of the existing or available data, emotionalism or bias associated with particular risks, distortions or misconceptions conveyed by mass media, or simply uncertainty. It is important to avoid these types of misperceptions because they can result in our expending critical time and resources into the reduction and mitigation (2) of small risks rather than larger, more serious risks.

Our next activity will be the Perceived Risk worksheet. We're each going to rank each of 29 perceived hazards, from 1-29, where 1 is the riskiest hazard or hazardous behavior. Then we'll compare our individual lists to the list created by three different audiences: League of Women Votes, college students, and experts (Handout 1).

Now that we have a better appreciation for how the perception of risk can differ among different groups of people, we will turn our attention to how experts evaluate risk. **Risk assessment is the process of evaluating and predicting the likelihood and extent of harm from a particular action**. a risk assessment is usually performed to inform the policy decision-making process and often is the factual basis used to develop governmental regulatons which attempt to mitigate risks to the general population. Risk assessments involve extensive reviews of current knowledge on the particular hazard or hazards being evaluated, and can be quite complex. To perform a risk assessment, researchers often use a fault tree analysis, toxicity testing, and epidemiological studies. Fault tree analysis is typically constructed after an event occurs; it is built to understand better a system and where a problem occurred. These types of analyses are a reaction and solution after a problem occurs to prevent accidents or problems in the future. There are two main tools in a toxicity test, a dose-response curve and data extrapolation from wildlife to humans. These types of risk assessments are common in the EPA testing phases to determine the limits of exposure for humans to different types of element and chemical and radiological contaminants. Epidemiology studies measure the effects of disease on populations and these risk assessments are done to determine how to prevent the spread of disease in the future (like washing your hands).

Today, we will understand what risk is and how it is measured in our daily lives.

Example of a dose-response curve:



In our last activity, we will look closer at toxicity and epidemiological studies because these types of studies often utilize environmental monitoring data and are involved in the development of human risk assessments. In this activity, we will evaluate a dose-response curve for a food additive, saccharin, and learn how scientific data were used to determine that saccharin can cause negative health effects (Handout 2).

Resources

This lesson was adapted from multiple lessons in the Project Learning Tree book, Exploring Environmental Issues: Focus on Risk (1998).

1. Krause, Malmfors, and Slovic 1992 B
2. Flynn, Slovic, and Mertz 1996 C

Disclaimer

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Definitions

Risk – the probability, or likelihood, that a harmful consequence will occur as a result of exposure to a hazard.

Risk Assessment – the process through which one attempts to evaluate and predict the likelihood and extent of harm that may result from a health or safety hazard

Personal Risk - often evaluated based on past experiences and qualitative information

Societal Risk – the relative risk to a large group, community, or society

Qualitative – relating to, measuring, or measured the quality of something rather than its quantity

Quantitative – relating to, measuring or measured by the quantity of something rather than its quality

Probability – the extent to which something is probable; the likelihood of something happening or being the case

Values – the relative worth an individual places on something

Handout 1

What is the Perceived Risk?

Rank these activities from 1-30 from riskiest (1) to least risky (30). We'll discuss how three other groups evaluated these risks compared to how we evaluated them.

Activity or Technology	Rank
Alcoholic beverages	
Bicycles	
Commercial aviation (flying in an airplane)	
Contraceptives (birth control)	
Electric power (non-nuclear)	
Firefighting	
Food coloring	
Food preservatives	
General aviation (flying an airplane)	
Handguns	
High School/College Football	
Home appliances	
Hunting	
Large construction	
Motor vehicles	
Motorcycles	
Mountain climbing	
Nuclear power	
Pesticides	
Police work	
Power Mowers	
Prescription antibiotics	
Railroads	
Skiing	
Smoking	
Spray cans	
Surgery	
Swimming	
Vaccinations	
X-rays	

Handout 2

A Second Look at Saccharin

- In the 1970s, research was conducted on rats to study the carcinogenic effects of saccharin consumption.
- In 1977, results indicated that out of 200 rats that were fed saccharin, 17 developed bladder tumors. This group was compared to 100 control animals who were not fed saccharin, 2 of which developed tumors.
- The research performed on rats involved feeding the animals high doses of saccharin, equal to approximately 5 percent of their body weight.
- As a result of consumer demand for saccharin, in 1977 Congress passed a law prohibiting the FDA from banning the product. However, any product containing saccharin was (and still is) required to carry a warning label.
- In 1981, saccharin was added to the government's list of suspected carcinogens.
- Scientists have continued to study saccharin, attempting to discover how it produces tumors in male rats. In general, results from toxicity tests indicate that it is a combination of the high doses fed to the animals and the acidic nature of rat urine that results in cancerous tumors. The factors that seem to cause the development of tumors in rats are not thought to occur in humans.
- Also, a 23-year study conducted on monkeys found that saccharin consumption does not have a cancer-causing effect on the primates.
- Some scientists have argued that it is still too early to consider removing saccharin from the list of suspected carcinogens. They cite epidemiological studies conducted in the early 1980s that pointed to an increase of cancer among some subgroups of artificial sweetener users.

In the end, the question is still, should the National Institutes of Health take saccharin off of the government's list of suspected carcinogens?

What do you think? Will you continue to use an artificial sweetener?

McGinley, Laurie. "How Sweet It Is," The Wall Street Journal, 29 October 1997
Stolberg, Sheryl G. "Expert Panel Rebuffs Bid to Absolved Saccharin," New York Times, 1 November 1997