

Lecture 1: Introduction to Public Health Risk Assessment

- ✚ **Goals for the lecture**
- ✚ **What is the public Health Risk Assessment and Why we need it?**
- ✚ **The Risk Assessment Process, methods and resources**
 - **Hazards Identification**
 - **Dose- response relationship**
 - **Exposure Assessment**
 - **Risk Characterization**

1. Risk

A very typical starting point to define risk is the realization that there is a certain amount of risk in almost everything we do since we all eventually die someday. In other words, the chances that we die are 1.0 or 100 percent. One approach to talk about risk is to gather data on all causes of deaths. For example, in the United States in 1992 there were 521 thousand deaths because of cancer from a total of 2.177 million deaths from all causes. This means that the risk for an individual to die of cancer then was 0.24 or 24 percent. Presenting risks as probabilities that one could die from is a much more specific way to express risks rather than looking at the population as a whole; however, a scientist or an engineer perception of this numerical representation who is familiar with numbers differs from an individual who lives next to a source of pollution.

Environmental risk assessment that deals with reproductive health problems is concerned with the incremental probabilities of some damage or disruption occurring to reproductive organs or processes.

2. Risk Assessment

One of the goals of risk assessment is reduce the incremental risk and the cost of controlling it an acceptable level. Thus, it is concerned with the probabilities that certain population or a group of individuals exposure to one or a number of chemicals triggers a response or causes a damage such as cancer, reproductive failure, neurological damage, developmental problem or birth defects. The National Academy of Science was the first to break down risk assessment to its four steps: hazard identification, dose-response assessment, exposure assessment and risk characterization.

A human health risk assessment is the process to estimate the nature and probability of adverse health effects in humans who may be exposed to chemicals in contaminated environmental media, now or in the future.

3. A human health risk assessment addresses questions such as:

- What types of health problems may be caused by environmental stressors such as chemicals and radiation?
- What is the chance that people will experience health problems when exposed to different levels of environmental stressors?
- Is there a level below which some chemicals don't pose a human health risk?

- What environmental stressors are people exposed to and at what levels and for how long?
- Are some people more likely to be susceptible to environmental stressors because of factors such as age, genetics, pre-existing health conditions, ethnic practices, gender, etc.?
- Are some people more likely to be exposed to environmental stressors because of factors such as where they work, where they play, what they like to eat, etc.?

The answers to these types of questions helps decision makers, whether they are parents or public officials, understand the possible human health risks from environmental media.

1. Health risk assessment steps:

- **Planning and scoping:**

EPA begins the process of a human health risk assessment with planning and research.

- **Step 1: Hazard identification:**

Examines whether a stressor has the potential to cause harm to humans and/or ecological systems, and if so, under what circumstances.

- **Step 2: Dose-response assessment:**

Examines the numerical relationship between exposure and effects.

- **Step 3: Exposure assessment:**

Examines what is known about the frequency, timing, and levels of contact with a stressor.

- **Step 4: Risk characterization:**

This is the last step of risk assessment which is the integration of the previous three steps, which results in an estimate of the magnitude of the public health problem. While it seems more convenient to simply estimate individual exposure and multiply that by the number of people exposed to get a single number that represents the risk a certain population is facing, it important to understand that these risk estimates will be used by policy and decision makers who will need to weigh these evidence against other various social costs. Both parties (risk assessors and policy makers) need to accept the fact that some if not most of these estimates are overemphasized for the sake of safety. Nevertheless, it must be emphasized that these estimates are no constants and extremely uncertain. In order to do so, The National Academy of Sciences proposed a few questions that should be answered in any risk characterization process. Some of these questions are: