
Chapter 5

Health Effects Assessment

Learning objectives

- Understand the spectrum of potential adverse environmental health effects in terms of type, severity, timing of onset and duration.
- Be able to develop a case definition and symptom questionnaire.
- Understand the strengths and weaknesses of various data sources for health outcomes including vital records, survey data, hospital records, and registry data.
- Understand typical environmental health effects in key organ systems and be aware of sources of information on health effects of specific exposures.

5.1 Concepts of health effects measurement

All organs and systems of the body can be affected adversely by exposures to environmental hazards. Adverse effects range from subtle physiological and biochemical changes that may be asymptomatic, to individual perceptions or symptoms of illness, to clinically diagnosed disease, and finally, to death. In general, toxic agents have specific molecular and cellular components which they target – so that many toxic agents cause specific effects in particular target organs while other agents impact on multiple tissues and organs of the body.

Toxicity is the capacity of a toxic agent to produce injury in an organism. Severity of toxicity depends on the route and magnitude of exposure and on the dose received by the target organ system. The extent and pattern of injury at a given dose is modified by route of absorption and, in the case of chemicals, by the distribution and metabolism in the organism, and the rate of excretion. The severity of toxicity is also affected by the extent to which the organism is susceptible to the hazard. Consequently, even with a similar dose, toxic effects can vary between humans and other organisms, among human sub-populations such as adults compared to children, and among individuals within the same sub-population.

Lead is an example of an environmental hazard that produces a wide range of adverse outcomes at different doses, including both clinical and subclinical toxicity, and produces different effects at different concentrations in children compared to adults (ATSDR, 1997; Fischbein, 1998). (See Figure 5.1.) **Subclinical toxicity** refers to harmful health effects that may have been caused by an environmental exposure to a toxic agent but are not clinically recognizable. Encephalopathy, anaemia, wrist drop and renal failure are among the clinically obvious manifestations observable at the upper end of the range of toxicity. Slowed nerve conduction, impaired biosynthesis of haem, and altered excretion of uric acid are some subclinical effects. It is important to note that these subclinical changes represent adverse reactions to lead and are not merely physiological adjustments to its presence.