CHILDREN AND CHEMICALS

TRAINING FOR HEALTH CARE PROVIDERS
SECOND EDITION

World Health Organization

Children's Health and the Environment
WHO Training Package for the Health Sector
World Health Organization
www.who.int/ceh

WHO/CED/PHE/EPE/19.12.15

Notes:

• Please add details of the date, time, place and sponsorship of the meeting for which you are using this presentation in the space indicated.

• This is a large set of slides from which the presenter should select the most relevant ones to use in a specific presentation. These slides cover many facets of the problem. Present only those slides that apply most directly to the local situation in the region.
This presentation deals with children and chemicals – a topic of great concern for parents and communities, and also for policy-makers, that has been the subject of a number of international recommendations.

This module is also an introduction to other more detailed modules on chemicals, e.g. lead, mercury and pesticides. Health care providers can play a key role in reducing children’s exposures to chemicals.

Learning objectives

• Learn about chemical hazards – what they are and the risks they may pose to children
• Identify the scenarios – how, where and when are children exposed?
• Learn about diseases caused by acute and chronic toxic exposures in children
• Know how to assess, prevent and manage children’s toxic exposures
Note:
When selecting the slides to include in your presentation, please choose only those of relevance to the region and/or interests of your audience.

Image:
• © WHO / SEARO / Sanjit Das
Outline

• Sources of exposure
• Toxicology
• Exposures
• Health effects
• Treatment
• Prevention

Image:
• © WHO / SEARO / Sanjit Das
At the global level, WHO has identified main environmental threats to children's health. All of these threats have either a strong chemical component or are related to the use of chemicals.

These threats are as follows:

- **Chemical hazards.** Exposure to both the "old" and "new" chemicals, of anthropogenic and natural origin, in consumer products or materials that are present in the places where children spend time, can be dangerous.

- **Household and ambient air pollution.** Particulate matter and gases such as ozone, sulfur dioxide, nitric oxides, polycyclic aromatic hydrocarbons and carbon monoxide, are some of the typical air contaminants, byproducts of the polluting fuels combustion, whose effects on children's morbidity and mortality have been clearly demonstrated.

- **Tobacco smoke** is very rich in particles and polycyclic aromatic hydrocarbons.

- **Water.** Although in developing countries the main concern is microbiological contamination, a number of chemical water pollutants have a tremendous impact on public health, namely: arsenic, lead, fluoride and pesticides.

- **Sanitation and hygiene.** Lack of both safely managed sanitation and hygiene hinders the maintenance of clean environments – the washing, cleaning and removal of chemicals, dirt and pollutants.

- **E-waste** and other dangerous industrial or agricultural residues may be responsible for an increasing number of contaminated urban and rural sites. Landfills can accumulate dangerous metals and persistent pollutants.

References:


Figure:

Chemicals are used in everyday life — they bring in numerous benefits, such as protecting human and animal health, promoting hygiene, protecting crops and controlling vectors of disease. However, chemicals may also pose risks to human and animal health. Exposures to chemicals in the micro- and macro-environments of children may cause functional and organic damage, especially during periods of vulnerability. Many become unwanted pollutants and some of these are persistent in the environment.

References:
Children may be exposed to chemicals through different media such as air, water, food or soil dust. Exposures can happen during transport, use and disposal, or due to combustion or other process. Different chemicals of exposure include:

- naturally occurring metals, vegetal and animal toxins
- manufactured products, e.g. hydrocarbons, pesticides, pharmaceuticals, cleaning products, and
- waste, combustion and other byproducts.

This complex diagram shows how chemical exposures may be addressed by different prevention policies and programs. These programs are the key to promoting healthy environments for children and preventing chemical exposures.

Anthropogenic sources are those of human origin. These include the pollution of the environment due to industry, traffic and pesticides. Some chemicals are naturally present in the environment, but they can also cause adverse effects in humans. Natural chemicals can also be augmented by human activity, like mercury from mining or nitrogen and fertilizer. Examples of natural chemicals:

- Arsenic in water causing arsenicosis
- Fluoride in water causing fluorosis
- Fluoride in the air produced from the burning of fluoride-rich coal
- Blue-green algae toxins in recreational waters
- Aflatoxins in food, such as maize or other stored grains
- Cyanogenic or cardiac glycosides in some foodstuff, e.g. cassava, foxglove, oleander
- Envenomations due to bites and stings

References:


Figure:

Note to user: For each source of exposure, give examples that are pertinent to the area and/or your personal experience on the subject.

**Air:** It is important to differentiate between indoor and outdoor pollutants. Indoor pollutants include particulate matter, gases, vapours as well as biological material and fibres. These contaminants are produced by tobacco smoke, stoves and construction materials. Pesticides and other chemicals for household use are present in the home. Outdoor pollutants vary according to density of traffic, extent of industrialization, time (of the year and of the day) and climate. The six main outdoor pollutants are: ozone ($O_3$), particulate matter ($PM_{10}$ and $PM_{2.5}$), lead, sulfur dioxide ($SO_2$), carbon monoxide ($CO$) and nitrogen oxide ($NO_2$).

**Water:** Used for drinking, cooking, preparation of infant formula, bathing and swimming. Groundwater or surface water may be contaminated by point sources of pollution, e.g. industrial discharge, or non-point sources such as agricultural and rural run-off, soil contamination and atmospheric deposition. Some contaminants of concern are: arsenic, chromium, lead, mercury, nitrates, benzenes, pesticides, polychlorinated biphenyls (PCBs) and disinfectants such as chloramine and chlorine.

**Food:** Food may have a large range of contaminants, from additives, such as colourings, flavourings and preservatives, to pesticides, as residues or as contaminants, and mycotoxins, and other natural toxins in doses high enough to produce toxic effects, including some shellfish and fish toxins. Mercury and PCBs can contaminate fish, and mycotoxins can contaminate grains. Special attention should be paid to the diet of infants, children and adolescents in order to assess potential exposure to toxicants.

**Soil and Dust:** Children may be exposed to soil contaminants by different pathways. Inhalation of dust steamed from contaminated soil and soil and dust ingestion. Soil may be the source of exposure particularly to persistent contaminants like metals and persistent organic pollutants (POPs). Dust may contains many other chemicals such as pesticides, plasticizers, flame retardants, polycyclic aromatic hydrocarbons (PAHs), etc. Hand-to-mouth behaviour and living zone closer to the ground put children at greater risk compared to adults. The upper percentile of soil and dust ingestion for children under 6 years of age is 200 mg/day.

**Building materials:** Bisphenol A in plastics, lead in paints, asbestos in construction materials

**Consumer products:** Toys, baby cots and other materials that come into close contact with children may have toxic components or contaminants, such as leaded paint used on wooden toys. In the medical domain, there is concern
about the presence of phthalates in tubes and in catheters, as well as in pacifiers. These products may also be found in toys. A number of products applied to children may contain chemicals with toxic effects, e.g. talcum powder and body lotions.

References:
Chemical substances provide important functionality in a wide range of products. Many chemicals can be used with a high degree of safety when best practices are followed. However, the use of toxic chemicals in articles is a growing concern for public health and the environment.

Children may be exposed in different parts of product lifecycle: during manufacturing, use or manipulation, discharge.

These images show common chemicals that may be present in homes, schools or open places.

Some of them are natural toxins from plants, venomous animals or marine food. These include bites and stings: envenoming by snakes, scorpions, spiders, bees. Other natural toxicants may be present naturally in the soil or water, such as fluoride, arsenic, asbestos.

**Consumer products and materials:**
Chemical products may be dangerous for children, such as:
- Pharmaceuticals: sedatives, analgesics, contraceptives, syrups, contaminants
- Household products: bleaches, cleaners, detergents, solvents, kerosene (paraffin)
- Cosmetics: perfumes, shampoo, nail products
- Plants and mushrooms: berries, seeds, leaves
- Drugs of abuse: alcohol, illicit drugs of abuse, tobacco
- Pesticides: insecticides, rodenticides, herbicides
- Carbon monoxide from indoor combustion

Other materials may contain toxicants that remain from manufacturing.
- **Toys** and children’s jewellery can contain lead in the form of lead paint and metal clasps, chains or charms. Lead is also used in crayons, as a stabilizer in some toys. Lead may leach out of these products when they are used by children and when discarded. See **Lead** module.
- **Electronic products and batteries:** Many toxic materials are found in personal computers, including lead, cadmium, mercury, beryllium, antimony, brominated flame retardants, perfluorinated compounds, and polyvinyl chloride plastic. Improper recycling can contaminate environment resulting in chronic exposure and poisonings in surrounding areas.
- **Textiles:** Perfluorinated compounds (PFCs) are commonly used as stain- and water-repellents in textile surfaces and are applied during the production of all-weather clothing and other textiles such as tents and tablecloths.
Unbound PFC chemicals on treated textiles may be released during wear, washing and disposal.

- **Furniture:** The use of fungicides and new semi-synthetic materials in furniture can cause skin irritation and allergenic effects.

**References:**


**Images:**

In 2010 IPCS/WHO presented specific reports for decision makers about the 10 chemicals or groups of chemicals that were prioritized according to public health concern based on an expert survey. New evidence may add more chemicals that have been associated with noncommunicable disease as other POPs apart from dioxins or PAHs.

**Note:** For more detail, refer to modules on *lead, mercury, pesticides, other metals, POPs, household air pollution* and *ambient air pollution*.

**References:**

**Figure:**
Children are more vulnerable to exposure and effects of chemicals

Note: Refer to modules *Children are not little adults* and *Why children* for more information.

References:


Outline

• Sources of exposure
• Toxicology
• Exposures
• Health effects
• Treatment
• Prevention

Image:
• © WHO / SEARO / Sanjit Das
The capacity of a substance to produce injury is affected by many factors, including its absorption, distribution, site of action or detoxification, excretion and site of action.

**References:**

Children have a dynamic physiology that is turned up to high because of growth demands. Children are in an anabolic state and require larger amounts of energy, water, oxygen and nutrients than do adults. Absorption is different and frequently increased in children because they are anabolic and active. They are geared to absorb nutrients very efficiently. For example, lead follows calcium, which is essential for skeletal and cellular growth. A child will absorb between 40% and 50% of a given ingested dose of lead, whereas a non-pregnant adult will absorb between 3% and 10%. Nutritional deficiencies, particularly anaemia, which is common in rapidly growing children, will increase lead absorption.

Some chemicals are dangerous when ingested and must be detoxified by metabolism. Others are not immediately dangerous upon ingestion but may become dangerous when metabolized, e.g. paracetamol overdose or methyl alcohol. Either way, these processes are likely to be different in children, but unfortunately not in predictable ways. Particularly during fetal growth and in the first 6 to 12 months of life, important metabolic pathways such as cytochrome P450 systems and glutathione conjugation are significantly reduced in efficiency. Most known toxicants are detoxified in the body, so the immaturity of these systems in children increases the duration and amount of any given internal dose.

Distribution is different in children from that in adults and varies with age. For example, the blood–brain barrier differs in the developing brain versus the adult brain, so substances such as lead readily cross into the developing central nervous system.

The lifetime of the chemical in the blood or other tissues may vary from hours (hydrocarbon solvents), to days or weeks (some pesticides) to months or years (lead and POPs).

Elimination may be decreased in early postnatal life. For example the glomerular filtration rate of newborns is substantially less than that of adults, and premature infants will experience even lower rates.

**References:**
Toxicodynamics refers to the process of interaction between a substance and the organs or systems in the body, resulting in effects. It is equivalent to the mechanism of action, toxicity or toxic effects.

Effects may impact:

- **Critical windows of exposure**: Every organ develops according to a strict "timetable" in which changes take place at specific times. There are periods during which an organ may be particularly sensitive to the adverse effect of a chemical, radiation or thermal conditions. These are called critical windows of exposure.

- **Central nervous system**: This is a precisely regulated system that entails numerous processes. Cells divide, multiply, migrate and differentiate; cell connections are continually formed; numerous biochemical changes take place; neurotransmitters, synapses and receptors are set up to enable the effective transmission of signals. The brain growth spurt, a period of rapid development, occurs in the fetus in the third trimester of pregnancy and continues into the first 2 years of life. The developing central nervous system is a potential target for neurotoxic substances.

- **Immune system**: The immune system develops from pluripotent stem cells that migrate from the circulatory system into lymphoid organs and differentiate into a wide variety of cell types, including B- and T-lymphocytes, macrophages and granulocytes. The human immune system is not totally protective at birth. Important developments occur after birth, in the interaction with the environment that leads to acquisition of immunological memory. Toxicants, such as lead PCBs may alter pluripotent stem cells, T-lymphocytes and the thymus.

- **Hormone-dependent sexual development**: Hormones are signalling molecules that enable cells, tissues and organs to interact with the environment and function in a harmonized manner. Hormones play a crucial role in sex differentiation: male sex hormones cause the embryo to develop as a male at six weeks of gestation. Later on, hormones control puberty, ovule maturation, spermatogenesis, gestation, birth and lactation.
  - The thyroid produces hormones which are crucial for the correct development of organs, such as the brain and the gonads. Some chemicals have been proved to have an endocrine-disrupting capacity in wildlife. The possibility of such effects in humans should be taken seriously as these effects are biologically plausible. The effects may occur by mimicry, where such chemicals behave like hormones, antagonism, preventing hormones from bonding, or disrupting production, conversion, transportation or excretion of hormones.

**References:**


Image:
• © WHO / Heba Farid
Chemicals cause diseases by different and complex mechanisms of action that can be detected at different levels, including:

- Systemic/target organ diseases
- Cellular dysfunction, and
- Molecular alterations.

References:
Many chemicals, such as POPs and methylmercury enter the body at a young age, and due to their long half lives, persist long enough to have adverse fetal effects on the next generation. Exposures can affect the next generation even when the mother has minimal to no symptoms.

Examples include:

- **Yusho and Yu-cheng disease in Japan and Taiwan:** PCB and dioxin exposure to kanchlor has occurred during the making of rice oil in Japan in 1968 (called Yusho disease) and in Taiwan in 1979 (Yu-cheng disease). Children of Yusho and Yu-Cheng patients presented with reduced growth, dark pigmentation of the skin and mucous membranes, gingival hyperplasia, xerophthalmia, oedematous eyes, dentition at birth, abnormal calcification of the skull and rocker bottom heel. A high incidence of low birth weight was reported. Infants born to women who had been exposed to PCBs exhibited numerous effects, including neurobehavioural deficits and lower overall age-adjusted developmental scores among the exposed children.

- **Case of methylmercury in Iraq:** Methylmercury exposure occurred in Iraq after contamination of crops that were sprayed with a methylmercury based fungicide. Effects on the fetus included spasticity, seizures, and neurodevelopmental delay.

**References:**

Outline

• Sources of exposure
• Toxicology
• Exposures
• Health effects
• Treatment
• Prevention

Image:
• © WHO / SEARO / Sanjit Das
Circumstances of exposure

• Unintentional
• Intentional
• Iatrogenic or therapeutic error
• Occupational
• Environmental

The potential circumstances of exposure to chemicals in children are listed here:

• **Unintentional** – is the most common circumstance of exposure in small children who are "little explorers", ready to touch and taste everything at their ground-level microenvironment, e.g. colourful pills, berries and plastic bottles.

• **Iatrogenic** – observed mainly in the medical setting, such as when medications are wrongly administered, e.g. overdose or medication error.

• **Intentional** – infrequently seen exposures caused by individuals close to children or children themselves. Intentional exposures include:
  • Homicide – e.g. children overdosed with pharmaceuticals, intentionally exposed to carbon monoxide or administered toxicants;
  • Munchausen syndrome – simulation or induction of disease in children, in this case through the administration of pharmaceuticals or chemicals, usually by psychologically disturbed individuals close to the child
  • Chemical battering – administration of pharmaceuticals and other substances, e.g. sedatives, sleeping pills, table salt or others, to children;
  • Solvent abuse ("sniffing") – a form of recreational drug use and abuse, seen in older children and adolescents
  • Suicide attempt – completed or attempted suicides, observed mainly in psychologically unstable adolescents
  • Abortifacient – use of abortion-inducing substances by female adolescents frightened by the consequences of unwanted pregnancy, and
  • Warfare agents – exposure of children to chemicals used in the context of war.

• **Occupational** – young workers’ exposure to dangerous and/or unsafe chemicals in the workplace when engaged in child labour, or "take-home exposure" by parents. Pregnant women can also expose their unborn children at work. Furthermore, working parents may bring chemicals back to the home on their clothes, skin, or hair if they are not adequately protected from chemical exposures while at work.

• **Environmental** – exposure of children to chemicals present as pollutants or contaminants in their environment. This growing cause of concern and relatively new approach to children's health has gained recognition in recent decades. These chemicals may be from anthropogenic or natural sources.

**References:**


Image:

• © WHO / Pallava Bagla
Each type of exposure has unique effects on the physiologic system of the developing child.

Examples:

**Acute poisonings**
- Single: Carbon monoxide
- Repeated: Aspirin overdose
- "Hit and run": Thalidomide during gestation leading to phocomelia; diethylstilboestrol exposure in utero leading to cervical cancer

**Chronic exposures**
- Lead poisoning
- Arsenic exposure causing skin or bladder cancer

"Acute on chronic"
- Organophosphorus pesticide exposure on a chronically exposed child

Effects depend upon the type of exposure, dose and timing as well as the characteristics of the chemical involved and the clinical, nutritional and developmental status of the child. While acute poisonings are often the easiest to identify or diagnose, the other exposure types can be equally or more severe, but difficult to diagnose. Therefore, they pose a special challenge for the health care provider.

**References:**
Focusing on pharmaceuticals for a moment: while these may often be therapeutic to adults, if ingested by a child, many pharmaceuticals have the potential to be fatal at very small doses.

This is a list of some medications that can be dangerous and fatal to a child with even one pill or teaspoon that clinicians should be familiar with.

**References:**

---

**Potentially severe acute poisonings**

- Benzodiazepines
- Tricyclic antidepressants
- Opioids
- Theophylline
- Antidiabetics
- Calcium channel blockers
- Beta blockers
- Methyl salicylate
- Iron

- Quinidine
- Chloroquine
- Camphor
- Organophosphate
- Paraquat
- Methanol or Glycols
- Fentanyl
- Crystal meth

*One teaspoon or pill can be dangerous!*
Effects depend on the type of chemical, the dose and timing of exposure.

In general,

- **High-dose exposures** tend to produce poisoning and the diagnosis is usually quite clear, e.g. the child is found with an empty bottle of medicine and presents drowsiness.
  - A child with Pica behaviour who eats lead contaminated paint flakes may exhibit elevated blood lead levels and clinical symptoms.
- **Low-dose exposures** may produce undetected or subtle effects, which may be difficult to diagnose, e.g. anaemia due to lead exposure or adverse effects on neurological development.

**References:**


**Image:**

- © WHO / Tom Pietrasik
Unintentional poisonings

According to poisons centres:
• Children under five years of age comprise nearly half of poison exposures.
• The number of poisoning cases may be underestimated.
• Cases of exposure are mostly acute and unintentional.
• Mortality is usually low but varies by region.

Note to user: Search for statistical data of children poisoning in your country or region, or include information provided by local or national poison control centres.

References:

Image:
• © WHO / Petterik Wiggers
Children’s chemical exposures are magnified in developing countries

- Unsafe use of chemicals
- Increasing pollution and uncontrolled use of chemicals
- Highest increase in chemical production
- Chemical dumping
- Additional health risk factors: malnutrition, infectious diseases
- Child work and scavengers
- Lack of awareness of risks
- Despair at the magnitude of the problem

Children’s environmental health and chemical safety problems are magnified in developing countries and countries in transition and in developing parts of the world for reasons including the following:

- Unsafe use of chemicals due to lack of information and education on their safe and judicious use; use of illicit products
- Increasing pollution and uncontrolled use of chemicals due to lack of appropriate regulatory measures or the impossibility of enforcing them, including lack of personnel, controls and surveillance
- Chemical dumping and waste sites adjacent to populated areas
- Additional factors such as malnutrition, infectious diseases and poverty
- Lack of awareness about risks, cultural aspects, and poor access to information
- Lack of interest because of other urgent, immediate health priorities
- Despair at the magnitude of the problem, which may seem impossible to solve.

The highest increase in chemical production in terms of sales is projected for non-OECD countries

References:
Outline

• Sources of exposure
• Toxicology
• Exposures
• Health effects
• Treatment
• Prevention

Image:
• © WHO / SEARO / Sanjit Das
Clinical and subclinical effects

Clinical features observed depend upon:
- Agent
- Dose
- Timing and length of exposure

Effects may be:
- Asymptomatic
- Acute and evident: toxic syndromes
- Chronic and subtle: undefined symptoms
- Detected only by laboratory studies

The clinical effects observed in children depend upon the type of chemical or pollutant involved, the dose, timing and length of exposure. Typical examples include:
- Acute poisoning by organophosphorus pesticides, with a characteristic syndrome: miosis, sweating, headache, bradycardia, convulsions.
- Chronic lead exposure: the child may be asymptomatic for some time and later present with anaemia, abdominal pain, fatigue, behavioural changes and learning disabilities.

Some exposures may not produce obvious clinical effects, but will lead to disease after some time or in adulthood, e.g. air pollutants, arsenic in water.

In some instances, these exposures may be assessed through laboratory studies in individuals. Some effects may only be apparent through evaluation of large populations, e.g. IQ testing and population level exposure to PCBs or lead.

References:
Adverse pregnancy outcomes were observed for mothers exposed to different environmental or occupational risk such as ambient air pollution, second-hand tobacco smoke and other household air pollutants as well as chemicals.

Endocrine disrupting chemicals, such as POPs, some pesticides and cosmetics, may be responsible for low birth weight and premature birth.

Chronic exposure to lead, mercury, some pesticides and plasticizers was associated with neurodevelopment disorders. It is estimated that 12% of the disease burden in DALYs of children with neuropsychiatric disorders is related to environmental risks.

Air pollution is associated with asthma and other respiratory diseases, such as pneumonia, in children.

Second-hand tobacco smoke, pesticides and hydrocarbons are suspected to increase the risk of congenital anomalies.

Many components of household and ambient air pollution as well as pesticides are associated with increased risk of cancers.

References:
Outline

- Sources of exposure
- Toxicology
- Exposures
- Health effects
- Treatment
- Prevention

Image:
- © WHO / SEARO / Sanjit Das
Unfortunately, only the minority of exposures can be measured, understood and treated. Specific analyses may be not available in general hospitals especially in developing countries.

Laboratory studies are important in the area of paediatric toxicology in order to:
• confirm exposure by detecting levels in biological fluids: blood, urine, hair
• determine the magnitude and severity of exposure; compare with reference or intervention levels
• assess and measure effects, e.g. levels of anaemia, cholinesterase inhibition
• monitor the efficacy of treatment, and
• follow the clinical evolution after treatment or environmental interventions.

Suggested examples:
• Lead exposure— measuring blood lead levels
• Exposure to organophosphorus pesticides— confirmation by measurement of cholinesterase in red blood cells or whole blood.

Reference:

Image:
• © WHO / Antonio Suarez Weise
The treatment of toxic exposures in children varies according to the chemical involved, type/level of exposure, clinical effects observed and results of laboratory tests.

Resuscitation includes intubation, ventilation, or other life-saving measures.

Specific example:

**Organophosphorus pesticide**

- Acute poisoning by an organophosphorus pesticide may require decontamination, such as washing of the skin, or possibly gastric lavage, under special circumstances, and the antidote atropine and the administration of enzyme reactivators, such as pralidoximes.

References:

The treatment of toxic exposures in children varies according to the chemical involved, type/level of exposure, clinical effects observed and results of laboratory tests.

Specific example:

**Lead**

- Chronic lead exposure requires removal of the child from the source of exposure (e.g. contaminated soil or water, paint chips in the home, stopping use of leaded ceramics) and personal and home hygiene measures. Environmentally-exposed children may have a blood lead level of around 10–15 µg/dL. If blood lead levels are above 45 µg/dL, the use of a chelating agent, such as succimer, should be considered. If the child presents with lead encephalopathy, intensive care is required as well as the administration of chelating agents.

**References:**

Outline

- Sources of exposure
- Toxicology
- Exposures
- Health effects
- Treatment
- Prevention

Image:
- © WHO / SEARO / Sanjit Das
Prevention is the single most effective means of protecting children

Health care providers play a key role in:

- Identifying the problem
- Defining its determinants and characteristics
- Informing the community – and the children!
- Educating colleagues and other professionals
- Raising the awareness of policy-makers
- Promoting the implementation of the appropriate measures
- Helping to evaluate the efficacy of preventive measures

Health care providers play a key role in many aspects of the prevention of exposure. These are:

- **Identifying the problem** What are the main toxic exposures in children? What are the main causes of acute poisonings? Are there any cases of chronic exposure to environmental pollutants? Is there a high incidence of diseases that may be linked to chemicals in the environment? Paediatric hospitals and poisons centres may be able to provide statistical and epidemiological data on the subject.

- **What are the determinants and characteristics?** Are exposures in children acute or chronic? Where do they occur? When and how? Are there any predisposing factors? Which populations or groups are affected? Are they predominantly urban or rural?

- **Informing the community – and the children!** The community whose children are exposed to chemicals and pollutants in the environment should be informed about the situation in a clear manner. Social workers and communications experts may provide valuable advice on how to communicate risks or potential threats to the community, and how its members may avoid them and protect their children.

- **Educating colleagues and other professionals** It is especially important to educate those who should recognize and manage the effects of chemicals on children’s health, e.g. nurses, physicians, primary health care workers. Those who will help in assessing environmental issues should also be educated.

- **Raising the awareness of policy-makers about the problems identified** Policy-makers should be made aware of the risks facing children – poisonings and potential chronic exposures.

- **Promoting the implementation of the appropriate actions** The implementation of the appropriate measures should be promoted in consultation with key partners including policy-makers, doctors, nurses, teachers and parents.

- **Evaluating the efficacy of preventive measures** The efficacy of preventive measures should be evaluated and the community should be informed of the findings!

References:


Create and enforce legislation to promote the safe use and disposal of chemicals. Promote safe practices to reduce chemicals in the environments of children.

**References:**


Protecting children from chemical hazards

- Train healthcare providers on recognition, prevention and management of toxic exposures.
- Train health care professionals on the use of the Paediatric Environmental History.
- Incorporate the teaching of chemical safety and health into school curricula.
- Create legislation for the safe use and disposal of chemicals.
- Promote policies to remedy polluted sites and hotspots.
- Avoid the construction of homes, schools and playgrounds near polluted areas and hazardous installations.

Note to user: More information on taking the environmental history is available in the Paediatric Environmental History module.

- Create and enforce legislation to promote the safe use and disposal of chemicals.
- Promote policies to reduce and remedy environmental pollution.
- Avoid the construction of homes, schools and playgrounds near polluted areas and hazardous installations.

References:

Protect children from all chemicals

- Publications for all audiences
  - [www.who.int/ceh](http://www.who.int/ceh)
- Summary of Principles for Evaluating Health Risks in Children Associated with Exposure to Chemicals
- Training package on child health and environment
- National profiles on child health and environment
- Paediatric environmental health history
- UNEP/WHO Toxicology in the classroom toolkit for schoolchildren

References:

International agreements on children and chemicals

- Basel Convention
- Stockholm Convention
- Rotterdam Convention
- Minamata Convention
- Strategic Approach to International Chemicals Management (SAICM)
  - World Health Assembly Resolution 63.25
  - World Health Assembly 70

Note to user: Provide the agreements that are relevant to the setting of the course and participants, and mention those ratified and/or followed-up in the country.

Various international legislative efforts try to control the movements of hazardous substances between continents and countries.

The Basel Convention controls the transboundary movement of hazardous wastes and their disposal. It is a comprehensive environmental agreement in relation to tackling the issues surrounding e-waste and its management. In 2019 the Basel Convention had 187 parties, and 14 Basel Convention Regional and Coordinating Centres have been established for capacity building and technology transfer.

The Rotterdam Convention promotes shared responsibility and cooperation between countries in the international trade of hazardous chemicals, including banned or controlled pesticides and industrial chemicals, in order to protect human health and the environment. As of 2019, there were 161 parties to the Rotterdam Convention.

The Stockholm Convention requires parties to eliminate production of and restrict import and export of persistent organic pollutants. As of 2019, there were 183 parties to the Stockholm Convention.

The Minamata Convention on Mercury is a global treaty to protect human health and the environment from the adverse effects of mercury. It was agreed at the fifth session of the Intergovernmental Negotiating Committee on mercury in Geneva, Switzerland in January 2013, and adopted later that year in October 2013 at a Diplomatic Conference (Conference of Plenipotentiaries), held in Kumamoto, Japan. As of 2019, there are 115 parties to the Minamata Convention.

The Strategic Approach to International Chemicals Management (SAICM) is a policy framework created to foster multisectoral and multi-stakeholder engagement in the sound management of chemicals. It aims to ensure that, by 2020, chemicals are produced and used in ways that minimize significant adverse impacts on the environment and human health. This has included phasing out lead in paint, providing information on chemicals in products, as well as managing e-waste.

The Sixty-third World Health Assembly, convened in 2010, approved resolution WHA63.25 Improvement of health through safe and environmentally sound waste management. This resolution urged Member States to assess health aspects of waste management and supported greater awareness, improved cooperation and increased capacity in e-
e-waste management.

References:


Acknowledgements for current version

Reviewers: Atsuko Araki (Japan), Machiko Minatoya (Japan), Reiko Kishi (Japan), Lesley Brennan (Canada), Carolyn Vickers (WHO)

Initial edits by Kathy Prout (WHO)

Final review, technical and copy-editing: Gloria Chen (WHO Consultant)

WHO CEH training project coordinator: Marie-Noël Brund-Drisse (WHO)

WHO is grateful to the ISDE for organizing the working meeting of the Training Package in 2016.

This publication was made possible with financial support from the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, Germany.

Update: January 2020

Design by L’IV Com Sàrl, Villars-sous-Yens, Switzerland.
Acknowledgements from past versions

WHO is grateful to the US EPA Office of Children's Health Protection for financial support that made this project possible and for some of the data, graphics and text used in preparing these materials for a broad audience. Further support was kindly provided by the UK Department of Health.

First draft prepared by Jenny Pronczuk (WHO)

With the advice of the Working Group Members on the Training Package for the Health Sector: Cristina Alonso (Uruguay); Yona Amitai (Israel); Stephan Bose-O’Reilly (Germany); Stephania Borgo (ISDE, Italy); Irina Buka (Canada); Ernesto Burgio (ISDE, Italy); Lilian Corra (Argentina); Ruth A. Etzel (WHO); Ligia Fruchtengarten (Brazil); Amalia Laborde (Uruguay); Leda Nemer (WHO/EURO); Jenny Pronczuk (WHO); Roberto Romizzi (ISDE, Italy); Christian Schweizer (WHO/EURO); Katherine M. Shea (USA).

Reviewers: Ligia Fruchtengarten (Brazil), Josef G. Thundiyil (USA), Renee Modica (USA), Carolyn Vickers (WHO), Huw Brunt (UK), Gary Coleman (UK), Raquel Duarte-Davidson (UK), Elaine Lynch Farmery (UK), Alison M. Good (UK), Mark Griffiths (UK), John Thompson (UK), Laura Yates (UK)

WHO Project coordination: Ruth A. Etzel and Marie-Noëlle Bruné

Latest update: October 2011 prepared by Halshka Graczyk and Lydia Tempesta
Suggested citation: