Children’s health and the environment
WHO training package for the health sector

WHY CHILDREN
TRAINING FOR HEALTH CARE PROVIDERS
THIRD EDITION

[Date ... Place ... Event ... Sponsor ... Organizer]

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 or regional situation. Where relevant, adapt the information, statistics and photos within each slide to the particular context in which this module is being presented. For instructions on how to use this module visit: https://www.who.int/publications/i/item/WHO-CED-PHE-EPE-19-12-02;

• Why children is one module from a larger training package focused on children’s environmental health. Consult these other modules where relevant. Throughout Why children, a number of different modules are suggested that contain more relevant information. To see the full package visit: https://www.who.int/teams/environment-climate-change-and-health/settings-populations/children/capacity-building/training-modules;

• the World Health Organization (WHO) reference number for the module Why children: training for health care providers, third edition is WHO/HEP/ECH/CHE/23.01;

• for more information on WHO’s work on children’s environmental health, please visit: https://www.who.int/health-topics/children-environmental-health.
After this presentation you should:
• understand the global importance and public health impact of children’s exposure to environmental threats;
• gain an understanding of the special vulnerability of children;
• gain an understanding of the environmental threats to children’s health in low- and middle-income countries (LMICs) and high-income countries (HICs);
• be able to consider how different stakeholders can take action to protect children’s health from environmental hazards.

Learning objectives

• Understand the global importance and public health impact of children’s exposure to environmental threats

• Learn about the special vulnerability of children – new knowledge, new concepts

• Consider the threats to children’s health in low- and middle-income countries and high-income countries

• Consider how different stakeholders can take action
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.

This training module includes:
• the magnitude of the environment and its affects on child health;
• children’s special vulnerabilities to environmental hazards;
• main global environmental risks threatening child health;
• future directions to protect children from environmental hazards.

Photo:
• © WHO/ Yoshi Shimizu. During low tide, children are playing on a beach in South Tarawa, Kiribati.
This module begins with the magnitude of the problem and discuss the definitions used in this module, the latest data on child mortality and the contribution of the environment to child mortality.

The environment in which children live, grow, play and learn has an impact on their health. Numerous child health and development problems can be attributed to environmental exposure, for example poor access to clean water, sanitation and hygiene, household and ambient air pollution, vectors of disease and global climate change. This module discusses the magnitude of environmental exposures on child health and development and some of the actions that health professionals can take to reduce and prevent these exposures.

Photo:
- © WHO/Yoshi Shimizu. During low tide, children are playing on a beach in South Tarawa, Kiribati.
This module will use the World Health Organization’s (WHO) definitions of newborn, infant, child and adolescent.

**WHO defines (1):**
- **a newborn** as a person aged 0–28 days;
- **an infant** as a person aged 1–11 months;
- **a young child** as a person aged 1–4 years;
- **a child** as a person under 19 years of age and;
- **an adolescent** as a person aged 10–19 years.

References to **child mortality** usually refer to children aged 0–59 months (or children under the age of 5 years).

There are many other definitions of “child” that are commonly used. For example, the United Nations Convention on the Rights of the Child defines “children” as those below 18 years of age (2).

**References:**

**Photo:**
- © WHO/ Yoshi Shimizu. Children playing on the beach at low tide, Hangan village, Papua New Guinea.
Children hold a special place in our global society. The world they inherit is one shaped by adults and past generations, but today’s children will build our futures. With 26% of the world population under 15 years of age, it is imperative that they have healthy environments to grow, learn and thrive.

This slide shows the percentage of children under the age of 15 as a proportion of the total world population and of high- middle- and low-income country populations. In 2021 under 15–year olds made up:

- 26% of total world population (2.02 billion children);
- 42% of low-income countries’ population (302.32 million children);
- 25% of middle-income countries’ population (1.50 billion children); and
- 16% of high-income countries’ population (202.12 million children) (1).

The difference between the percentage of population that is under 15 years of age in low-income countries when compared to high-income countries is stark.

**Note:** Find the percentage of your country’s population that is under 15 years of age at: [https://population.un.org/wpp/](https://population.un.org/wpp/).

**Note on terminology:** low-, middle- and high-income countries are defined by per capita gross national income (GNI) in US dollars. In 2022, they were defined as:

- **low-income:** countries with less than $1046 GNI per capita
- **middle-income:** countries with between $1046 and $12 695 GNI per capita
- **high-income:** countries with more than $12 695 GNI per capita (2).


**References:**

Figures:
Produced with data from:
In 2021, an estimated 5 million children under 5 years of age died globally. Almost half of these deaths, 2.3 million, were in newborns (0–28 days old). More than half of all deaths in children under the age of 5 (2.8 million in 2021) were concentrated in the Sustainable Development Goal (SDG) region of sub-Saharan Africa (1). Globally, the leading causes of death in children under 5 years continue to be (1):

• premature birth and birth complications;
• acute respiratory infections;
• diarrhoea;
• malaria.

Many of these deaths were preventable. This module describes the role of the environment in children’s health and the opportunities it presents to reduce morbidity and mortality in children. If all countries reach the SDG child survival targets by 2030, almost 10 million lives under 5 years of age would be saved (1).

Note: find the number of under 5 deaths in your country in 2021 at: https://childmortality.org/data.

Note: find the leading causes of under 5 mortality in your country at: https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates/ghe-leading-causes-of-death.

Reference:

Map:
• © WHO.
Eliminating preventable child deaths is a major target of the Sustainable Development Goals (SDGs). The SDGs are a set of global targets to achieve by 2030 and were adopted in 2015 by United Nations Member States (1). The graph displayed here shows that child mortality has decreased in all SDG regions between 1990 (represented by the pale yellow bar) and 2021 (represented by the brown bar). The dotted blue line represents the SDG country target for 2030.

This graph also shows that child mortality continues to disproportionately affect certain regions of the world. Sub-Saharan Africa, Oceania and central and southern Asia have the highest under 5 mortality rates (2). Low- and middle-income countries (LMICs) are disproportionately affected.

Sub-Saharan Africa continues to have the highest rate of under 5 mortality at 74 deaths per 1000 live births in 2021. This is almost 19 times higher than the average in the region of Australia and New Zealand, where the rate is lowest. As per the 2021 data, 54 countries are not on track to reach the SDG target on under 5 mortality. Most countries that are not on track to reach the under 5 mortality target are located in the SDG region of sub-Saharan Africa, or are classified as LMICs. If these countries accelerated progress to achieve the SDG goal on under 5 mortality by 2030, almost 10 million child lives could be saved (2).

Note: find the under 5 mortality rate in your country in 2021 at: https://childmortality.org/data.

References:

Figure:
Environmental hazards disproportionately affect low- and middle-income countries (LMICs). This graph shows the distribution of deaths attributable to the environment in 2016, by World Health Organization (WHO) region and World Bank country income group (as of the World Bank lending group classification for financial year 2018). Low- and middle-income countries (LMICs) in the African and South-East Asia Regions bore almost two-thirds of all deaths attributable to the environment in 2016. While the burden of environmental factors may not be borne equally, every region is affected (1).

In 2016, almost 1.6 million children under 5 years of age died due to environmental factors (1).

Reference:

Figure:
Produced with data from:
In 2016, almost 1.6 million deaths in children under 5 linked to the environment

- **Respiratory infections**: 511,700 deaths
- **Diarrhoea**: 297,000 deaths
- **Neonatal conditions**: 244,000 deaths
- **Malaria**: 229,000 deaths
- **Unintentional injuries**: 177,000 deaths

28% of deaths in children under 5 years linked to the environment in 2016

The most recent World Health Organization (WHO) analysis in 2016 determined that more than 28%, or almost 1.6 million, of all deaths in children under 5 were attributable to the environment. This is represented on the lower right of this slide. Because the environment is modifiable, these deaths were preventable. The bars in this infographic show the number of under 5 deaths in 2016 linked to environmental factors for each cause of death shown (1).

The main causes of death in children under 5 are diseases that have a strong environmental component (1). For example:

- **Respiratory infections**, including pneumonia, can be caused by exposure to both household and ambient air pollution and second hand smoke (2);
- **Neonatal conditions**, including prematurity, may be caused by maternal exposure to household air pollution, chemicals such as some pesticides, second hand smoke and poor water and sanitation in birth settings (1);
- inadequate drinking-water, poor sanitation and hygiene and open defecation lead to **diarrhoea** (2);
- **Unintentional injuries**, such as traffic injuries, poisonings and burns, are linked to poor road design and urban planning, unsafely stored and unlabelled chemicals and the use of unsafe cooking, heating and lighting technologies and fuels in homes (3); and
- proliferation of vectors in the environment results in diseases such as **malaria** (2).

The following slide displays the environmental contributions to these causes of under 5 mortality in more detail.

**Note:** for more information please see the available modules on Ambient air pollution, Childhood respiratory diseases linked to the environment, Household air pollution, Sanitation and hygiene, Water and Why children.

**References:**

Figure:
Produced with data from:
Both mortality and morbidity can be reduced in children under 5 years of age with modification of environmental factors. This figure illustrates the burden of disease, measured in disability adjusted life years (DALYs), for children under 5 for selected diseases that were caused at least in part by environmental factors in 2016 (1).

DALYs for a disease or health condition are the sum of years of healthy life lost due to disability and years of life lost due to premature mortality. In 2016, it was estimated that 27% of DALYs in children under the age of 5 could have been prevented by changes to environmental factors (2).

References:

Figure:
Produced with data from:
Children in rural and urban settings are exposed to different environmental conditions and risk factors. Childhood poverty exists in both settings and exacerbates different environmental issues found in both rural and urban settings. Major differences exist between urban and rural areas between different countries and children may be exposed to multiple environmental risks at once. This slide gives an idea of some of the environmental differences that may be experience by children living in urban areas in comparison to children living in rural areas.

### Urban areas may have:
- Better access to:
  - Health care and health services
  - Education
  - Water, sanitation and hygiene facilities and services
  - Public transport

### But may experience:
- Overcrowding
- Air pollution, both ambient and household
- Traffic (pollution and injury)

### Rural areas may have:
- Better access to:
  - Green spaces
  - Less crowding
  - Clean air

### But may experience:
- Poor access to health care
- Poor access to water, sanitation and hygiene services and facilities
- Poorer access to education
- Pesticide exposure

**Poverty and inequity bring out the worst environmental threats**

**Children in rural and urban settings are exposed to different environmental conditions and risk factors. Childhood poverty exists in both settings and exacerbates different environmental issues found in both rural and urban settings. Major differences exist between urban and rural areas between different countries and children may be exposed to multiple environmental risks at once. This slide gives an idea of some of the environmental differences that may be experience by children living in urban areas in comparison to children living in rural areas.**

**In urban areas children often have better access to:**
- health services, including immunization programs and access to health care facilities (1);
- education and opportunities to pursue further education opportunities (1);
- water, sanitation and hygiene facilities and services (2);
- public transport makes travel to school or health care facilities more affordable and accessible and promotes healthy lifestyles (1).

**However, in urban areas children also face environmental challenges.** Children living in urban areas also face issues such as:
- overcrowding, where the number of people in a house exceeds the capacity to provide adequate shelter, space, privacy and facilities. overcrowding places pressure facilities and services that are vital to ensure children grow up in healthy and safe environments (1);
- high levels of ambient air pollution from fossil fuel energy production, traffic pollution and waste incineration (3);
- high levels of household air pollution from polluting fuels and technologies (3); and
- traffic, which is linked to both air pollution and high rates of injury among children (1).

Children who live in low-socioeconomic areas in urban settings, such as slums, may suffer from higher exposure to the above mentioned factors compared to their counterparts living in wealthier, urban areas.

**In comparison, children living in rural areas may have (1):**
- better access to green spaces;
- less crowding, which can reduce the pressure on essential facilities and services and can help reduce the spread of infectious diseases; and
- breathe cleaner air (however, air pollution can differ dramatically from region-to-region, seasons and depending upon industry in the area).

**However, children living in rural areas may also experience:**
- Poor access to health care (1);
• Poor access to WASH facilities and services (2);
• Poor access to education services and opportunities (1); and
• Higher pesticides exposure from agricultural activities (1).

In both urban and rural areas, children living in poverty experience inequity and are more likely to be affected by these issues, which can adversely impact their health, development and future.

Note: if you have examples of the urban-rural divide in your country or region, they can be used here.

References:
It is important to stress that all the effects and diseases resulting from chemical, physical and biological threats have high personal, social and economic costs. Environmental-related illnesses in children can cause (1):

- increased medical expenses, leading to financial stress on families;
- increased governmental health care expenses, reducing the amount of spending available for other services, such as education;
- sickness, disability and death in children, which in turn is linked to personal agony among family and community;
- sick days away from school, leading to a reduction in education;
- productivity lost by parents and carers who may need to stay home and care for unwell children, and may lead to additional financial stress on families; and
- reduced long-term productivity of the country.

**An example:** In 2015, the estimated cost of asthma in Australia was 28 billion Australian dollars. This estimate includes the cost of disability, premature death, healthcare and loss of productivity and wages, including lost income of carers (2).

**Example:** malaria is a major cause of mortality in Malawi. In 2019, a study completed in Malawi estimated that malaria was the cause of 15% of hospitalizations and between 5–11 days of productivity were lost per episode (including schooling). Estimates found that welfare loss, which includes mortality, cost of illness, lost productivity and lost learning, due to malaria was equivalent to 1.7% of Malawi’s gross-domestic product (GDP) in 2019 (3).

**Note:** replace these examples with a national or regionally-specific study, if estimates exist.

**References:**


As the world continues to change, new driving forces and global environmental changes pose challenges to human health and the environment. These challenges are contributing to environmental degradation. **New driving forces**, challenging human health and development include:

- **chemicals** that can travel long distance from the point of production, for example in air or water, and may contribute to chemical risks in international populations (1);
- **hazardous wastes**, such as electronic and electrical waste, are increasing in every area of the world and pose significant threats to children’s health if they are improperly managed, disposed of or recycled (2,3);
- **globalization**, which increases the number of people who may be exposed to infectious diseases (4);
- **new industrialization** may expose populations to different pollution threats, for example higher levels of air pollution (5);
- the increase in global **urbanization** may lead to greater access to services and opportunities, but may also overburden essential services in overpopulated urban areas (4,5);
- **poverty and inequity** may afflict children throughout childhood and the rest of their lives for many reasons, including disease and conflict (6);
- **unsustainable consumption** may lead to overuse of chemicals, such as pesticides (5); and
- **finally,** populations are growing rapidly in low- and middle-income countries (LMICs), especially in urban areas, where it it expected to grow fastest (7).

**Global environmental change** is having an impact on children’s health. **Almost every child in the world is affected by major climate and environmental hazards, shocks and stressors (6).** Global environmental changes include climate change, desertification, deforestation, loss of biodiversity, increases in animal agriculture, increases in forest fires and depletion of the ozone layer (8).

New driving forces and global environmental change can lead to environmental degradation and children are one of the most vulnerable groups now and in the future.

**Note:** desertification refers to the development of desert-like conditions (including loss of vegetation and deterioration of soil quality) as a result of human activities or changes to the climate (9). **Deforestation** refers to the removal through human activity of forests and undergrowth, usually for agricultural or construction purposes (9).

**Note:** for more information, please see the available modules on **Children and chemicals** and **Global climate change and child health**.
References:
Having introduced the magnitude of children’s environmental health issues broadly, the module will now discuss what makes children especially at risk to environmental hazards.

Photo:
• © WHO/ Yoshi Shimizu. During low tide, children are playing on a beach in South Tarawa, Kiribati.
Environmental exposures start in the womb. Maternal exposure to some chemicals found in the environment can pass across the placenta and expose the fetus to potentially harmful substances. Exposure to harmful substances in utero can cause health effects that last a lifetime (1).

This infographic illustrates some of the environmental exposures that can threaten the health of a fetus, and which may cause lifelong health affects. These environmental exposures include:

- toxic chemicals, such as lead and mercury
- pollution from industries
- forest fires
- household air pollution

Reference:

Figure:
Historically, environmental protections have been based on protecting adults, often in occupational settings. It was assumed that such protections would protect children as well.

It is now well recognized that unborn children (including the embryo and fetus) and children (infants and all life-stages until the completion of adolescence) are often at a different and increased risk from environmental hazards compared to adults. There are four broad categories that explain these differences.

1. Children often have different and unique exposures to environmental hazards compared to adults. Children can be exposed in utero to chemical agents (pollutants and pharmaceuticals), physical agents (radiation, heat) and biological agents (viral or parasitic). There is growing evidence that parental exposure prior to conception can also independently affect children’s health. Babies can be exposed after birth to pollutants that pass into their mother’s milk. Neither of these routes of exposure occur in adults or older children. Children also have pathways of exposure that differ from those of adults due to their developmental stage and physical size. For example, young children engage in normal exploratory behaviours including hand-to-mouth and object-to-mouth behaviours, and non-nutritive ingestion which may significantly increase exposure over that in adults. In addition, children live closer to the ground and have larger surface area to volume ratios than adults, consequently exposing them to pollutants that settle close to the ground, or which are absorbed through the skin (1,2).

2. Due to their dynamic developmental physiology children are often subjected to higher exposure of pollutants found in air, water and food. Because they are anabolic and rapidly growing, they breathe more air, eat more food and drink more water per unit of body weight than adults. Children also often absorb nutrients more efficiently. Therefore, pollutants can result in higher internal doses in children compared to adults. These exposures may be metabolized and excreted quite differently by an immature set of systems compared to the way they are dealt with in fully mature, adult systems. Furthermore, the developmental component of a child’s physiology is changing; maturing, differentiating and growing in phases known as “developmental windows”. These phases can be understood as “windows of vulnerability” and create unique risks for children exposed to hazards which can permanently alter normal functioning and may have lifelong impacts on the health and development of children. Due to cognitive immaturity, children may have limited ability to understand and move out of danger, both from toxic agents and dangerous situations which could result in harm. Young children cannot read safety labels or warnings and older children, who can read, may not fully understand them. This characteristic is obvious in the pre-ambulatory period, but also persists through exploratory toddler behaviour and even into the high-risk behaviours seen in adolescents (1,2).
3. Children have a longer life expectancy, so they have longer to manifest a disease with a long latency period, and longer to live with toxic damage which may manifest in childhood or much later in life. Increasingly, research is identifying that early life environmental exposure can contribute to chronic disease later in life (2).

4. Finally, children are dependent upon adults to protect them and ensure a safe environment. Children trust the adults in their lives to nurture and protect them through actions and decisions until they can protect themselves through their own individual, collective and political action (2).

References:
There has been an explosion of knowledge about fetal development over the past few decades. It may be difficult to remember that only 60 years ago the discovery was made that the fetus is vulnerable to maternal exposure. In the late 1950s and early 1960s, thalidomide was prescribed in many countries to pregnant women to relieve nausea. However, the developing embryo is especially vulnerable to thalidomide and even a single dose of thalidomide during the embryonic period can result in irreversible damage (1). The phocomelia epidemic resulting from the use of thalidomide by pregnant women was an early and dramatic example of the ability of chemicals to cross the placenta and negatively affect the health of the fetus.

Fetuses have periods of special vulnerability. The fetus is connected to the mother through the placenta, where gas and nutrient exchange occurs. Different kinds of exposure can affect the metabolism of the mother or fetus and may consequently disturb fetal development (2). The figure used in this slide illustrates the embryonic and fetal stages of pregnancy. The majority of developmental changes occur during the embryonic and fetal periods (as shown in the top bar of the illustration). This figure also illustrates the precise timing in which vital organ and system development occurs (3). As organs and systems are going through rapid periods of development, fetuses have unique vulnerabilities that are not seen in adults (2). If these processes are exposed to teratogens, normal fetal development can be affected and irreversible damage may be caused.

More than one system of the fetus can be susceptible and different pathology may occur depending upon the timing of exposure in utero (2). Timing is illustrated in the figure by the pink and yellow bars. The pink bar represents periods of high sensitivity to teratogens, while the yellow bar represents periods where the organ or system remains sensitive, but less so than the period represented in pink.

For example, the development of the heart is highly sensitive to teratogens from midway through week three of pregnancy until midway through week 6 when sensitivity is reduced until week 12 and then drops off. In comparison, the central nervous system is highly sensitive from week 3 until the beginning of week 6. However, unlike the heart, the central nervous system remains sensitive to teratogens for the remainder of pregnancy.

It is important to also note the different responses to insults shown on the bottom bar of the figure. Significant insult during the embryonic phase will result in pregnancy loss (during the first two weeks) or major organ malformation (from weeks 3 to 7). During the fetal stage, damage is more subtle and related to physiological defects and minor morphological abnormalities (3).

References:


**Figure:**
The third section of this module discusses the main global environmental risks to children’s health.

Photo:
- © WHO/ Yoshi Shimizu. During low tide, children are playing on a beach in South Tarawa, Kiribati.
This slide describes some of the environmental hazards that affect children.

This section of the training module will discuss the following global environmental health risks facing children today:

- **Air pollution, both household and ambient**: which triggers and aggravates respiratory diseases, including pneumonia and asthma
- **Global climate change**: is affecting the health of children in every region of the world
- **Inadequate or poor access to safe and clean water and sanitation and hygiene facilities**: leads to illness and disease in children, such as diarrhoea
- **Vectors of disease**: are major causes of death in children under the age of 5
- **Chemical hazards**: includes exposure to persistent organic pollutants (POPs) and pesticides
- **E-waste**: is the fastest growing waste stream in the world, containing many toxic hazards
- **The built environment**: which can cause road accidents, drowning and burns
- **Child labour**: which places children at risk from occupational exposures
- **Emerging issues**: such as plastics, endocrine disrupting chemicals and predatory marketing practices are threats to child development and health.

The following slides give more detail about each risk.

**Photo:**

- © WHO SEARO/ Florian Lang. The photo on this slide shows girls in India collecting water from a well. Due to drought, the girls are forced to walk 2 kilometres from their village to the well.
Ambient air pollution was attributable to more than 146,000 deaths in children under 5 years of age globally in 2019 (1). Almost all these deaths occurred in low- and middle-income countries (LMICs). Additionally, the World Health Organization (WHO) estimated that in 2019, 99% of the world’s population lived in locations where the air quality exceeded the WHO guidelines, placing their health and development at risk (2).

Children may be affected by ambient air pollution exposures experienced during fetal development. Maternal exposure to ambient air pollution has been linked to preterm birth, low birth weight and infant mortality. Additionally, children may also experience increased exposure to ambient air pollution due to greater time spent outdoors. Ambient air pollution can trigger and exacerbate asthma, may lead to reduced lung function and growth and is strongly linked with incidence of childhood otitis media (3). Ambient air pollution is a known carcinogen (4). Air pollution is also a suspected neurotoxicant and may cause children living in highly polluted areas to experience cognitive defects (2).

Fine particulate matter (PM$_{2.5}$ and PM$_{10}$) and particulate matter (PM) are indicators of ambient air pollution. PM$_{2.5}$ and PM$_{10}$ can be inhaled and enter the respiratory and cardiovascular systems. Levels of particulate matter are generally highest in urban areas. This map shows annual average concentrations of PM$_{2.5}$ and shows the regions where PM$_{2.5}$ are highest. Countries in dark purple have the highest average annual concentration of PM$_{2.5}$. Asian and African urban centres tend to have the highest levels of PM$_{2.5}$ (5).

Significant sources of ambient air pollution in urban areas include (2,3):
- vehicle and industry emissions
- fossil fuel energy production
- residential heating, cooking and lighting
- waste incineration.

In rural areas, sources of ambient air pollution include (2,3):
- agrochemicals
- burning agricultural waste
- deforestation
- charcoal production
- biomass burning
- domestic heating, cooking and lighting
- forest fires
- dust storms.
Note: see the Ambient air pollution and Childhood respiratory diseases linked to the environment modules for more information.

References:

Map:
Globally, more than 237 000 deaths in children under 5 were attributable to household air pollution in 2019. Almost all these deaths occurred in low-and middle-income countries (LMICs). (1)

There is consistent evidence that exposure to household air pollution can lead to acute lower respiratory infections in children under 5 years of age. (2) Acute respiratory infections, particularly pneumonia, continue to be the leading infectious cause of death in children worldwide, accounting for 14% of all deaths of children under 5 years of age in 2019, or more than 740 000 deaths. (3) The most affected areas are south-east Asia and sub-Saharan Africa. (4)

In 2020, an estimated 2.4 billion (or about 30% of the global population) still relied on polluting fuels and technologies for cooking. The overwhelmingly majority reside in LMICs. Polluting fuels include biomass (wood, dung, crop residues and charcoal), coal, and kerosene. Exposure to these pollutants can be prevented by switching to clean fuels and technologies including electricity, liquefied petroleum gas, piped natural gas, biogas, solar and alcohol fuels. (5–7)

Cooking, heating and lighting with polluting fuels on open fires or traditional stoves can result in high levels of household air pollution, especially if there is poor ventilation. Household air pollution from these sources can contain a range of pollutants that are damaging to health, including fine particles and carbon monoxide, and levels of particulate pollutants may be many times higher than the maximum exposure level recommended by the World Health Organization (WHO). (8,9)

Second-hand smoke is also an important and widespread exposure in indoor environments. For example, second-hand smoke from cigarettes can release thousands of chemicals as gases, particles and vapours. (10)

Children who must travel long distances to collect wood for cooking and heating may miss school and are vulnerable to attack and injury. Girls tend to spend more time collecting fuel than boys. (8)

Note: see the Childhood respiratory diseases linked to the environment, Household air pollution and Second-hand smoke modules for more information.

References:


The Children’s Climate Risk Index found in 2021 that almost all children in the world are at risk to at least one climate-related risk and approximately 1 billion children live in extremely high-risk countries (1).

Human influence on the climate is virtually certain. The strong consensus of global experts on climate and earth sciences agree that human activities are, and have been for decades, the major drivers of global climate change. Burning of fossil fuels and deforestation, along with other greenhouse gas releases associated with agriculture and industry, have rapidly changed the atmosphere, warming the air and the oceans (2).

Global climate change is threatening the health of children in every region of the world and is the single biggest threat to humanity (3,4). Children are particularly vulnerable to the effects of climate change-related vulnerabilities, and children in the poorest countries are at the highest risk (3). A recent systematic review found that climate change is affecting child health by multiple routes including rising temperatures, increased incidence of flooding and drought periods, air pollution and changes in vector patterns and infectious diseases (5).

Climate change is a powerful disease modifier. This means that at current temperatures, existing climate-sensitive health impacts are made worse than in previous times of lower average temperatures and more stable and predictable weather. Diseases that are likely to be affected include vector- and water-borne diseases (4).

**Note:** see the module on *Global climate change and child health* for more information.

**References:**

**Photo:**
© WHO/ Yoshi Shimizu. This photo shows children sitting on a coastal village wall that has been experiencing extensive erosion due to rising sea levels, Kiribati.
Access to safe water and sanitation and hygiene facilities is a universal need and a basic human right.

The number of children dying from diarrhoeal diseases has fallen from approximately 1.2 million in 2000 to an estimated 484,000 in 2019 due to various public health accomplishments, including improved access to safe water and sanitation and hygiene facilities (1). These improvements have reduced morbidity and mortality among children, especially in high-income countries (HICs). However, further interventions could reduce health effects even more.

In 2020, 771 million people still did not have access to even a basic drinking service. Half of these people reside in sub-Saharan Africa (2). In 2020, 3.6 billion people lacked access to basic sanitation services, including 494 million people who still practice open defecation and 2.3 billion people lacked access to basic hygiene services, including 670 million people with no handwashing facilities at all (2).

The graphic on the slide illustrates the percentage of the global population (y axis) with access to safely managed water in 2015 and in 2020 (x axis). The percentage of the global population with access to safely managed water increased from 70% in 2015 to 74% in 2020 (2). Access to water is measured on a ladder, which can be seen at the top right hand side of the graphic. “Safely managed” refers to a water source that is accessible, available when needed and free from faecal and chemical contamination. On the other end of the scale, “surface water” refers to people who have only access to drinking water directly from a lake, river, dam, pond, stream, canal or irrigation canal (2).

The consequences of inadequate access to safe water and sanitation and hygiene facilities have a heavy toll, especially for children. Lack of safe water, sanitation and hygiene facilities contribute to child deaths, disease and malnutrition; increases the burden on the public health systems; and negatively affects children’s schooling, particularly in girls. Girls may not go to school if there is no toilet, especially during menstruation (2). Children who need to collect water from significant distances from their homes may also miss school, face injuries due to hard physical labour associated with carrying water and may find themselves faced by violence situations. Women and girls are often more affected than men and boys (3).

Note: see the Sanitation and hygiene and Water modules for more information.

References:


Figure:
Major global demographic, environmental and societal changes occurring over the 21st century have contributed to the re-emergence and spread of vector-borne and other diseases, many of which have an important impact on children’s health and development. Many vector-borne diseases are preventable and treatable.

Vectors thrive in specific environments, but with proper management they can be reduced and diseases can be prevented. Land and water management, high temperatures and humidity, heavy rainfall, stagnant water, use of pesticides and some agricultural practices can influence the spread of vector-borne diseases. Poverty and limited access to healthcare affect access to treatment and prevention techniques, such as insecticide-treated mosquito nets (ITNs) (1,2).

Climate change is contributing to the spread of vector-borne diseases. More warm days, higher temperature, rainfall patterns and humidity have positive effects on some vectors, such as mosquitoes, providing more opportunities for them to survive, travel and provide longer disease transmission seasons. It is difficult to precisely estimate the effects that climate change are having on vector-borne diseases due to confounding factors including land use and global travel (3,4).

A disproportionate amount of the disease burden of four key vector-borne diseases - malaria, schistosomiasis, dengue haemorrhagic fever and Japanese encephalitis - falls on children under 5 years of age.

**Malaria** is caused by a protozoan (plasmodium) and transmitted through an infected female mosquito (*Anopheles*). In 2020, malaria caused an estimated 486 000 deaths in children under the age of 5 years (1). 96% of all malaria deaths in 2020 occurred in the African Region and 80% of all malaria-deaths in the Region were in children under the age of 5 (1,2). Malaria is preventable and treatable with the correct tools, strategies and treatments (1).

**Schistosomiasis or "Bilharzia"** is caused by flukes (Trematodes) released by snails in fresh water, and which can penetrate the skin of children. The disease is endemic in 78 countries. It is estimated that at least 90% of those requiring treatment for schistosomiasis live in the African Region. Children are exposed through infested water and inadequate sanitation. Liver, kidney and bladder damage may result in long-term health complications. Schistosomiasis is associated with anaemia, stunting and reduced cognitive abilities in children. Chronic schistosomiasis can result in death, however global mortality estimates vary widely (5).

**Dengue fever** can be caused by four different dengue viruses transmitted by infected female mosquitoes (*Aedes*). Dengue occurs largely in urban areas in tropical and sub-tropical areas. It is now present in every region of the world. In children, it may develop into dengue haemorrhagic fever or shock, which have high mortality rates. Dengue is a
leading cause of illness in some countries in Asia and Latin America. In 2015, the World Health Organization (WHO) reported 4032 deaths from dengue fever, mostly among younger age groups (6).

**Japanese encephalitis** is caused by a *Flavivirus* transmitted by mosquitoes (*Culex*), that breed particularly in flooded rice fields. Outbreaks occur mainly in Asia and South-East Asia, including eastern parts of Russia and some regions of northern Australia (7). Research shows an estimated 68 000 clinical cases globally each year, with up to 20 400 deaths. It primarily affects children and has up to a 30% fatality rate in cases with disease symptoms. 20% to 30% of survivors live with permanent behavioural, intellectual or neurological damage including paralysis, seizures or inability to speak (8).

Other vector-borne diseases affecting children include **Lyme disease**, **trypanosomiasis** (also known as African sleeping sickness) and **Zika virus** (9).

**Note:**

**References:**

**Photo:**
- © WHO/Yoshi Shimizu. A woman breastfeeds her baby under a mosquito net, Kiribati
Malaria is a leading cause of child mortality. In 2020, malaria killed more than 486,000 children under 5 years of age. The highest rates of death and disease burden from malaria occur in the World Health Organization’s (WHO) African Region, which carries 95% of malaria cases and 96% of all malarial deaths (1).

Vector control is a key component of malaria prevention. Two forms of vector control are recommended by WHO; insecticide-treated mosquito nets and indoor residual spraying.

Pyrethroids are currently the only class of insecticide recommended for use with insecticide-treated mosquito nets, which puts this form of vector control at a high risk for mosquito resistance. At this point, there has rarely been an association between resistance and efficacy of long-lasting insecticidal nets. However, a rotational approach to using different classes of insecticides is recommended to prevent resistance in the future (2).

The use of insecticides for indoor residual spraying also raises concern over pesticide resistance and the potential effects the chemicals may have on the health of children and the environment. Insecticide formulations for indoor residual spraying are recommended to contain only one insecticide belonging to one of four classes: pyrethroids, carbamates, organophosphates, or organochlorines (3). Indoor residual spraying for malaria is recommended only in countries in which malaria is endemic. WHO seeks to eventually eliminate the use of certain insecticides used in malaria control and supports the development of alternative effective and sustainable vector control methods. WHO has developed specific guidance and risk assessment models for the various insecticide-based methods to ensure there are no unacceptable risks to vulnerable populations, including children (3).

The WHO global technical strategy for malarial 2016–2030 has three key pillars:

1. ensuring universal access to malaria prevention, diagnosis and treatment
2. accelerating efforts towards elimination and attainment of malaria-free status
3. transforming malaria surveillance into a core intervention (4).

Since 2000, the number of children under the age of 5 years in malaria-affected countries using insecticide-treated mosquito nets has increased from 3% to 49% in 2020 (2). Further environmental modifications can reduce malaria incidence and mortality.

References:
This photo shows two children sitting in front of a bed that has been covered by a mosquito net. Behind the two children, a third child is resting on the bed, protected by the mosquito net.

Insecticide-treated mosquito nets are considered one of the essential measures to prevent malaria in children. Insecticide-treated mosquito nets are generally considered an affordable malaria prevention method. In 2020, the use of insecticide-treated mosquito nets had increased considerably since 2000, across global malaria-affected populations. In particular, use of these nets increased from 3% to 49% in children aged under 5 years and pregnant women (1).

Indoor residual spraying is an example of an environmental management technique that can be taken to reduce and prevent the risk of vector-borne diseases in children. Other environmental management techniques that so not include the use of insecticides include:

- use of screens on doors and windows to reduce contact between children and vectors;
- environmental modification, including canal maintenance and removal of aquatic vegetation; and
- permanent changes and infrastructure investments, for example improved water infrastructure design, building drains and improving wastewater management (2).

References:


Photo:

- © WHO/Yoshi Shimizu. Children sitting next to the mosquito net protecting their bed, Samoa.
Children are exposed to many different chemicals everyday. Chemicals are ubiquitous in everyday life and many are very useful. While many chemicals are useful, their production, use and disposal can pose risks to children’s health. More than 160 million chemicals are known to humans, most them manmade. The toxicity to humans of most of these chemicals is unknown. Data on chemical toxicity and human health is limited to a small number of individual chemicals, tested mostly for acute, high dose exposure. Data on mixed chemical exposures, the kind that humans experience daily, are extremely scant (1).

The World Health Organization (WHO) estimated that 2 million deaths globally were attributed to select chemical exposures in 2019. Cardiovascular diseases, chronic obstructive pulmonary disease and cancers make up the largest proportions of deaths attributed to chemicals in 2019 (1,2).

Toxic chemicals of concern to children’s health include:

- **lead**: a well-studied and major developmental neurotoxicant. Children worldwide are exposed to lead through a variety of sources including, mining, leaded paint and pipes, battery recycling and waste burning (3);
- **mercury**: there are three types of mercury; elemental, inorganic and organic. All humans are exposed to mercury, usually at very low levels. Chronic and acute mercury exposure can affect many systems in the human body. In utero and early childhood mercury exposure can permanently impair neurodevelopment (4);
- **pesticides**: while pesticides have an important public health role in the control of certain pests and vectors of disease; they may also pose acute and chronic risks to children and the environment. Pesticide ingestion is a leading cause of both unintentional poisonings and self-inflicted injuries (2). WHO recommends reducing the use of pesticides wherever possible (5);
- **persistent organic pollutants (POPs)**: are organic chemicals that remain in the environment for long periods of time, even after being banned or eliminated from use. A number of POPs are banned under the Stockholm Convention. POPs bioaccumulate and can adversely impact a number of systems in the human body (6);
- **arsenic**: occurs naturally in groundwater in many countries and can contaminate the environment through industrial processes and mining. Arsenic contamination of drinking water is a problem in countries across Latin America and Asia. In utero and childhood exposure to arsenic have been associated with negative impacts on birth outcomes, cognitive development and childhood mortality. Arsenic is classified as carcinogenic to humans (7);
- **mycotoxins**: are naturally occurring toxins produced by some moulds. They can be found in some foods, including crops. They pose a significant threat to the health of children. Mycotoxins are particularly of concern in the African Region, where they are endemic (8);
- **many other chemicals are of concern to children’s health. More information on these can be found in the modules listed below.**
**Note**: highlight the toxic chemicals that are the main concerns to child health in your community, country or region.

**Note**: for more information on chemicals see *Children and chemicals, Lead, Mercury, Mycotoxins, Persistent organic pollutants, Pesticides* and *Water* modules.

**References**:
E-waste is the fastest growing solid waste stream in the world, increasing three times faster than the world’s population (1). Each year millions of electrical and electronic devices are discarded as products break, or become obsolete, and are discarded by consumers. The discarded devices are considered e-waste and can become a threat to the environment and to human health if they are not treated, disposed of and recycled appropriately (2).

E-waste contains valuable resources (such as copper) that can be reused if recycled appropriately. However, e-waste also contains many toxic substances that pose risks to human health if it is not recycled properly. For example, many items found in e-waste contain significant amounts of lead, a known neurotoxicant that is particularly dangerous to the health and development of children (2).

A significant informal e-waste recycling sector exists across the world, primarily in low- and middle-income countries (LMICs). Informal e-waste recycling uses activities that often have few or no environmental controls and consequently contaminate air, dust, soil, water and food. Children are at particularly high risk to contamination due to e-waste recycling.

Research on exposure to toxic components of e-waste and associated child health outcomes is growing. E-waste may be linked to the following health effects in children:

- adverse neonatal outcomes, including increased rates of stillbirth and premature birth
- negative neurodevelopment, learning and behaviour outcomes
- reduced lung and respiratory function and increased asthma incidence (2,3).

**Note:** for more information on e-waste see the module *Electrical/ electronic waste and children’s health*.

**References:**


**Photo:**
© Kwadwo Ansong Asante. This photo shows a recycling worker in Agbogloshie, Accra, Ghana carrying various e-waste items. In the background we can see substantial environmental pollution, in part from e-waste recycling activities.
Injuries are usually classified on the basis of intentionality. Injuries are categorized as either intentional or unintentional.

**Intentional** injuries include homicides, sexual assault, neglect, abandonment and maltreatment, self-harm and collective violence. Intentional injuries may be linked to environmental factors including the built environment, inadequate sanitation services, lack of product safety standards and easy access to harmful items, such as firearms (1,2). Intentional injuries caused more than 1.2 million deaths in 2019, including more than 22 000 deaths in children under the age of 5 and almost 29 000 in children between 5–14 years (3). Evidence suggests that small children are more vulnerable to collective violence, whereas older children and adolescents are at greater risk of self-harm.

**Unintentional injuries in children** are often the result of the built environment, including housing, in which children live, play and learn. Unsafe and unhealthy built environments can increase the risk child death or disability due to road injuries, poisonings, falls, fire and burn injuries, drowning, as well as exposure to mechanical forces and natural disasters. Unintentional injuries caused more than 3.1 million deaths in 2019, including more than 265 000 deaths in children under the age of 5 and almost 200 000 deaths in children between 5–14 years (3). Evidence suggests that small children are more vulnerable to injuries such as burns, drownings, falls and drownings. Older children and adolescents are at higher risk of road injuries.

Both intentional and unintentional injuries tend to be more prevalent in boys. The exception to this is fire and burn injuries, where girls are more likely to be effected. This is possibly due to exposure to unsafe cooking arrangements and higher prevalence of girls contributing to cooking tasks (3). Rates and patterns of injury vary from country to country.


**References**:
Photo:
• © WHO/Yoshi Shimizu. Three children and one adult ride on a motorcycle without helmets. Motorcycle helmets are essential safety equipment for child passengers on motorcycles, Cambodia.
Unintentional injuries accounted for more than 265 000 deaths in children under 5 years of age in 2019. The top 5 unintentional injuries that caused child mortality in 2019 were road injuries, drowning, exposure to fire, heat and other hot substances, poisoning and falls. Deaths in children under the age of 5 in 2019 from other unintentional injuries included exposure to mechanical forces and natural disasters (1).

For children between 5–14 years of age, injuries are a leading cause of death. In 2019, almost 200 000 children between 5–14 years of age died from unintentional injuries. In particular, drownings and road injuries, which killed more than 35 000 and almost 100 000 children between 5–14 years, respectively. Overall, boys in this age group were more affected than girls (1).

Children who survive injury may suffer life-long disability (2).

Note: use the data table to calculate injuries in your country: https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates/ghe-leading-causes-of-death.

References:
Unintentional poisonings are considered to include poisonings by chemicals or other noxious substances, including drugs, toxic vapours and gases (1).

Children make up a significant proportion of deaths due to unintentional poisonings. The graph featured on the slide shows the percentage of global deaths in 2019 (y axis) by age group attributed to unintentional poisoning. The graph shows that deaths attributed to poisonings increase dramatically during childhood and peak in children under the age of 15 years (x axis). Mortality due to poisoning greatly decreases as children enter adolescence and continue to decline throughout adulthood (2).

Mortality due to unintentional poisoning is usually low but this varies from region-to-region. Almost all deaths from unintentional poisoning in 2019 occurred in low- and middle-income countries (LMICs). Unintentional poisonings accounted for more than 18 000 deaths and more than 1.6 million disability-adjusted life years (DALYs) in children under the age of 5 years in 2019 (3,4). The number of poisoning cases is an under-reported and under-recognized major public health concern (5). The majority of childhood poisonings were attributed to environmental factors in 2016 (6), however this statistic is unavailable for 2019.

Household chemicals especially pesticides, drugs, cosmetics, personal care products, and, in some LMICs, kerosene, are among the common causes of unintentional childhood poisonings (7). Unintentional poisonings can be avoided by carefully labelling products containing chemicals, keeping them in childproof containers, keeping them out of children’s reach and avoiding storing chemicals in reused food containers, such as soft drinks or milk bottles.

**Note:** for more information on unintentional poisonings see **Children and chemicals** and **Pesticides** modules.

**References:**


Figure:

Some of the worst forms of environmental exposure to children occur in the context of child labour.

Between 2016 and 2020, strides in eliminating child labour stagnated. The percentage of children in child labour in 2020 remained the same over the four-year period, however the absolute number increased by more than 8 million (1). Child labour reduces the available time that children have to attend education and can place them in situations that are hazardous to their health and development (2).

In 2020, **160 million children between 5–17 years of age** were involved in child labour. This included 63 million girls and 97 million boys. More boys than girls are involved in child labour across all age groups (1). The agricultural sector accounts for the largest share of child labour. Children working in agricultural labour may be exposed to dangerous chemicals, such as pesticides, heavy machinery and insect and animal bites, which may be vectors of disease (1).

In 2020, **79 million children between 5–17 years of age, or nearly half of all those in child labour,** were involved in **hazardous child labour.** Hazardous child labour directly endangers the health, safety and moral development of children. Hazardous labour includes mining work, working directly with hazardous chemicals, exposure to dangerous machinery, tools and equipment and exposure to high levels of noise and temperatures (1).

**Note:** if available, state whether the country has ratified the International Labour Organization/International Programme on the Elimination of Child Labour conventions.

**Note on terminology:** not all children who work are in child labour. **Child labour** is defined as work that deprives children of their childhood, their potential and their dignity, and that is harmful to physical and mental development. **Hazardous child labour** is defined as labour that jeopardizes the physical, mental or moral well-being of a child, either because of its nature or because of the conditions in which it is carried out, is known as “hazardous work” (2).

**References:**
Photo:

- © WHO/Florian Lang. This photo shows children carrying bricks in Cox’s Bazar, Bangladesh. The bricks will be used to build a community toilet.
Emerging and re-emerging environmental issues are potential threats to children’s health and development. Some examples include:

- **Endocrine disrupting chemicals (EDCs)**, which have been the subject of increasing research over the past 20 years. EDCs and potential EDCs are found in numerous everyday items and can leach into food and water. Research has found connections between some EDCs and effects on numerous body systems in humans. These findings are supported by animal studies. EDCs are a particularly significant threat to children as they are going through important periods of physiological development which may be irreversibly changed by EDCs. Some examples of EDCs include polychlorinated biphenyls (PCBs), which were used in electrical equipment, and may include phthalates, which are used in many plastic items such as food containers.

- **Plastics** exist in numerous forms and pollute every corner of our world. A child’s environment is polluted by millions of tonnes of plastics and exposure is ubiquitous. Children may have increased exposure to plastics due to their exploratory behaviours and due to the large number of items for children that are composed of plastics. Microplastics have recently been identified in the human bloodstream; while animal studies have found evidence that microplastics can cross the blood brain barrier. Some plastics contain known or suspected EDCs. However, our understanding of how plastics affect child health is currently limited and greater research is needed.

- **Predatory marketing practices** are targeting children. Marketing of foods high in sugar, fat and salt to children has been prevalent for many years. More recent marketing efforts are making harmful activities attractive to children, including alcohol, smoking, vaping, gambling, and online gaming. While many high-income countries (HICs) have tightened marketing regulations on products deemed harmful to children, many of these are voluntary and not enforced. Businesses have also shifted their focus to low- and middle-income countries (LMICs) where regulations may not yet restrict such advertising.

More research is needed across all the above issues to better understand their effects on child health and development and to develop ways to reduce and prevent harmful exposures to children. Research needs to be conducted in LMICs where children face multiple burdens of disease to emerging and re-emerging issues alongside ongoing traditional threats, such as vector-borne and infectious diseases.

**References:**


A review of the global environmental threats to children's health, one by one, helps to provide an understanding of why many paediatric illnesses are linked to pollutants in the environment, which may cause, trigger or exacerbate diseases.

Let us consider some examples that illustrate the fact that environmental risks do build up. Exposures do not occur in isolation but rather combine in different settings and under various circumstances.

In 2016, modifiable environmental factors caused (1):

• 23% of the global disease burden in disability-adjusted life-years (DALYs)
• 27% of the global disease burden in DALYs in children under 5
• 24% of global deaths, and
• 28% of deaths in children under 5.

Many paediatric diseases are linked in one way or another to circumstances where several threats are combined. These threats include (1):

• **Heavy traffic**: where exposure to noise, particulate matter and the risk of injury coexist;

• **Toxic waste sites**: where children are exposed to toxic products, healthcare waste such as used needles, discarded contaminated food, vectors of disease and dioxins and toxic fumes from burning waste;

• **Contaminants in water, food and objects**: may expose children to multiple chemicals at once, as well as vectors of disease;

• **Pollutants** where children grow, learn and play: including, childhood exposure to pesticides in soil and water in agricultural settings, household chemical products at home, pollutants brought home on family member’s clothing and household and ambient air pollution.

**Reference:**

**Photo:**
© WHO/Anna Kari. Children playing at a garbage dump close their home, Philippines.
Countries across the world have experienced rapid increases in life expectancy and decreases in childhood mortality over the past few decades. The improvements in global life expectancy and childhood mortality are largely due to the reduction in traditional diseases, such as respiratory infections and vector-borne diseases, due to preventative measures and increased access to treatments. However, as some diseases have declined, other chronic, noncommunicable diseases (NCDs) have emerged around the world (1). Changes and shifts in disease patterns and burdens of disease is often referred to as the “epidemiological transition” and describes traditional and emerging challenges to human health. The epidemiological transition is a dynamic process and has several overlapping stages, including the re-emergence of infectious diseases (2).

In many low- and middle-income countries (LMICs) ongoing challenges to children’s health and development continue to include (1,2):
- respiratory infections, such as pneumonia
- diarrhoeal diseases
- vector-borne diseases, such as malaria
- HIV/ AIDS
- unintentional injuries, including drownings and poisonings.

In many high-income countries (HICs), the environmental factors associated with these diseases have been largely addressed through improved access to safe drinking water and to adequate sanitation and hygiene services, waste, hazardous chemicals and pesticides management and improvements in treatment and prevention, such as antibiotics and vaccines. This has led to a significant decline in the burden of disease from many infectious and vector-borne diseases. However, discrepancies do still exist in HICs, especially within low-income communities (2).

HICs, while having largely addressed these diseases are now experiencing other challenges, largely NCDs, associated with an increasing ageing population and changing lifestyles. Evidence suggesting that environmental factors experienced during fetal development and childhood can impact the development of NCDs later in life, is also increasing. NCDs are increasing globally and are now among the leading causes of mortality worldwide. NCDs that may affect children’s health and development include (2):
- asthma
- cardiovascular disease
- neurodevelopmental and behavioural disorders
- cancers, such as leukemias and lymphomas
- endocrine disruption and related diseases
- metabolic disorders, such as diabetes and obesity
• reproductive disorders.

LMICs are experiencing the “double burden” of disease. This means they continue to face a significant burden of disease and mortality from traditional diseases, while also experiencing emerging diseases that are more characteristic of HICs. In the diagram on the slide this is illustrated by the overlapping of the circles. Additionally, the “double burden” of disease can be compounded further in LMICs by malnutrition and poverty.

References:
Children in all countries are exposed to environmental risks factors. However, the risks vary from country to country and even within the country, and in different communities (for example, urban and rural). The aim of this slide is to compare some of the different risk factors that children may face in different parts of the world.

One useful way of considering these diverse risk factors is to consider some of the challenges faced in low- and middle-income countries (LMICs) when compared to those faced in high-income countries (HICs).

In LMICs some of the significant environmental challenges include:

• **Contaminated water and access to safe and clean water**, which is strongly linked to diarrhoeal disease, is one of the most significant causes of mortality for children under the age of 5 years. The photo on the left of the slide shows children in a poor, urban area of Cameroon washing and drying clothes using creek water that is also an open sewer. This puts the children at risk of contracting many infectious diseases.

• **Household air pollution**, caused primarily by polluting fuels used for cooking, heating and lighting. Household air pollution is strongly associated with the development of pneumonia and lower respiratory infections in children. Household air pollution is also linked to common children diseases, including asthma and otitis media.

In comparison, in HICs the above challenges have largely been addressed and the significant environmental challenges have shifted to include:

• **Ambient air pollution**, caused by fossil fuel combustion for energy production, transport, residential cooking, heating and lighting, residential and agricultural waste incineration and forest fires. Ambient air pollution is linked to numerous health effects in children including adverse birth outcomes, asthma exacerbation and development, some childhood cancers, otitis media and may be linked to negative neurodevelopmental effects.

• **Chemicals** are ubiquitous in our environment and children are exposed daily to multiple chemicals. Chemicals have been linked to many health effects in children including birth defects, neurodevelopmental and behavioural effects, endocrine disruption and cancers. Some of these diseases may be latent and appear many year after exposure. The photo on the right shows a child at home with their mother. Surrounded by them we can see toys, cosmetics and a spray bottle. These items may contain chemicals that may be harmful to the child’s health and development.

• **Pesticides** that have been widely and indiscriminately used. Pesticides have been linked to a number of adverse health outcomes in children including birth defects, cancers and neurodevelopmental issues.

However, HICs and LMICs also share some of the same environmental health challenges. As regulations in many HICs have become more stringent, chemical manufacturing has shifted to LMICs where there may be fewer regulations, greater demand and lower labour costs. Chemicals, including pesticides, are an increasing environmental concern in
LMICs and expose these populations to the health threats that may be associated with these chemicals (4).

Additionally, climate change is creating emerging health challenges for every child in every country around the world. For example, children are heavily affected by changing weather patterns, such as heat waves, droughts and floods and associated emerging and re-emerging diseases, such as dengue fever, associated with these changes. Children in LMICs are among the most vulnerable to climate change (5).

Note: if you have a regional or local photo that is relevant to this slide, use it here.

References:

Photos (left to right):
• © WHO/ Anna Kari. Washing and drying clothes next to the little creek that is now an open sewer, Cameroon.
• © WHO/ Malin Bring. Mother holding baby who is sucking on his hand, Romania.
The final section of this module discusses future directions in building healthy environments for children.

Photo:
• © WHO/ Yoshi Shimizu. During low tide, children are playing on a beach in South Tarawa, Kiribati.
Health care professionals have a critical role to play in maintaining and stimulating changes that will restore and protect children’s environmental health.

Understanding and staying informed about the environmental influences on health and disease will allow health care workers to advocate for and create conditions that keep children safe and healthy. Health care workers can look for ways in our professional, political and personal lives to support environmental health and sustainable development.

At the one-to-one patient level, health care workers can take an environmental history at each visit, include environmental etiologies in differential diagnoses, and add environmental considerations to preventive advice. Health care workers can be dissatisfied with the diagnosis of “idiopathic” and look hard for potential environmental causes of disease and disability. Health care workers can stay informed about the specific environmental conditions and risks of local and regional areas, which will help to prioritize activities.

Health care workers can identify and publish sentinel cases and develop and write up community-based interventions.

Health care workers can educate patients and families by including environmental protections in anticipatory guidance during each visit. Health care workers can do formal presentations, continuing education programs, e-learning, and case studies on children’s environmental health for colleagues and professional students.

Health care workers can become vigorous advocates for the environmental health of children and future generations. It is not enough to be an informed citizen, writing letters and articles, testifying at hearings and approaching elected officials with educational and positive messages, avoiding "scarems" and "alarmism", but providing evidence for action and clear proposals for remedial and preventive activities.

And, health care workers can recognize that as professionals with an understanding of both health and the environment, they are powerful role models. Choices will be noticed: they should be thoughtful and sustainable.

Photo:
• © WHO/Yoshi Shimizu. A family visits with a health worker in Papua New Guinea.
Children represent the future of our societies and they have the right to healthy, clean and safe environments.

Different sectors can work together to prevent harmful exposures to environmental toxicants and protect children’s health and future generations from harm.

At the national level, governments and national stakeholders can:

• **recognize** environmental health issues in their country, with a particular focus on those affecting children’s health and development;

• **develop and implement sustainable policies** that work to address and improve environmental health issues in their national context; and

• **take and support actions** that reduce toxic environmental health threats at national and local levels.
The Sustainable Development Goal era began in 2015 with countries committing to a global development agenda for the next fifteen years. Many of the SDGs relate to children’s environmental health, as action is required from multiple sectors, but the goal that targets health specifically is SDG 3: Ensure healthy lives and promote well-being for all at all ages.

Each SDG contains targets to achieve the overall goal, and Target 3.2 focuses directly on child mortality, as shown on the slide. Indicators for monitoring progress Target 3.2 include:

- Indicator 3.2.1: Under 5 mortality rate
- Indicator 3.2.2: Neonatal mortality rate

Other targets included in SDG relating to children’s environmental health as discussed in this module are listed here:

- **Target 3.3**: By 2030, end the epidemics of AIDS, tuberculosis, **malaria** and neglected tropical diseases and combat hepatitis, **water-borne diseases and other communicable diseases**
- **Target 3.6**: By 2030, halve the number of global deaths and injuries from road traffic accidents
- **Target 3.9**: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination
- **Target 3.A**: Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate (1)

Attention to children’s environmental health is crucial in achieving these goals, and health care professionals are in an excellent position to champion the cause!

**Reference:**

**Figure:**
- © United Nations
The Sustainable Development Goals (SDGs) are 17 standards that provide a broad framework for economic, social and environmental development. Agreed upon in 2015 by the United Nations (UN) General Assembly, each goal is broken into several targets with accompanying indicators. These targets are due to be achieved by 2030. The SDGs emphasize that health is inextricably linked to factors such as poverty, inequity, climate change and pollution (1,2).

The achievement of SDG 3 – ensuring health lives and promoting good health for all at all ages - cannot be achieved without the achievement of all other relevant SDGs that will protect children’s environmental health now and in the future.

The following SDGs are of particular importance to ensuring children’s health and well-being (2):
1. No poverty
2. Zero hunger
3. Clean water and sanitation
4. Affordable and clean energy
5. Decent work and economic growth
6. Industry, innovation and infrastructure
7. Reduced inequalities
8. Sustainable cities and communities
9. Responsible consumption and production
10. Climate action.

The SDG framework emphasizes the multifaceted nature of these challenges, and the intersectoral collaboration that will be required to address these preventable environmental risks, for the sake of our children’s health. The graphic shown on the slide illustrates the need for a multisectoral approach to achieving the SDGs by 2030 – and ensuring children’s health and futures are protected from environmental hazards.

**Note:** go to [http://www.un.org/sustainabledevelopment/sustainable-development-goals](http://www.un.org/sustainabledevelopment/sustainable-development-goals) to view the full list of SDGs, their targets and indicators.

**References:**
Figure:
Over the past 30 years, the importance of protecting children’s health and their environments has been recognized internationally.

This is a long list, with the international agreements and recommendations that refer to the need to protect children from environmental threats.


1992 Agenda 21, Chapter 25 (United Nations Conference on Environment and Development)  
https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf

1997 Declaration of the Environment Leaders of the Eight on Children’s Environmental Health  
https://apps.who.int/iris/bitstream/handle/10665/67382/WHO_SDE_PHE_02.06.pdf

2002 United Nations General Assembly Special Session on Children  

The Bangkok Statement: A pledge to promote the protection of children’s environmental health  

World Summit on Sustainable Development  

Healthy Environments for Children Alliance  
https://www.who.int/initiatives/healthy-environments-for-children-alliance

Children’s Environmental Health Indicators  
https://www.who.int/publications/i/item/WHO-HSE-PHE-EPE.09.1

2003 Intergovernmental Forum on Chemical Safety: Forum IV Recommendations on Children and Chemicals  
https://www.who.int/publications/m/item/fourth-session-of-the-intergovernmental-forum-on-chemical-safety---final-report

2006 Strategic Approach to International Chemicals Management – Global Plan of Action  

2008 World Health Assembly resolution: Climate change and health

2009 Busan Pledge for Action on Children’s Health and the Environment

2011 Global Alliance to Eliminate Lead Paint

2012 World Health Assembly resolution: Drinking water, sanitation and health

2013 Minamata Convention on Mercury

2015 UN Sustainable Development Goals

2015 Global Strategy for Women’s, Children’s and Adolescents’ Health 2016-2030

2015 World Health Assembly resolution: Health and the environment addressing the health impact of air pollution

2019 World Health Assembly resolution: The role of the health sector in the Strategic Approach to International Chemicals Management towards the 2020 goal and beyond

2019 WHO global strategy on health, environment and climate change

2021 The human right to a clean, healthy and sustainable environment

FUTURE DIRECTIONS

WHY CHILDREN

2005 Healthy Environments, Healthy Children: Commitment For Action, Buenos Aires


2008 World Health Assembly resolution 61.19: Climate change and health [https://apps.who.int/iris/handle/10665/23547]

2011 Global Alliance to Eliminate Lead Paint [https://www.who.int/initiatives/global-alliance-to-eliminate-lead-paint]

World Health Assembly resolution 64.24: Drinking-water, sanitation and health [https://apps.who.int/iris/handle/10665/3587]


World Health Assembly resolution 68.8: Health and the environment: addressing the health impact of air pollution [https://apps.who.int/iris/handle/10665/253237]

2016 World Health Assembly resolution 69.4: The role of the health sector in the Strategic Approach to International Chemicals Management towards the 2020 goal and beyond [https://apps.who.int/iris/handle/10665/252784]

2019 WHO global strategy on health, environment and climate change: the transformation needed to improve lives and well-being sustainably through healthy environments [https://apps.who.int/iris/handle/10665/331959]


Note: select and mention only the most relevant international agreements and declarations to your context. Consult the relevant websites if you wish to expand on any of these or consult your national websites, where relevant, to give more localized information on the progress of these agreements and
declarations. Additionally, if there is a regional convention, treaty or declaration relevant to children’s environmental health in your context, it could be used here.

**Note**: the conventions, treaties, declarations, initiatives and resolutions mentioned here are only examples of some of the global actions that have been taken to protect children’s environmental health. For more relevant conventions please also see the modules on *Children and chemicals*, *Electrical/electronic waste and children’s health*, *Persistent organic pollutants* and *Pesticides*.
The World Health Organization (WHO) has been working on children’s environmental health and associated issues for more than 20 years. WHO is undertaking a number of technical activities, in partnership with different organizations, such as the network of WHO collaborating centres, the International Network for Children’s Health, Environment and Safety (INCHES), International Society of Doctors for the Environment (ISDE), other United Nations (UN) agencies and other organizations (1,2).

One of the key tools available are the "train the trainers" materials for health care providers. The WHO Training Package for the Health Sector is a tool to help build the capacity of the health sector to deal with the adverse effects of environmental factors on child health. Why Children is one of the introductory modules in the training package (3).

Creating healthier, cleaner and safer environments for children will contribute to a more secure future for the world.

References:

Photo:
• © WHO. World Health Day 2022, “Our planet, our health”. 
For more information on children’s health and the environment see the World Health Organization (WHO) training package on children’s environmental health for the health care sector (1). The following modules may be of particular interest:

- Air pollution package – this includes Ambient air pollution, Childhood respiratory diseases linked to the environment, Household air pollution, Indoor air pollution and Second-hand smoke
- Children and chemicals
- Children are not little adults
- Global climate change and child health
- The paediatric environmental history
- Sanitation and hygiene
- Water.

To read more on children’s health and the environment see the below references:

- Inheriting a sustainable world? Atlas on children’s health and the environment (2)
- Don’t pollute my future! The impact of the environment on children’s health (3)
- Children’s health and the environment: a global perspective: a resource manual for the health sector (4)
- Preventing disease through healthy environments: A global assessment of the burden of disease from environmental risks (5).

References:
Acknowledgements for current version

Initial edits by Julia F. Gorman (WHO consultant).

Working group for current version: Marie-Noël Bruné Drisse (WHO), Gloria Chen (USA), Julia F. Gorman (WHO consultant), Amalia Laborde (Uruguay), Katherine M. Shea (USA).

Reviewers: Maria Brown (UNICEF), Bernadette Daelmans (WHO) and Patrick Hicks (Canada).

Final review, technical and copy-editing: Julia F. Gorman (WHO consultant).

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

This publication was made possible with financial support from the Swedish International Development Cooperation Agency (SIDA), Sweden.

Update: September 2022.

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 and the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, Germany.


With the advice of the Working Group Members on the Training Package for the Health Sector: Cristina Alonso (Uruguay); Yona Amitai (Israel); Stephan Boese-O’Reilly (Germany); Stephanie Bongo (ISDE, Italy); Irena 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). WHO is grateful to the ISDE for organizing the working meeting of the Training Package in 2016.

Reviewers: Giorgio Tamburlini (Italy); Irma Makalinao (Philippines); Ligia Fruchtengarten (Brazil); Yona Amitai (Israel); Ruth A. Etzel (USA); Daniel Beltramino (Argentina); Fiona Goldizen (Australia); Irena Buka (Canada); Katherine M. Shea (USA).

Previous update: January 2019.

Editing assistance: Kathy Prout (WHO) and Gloria Chen (WHO consultant).

WHO CEH Training Project Coordination: Marie-Noel Bruné Drisse.
Suggested citation: