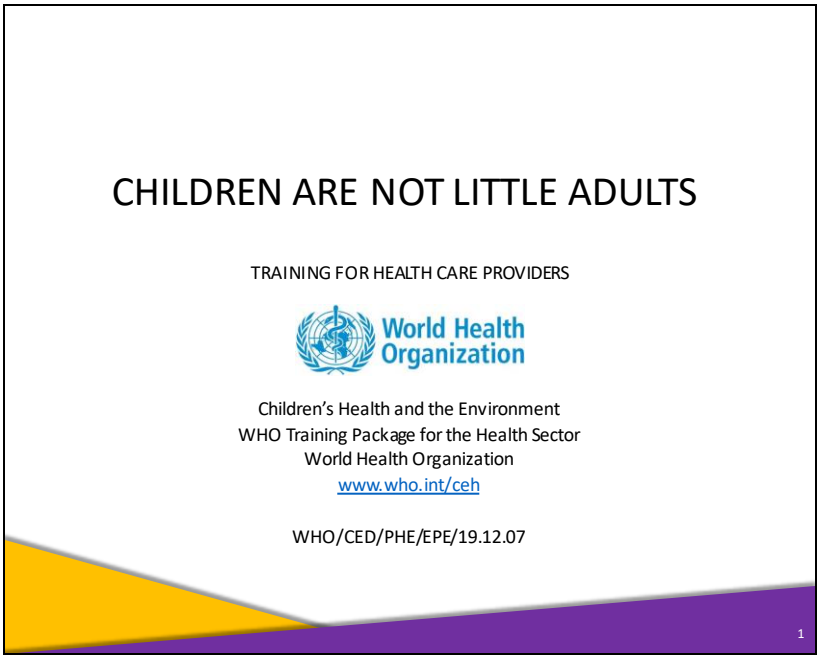


Notes:

- 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.

Until about six centuries ago, European artists represented children as miniaturized adults just as we see in the 13 th century icon on the left of the slide.

Note: Second picture will appear with mouse click

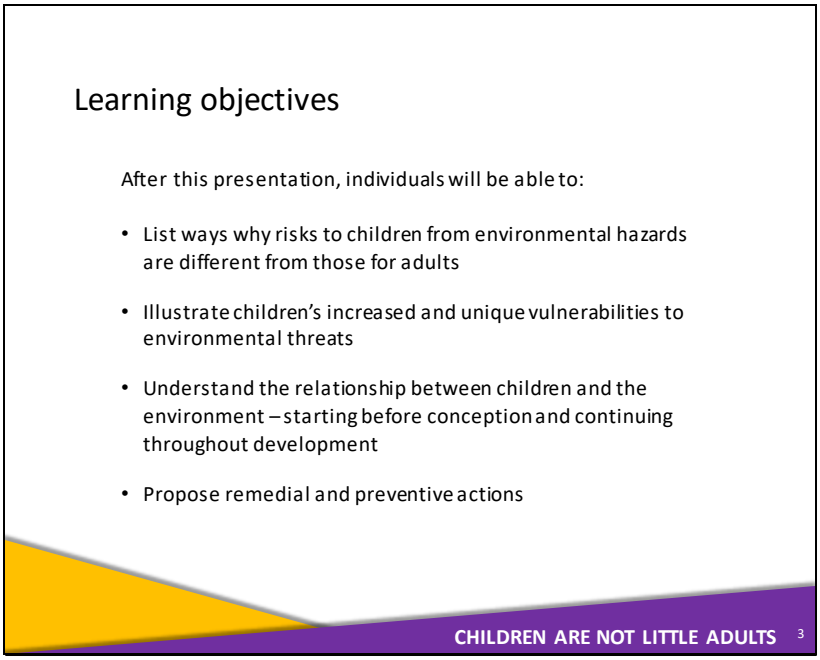
On the right side of the slide you can see how artists of the Renaissance painted children. By the Renaissance artists realized that children were not simply miniaturized adults: they have big heads, long trunks and short limbs, as seen in this "Madonna and Child" by Raphael.

Despite changes in art, we often forget that children are not little adults. Until the mid-20th century, doctors following the standard medical practices of the industrialized countries understood paediatric exposures as simple extrapolations from adult occupational exposures. By now, we know many of the physiological and behavioural differences between children and adults; with this knowledge, we can build healthy environments that protect children from their unique exposures and allow them to grow and thrive.

Notes: Use images that are regionally or culturally appropriate for illustrating the inaccuracy of thinking of children's environmental risks simply as scaled down adult risk.

Photos:

- Madonna and Child, Giotto (left); The Niccolini-Cowper Madonna, Raphael (right)
    - Courtesy National Gallery of Art, Washington



All children deserve to grow and develop, play and learn, in a healthy environment where they can reach their full potential as citizens of the world. Sustainable development has at its core healthy children. Health is much more than mere absence of illness; it means protection not only from toxic chemicals, physical injury and infections, but also from poverty, inequity and child labour. It is the responsibility of today's adults to identify hazards and conditions in the complex and changing environments of children that impair their ability to grow and mature safely and in good health.

After this talk, we hope that you will be able to satisfy these four learning objectives:

- Be able to list ways in which risks to children from environmental hazards are different from those for adults.
- Be able to illustrate children's increased and unique vulnerabilities using real-world examples of environmental threats: biological, physical, and chemical.
- Understand that the relationship between children and their environment begins before conception and continues throughout development.
- Propose remedial and preventive actions.

Note:

- When discussing environmental determinants of health and disease, the term "child" or "children" can be problematic. Exposures to parents prior to conception, exposures to mothers during pregnancy and exposures to newborns (up to 28 days), infants (28 days to 1 year), young children (1-4), older children (5-9) and adolescents (10-19) can all have profound impacts. It is important to be attentive to how different agencies collect and report childhood health and exposure data since each institution or agency is likely to have a slightly different set of definitions and age categories. For the purposes of this presentation we will use the term children as defined in the United Nations Convention on the Rights of the Child: every human being below 18 years of age, unless under applicable law, majority is attained earlier.

References:

- Cohen Hubal EA, de Wet T, Du Toit L, Firestone MP, Ruchirawat M, van Engelen J et al. (2014). Identifying important life stages for monitoring and assessing risks from exposures to environmental contaminants: results of a World Health Organization review. Regul Toxicol Pharmacol. 69(1):113-24. doi:10.1016/j.yrtph.2013.09.008.
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- Pronczuk-Garbino J, editor (2005). Children's health and the environment: A global perspective. A resource manual for the health sector. Geneva: World Health Organization.

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- Etzel RA, editor (2012). Environmental Health, 3rd ed. Elk Grove Village, IL: American Academy of Pediatrics.
- WHO (2017). Inheriting a sustainable world? Atlas on children's health and the environment. Geneva: World Health Organization. (http://www.who.int/ceh/publications/inheriting-a-sustainable-world/en/, accessed 2 April 2018).
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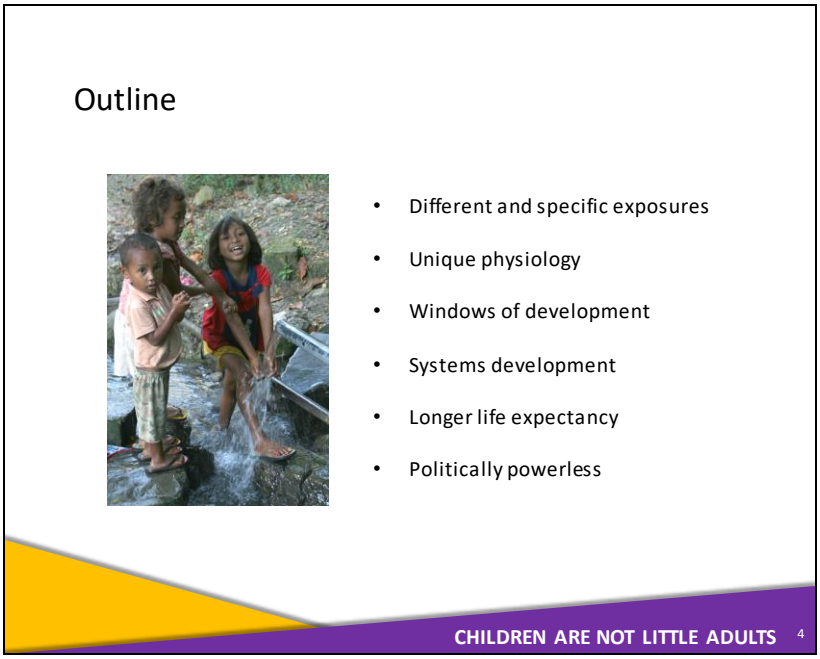


Note:
When selecting the slides to include in your presentation, please choose only those of relevance to the region and/or interests of your audience.

We now recognize that children are often at a different and increased risk from environmental hazards compared to adults. There are four large categories of reasons that explain these differences.

1. Children often have different, and sometimes specific, exposures to environmental hazards compared to adults.
2. Due to their dynamic developmental physiology children are often subjected to higher exposures to pollutants found in air, water and food. These exposures may be handled quite differently by an immature set of systems 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 "critical windows of vulnerability" have no parallel in adult physiology and create unique risks for children exposed to hazards that can alter normal function and structure.
3. Children have a longer life expectancy. Therefore they have longer to manifest a disease with a long latency period, and longer to live with toxic damage.
4. Finally, children are politically powerless; they are defenseless. With no political standing of their own, they must rely on adults to protect them from toxic environmental agents. Each of these points is illustrated in more detail in the following slides.

Image:
- © WHO /Joao Soares Gusmao

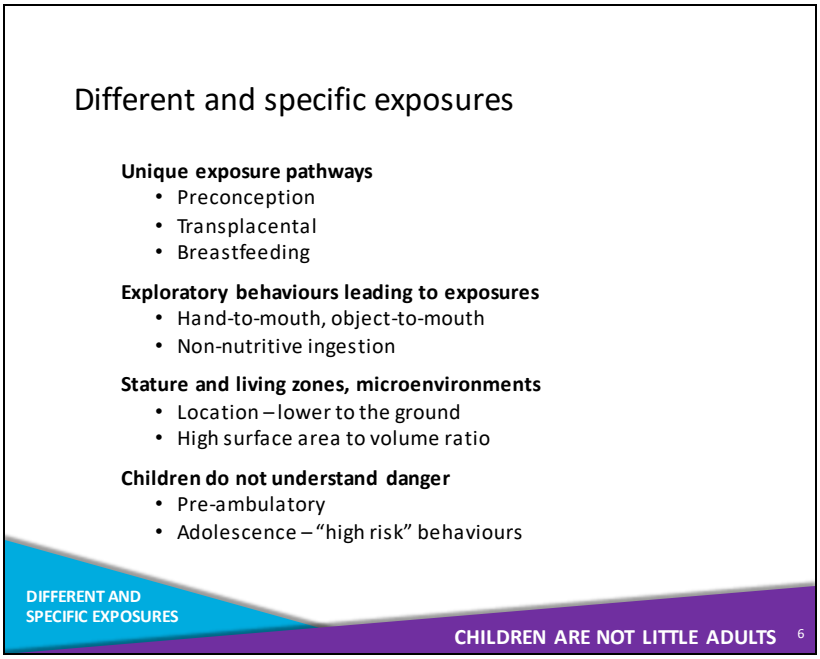
Outline

- Different and specific exposures
- Unique physiology
- Windows of development
- Systems development
- Longer life expectancy
- Politically powerless

We begin with different and specific exposures of children

Image:

- © WHO /Joao Soares Gusmao



Children have unique exposure pathways. Environmental exposures to either mother or father can affect the viability and health of a fetus – these are known as "preconception" exposures. Children can be exposed *in utero* to toxic environmental agents that cross the placenta. Such exposures can be chemical (pollutants and pharmaceuticals), physical agents (radiation, heat) and biological (viral, parasitic). They can also 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.

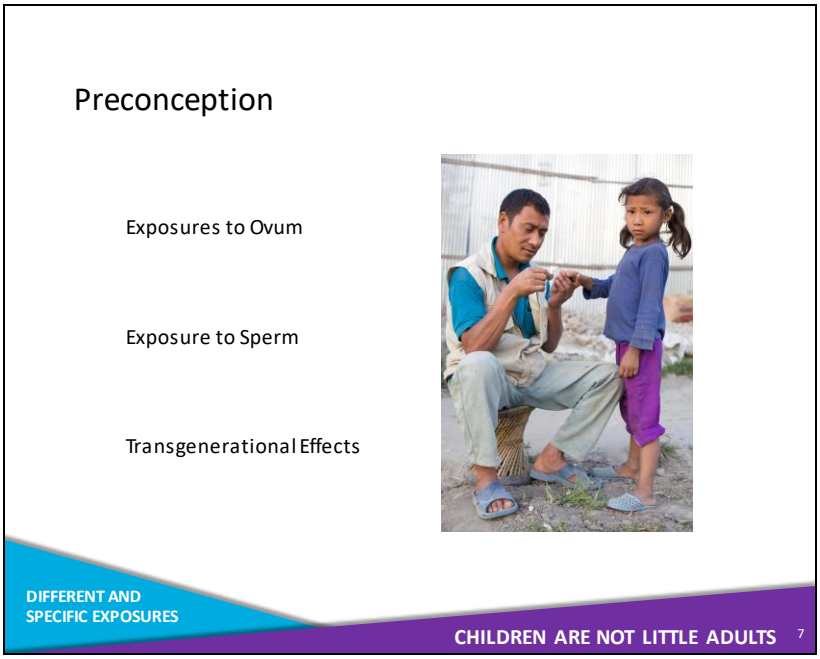
Children also have pathways of exposure that differ from those of adults due to their size and developmental stage. For example, young children engage in normal exploratory behaviours including hand-to-mouth and object-to-mouth behaviours, and non-nutritive ingestion which may dramatically increase exposure over that in adults.

Children's physical differences also cause them to reside in a different location in the world, i.e. closer to the ground. Pollutants such as mercury, solvents and pesticides are concentrated in their breathing zone and deliberate applications of pesticides and cleaning solutions make them more readily accessible to small children. Because they are small, they have a high surface area to volume ratio and can have dramatically higher absorption through dermal contact than adults.

And, they may have much more limited ability to understand and move out of danger, both from toxic agents and dangerous situations which could result in injury. This characteristic is obvious in the pre-ambulatory phase, but persists through exploratory toddler behaviour and even into the high-risk behaviours seen in adolescence.

References:

- Pronczuk-Garbino J, editor (2005). Children's health and the environment: A global perspective. A resource manual for the health sector. Geneva: World Health Organization. (http://www.who.int/iris/handle/10665/43162, 8 November 2018).



Increasing evidence from animal studies is identifying risks to offspring from exposure to environmental toxicants prior to conception both to mothers and fathers. Human data are limited but consistent with animal studies.

Exposures to human ova can occur during fetal life when all ova develop and remain in the prophase of the cell cycle – as well as during later life up to and including the full development of the ovum during a normal ovulation cycle. Evidence supporting vulnerability to environmental exposures includes increased nondisjunctional events with increasing maternal age and transgenerational effects in male and female grandchildren of grandmothers exposed to DES during pregnancy.

Exposure to sperm are more easily studied and data suggest an increased risk of some birth defects with paternal occupational exposures including pesticides and ionizing radiation.

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- UNEP, WHO (2013). Bergman A, Heindel JJ, Jobling S, Zoeller RT, editors. State of the science of endocrine disrupting chemicals – 2012. Geneva: United Nations Environment Programme, World Health Organization. (http://www.who.int/ceh/publications/endocrine/en/, accessed 21 February 2018)