
This chapter is based on a verbal presentation given to the Quality of Childhood Group in the European Parliament by Anne Stauffer and Peter van den Hazel in January 2011, hosted by MEP Gerald Häfner. Notes taken during the presentation were formulated into the article which has been checked and approved by the authors.

Children and Environmental Health

by Peter van den Hazel co-founder of the International Network on Children's Health, Environment and Safety (INCHES), and Anne Stauffer, who represents the Health and Environment Alliance (HEAL) of which INCHES is a member.

SUMMARY

There is growing concern about the effects of environmental threats on children's health. Environmental factors are having an ever greater impact on the lives and, more importantly, on the health of children across the globe. It is time to take action to protect one of the most vulnerable sectors of society. Humans are now producing more chemicals than ever, and while there is some regulation in place it is often not enough, and further research needs to be done on how chemical exposure affects children. Recently we have accepted the vulnerability of children to toxins and that they are more vulnerable at some times rather than others.

Because of children's dynamic and continuous process of growth and development, the effects of environmental threats may be cumulative (for example, in some instances children may be exposed repeatedly to toxicants or radiation and their effects continue to accumulate). Childhood exposure may affect health in adulthood, or the health of the next generations (i.e. effects are intergenerational, as is the case with children born to mothers who were exposed to lead in their childhood). Exposure may have long-term consequences and produce permanent disability.

Policy makers have only recently begun to consider children when making environmental policy.

We need to prevent harmful exposures and protect children's health.

Governments and stakeholders need –

- *To recognize the issues*
- *To develop and implement policies*
- *To take and support actions*

Healthcare providers need –

- *To learn about environmental threats*
- *To diagnose, prevent and treat*
- *To investigate – look at the causal chain*
- *To inform parents and children*
- *To act as advocates for children.*

There is growing concern about the effects of environmental threats on children's health. New-born children and adolescents represent 40% of the world's population. Children under 5 years of age represent 10% of the world's population; and adolescents represent 20% of the total, of which 85% live in developing countries.

When I refer to "children" I am referring to all age groups, from conception (embryonic and foetal stages) to the end of adolescence. To put this in perspective, that equates to 2 billion children. However, policy makers have only recently begun to consider children when making environmental policy. Environmental factors are having an ever greater impact on the lives and, more importantly, on the health of children across the globe and it is time to take action to protect one of the most vulnerable sectors of society.

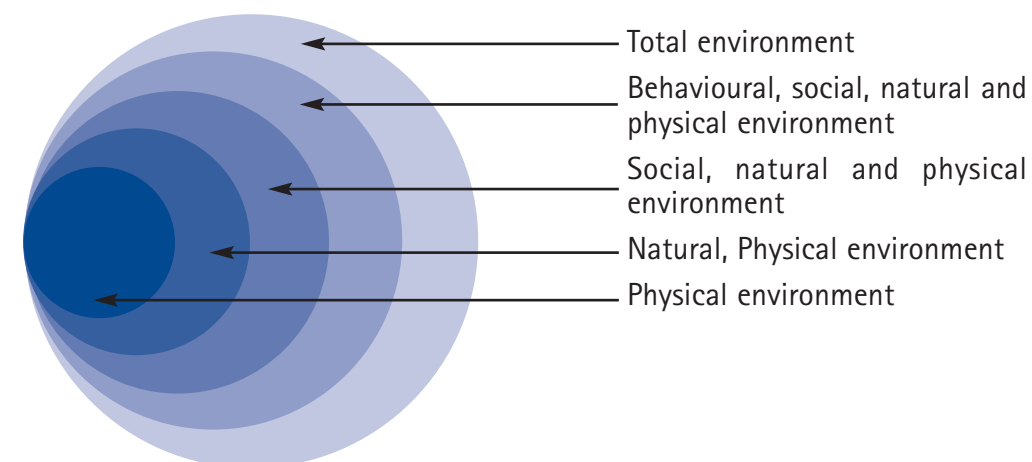
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Children have "windows of susceptibility" to environmental threats. These are specific periods in their development when the effect of a chemical, physical or biological agent is major and may result in adverse health outcomes.

Everybody requires a safe, clean and healthy environment. However, children are special and they require both a protected and protective environment to enable:

- the newborn to survive (the highest mortality rate is in children aged under 5 years in developing countries);
- the child to grow, be able to go to school and learn; and
- the adolescent to mature under good conditions and able to face the challenges of adulthood.



Source of image: BMM

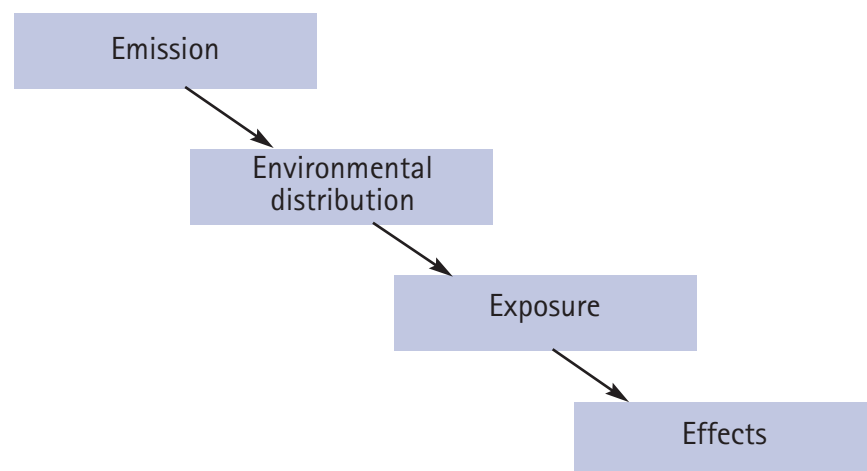
Before continuing it is important to define what is meant by "Environment". A child's environment can be broken down into at least four different spheres, as shown in the illustration above. The behavioural, social, natural and physical environments are distinct from each other for theoretical purposes but these four spheres build upon each other and combine to create the total environment. The sphere which has the greatest influence is the physical environment, and generally this is the sphere that we are referring to when talking about a child's environment. However, it must be looked at in the context of the other spheres.

It is important to look at children with a special focus because they are different from adults in many ways. All aspects of the environment will often affect children differently than they might an adult. Therefore it is essential to distinguish children from adults in any discussion on environmental health policy.

It is expected that children should reach their full potential and be contributing members of society. However, the effects of the environment on children are not restricted to that individual; they can also be cumulative – i.e. affect future generations. Effects might appear in adulthood but have their origin in childhood or before children are born.

Primarily however it is important in this case to focus on the physical environment. This brings the discussion to what can be termed the "Causality chain". The causality chain frames any discussion on children's environmental health. Policy makers should be looking at where the problems are on this chain and use this information to create policy.

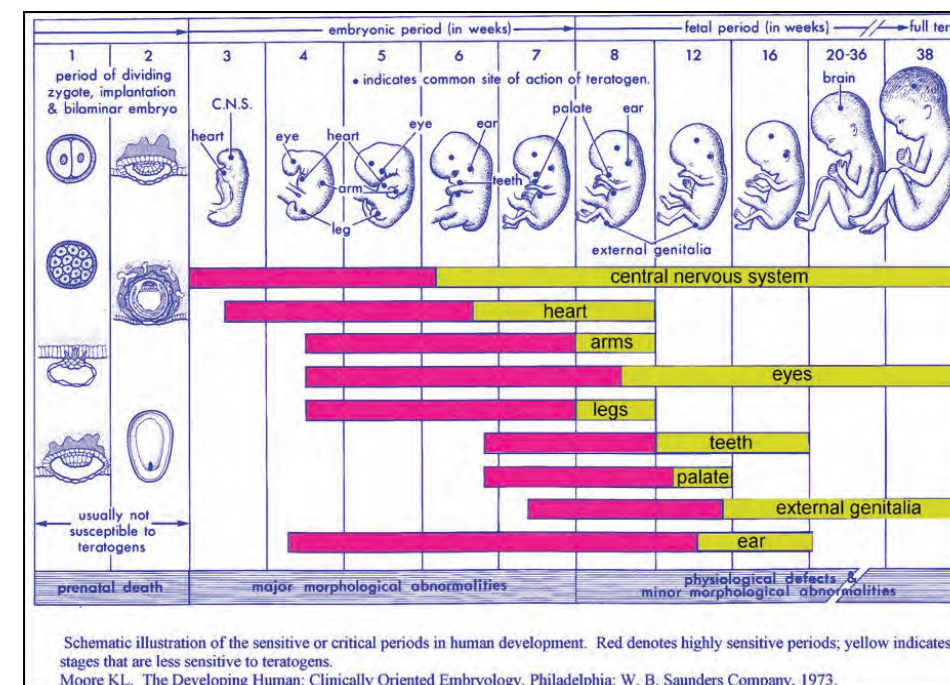
Causality Chain



Source of image: BMM

Windows of Susceptibility

Humans are now producing more chemicals than ever, and while there is some regulation in place it is often not enough and further research needs to be done on how chemical exposure affects children. Children and environmental health is a new discipline. Recently we have accepted the vulnerability of children to toxins and that they are more vulnerable at some times rather than others. We also now accept that different environmental factors such as social class can exacerbate these problems. Examples include exposure to mercury or lead which can lead to learning disabilities. In addition, a possible link between exposure to lead and a drop in IQ has been identified. Examples such as this tell us that we need more information about the timing risks involved in exposure to some environmental factors.



Source of image: Moore, Elsevier INc. 1973

In early foetal development, children are in windows of susceptibility, where exposure can cause birth defects and problems associated with the nervous system, immune system, respiratory system and the reproductive system.

Physiological differences between children and adults are manifest in the immaturity of organ systems. These organ systems do not yet function in the same way as they do in adults. Because important systems are still differentiating and growing, children have unique susceptibilities not seen in adults — and critical time windows for those susceptibilities. The critical times are as follows:

- preconception
- gestation (susceptibility to: thalidomide, Diethylstilboestrol (DES), ionizing radiation, methyl mercury, lead)
- post-natal (susceptibility to: second-hand tobacco smoke, lead)

There has been an explosion of knowledge about child development in the past decade and it is hard to imagine that only about 50 years ago the discovery was made that the foetus is vulnerable to exposures. The phocomelia epidemic resulting from the use of thalidomide by pregnant women was an early and dramatic example of the ability of chemicals to traverse the placenta and damage the foetus. Additionally, thalidomide administered during a small, 4-day window between gestational days 20 and 24, may increase the risk of autism (Stromland, 1994). More than one system can be susceptible and different pathologies may occur depending upon the dose and timing of exposure.

Now we know that other exposures during gestation, some of which are listed here, can harm the systems of the developing child. We also know that the preconception exposure of parents, as well as postnatal exposure of both parents, can harm children. Significant harm can be caused during the embryonic phase. Exposure to certain chemicals or environmental factors will result in pregnancy loss (first 2 weeks) or major organ malformation. During the foetal stage, damage is more subtle and related to system dysfunction.

Of a population of 100 Swedish thalidomide embryopathy cases, at least four met full criteria for DSM-III-R autistic disorder and ICD-10 childhood autism. Thalidomide embryopathy of the kind encountered in these cases affects foetal development early in pregnancy, probably on days 20 to 24 after conception. It is argued that the possible association of thalidomide embryopathy with autism may shed some light on the issue of which neural circuitries may be involved in autism pathogenesis.

Although the special susceptibility of children has been recognized for decades (especially by paediatricians), it is only in the last decade that this vulnerability has been NEWLY recognized. Effects of chemicals depend upon i) toxicity, ii) dose, iii) timing and iv) amount of exposure. There is new, more detailed information about the specific effects of some chemicals on the developing foetus. There is new, more sophisticated knowledge about toxicokineticsⁱ and toxicodynamicsⁱⁱ. The importance of the TIMING of exposure is now recognized. Dose refers to the quantity of a chemical, whereas type/amount refers to frequency of exposure (e.g. is it repetitive?).

In the poorer regions of the world, the adverse effects are further exacerbated or magnified by poverty, malnutrition, urbanization, degraded environments and stress (such as is experienced in refugee camps, or areas affected by drought, tornadoes, floods, or in areas of war or conflict).

Timing of the window of susceptibility

The importance of the TIMING of exposure should be stressed. The precise moment when exposure occurs may correspond with a critical developmental period when rapidly changing organs or physiological functions may be affected by chemical or physical agents. These are called "windows of vulnerability".

Two examples of exposure *in utero* and its significant effects later in the life of the child are given to illustrate this concept.

1. Exposure to diethylstilboestrol (DES) administered to pregnant women (to prevent miscarriage and premature labour) produced vaginal cancer in the daughters (during adolescence and early adulthood) and malformations in the sons.

Some cancers are believed to be due to or triggered by exposures early in life, which may have no immediate effects. Many chemicals are well known to be carcinogenic in animal experiments, but it may take decades to prove their effects in humans. However, an animal carcinogen, vinyl chloride, causes cancer in animals even after SHORT exposures early in life (Soffritti, 2002).

2. Exposure to heavy metals *in utero* – for example, to lead and mercury – may have no apparent effect on the newborn, but a few months or years later, as the child grows, the neurological and learning disabilities become evident.

The mechanisms of action of these early effects may be:

- interference in genetic expression;
- endocrine effects (e.g. on the thyroid – which has a great influence during growth and development);
- alteration of cell development; and
- effects on neuronal migrationⁱⁱⁱ.

There is a clear need for more research on the mechanisms to help to explain how and when the adverse effects occur.

It is important to stress that risk assessments should consider explicitly the unique exposure and biological characteristics of the foetus, the child and the adolescent¹.

The Ramazzini Foundation research programme on experimental carcinogenicity bioassays for the identification of exogenous carcinogens (environmental and industrial above all) began in 1966. This project has included 398 experimental bioassays on 200 compounds/agents using some 148 000 animals monitored until their spontaneous death. Among the studies already concluded, 47 agents have shown "clear evidence" of carcinogenicity. The results have demonstrated for the first time that (1) vinyl chloride can cause liver angiosarcoma as well as other tumours; (2) benzene is carcinogenic in experimental animals for various tissues and organs; (3) formaldehyde may produce lymphomas and leukaemias; and (4) methyl-tert-butyl ether (MTBE), the most common oxygenated additive used in gasolines [petrol], can cause lymphomas/leukaemias. Many of the results achieved have led to the introduction of norms and measures of primary prevention.

There is a need for more research and risk assessment to consider the characteristics of the foetus/child.

About 5,000,000 children under the age of 14 die as a result of diseases that relate to environmental conditions, mainly in the developing world.

Main global environmental health risks

About 5,000,000 children under the age of 14 die as a result of diseases that relate to environmental conditions, mainly in the developing world.

The main risks are:

- *Household water insecurity.* This is one of the main causes of diarrhoea. The WHO has issued recommendations for safe drinking water. When these recommendations are followed, this drinking water does not represent any significant risk to health over a lifetime of consumption, including different sensitivities that may occur at different life stages.
- *Poor hygiene and sanitation.* This leads to inadequate washing and cleaning practices, and therefore to disease.
- *Air pollution,* both indoor and outdoor. This triggers or aggravates respiratory diseases.
- *Disease vectors^{iv}.* These cause one million deaths a year in children, due to malaria, dengue fever, leishmaniasis, Japanese encephalitis and others.
- *Chemical hazards.*
- *Injuries and accidents.* Injuries including road accidents, drowning, burns and poisoning cause 400 000 deaths per year.
- *Emerging issues.* These include global change (climate and others), ozone depletion, electromagnetic radiation, contamination by persistent organic pollutants...

Every day 50 jumbo jets full of children die due to the above mentioned factors.

Water

Access to safe drinking water was 77% in 1990 and although this has increased it has not increased enough.

In all developing regions, the percentage of the population served by adequate sanitation and drinking-water has increased between 1990 and 2002. Although access to water and sanitation has increased in the last decade from 77% of the world's population in 1990 to 82% in 2000, the world's population has also increased, and, as a result, there are still large numbers of people who have NO access to these basic services.

This takes a very heavy toll, especially on children. The consequences of inadequate water and sanitation include:²

- A high number of deaths in children under 5 years, every year.
- Disease and malnutrition
- High costs for the public health system.
- Children's education is affected, as they often lose days of schooling. In some countries, girls are affected even more than boys as they do not go to school if there are no toilets – especially after menarche.
- Self-esteem and dignity are very low when the child is ill all the time, cannot go to school and becomes a burden to the family and the community.

In total 1,300 000 deaths of children under 5 years of age every year can be attributed to either no water supply or no sanitation.

Air pollution

More than two billion people worldwide continue to depend on solid fuels, including biomass fuels (wood, dung, agricultural residues) and coal, for their household energy needs.

Cooking and heating with solid fuels on open fires or traditional stoves results in high levels of indoor air pollution. Indoor smoke contains a range of health-damaging pollutants, such as small particles and carbon monoxide (CO), and levels of particulate pollutants may be many times higher than accepted guideline values.³

There is consistent evidence that exposure to indoor air pollution can lead to acute lower respiratory infections in children under 5 years old, and chronic obstructive pulmonary disease and lung cancer (where coal is used) in adults.

Acute respiratory infections, in particular pneumonia, continue to be the biggest killers of young children and cause more than 2 million deaths annually. This is almost exclusively a problem of children in developing countries.

Some countries are reporting a rising trend of "wheezing".

- The heavy use of coal and biomass fuels (the most polluting fuels) is linked to respiratory (and other) effects on children.
- Suspended pollutants may carry infectious agents into the lungs and also predispose children to infection: other particles may carry chemicals that predispose children to lesions and infection.
- Not only are the particles noxious, but so too are carbon monoxide and other toxic gases released as products of combustion.
- Second-hand tobacco smoke is a major concern.

There are also issues due to the proximity of homes to highways. Just living somewhere that is exposed to traffic can affect lung function especially as the person grows older.

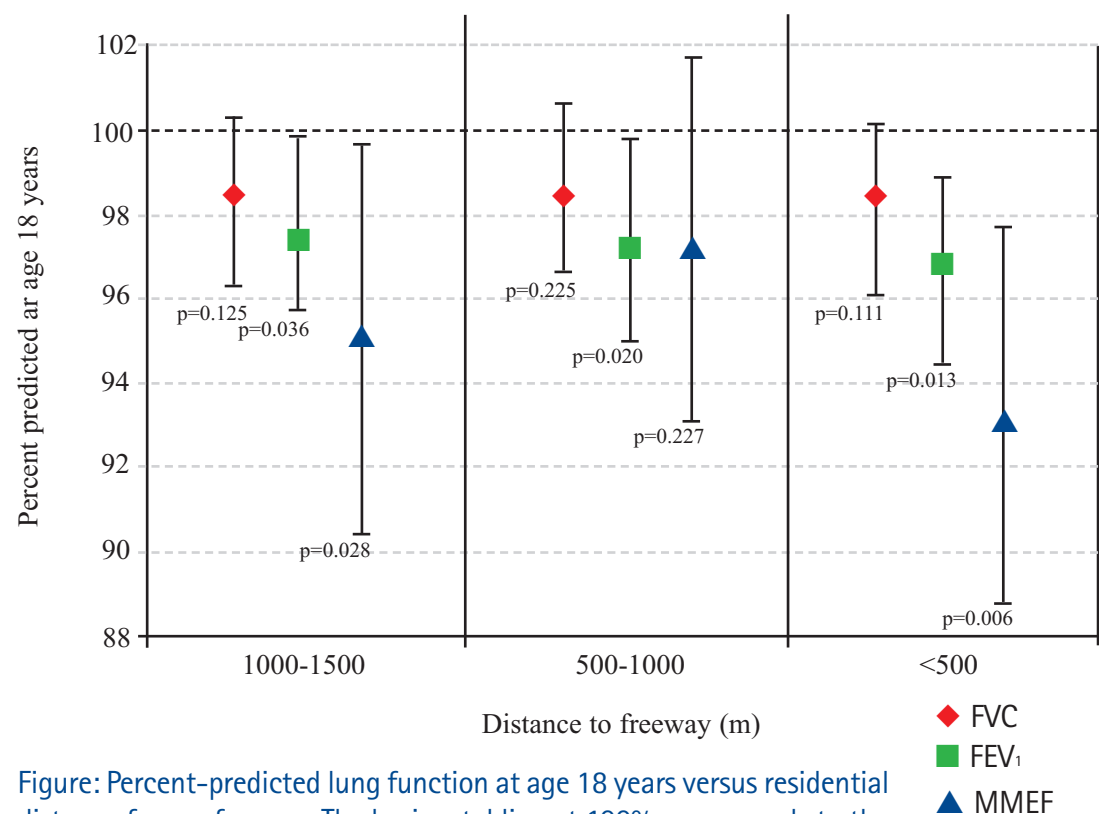


Figure: Percent-predicted lung function at age 18 years versus residential distance from a freeway. The horizontal line at 100% corresponds to the referent group, children living >1500m from a freeway.

Source of image: Gauderman et al. 2007

FVC: Forced Vital Capacity

FEV: Forced Expiratory Volume

MMEF: Maximum Mid-expiratory Flow

Unintentional poisonings and chronic low-level exposure to chemicals are taking a heavy toll on children's health.

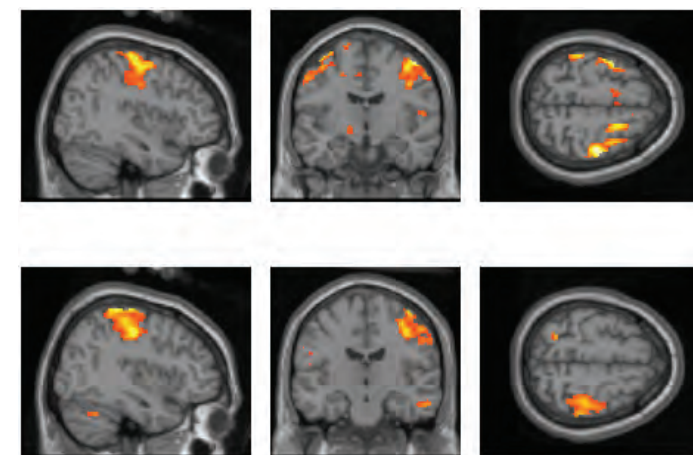
Chemicals

Unintentional poisonings and chronic low-level exposure to chemicals are taking a heavy toll on children's health. Unintentional poisonings account for 35,000 deaths per year in children under 14 years of age according to the WHO. Some adverse effects on health and development due to unknown causes are being attributed to chemicals – for example to some "new" pollutants, or poorly-tested chemicals. This is combined with a rising trend of adverse effects linked to chemicals, for example, chemicals with endocrine-disrupting properties are a cause of global concern. There are also "unexplained" paediatric diseases that may be linked to chemicals. For example, sudden infant death syndrome is related to tobacco use by the mother or in the home of the newborn.

The main chemicals of concern are:

- lead: a major development toxicant, worldwide;
- mercury: distribution ubiquitous, may affect the foetus and child;
- pesticides: their unsafe use creates important public health and environmental problems; (Pesticides include aldrin, dieldrin, chlordane, DDT, endrin, heptachlor, mirex, toxaphene. Industrial chemicals include PCBs and HCB. Unintended by-products include dibenzodioxins, dibenzofurans.);
- POPs (persistent organic pollutants): are they linked to reproductive dysfunction? Cancer?
- nitrates: risk of methaemoglobinaemia in newborns;
- fluorides: risk of dental and/or osteoskeletal fluorosis in some countries;
- arsenic: serious problem of contamination of drinking-water in Bangladesh, India, and a few other countries;
- mycotoxins: an endemic problem in some African countries; and
- other chemicals.

Some chemicals that are illegal in Europe but still used in China affect children adversely. Children who are exposed to chemicals before birth show damage to the brain and brain function when tested. Modern imaging methods show that children with high prenatal pollutant exposure must activate brain regions not needed by children who have not been exposed.



Source of image: R.F. White et al.

The upper row contains images of pre-natal children who have been exposed to MeHg+PCB. The bottom row is a brain from a child in the control group who has not been exposed to the chemical. Finger tapping with the left hand activates motor cortex on the right AND the left while on non-exposed controls (the lower set of photos) only the right motor cortex is activated. Thus the brain is stressed in compensating for the affected area due to exposure of the chemical compounds.

Cancer

We need to find out the causal relations for cancer. The fact is that there are large numbers of children with cancer and the best answer is to find out what is causing the disease so that we can attempt to treat them, and prevent further ill-health and deaths.

Rates of cancer must always be looked at in terms of increasing standards of care. An important issue for our policy makers and one that has traction already is the burden of cancer among our children. Cancer incidence among children aged 0–14 years has been increasing slightly, by about 0.6% per year, since 1975. Cancer-related mortality in children aged 0–14 has been stable since 1998, after decreasing steadily from 1975 to 1998 by 2.9% per year.

Testicular cancer is still increasing. Decreased sperm quality may also be a result of increased chemical exposure. Increased chemical exposure could also be responsible for a range of other cancers, and the body of science on this is growing.

We need to find out the causal relations for cancer. It does not really matter if the figures are going up or not. The fact is that there are large numbers of children with cancer and the best answer is to find out what is causing the disease so that we can attempt to treat them, and prevent further ill-health and deaths.

Injuries and accidents

Unintentional injuries account for over 400 000 deaths every year worldwide – the majority in children and adolescents. Those who survive are often left to suffer life-long disability. In Europe, 3 out of 10 deaths in the 0–4-year age group are as a consequence of injury. Injuries are usually classified on the basis of "intentionality" – i.e. as intentional or non-intentional. The word "accident" should not be used, as it carries the notion of inevitability – whereas, in effect, accidents should not occur as they are 100% preventable.⁴

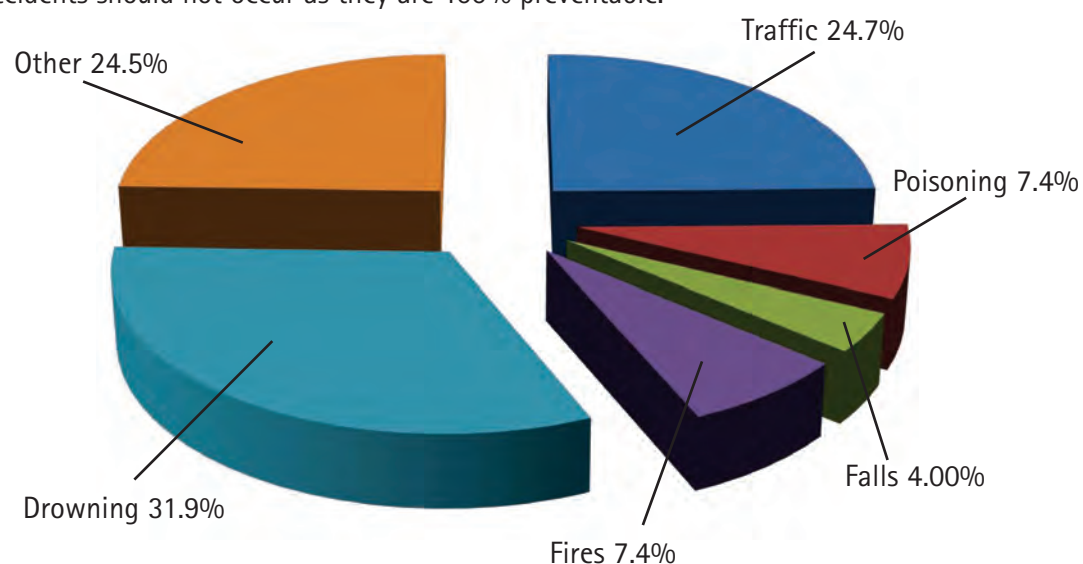


Figure: WHO, Global burden of disease database, Version 1, Geneva, World Health Organization, 2001.

Injuries are usually classified on the basis of "intentionality".

- Road traffic injuries, poisoning, falls, fire and burn injuries, and drowning are unintentional in children (in most cases).
- Homicides, sexual assault, neglect and abandonment and maltreatment are intentional, as are suicide and collective violence (war).
- Evidence suggests that small children are more vulnerable to injuries such as poisoning, drowning, burns, and maltreatment by caregivers
- and adolescents are more vulnerable to road traffic injuries, interpersonal violence and sports injuries.
- Injuries tend to be more prevalent in boys. The general rates of injuries due to burns and car accidents tend to be higher in boys. There are some exceptions such as injuries related to horse-riding in Australia and the United Kingdom and in girls working as cooks and cleaners (Ian Scott, VIP/WHO, personal communication). Poor children live in the most unsafe and unhealthy environments – and are particularly vulnerable as they have fewer chances of overcoming the risks and fewer advantages, such as access to education and health services.
- Rates and patterns of injury vary from country to country.

Emerging issues

Emerging issues are new or "re-emerging" potential threats to children's health and development.

For some of the following, the effects have not been fully demonstrated, but there is growing evidence about potential effects on children.

- **Global climate change** – global warming and its effects on vectors and on vector-borne diseases, which are a major "killer" of children.
- **Ozone depletion** – and overexposure to ultraviolet radiation, to which children are very susceptible.
- **Some radiations** – give cause for great concern and are currently the subject of studies.
- **Contamination by persistent organic pollutants (POPs)** – effects have been demonstrated in wildlife; acute toxic effects have been observed in humans; effects of low-level exposure are currently under study.
- **Endocrine disruption** – due to anthropogenic^{vi} and natural compounds with endocrine effects which have been demonstrated in animals, and are suspected in humans. Endocrine disruptors are linked to cancer, diabetes, behavioural and attention deficit disorders, as well as impaired fertility. Bisphenol-A is a suspected endocrine disruptor.

Research Issues

What are the research issues at stake?

- Air pollution – this is a hot topic with a new article produced almost daily
- Soil contamination
- Social inequalities – living situations which mean that children are exposed to factors which others are not. Poor housing etc.
- Cancer prevention through environmental protection.

LONG TERM STUDIES ON ENVIRONMENTAL RISK FACTORS AND CHILDREN	
Chemicals	
Lead, Mercury, PCBs, Pesticides, POPs, Manganese, Chromium, Vanadium	
Physical Factors	
Noise, radiation, air, water, soil pollution, food contamination, mycotoxins, unintentional injury	
Biological Factors	
Vector-borne diseases	
Psychosocial Factors	
Poverty, child abuse/neglect, violence, parental mental illness, substance abuse	
Built Environment Factors	
Housing, crowding	
Sanitation Factors	
Lack of potable water	
Adequate Nutrition Factors	
Food safety, food security, food additives	
Media Impact Factors	
Television, internet	
Physical Activities Factors	
Time and location, playground, toys	
Social Network And Participation Factors	
War And Conflict Factors	
Socioeconomic Changes	
Individual, household and community	
Life Crises Factors	
Natural disasters; maternal death; access to health/social services	

These are the environmental risk factors under consideration by the WHO project on Long term Studies that is being undertaken in close collaboration with the National Children's Study in the USA and approximately 15 other countries.

The Working Group, with participants from over 15 countries, compiled this initial list with the core set of environmental risk factors that should be considered when collecting data on children's environments and health.

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A review of the GLOBAL environmental threats to children's health, considered 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. There are many examples that illustrate the fact that environmental risks build up, do not come "alone", but rather combine in different settings and under various circumstances. Preliminary estimates suggest that up to one third of the GLOBAL burden of disease can be attributed to environmental factors. Over 40% of this burden falls on children under 5 years of age, who make up about 10% of the world population.⁶

Many paediatric diseases are linked in one way or another to circumstances where several threats are combined:

- heavy traffic where exposure to noise, heat, particulate materials and the risk of injury coexist;
- toxic waste sites – where children are exposed to toxic products; discarded contaminated food; vectors of disease; dioxins and toxic fumes, where waste is burned; plus a social environment that may predispose them to injury and violence;
- industrial effluents;
- contaminants in water, food and objects; and
- pollutants where children live, grow, play, and work.

The social and economic cost

It is important to stress that all the effects and diseases resulting from chemical, physical and biological threats have high social and economic costs. For example increased medical expenses, sickness, disability and death, sick days away from school, productivity lost by parents not able to go to work, personal agony of families and communities, and reduced long-term productivity of the country.

What the EU is doing and Specific EU laws

Protecting children's health from environmental pollution has gained importance on the EU policy agenda, even though much remains to be done to ensure adequate protection.

The European Environment and Health Action Plan (EHAP, 2004–2010) is a good example. EHAP gave direction for research and policy action on health and the environment, and had a clear focus on protecting children. As part of EHAP, training modules with the WHO were developed which were provided to countries and required organisations to host them. The training provided is for public health people.

The recent Pesticides laws – the Authorisation and Use of Pesticides – includes a new statement which mentions children. It states that pesticides should not cause short or long term effects on children and vulnerable groups. This helps with risk assessment, and places the focus on risks to vulnerable groups. The law also states that there are certain chemicals which we should not authorise any more because they are carcinogenic or damaging in some other way (the so-called hazard-based approach which is a major breakthrough). Under the Directive on sustainable use,

EU member states are also asked to ensure that in public spaces which are frequented by children and other vulnerable groups (for example public parks or schools), pesticide use is minimised or even stopped. Such pesticide-free areas are an important way to protect children's health.

Legislators need to be reminded that new rules that they make have to ensure the reduction of exposure to biocides for children.

The EU is now discussing a law on biocides (that is non-agricultural pesticides such as disinfectants, wood preservatives or insect products) However, concerns specifically related to children have not been mentioned in discussions. Legislators need to be reminded that new rules that they make have to ensure the reduction of exposure to biocides for children. This includes biocides with developmental neurotoxic or immunotoxic properties, putting those substances which interfere with the neurodevelopment of children on the list of candidates for substitution. This will encourage the development and use of less harmful alternatives.

The EU Air Quality Directive of 2008 also recognises children's vulnerability. However, most member states have had problems with keeping to the EU air quality limits, and also we lack information on how they have fulfilled the requirements to inform vulnerable groups of when pollution levels are being exceeded.

There has been a lot of attention on outdoor air quality. Given that we spend the majority of our time indoors, it is also necessary to develop a harmonised framework to ensure good indoor air quality. In order to get the discussion started, the EU should publish a Green Paper.

EU Chemicals Policy REACH (The Regulation on the Registration, Evaluation, Authorisation and Restriction of Chemicals): this law has great potential to reduce exposure to hazardous chemicals for children, vulnerable groups and everyone else, but the process of phasing out and substituting these hazardous chemicals needs to be speeded up. For example, there are currently only about 40 substances on the candidate list (from the inclusion in this list follows a decision on restricting use of a specific substance), while independent assessments consider there are at least 1000 substances which should be included. This shows that the process is too slow and that there is no focus on children.

There also needs to be more research into combination of chemicals and policy action on it. As mentioned above, the EHAP has been a strong and important driver to protect children's environmental health. We need to have such a continued framework, for targeted research and policy actions. There has been support for a second EHAP from stakeholders and EU member states alike, so now the EU Commission needs to start the process of drafting this second EHAP.

In the past, members of the European Parliament have been strong advocates for children's environmental health concerns. It is important that MEPs raise their voice for children in order to secure their protection into the future.

Success Stories and Challenges

Some progress has been made in relation to exposure reduction/disease prevention in children in the recent past. For example there has been a 90% reduction in lead poisoning, a reduction in the use of asbestos and the restriction of two neurotoxic organophosphate pesticides.

However, for every good story there is a bad story or even two of these.

For example take endocrine disruptors, which interfere with immune system by acting as hormones, etc. Scientists have issued warnings on EDCs for a while, and the body of evidence has grown immensely. However policy development has been too slow with regard to these. While there has been an EU strategy on endocrine disruptors for 10 years, criteria for determining which substances can actually be considered as EDCs will only be adopted by 2013.

BPA is a good example of an endocrine disruptor. Canada was the first country to ban the use of BPA in baby bottles. However, for a long time the EU food safety authority gave positive recommendations for the acceptable daily intake levels of BPA. Finally BPA in baby bottles will be banned from March 2011, but BPA is still contained in many other products so children are still being exposed to it.

Neuro-toxic substances also need to be tackled. These are only slightly addressed at EU level. The new Pesticides Authorisation Regulation recognises that these substances are problematic, but the measures proposed (the additional safety margin) do not go far enough. The combination of chemicals is also a big problem and more work needs to be done in relation to this in the future. We are only beginning to understand how combinations of chemicals affect us. We need to quickly identify these effects and implement this knowledge into the relevant legislation and policy.

Scientists and health experts know that environmental pollution has a high cost for individuals and society as a whole. We need to provide cost-benefit analysis to politicians to ensure that policy gets made. In addition, the inclusion of children in decision-making processes is also important.

On the list of further research and policy action is also research into "settings" i.e. what are the problems in schools? What are the problems in housing?, etc.

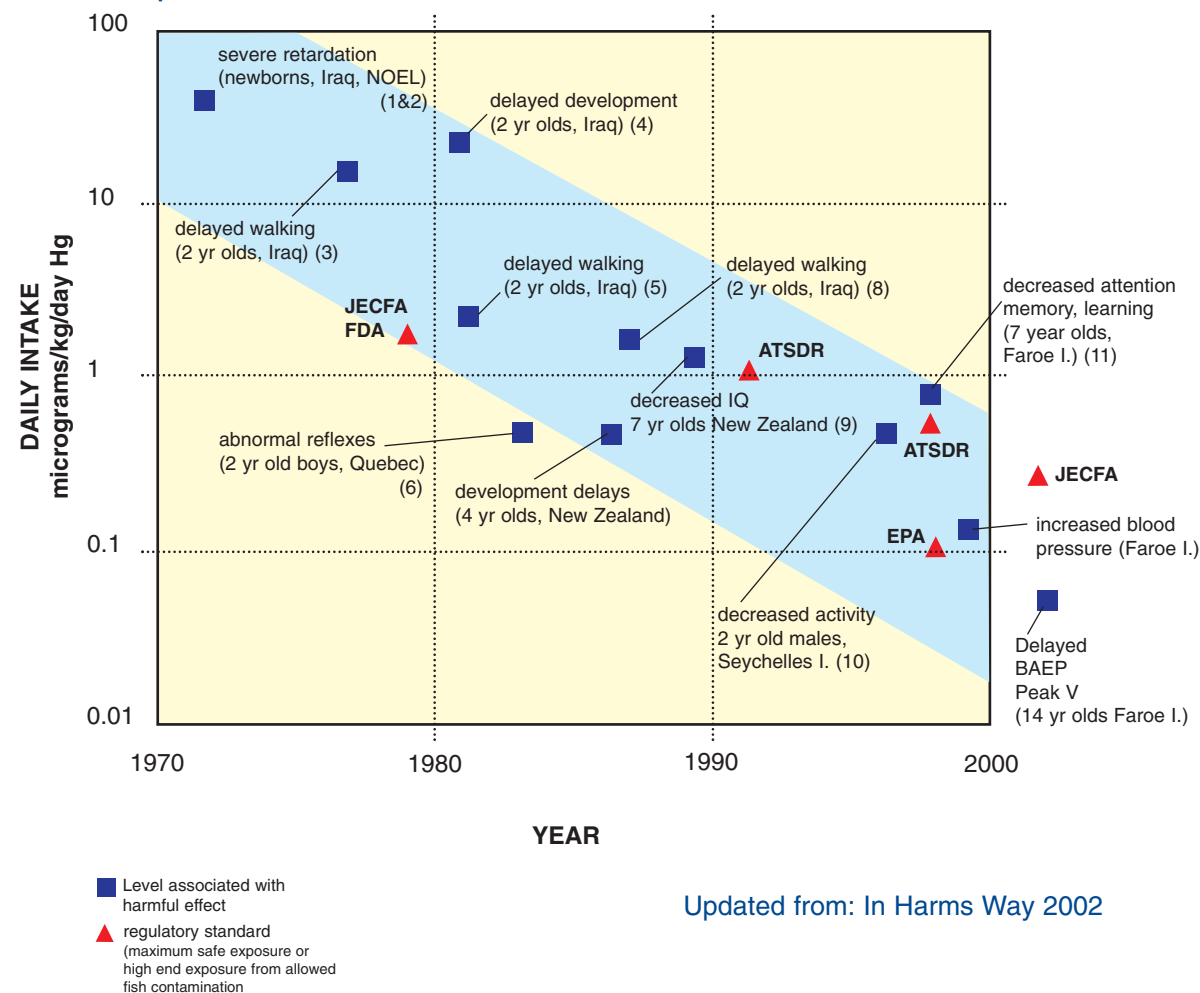
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How do we face challenges?

1. Make strict guidelines for child exposure to dangers.

Every time we agree that there are effects below the standards, norms and daily intake levels, this brings a decline in the norm.

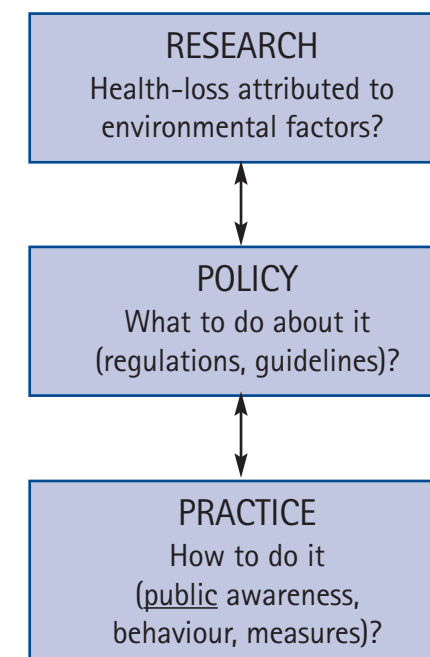
Norms improve due to better science



- Better control over the materials that we use, for example, building materials, toys, playgrounds. Defining stricter norms for child exposure
- Better quality of social/medical services – more public awareness, for instance, raising awareness of the dangers of smoking has been a success story. Next to be tackled are all the other compounds.

How do we relate content to actions?

Environmental health: main issues:



Do they factor in children into the research?

Usually not is the perception but it is crucial that policy makers consider children's perceptions.

The problem as an iceberg

Problems are usually presented by politicians. What are the best practices and how can we tackle the problems in a cost effective way? These questions only deal with the tip of the iceberg but for politicians solving these problems attracts more attention than finding the root of the problem, best practices, etc.

Broad questions are often asked without proper targets being set.



Multi-level governance: Who can tackle the problem?

- Organizations operating in a market environment (from multinational corporations to small and medium enterprises (SMEs));
- Organizations operating in a government or public sector environment (departments, quangos, inspectorates)
- Organizations operating in a civil society environment (non-governmental organisations, not related to any level of government, charities, religious organizations, schools, non-commercial hospitals, etc.)
- Citizens

We need to prevent harmful exposures and protect children's health

- Governments and stakeholders need –
 - to recognize the issues (the G8 countries have declarations but there are not many concrete actions).
 - to develop and implement policies
 - to take and support actions
- Health care providers need –
 - to learn about environmental threats
 - to diagnose, prevent and treat
 - to investigate – look at the causal chain
 - to inform the parents and the children
 - to advocate for children

Laws, policy and advocacy

Children are politically powerless. So the health sector and school system are sometimes the only ones who advocate on behalf of children. As children represent the future of our societies and have the right to healthier, cleaner and safer environments, different sectors are called to join forces and work towards the protection of children.

- Children have no political voice.
- They are defenceless in a world that adults have created for them and they are vulnerable to environmental hazards.
- Children do not vote.

There's a long tradition of advocacy in paediatrics with respect to abuse, neglect, toy and product safety. In the 1990s paediatricians and other professionals (especially in Northern Europe and North America) have begun to advocate changes in laws and regulations which will specifically protect children from environmental harm. There is a variety of mechanisms either proposed or in place designed to improve children's environmental health. They range from very local initiatives, rules and laws to international treaties and resolutions. It is critical that practitioners of children's environmental health become and stay politically active, in all countries.

Over the past 15 years, the importance of protecting children's health and their environments has been recognized internationally.

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

Are these being put into effect in the different countries?

- 1989 UN Convention on the Rights of the Child (1989): www.unhcr.ch/html/menu3/b/k2crc.htm
- 1990 World Declaration on the Survival, Protection and Development of Children (World Summit for Children): www.unicef.org/wsc/declare.htm
- 1992 Agenda 21, Chapter 25 (United Nations Conference on Environment and Development): www.un.org/esa/sustdev/documents/agenda21/index.htm
- 1997 Declaration of the Environment Leaders of the Eight on Children's Environmental Health: yosemite.epa.gov/ochp/ochpweb.nsf/content/declara.htm
- 1999 Declaration of the Third European Ministerial Conference on Environment and Health: www.who.dk/AboutWHO/Policy/20010825_2
- 2001 UN Millennium Development Goals: www.who.int/mdg
- 2002 United Nations General Assembly Special Session on Children: www.unicef.org/specialsession/
- 2002 The Bangkok Statement (WHO International Conference): www.who.int/ceh
- 2002 Organization for Economic Cooperation and Development Programme (OECD): www.oecd.org
- 2002 World Summit on Sustainable Development: www.johannesburgsummit.org/ Announcement of the Healthy Environments for Children Alliance and Indicators Initiative
- 2003 IFCS Forum IV Recommendations on Children and Chemicals: www.ifcs.ch
- 2004 The future for our children, Fourth Ministerial Conference on Environment and Health (CEHAPE, Children's environment and health action plan for Europe) Budapest: www.euro.who.int/childhealthenv/Policy/20030625_1

Recommendations and actions

Recommendation 1

- Recognition of the right of children to grow up in a safe and clean environment
- Child-friendly public policy in:
 - environmental management
 - sustainable economic development
 - urban planning – safe from home to school, etc
 - laws and judicial regulation

Recommendation 2

- Develop networks of 'centres of excellence' to serve as sources of accurate information:
 - Paediatric environmental health specialty units
 - Regional/ international networks
 - European Agency on Environmental Health (analogous to the European Centre for Disease Prevention and Control (ECDC))

¹Soffritti. Ramazzini Foundation cancer program: history and major projects, life-span carcinogenicity bioassay design, chemicals studied, and results. *Ann N Y Acad Sci*, 2002, 982:26.

²WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation. Global water supply and sanitation assessment 2002 report. Geneva, WHO, United Nation's Children Fund, 2000.
WHO/UNICEF. Meeting the MDG drinking water and sanitation target. A mid-term assessment of progress. Geneva, World Health Organization, 2004.

³WHO, World Health Report 2002 (according to which indoor air pollution is responsible for 2.7% of the global burden of disease).

⁴Initiating an alliance for action. Geneva, World Health Organization, 2002 (Document prepared for WSSD, September 2002).

⁵Githeko, Climate change and vector-borne diseases: a regional analysis, *Bulletin of WHO* (2000) 78 (9): 1136

⁶Smith. How much global ill health is attributable to environmental factors? *Epidemiology*, 1999, 10:573.

ⁱToxicokinetics explains the rate of action by contaminants on target organs by describing the amount, duration, and form of the toxicant interactions.

ⁱⁱToxicodynamics is considered to be the process of interaction of chemical substances with target sites and the subsequent reactions leading to adverse effects.

ⁱⁱⁱNeuronal migration is the method by which neurons travel from their origin or birth place to their final position in the brain.

^{iv}A vector is an insect or any living carrier that transmits an infectious agent.

^vMycotoxin is a toxic secondary metabolite produced by organisms of the fungus kingdom, commonly known as moulds.

^{vi}Anthropogenic: relating to, or resulting from the influence of human beings on nature.

Peter van den Hazel, MD, MPH

is the co-founder of the International Network on Children's Health, Environment and Safety (INCHES) whose mission is to promote healthy and supportive environments which protect the foetus and child from environmental and safety hazards. Since 1986 he has worked as an Environmental Health Specialist for several Municipal Health Services in Gelderland, the Netherlands. Since 1993 he has been a consultant for and partner in the Bureau of Environmental Medicine (BMM). He is the past President of the International Society of Doctors for the Environment, ISDE, (2001-2003). Dr. van den Hazel is the Co-founder and Chair of the board of INCHES. He successfully worked to ensure children's environmental health was an issue taken up at the World Summit for Children and the World Summit on Sustainable Development. Since 2002 he has been coordinator for several EU-funded projects like PINCHE (Policy Interpretation Network on Children's Health and Environment), CHEST (Children's Health, Environment and Safety Training), PRONET, PHEEDUNET, Climate TRAP and TOP (Training of Professionals). His daily practice consists of consulting in a broad range of environmental health issues.

Anne Stauffer is the Deputy Director at the Health and Environment Alliance, HEAL. Anne coordinates the organisation's overall policy input into the EU decision-making process and takes the lead on air quality, noise and pesticides policy files.

The Health and Environment Alliance (HEAL) is the leading European not-for-profit organisation addressing how the environment affects health in the European Union. HEAL's more than 70 member organisations, representing health professionals, patients, citizens, women, youth and environmental experts help to bring independent expertise and evidence from the health community to different decision-making processes.

Before joining HEAL, Anne worked as a research and policy coordinator in the European Parliament on environmental health issues. She holds an M.A. in Sociology and Political Science from the University of Freiburg, Germany, and has completed graduate work in Gender Studies in the United States.