

# THE EFFECT OF ENVIRONMENTAL HAZARDS ON THE HEALTH OF THE YOUNG

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*'If you go to American city,  
You may find it very pretty,  
Just one thing that you must beware,  
Don't drink the water and don't breathe the air'*

*T. Lehrer in 'Pollution'<sup>1</sup>*

The environment refers to the medium in which we exist. Our health depends on the ongoing events taking place in our surroundings. The environment can have direct or indirect hazardous effects on our health. Several noxious effects can reach us through ingestion, inhalation, and through contact with our skin. These hazards may also affect the unborn child, evading the protective and nurturing body of its mother.

The environment is relatively more hazardous to infants and children because they are structurally and functionally different from adults. Children have a larger surface area to body weight ratio. Their higher metabolic rate requires more oxygen intake. They grow at a faster rate, especially during the first six months of their life. Some body organs are functionally immature at birth and organ maturity progresses at different rates. Children also need more energy and fluids per unit body weight compared to adults. Thus, the greater requirement of fluids, food and air makes them more vulnerable to environmental hazards.<sup>2,3</sup>

Children require access to clean water, clean air and protection from polluting toxic substances in order to sustain normal growth and development.<sup>1</sup> The environment can be instrumental in assisting the develop-

ment of a child but also hazardous in many ways. Some of these noxious effects of the environment, their effects on the foetus during pregnancy and on infants and children will be described below.

**Poverty** is a major culprit behind many problems that will be described. Poor **nutrition** during pregnancy is harmful to the unborn child since its growth depends entirely on the maternal food supply. Lack of proper nutrition may result in intrauterine growth retardation. The proportion of low birthweight babies (usually taken as less than the 10th centile for gestational age) reflects the health and nutritional status of the mother.<sup>2</sup> Poverty is also the cause of widespread malnutrition affecting children across the world. Malnutrition makes children more prone to infection. Infection in turn, further exacerbates malnutrition resulting in a vicious cycle. Both malnutrition and infection are attenuated by breastfeeding. However, breast-feeding is not completely risk-free. Most fat-soluble chemicals ingested by the mother can be transferred to the child via breast-milk.

**Obesity** on the other hand, is the most common nutritional problem of children in many parts of the developed world, especially the United States, and is caused mainly by inappropriate environmental habits and

factors. The incidence of childhood obesity in the U.S. increases especially among children of elementary and high school age. This problem is also markedly on the increase in the UK<sup>4</sup> and in other Western countries, where about 10-15% of preschool children are considered to be overweight.<sup>5</sup> Some of the factors thought to increase the risk of childhood obesity are environmental factors indirectly exerting their effect on children such as having obese parents, being an only child and leading a 'sedentary life' by spending long hours watching TV instead of engaging in physical exercise.<sup>6</sup>

Childhood obesity has also been noted as a serious national problem in the Maltese Islands in the mid-1990's, increasingly affecting older children (around 10 years of age), females more than males.<sup>7</sup> Moreover, the incidence of overweight babies in Malta, with about 12% of the newborn baby population weighing 4 kgs and over, is higher than that of many other countries.<sup>8</sup>

**Lead poisoning** can occur through ingestion of contaminated food or water and also by inhalation of lead-polluted air. Central nervous system problems such as convulsions, behavioural changes, mental retardation, irritability, lack of coordination and clumsiness may

occur in children and may persist into adulthood.<sup>2</sup>

Women working in lead-using trades were found to have unusually high rates of infertility, spontaneous abortion, stillbirth and neonatal death. This observation in many parts of Europe, led to the banning of such trades for women.<sup>9</sup> Children, especially at an early age, (< 6 years) may ingest lead through contaminated soil, dust and also by eating leaded paint chips.<sup>10</sup> Eating food sold by street vendors, after being exposed to road dust containing high levels of lead is yet another source.<sup>2</sup> 'Clean' foods such as canned fruits, vegetables and fruit juices have been found to be the biggest contributors of lead in a child's diet.<sup>9</sup>

Drinking water coming from lead-lined water tanks or from copper piping joined by lead solder, used in modern water systems forms another source.<sup>2</sup> Adding lime, or in some areas, orthophosphate, has helped in preventing lead dissolving in the water-pipes.<sup>11</sup>

Automobile traffic emits exhaust gases containing predominantly inorganic lead aerosol. Use of lead-free gasoline, readily available in some countries, has produced cleaner air. Removal of lead from gasoline started in USA in 1972 and was completed in 1995. This practice has resulted in almost four-fold reductions in the median blood lead level of high risk children (6 months to 5 year olds) in Chicago.<sup>12,13</sup> However, the opposite is happening in developing countries where increase in traffic and unrestricted use of leaded petrol occurs in urban cities.

**Cadmium** is a heavy metal which enters the body through the same sources as lead and also through smoking (active or passive). Long-term exposure to cadmium can lead to renal

tubular dysfunction and bone defects. Such medical complications arose in Japan after the ingestion of rice grown in paddies, irrigated with cadmium-contaminated river water.<sup>2</sup>

In cases of **methylmercury poisoning** following ingestion of seafood in Japan, and dressed seed in Iraq, many infants were born with microcephaly, irritability, cerebral palsy, or later developed epilepsy.<sup>9</sup>

The environment can also be hazardous through deficiencies of certain essential trace elements. **Trace element deficiency** - Severe **Zinc** deficiency in childhood is associated with dwarfism and hypogonadism and this has been found especially commonly in the Middle East. In neonates, this can cause acrodermatitis enteropathica. Infants born to mothers with **Iodine** deficiency during pregnancy have a greater risk of both motor and mental retardation. **Iron** deficiency causes anaemia, which in infants has been shown to decrease intellectual ability. Lack of **Fluoride** in children is associated with dental caries.<sup>9</sup>

Another source of environmental hazard is through **pesticides** such as DDT and its derivatives which pass through the placenta and affect the fetus. Reproduction is affected and birth defects and cancer have been demonstrated in animal research.<sup>2</sup>

Accidentally ingested **polychlorinated biphenyls (PCBs)** slow fetal growth and later impair neural development. Eating rice-oil contaminated with PCBs led to a number of Japanese women giving birth to affected children. PCBs can also be excreted in breast milk.<sup>9</sup>

Inhalation of hazardous compounds adds to the list of environmental dangers. High levels of **Carbon Monoxide (CO)** are found in urban cities loaded with

heavy traffic. Another significant source of CO to the foetus is cigarette smoking (passive or active) by the pregnant mother.<sup>14</sup> This gas diffuses easily through the placental tissues, producing a concentration of 10 to 15 per cent higher in the foetus than in the mother. This jeopardises foetal oxygen availability leading to retarded growth, brain damage or death.<sup>12</sup>

**Cigarette Smoking and Environmental Tobacco Smoke (ETS):** This form of indoor pollutant produces intrauterine growth retardation and increases the risk of spontaneous abortions, premature deliveries and perinatal deaths.<sup>9,14</sup> An interesting finding is that children born to mothers who smoked during pregnancy were on average 1-2 cm shorter, compared to other children, after accounting for several confounding variables.<sup>9,14,15</sup> The intellectual ability and behaviour of these children may be affected.<sup>9,16,17</sup> There has also been some speculation of increased risk of childhood cancers in children exposed to smoking during pregnancy but further studies are still required in this area.<sup>9,14</sup>

Cigarette smoking and ETS have been known to cause respiratory problems for a long time. Children are especially at risk of developing asthma through ETS from their parents, mostly from their mother.<sup>14,18,19,20</sup> Some studies<sup>20,21,22</sup> have shown that lung function diminishes in children exposed to ETS. A higher incidence of otitis media, rhinitis, atopy and resorting to tonsillectomy has been associated with passive smoking (ETS).<sup>14,20</sup> Exposure to ETS is also thought to be a risk factor for Sudden Infant Death Syndrome (SIDS).<sup>2,14</sup> A relationship has also been found between ETS and the development of purulent meningitis in children.<sup>23,24</sup> Exposure of children to ETS has shown an increased risk of leukaemia and lymphoma during adulthood.<sup>20</sup>

Passive smoking (ETS) also predisposes children to increased lower respiratory tract illness rates, especially in the first year of life.<sup>20,25</sup>

Research has also shown that the physical distance between a baby and the nursing mother who smokes and the amount of cigarettes smoked correlates with the amount of Cotinine (used as a marker) found in the baby's urine. These mothers were not exposed to ETS but were smokers themselves, smoking either away from the baby or during breastfeeding. Babies of mothers who smoked while nursing were found to have even higher levels of cotinine in the urine.<sup>26</sup>

Smoking among the children themselves is a growing epidemic. Regular smoking at 10 - 15 years of age is becoming an increasingly common practice (among girls more than boys), especially in places like Italy, France and Germany where more than 30% are regular smokers at this age. Moreover, smoking tends to be associated with illicit drug use among these young people.<sup>27</sup>

Yet another hazard emerging from the environment is **illicit drug addiction**. Cannabis is widely consumed, besides other drugs like amphetamines, barbiturates and tranquillizers.<sup>2</sup> Drug abuse during pregnancy gives rise to premature deliveries. Low birthweight, smaller head circumference as well as SIDS were associated with opiate addiction.<sup>9</sup>

In 1973, Jones et al showed that excessive consumption of **alcohol** during pregnancy can lead to a variety of congenital malformations and low birthweight - the 'foetal alcohol syndrome'.<sup>28</sup> The combined effect of alcohol and smoking by a pregnant mother further aggravates the situation and leads to

twice as many stillbirths as when alcohol is consumed alone.<sup>2</sup> Children of alcoholic mothers are more likely to have behaviour problems and low IQs.<sup>9</sup>

**Loud noise** is yet another adverse effect of the environment, and which can lead to defective hearing. Pregnant mothers exposed to a lot of noise at work gave birth to children who showed an increased risk of hearing loss.<sup>9</sup>

**Food additives and preservatives** can be harmful to our health. Tartrazine (E102) is an additive commonly used in the form of an orange-yellow colouring, in both foods and drugs. E102 has been implicated in causing adverse reactions such as bronchospasm, urticaria and angioedema.<sup>29</sup>

Infants are more vulnerable to **waterborne chemicals and infections** than older children because of a larger water intake in relation to their body weight. Ground-water, and more so, well-water, can contain **nitrates**, especially in countries where use of nitrate fertilisers and manure in agriculture has increased. Bacteria in the GIT convert nitrates to nitrite and this induces methaemoglobinaemia, especially in infants. Another source is vegetables. WHO has recommended that infant formula milk should be prepared using low-nitrate water (at least <45mg/L). Nitrates can react with amines to form nitrosamines, which are potent carcinogens in animals. Such compounds are used in the manufacture of baby pacifiers.<sup>2</sup>

Lack of safe, clean **water** and sanitation services can lead to repeated attacks of infective diarrhoea in infants and children. In underdeveloped countries, this leads to malnutrition, stunting of physical and mental growth and a substantial number of deaths from dehydration.<sup>2</sup>

Poor drainage of stagnant waters and badly planned irrigation systems encourage mosquito infestation, many of which may carry malaria.<sup>2</sup> **Malaria** is endemic in 102 countries, placing over half the world's population at risk. Other **water-borne parasitic infections** such as schistosomiasis, transmitted by snails, is hazardous to the older age-group (10-14 years) who place themselves at risk by bathing and washing in infested canal water.<sup>2</sup>

**HIV infection** - AIDS poses another 'environmental' threat to the growing foetus. Babies born to infected women have 25-40 percent chance of being infected before or after birth. The infected children are almost all destined to die by the age of 5 years.<sup>2</sup> The few that survive are soon orphaned after their infected parents pass away. HIV infection can also be transmitted through breastmilk.<sup>30</sup>

Air pollution has become a major global problem affecting mostly children in more localised areas such as urban cities. Young children inhale twice as many air pollutants than do adults since more air is inhaled per unit body weight.<sup>11</sup> The effects of cigarette smoking and ETS on children have already been discussed above.

Another form of indoor air pollution is through **gas cooking**. Gas used for cooking, heating water or space heating is again quite hazardous to health, especially pregnant women who might be spending more time in the kitchen or in front of the fireplace. **Nitrogen dioxide** and **nitric oxide** emitted during cooking using oil stoves, gas-fired appliances and open fires leads to increased susceptibility to both bacterial and viral respiratory infections and impaired lung function.<sup>31,32</sup> In Moscow, the prevalence of childhood asthma was much higher in areas with high concentration of nitric ox-

ide and other pollutants.<sup>33</sup> Similar health effects occur with smoke and SO<sub>2</sub> pollution from coal consumption and industrial plants in developed countries.<sup>11</sup> The noxious effects of gas cooking was investigated in the Middle East among children of Kuwaitis and of Europeans living there. The lung function was significantly impaired in families using gas for cooking. Moreover their children were approximately 3cm shorter than children having electric cookers at home.<sup>34</sup>

**Wood-burning fireplaces** produce several pollutants which may include cancer-causing agents such as benzo-a-pyrene and other gaseous pollutants such as CO and formaldehyde. The famous London smog of 1952 led to over 4000 deaths affecting mostly children under the age of one. The disaster led to the Clean Air Act (1956) and an end to coal fires in the UK.<sup>9,11</sup>

**Ozone** is a dangerous irritant to eyes, throat and lungs.<sup>9</sup> Studies<sup>9,35</sup> carried out during periods of high ozone pollution has shown a baseline shift of pulmonary function in children and an increased number of hospital visits for asthma.

Streets, playgrounds and beaches can also be hazardous to children's health. **Junk foods** sold to young children are occasionally contaminated, some contain unlicensed colouring agents and additives and others are uncooked and/or unwashed.<sup>2</sup>

Children may be exposed to **dog-fouling** on playgrounds. In the UK, about 100 people a year, mostly children, become partly or totally blind as a result of ingesting the eggs of a parasite (*Toxocara canis*) found in dog faeces. Another type of *Toxocara* causes wheezing and skin rashes. **Salmonella** bacteria has also been known to contaminate playgrounds.<sup>11</sup>

**Toxic waste** (eg. cyanide waste) dumped illegally may end up in places such as playgrounds. Beaches polluted with **sewage** contain coliform bacteria which can cause infection of the gastrointestinal tract, ear, nose and throat, eyes and skin.<sup>11</sup> In 1957, a 6 year old girl developed polio and subsequently died after having bathed near a sewage outflow in the Solent, UK. Such a risk is diminished nowadays with increasing immunisation coverage.

**Ionising radiation** can also have hazardous effects on one's health. This form of radiation mainly affects the process of cell division. Brain damage in the foetus may occur especially if the pregnant mother is exposed to radiation during the first trimester.<sup>2</sup> Many children born after the atomic bomb attacks in Hiroshima and Nagasaki suffered severe mental retardation. Studies<sup>2,9</sup> have indicated that children born to mothers irradiated during pregnancy, are more likely to die of cancers, but further research is required in this area.

The natural level of radioactivity is increased by human activity such as medicine, nuclear fallout from weapon testing and industrial and nuclear plants using radioactive by-products.<sup>11</sup> Radiation affects cell-division mostly of blood-forming tissues, sex-glands and skin. **Leukaemia clusters** of children living close to nuclear plants, have been cause for much concern. Such a cluster occurred in a village close to a nuclear plant in Sellafield, UK in the early 1980s, initiating much research into the matter. However, leukaemia clusters have also been found in areas where power plants have been planned but never built. This might be explained by population migration to this area leading to epidemics of common viral infections in the new towns.<sup>9,11,36</sup> This in turn may contribute to a leu-

kaemia cluster (the **Kinlen Hypothesis**).<sup>37</sup>

Another type of radiation is **electromagnetic radiation** found wherever there is electric power. An increased risk of all cancers in children has been associated with the use of electric blankets. The use of electric appliances has been associated with premature labour.<sup>9</sup>

Children are adventurous and therefore more likely to be injured by falls, drowning, scalding, burns and accidental ingestion of dangerous liquids and drugs. Such incidents are also products of the environment. **Accidents** are more common in places where children live in poverty, poor housing and where social isolation of lone mothers exists.<sup>38</sup>

The environment is also a means of educating society. However, **education** is not available to all societies alike. In developing countries, around 50% of children attend primary school.<sup>2</sup> However, only about 20% of boys and 10% of girls attend secondary school. These percentages vary in different countries. More girls tend to be kept at home in order to do chores such as fetching wood and water in these developing countries. This later reflects itself in the lack of knowledge about hygiene and health in these girls who later bear their own children. This sex discrimination also extends further in some parts of Asia and Africa, with girls being given second rate health care and nutrition.<sup>2</sup> Lack of education results in lack of knowledge about the environment. This in turn, leads to inadequate use of facilities that the environment provides, with resulting malnutrition, ill health, illiteracy, poverty, crime and war.

**Child labour** is a preferred option to education in some countries. Poverty drives chil-

dren to go to work at a very tender age, partly to help their family income, and partly to help themselves especially if they are homeless. Some children work for long hours without proper rest and nutrition and are continuously exposed to risk especially in certain lines of work (toxic vapours, corrosive liquids, and a whole range of infections in garbage collecting). Ninety-eight percent of economically active children are in fact, found in developing countries.<sup>2</sup>

Poverty also drives children **homeless**; on the street with no roof over their head, begging, stealing, doing odd jobs like shoe shining and washing cars. Some of these children form gangs, or enter the drug trade or prostitution. The World Health Report in 1995 states that **extreme poverty** is 'the world's biggest killer and the greatest cause of ill-health and suffering across the globe'.<sup>39</sup>

Unfortunately, children are also victims of **war**. About 2 million children are estimated to have been killed in wars during the past decade. **Child soldiers** under the age of 16 years, numbered as many as 200,000 in 1988 alone. **Land-mines** provide the most lethal weapon of all, especially to children playing or working in fields. About 110 million land-mines still remain unexploded in 64 countries around the world.<sup>40</sup> Wars do not just kill children but many are disabled, left homeless, orphaned and many more are psychologically traumatised, probably for life.

## CONCLUSION

The state of our environment affects the health of all strata of society, especially that of infants and children. Besides the problems mentioned above, more ominous hazards with far-reaching consequences loom on the horizon. These include global warming, ozone depletion,

deforestation and desertification just to name a few. Global warming and ozone depletion are expected to change disease patterns as well as perhaps decreasing our immune response to various infections.<sup>2</sup> Children, again, are the most vulnerable sector of our population, and tend to be affected the most by these problems.

The United Nations Convention on the Rights of the Child, Article 24 specifically deals with environment stating that 'children have the right to live in a safe, healthy and unpolluted environment with good food and clean, drinking water'. Heads of State are continuously labouring towards reaching this goal; for some countries, this will obviously take longer than others.<sup>41</sup>

Mankind is permanently under the reign of the environment. We, as part of society, should treat our environment with care and reverence and make sure that we do not underestimate its influence on our health. Whenever we can, we should strive to try and make it better, especially for the sake of our voiceless population, the children of the world.

## Acknowledgements

The authors wish to acknowledge the useful advice given by Dr. S. Attard-Montalto, Chairman, Department of Paediatrics.

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