CHILDREN EXPOSURE
PAN Europe

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THE PESTICIDE GENERATION
CHILDREN ON THE FRONT LINE

Synthetic pesticides are toxic to biological systems by design.
Many act :
-by disrupting signaling mechanisms in the central nervous system –
-by inhibiting neurological function
-by acting as Endocrine Disruptors
Evidence from animal studies and adult occupational poisonings has demonstrated that these insecticides act via similar neurotoxic mechanisms in mammals following high-dose exposure
Less is known about the mechanisms of neurotoxicity at low-level exposures that are relevant to the general population.

Low-level pesticide exposures are an important concern in pregnant women and young children

Fetal and infant brains are rapidly developing, leaving them highly vulnerable to potentially long-lasting effects of pesticide exposure, such as disruption of brain architecture or circuitry

Adding to concerns for fetal exposure, pesticides are able to cross the placenta and fetuses tend to have lower levels of detoxifying enzymes both of which are thought to increase fetal susceptibility.

Low-level pesticide exposures during pregnancy or childhood have been found to be associated with neurodevelopmental deficits such --as lower IQ

-disorders such as autism

-attention deficit-hyperactivity disorder , and pervasive developmental disorder

An old story many times said ……

children are at **high risk of exposure to pesticides** that are used extensively in **urban schools, homes, and day-care centers for control of roaches, rats, and other vermin**.

-The **organophosphate insecticide chlorpyrifos** and certain **pyrethroids** are the registered pesticides most heavily applied in cities.

-Illegal street pesticides are also in use, including tres pasitos (a carbamate), tiza china, and methyl parathion.

-In New York State in 1997, the heaviest use of pesticides in all counties statewide was in the urban boroughs of Manhattan and Brooklyn.

-***Children are highly vulnerable to pesticides. Because of their play close to the ground, their hand-to-mouth behavior, and their unique dietary patterns, children absorb more pesticides from their environment than adults.***

The long **persistence of semivolatile pesticides** such as **chlorpyrifos** on rugs, furniture, stuffed toys, and other absorbent surfaces within closed apartments further enhances urban children's exposures.

Compounding these risks of heavy exposures are:

-children's decreased ability to detoxify and excrete pesticides and the rapid growth, development, and differentiation of their vital organ systems.

-These developmental immaturities **create early windows of great vulnerability.**

-Recent experimental data suggest that **chlorpyrifos** may be a developmental neurotoxicant and that exposure in utero may cause biochemical and functional aberrations in fetal neurons as well as deficits in the number of neurons.

- Certain **pyrethroids** exert hormonal activity that may alter early neurologic and reproductive development.

-Assays currently used for assessment of the toxicity of pesticides are insensitive and cannot accurately predict effects to children exposed in utero or in early postnatal life.

Protection of children, and particularly of inner-city children, against the developmental hazards of pesticides requires

- a comprehensive strategy that monitors patterns of pesticide use on a continuing basis

-assesses children's actual exposures to pesticides,

-uses state-of-the-art developmental toxicity testing,
and ***establish societal targets for reduction of pesticide use***.

Environ Health Perspect. 1999 Jun; 107(Suppl 3): 431–437.
doi: 10.1289/ehp.99107s3431

Prenatal exposure to organophosphate pesticides and risk-taking behaviors in early adulthood.

Sagiv, S.K., Rauch, S., Kogut, K.R. *et al.*

Environ Health **21**, 8 (2022).

https://doi.org/10.1186/s12940-021-00822-y Open Access Published: 10 January 2022

Fetus and child brain is more vulnerable to neurotoxic effects than adults In addition, exposure to pesticides during pregnancy could adversely affect fetal development because **pesticides can cross the placental barrier** and have even been found in **amniotic fluid**

In recent years, concern has arisen worldwide about the potential adverse
effects that could result from early-life exposure to pesticides. Asthma, bronchitis, and persistent
cough in children have been linked to gestational exposure to pesticides. The respiratory effects
of gestational exposure to pesticides are controversial

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Why *the developing brain is particularly susceptible to neurotoxicity?*

Because the blood-brain barrier restricts the passage of substances from blood to brain, in its absence, toxic agents can freely enter the developing brain

. In summary, the developing brain is extremely vulnerable to toxic insults because a large number of processes occur during an extended period of time.

Is the blood-brain barrier well developed at birth?
It is widely believed that in embryos and newborns, this **barrier is immature or "leaky,"** rendering the developing brain more vulnerable to drugs or toxins entering the fetal circulation from the mother

Between conception and age three, a child's brain undergoes an impressive amount of change. At birth, it already has about all of the neurons it will ever have. It doubles in size in the first year, and by age three it has reached 80 percent of its adult volume.

Thanks to recent advances in technology we have a clearer understanding of early brain development.

Neuroscientists can now identify patterns in brain activity that appear to be associated with some types of negative early experiences.

Genetic and environmental factors work together to shape early brain development.

Although the first stages of brain development are strongly affected by genetic factors, genes do not design the brain completely. Instead, when and where genes are used is fine-tuned according to the input they receive from the environment – this happens even during pregnancy when maternal nutrition and stress can influence the early phases of brain architecture.

These gene-environment relations allow for each child to adapt to their surroundings more readily and more quickly than they could if genes alone determined the brain's wiring. There are two major ways that genes and environment work together to sculpt the brain.

One is through inheriting certain forms of genes that can have very different interactions with the environment. The second is through environmental influences that can alter the read-out of genes without changes to the genes themselves. This second process is becoming better understood thanks to recent research in a relatively new scientific field called epigenetics.

The field of epigenetics has changed our understanding of how the environment interacts with our genes and how genes interact with the environment.

Epigenetics (meaning ‘above’ genetics) is the study of enduring changes in gene activity that do not change the DNA code itself, but through chemical changes, do influence how the code is used. Many environmental factors and experiences result in chemical ‘marks’ on certain parts of genes, and these epigenetic changes can influence the activity, or ‘expression’, of the gene.[12]
You can think of the epigenetic processes as the software that directs the functioning of a gene’s DNA hardware. Because the development of all cells, tissues, and organs is affected by when and how specific genes are expressed, epigenetic processes can be a powerful influence on health and well-being

Low-level pesticide exposures during pregnancy or childhood have been found to be associated with neurodevelopmental deficits such as lower IQ and disorders such as autism, attention deficit-hyperactivity disorder, pervasive developmental disorder.

Prenatal exposure to multiple pesticides is associated with auditory brainstem response at 9 months in a cohort study of Chinese infants
https://doi.org/10.1016/j.envint.2016.04.035

Highly hazardous pesticides (HHPs) seriously threatens the health and lives of children, infants and future generations.

Acute Poisoning

Commonly used organophosphates and carbamates cause fatigue, dizziness, blurred vision, vomitting, breathing difficulties, stinging eyes, burning nose, and itchy skin. Death can occur rapidly or over a few weeks.

Cancer

Childhood cancers most associated with pesticides are leukaemia, brain cancer, non-Hodgkin's lymphoma, neuroblastoma, Ewing's sarcoma (in bone tissue) and Wilm's tumuor (kidney).

Birth Defects

More birth defects occur more often among families of pesticide applicators and communities near areas where pesticides are used. Pesticides known to cause birth defects include dimethoate, endosulfan, carbaryl, benomyl, mancozeb, paraquat and 2,4-D.

Photo courtesy of Gilbert Sape

Asthma, Allergies and Immune System Problems

Chemicals could increase or decrease immune responses. A disruption in the normal development of the immune system could cause respiratory allergies, recurrent otitis media and paediatric coeliac disease.

Neurodevelopmental and Behavioural Disorders

Most are not observable at birth but become evident later in life. Lower IQ, attention deficit / hyperactivity disorder (ADHD), epilepsy, Tourette syndrome, mental retardation, dyslexia and cerebral palsy have been linked to pesticide exposure.

Reproductive Disorders and Abnormalities

Foetal exposure to endocrine disrupting pesticides cause infertility, endometriosis, menstrual irregularities, and uterine fibroids among females; and hypospadias and cryptorchidism among males.

Obesity, Diabetes and other Metabolic Diseases

Pre-birth and early childhood exposure to pesticides has been linked to obesity, diabetes, and other metabolic diseases.

Thank you

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