Time to Act:

Preventing Harm to Our Children

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Overview

Research in recent years has demonstrated that children and the developing fetus are uniquely vulnerable to health damage from toxic chemicals. Children are not little adults. Their organs and physiological processes are still developing. Toxic chemicals can disrupt the development of organs and systems during childhood, causing long-term, irreversible damage. Even exposure of parents to some substances can result in health problems for their children. Unfortunately, our laws and policies still focus on limiting chemical risks to healthy adults to so-called "acceptable" levels, rather than preventing harm to children. We have a history of ignoring clear warnings of potential health damage, which results in enormous costs to all of society.

The tragic history of lead poisoning of our children here in the Bay State demonstrates the repercussions of failure to protect children from environmental exposures. The problem is not limited to lead; children in Massachusetts are still excessively exposed to mercury, some pesticides, and hazardous air pollutants. Rates of cancer, developmental disabilities, and asthma and allergies in children, all of which have suspected environmental links, are on the rise.

There is sufficient scientific evidence that toxic chemicals currently in use are harming the health of our children. This evidence demands preventive action to protect our children's health and future, even though absolute, case-by-case, chemical-by-chemical proof of harm has not been established. Protecting those most vulnerable in the population from toxic chemicals is not only good public health policy, it will help ensure that all people are protected.

A new approach to decision-making is needed – the development of an action plan to protect children's health and development. The action plan would contain clear, measurable goals and targets for reducing and eliminating threats to children's health from chemical exposures. The plan would set in motion a process of identifying and instituting alternatives that prevent harm while achieving societal needs. We need to process in a comprehensive, organized way, but we need to begin now. Every day more children are harmed.

Rates of childhood illness with links to environmental exposures are on the rise

Scientific studies indicate that children's health and development are at risk from toxins they are currently exposed to in food, air, water, and commonly used products. Exposure in the womb or in childhood has been associated with the following health problems: birth defects, reproductive problems, cancer, developmental and neurological disorders, asthma, respiratory distress, and immune suppression. Rising rates of childhood illness suggest that pollutants or toxic products may be harming a large percentage of our children. These trends cannot be explained by better detection alone. Three areas of particular concern include: asthma and allergies, developmental disorders, and cancer:

Developmental disorders. It is estimated that nearly 17% of children in the United States under age 18 suffer from one or more learning, developmental, or behavioral disabilities. Attention-deficit hyperactivity disorder (ADHD) now affects approximately 3-6% (and possibly as much as 17%) of all schoolchildren and learning disabilities may affect 5-10% of children in public schools. The incidence of autism may be as high as 2 per 1000 children and its prevalence is estimated to have doubled between 1966 and 1997.

Asthma and allergies. An estimated 4.8 million children – 1 in 15 – under the 18 years of

age have asthma, making it the most prevalent (and potentially life-threatening) chronic disease among children. Asthma rates among children under 5 years of age increased by 160% between 1980 and 1994 and 74% among children 5 to 14 years of age. During this period, the estimated annual number of doctor's office visits for asthma more than doubled.

Childhood cancer. Each year in the United States, about 8000 new cases of cancer are reported among children under 15 years of age. Cancer is the second most common cause of death among children, after accidents. While childhood cancer mortality is down (due to better treatment), the overall incidence of cancer in children rose about 10% during the period 1974-1991, approximately 1% per year. According to more recent statistics maintained by the National Cancer Institute, between 1975 and 1998, the overall age-adjusted incidence of cancer in children under 14 increased by almost 21%. However, specific cancers have experienced much greater increases in incidence during this period (though these rates are often based on small numbers): Wilms' Tumor (38.9%); bone and joint cancers (65.9%); gliomas (a type of brain tumor) (38.7%); central nervous system tumors (30%); soft tissue cancers (31.2%); and acute lymphocytic leukemia (25.4%).

Children are more vulnerable than adults to the impacts of toxic chemical exposures.

Children are generally more vulnerable to injury caused by toxicants in the environment than adults, due to the combination of disproportionately heavy exposure plus biologic vulnerability.

The developing fetus and children are growing and developing, which makes them vulnerable. Small exposures can disrupt critical cellular processes, resulting in irreversible lifelong effects.
Children often absorb toxic substances more readily than adults and because of their immature metabolic systems, they are less able than adults to detoxify and excrete toxic substances from their bodies.
Pound per pound, children drink more water, eat more food, and breathe more air than adults. They also eat more of some kinds of food than adults, such as fruits, and do normal childhood activities like put their hands in their mouths, or crawl around on the floor. All of these factors put them at greater risk of harm from environmental exposures.
Children are exposed to toxic substances throughout life, increasing their risk of chronic health effects that show up later in life.

Children are exposed to a wide range of toxic chemicals that are largely untested.

An estimated 75,000 chemicals are used in commerce today and released into the environment, eventually reaching our bodies through the food we eat, the water we drink, and the air we breathe. A recent report by the U.S. Centers for Disease Control identified 27 toxic metals, industrial chemicals, and pesticides in the urine of adults and children not known to have any specific exposure to those substances. It is expected that many more chemicals will be found as additional testing is completed.

Despite known exposures to these substances, the U.S. Environmental Protection Agency has estimated that less than 10% of the industrial chemicals produced in the largest quantities (over one million pounds per year) have a full complement of publicly available basic toxicological screening data. More than 40% have no publicly available toxicity data. While more data is generally available about the health effects of pesticides, information on reproductive and developmental effects is often missing.

We know even less about the effects of low-level exposures to toxic chemicals during development, or the impacts of exposure to many different chemicals together. Given the

large number of chemicals in use and the discovery of more and more ways in which chemicals can disrupt a child's normal functioning, it is unlikely that we will ever see full data sets on toxicity for all hazardous substances.

We know so little about the effects of toxic chemicals on children's health that leading pediatrician and environmental health scientist Dr. Philip Landrigan has concluded, "by default, we are conducting a massive toxicological experiment and our children are the experimental subjects."

Costly Lessons from Early Warnings: Lead and Mercury

The tragic histories of lead and mercury demonstrate the potential impact of not taking action to protect children's health.

The toxicity of lead has been known for thousands of years. The dangers of lead poisoning to workers and children were recognized in the 19th century and by the first third of the 20th century there was a broad consensus on the impacts of lead on both child and adult health. In 1904, an Australian scientist reported a link between lead-based paint and childhood lead poisoning and urged "the use of lead paint within the reach of children should be prohibited by law." But despite public health and medical concern over the effects of lead on children, industries went ahead and widely incorporated lead into paint and gasoline, working actively to prevent government regulation and demanding that public health authorities prove the dangers to health. In fact, the lead paint industry purposely geared advertisements to children.

Lead is now recognized to be a developmental toxicant, resulting in decreased IQ; learning disabilities; and behavioral changes (decreased attention span, hyperactivity and aggressive behavior). Between 1976 and 1980 the average blood level in children in the United States was 16.5 micrograms per deciliter – meaning that the average child had a blood lead level higher than the level we know to affect behavior and cognition (10 micrograms/deciliter). Despite the removal of lead from gasoline and the subsequent 80% drop in blood lead levels in U.S. children (to 3.6 micrograms/deciliter), more than one million children in this country still have blood lead levels above the level known to result in adverse developmental impacts, with poor and minority children having the worst exposures (approximately 36% of African American inner city children have elevated blood lead levels. Recent evidence shows that even blood lead levels below the 10 micrograms/deciliter threshold can affect learning ability, which means that, millions of additional children are at risk of impairment from lead exposure.

As scientists learn more about the effects of lead on children, the "safe" level continues to drop, indicating that there is probably no "safe" level of lead exposure for children. The costs of childhood lead poisoning on the economy have been enormous: damage to the lives of millions of children, health and educational services, clean-up, and lost intelligence and productivity. It has been estimated that a 1 microgram/deciliter reduction of blood lead levels is worth at least $6.94 billion dollars for each year of children born, most of that from avoiding future earnings losses.

Mercury is another example of a pollutant where early warnings of potential harm were not heeded. Mercury exposures occur from coal-fired power plants, incinerators, industrial plant emissions, from discarded thermometers, electric switches, and fluorescent lightbulbs, and previously used pesticides. The neurological toxicity of mercury has been known for centuries (e.g., mad-hatter's disease), and its effects on children have been known since the mid 1940s. Its devastating effects on the human brain were discovered in the 1950s and

1970s after large scale-poisonings in Japan and Iraq. More recent studies have identified effects in children at even lower levels of exposure.

Large fetal exposures to methylmercury (one type commonly found in the environment) cause mental retardation while smaller fetal exposures, such as those resulting from regular maternal fish consumption, may cause lasting impairment of language, attention, and memory. Because of the build-up of methylmercury in fish, the Environmental Protection Agency estimates that 1.16 million women of childbearing age eat sufficient amounts of mercury contaminated fish to pose a risk of harm to their future children. Recent Centers for Disease Control data indicate that approximately 10% of women of childbearing age have levels of mercury in their bodies (as measured in urine) within one-tenth of the level estimated to result in abnormal scores on cognitive function tests in offspring. As is the case with lead, the estimated "safe" exposure to mercury continues to drop as evidence of its low-level effects on children increases.

The stories of lead and mercury show us how we can avoid making similar mistakes again.

Evidence pointing to harm accumulates for long periods of time before preventive actions are taken;
As evidence accumulates, scientists learn that lower and lower exposures can lead to adverse effects in children;
Environmental exposures have tremendous costs, both financial and in quality of life;
Corporate interference can result in continuing use of a known toxic product.

Case studies: Common exposures that can result in harm to children

The case studies described below provide three examples of environmental exposures that are potentially damaging to the health of children and the types of evidence available that build a compelling case for action. These chemicals are:

phthalates (widely used in vinyl plastic and other products);
solvents (used in many occupations and for household use)
dioxins (a by-product of industrial chlorine use) and PCBs (formerly used in electric transformers)

These cases demonstrate that: (1) exposure to adults (without any obvious signs of toxicity) can result in life-long adverse impacts in their children; (2) low level exposures during critical periods of development can result in irreversible long term effects; chemical exposures that might harm children are widespread – from products, factory emissions, and waste disposal; (3) scientifically demonstrating cause-effect relationships between chemical exposures and health effects in children is difficult and most often occurs only after harm has occurred; and (4) early scientific evidence of effects in animals and humans should be taken as an indicator of potential effects in children.

Phthalates: Used in Plastics and Cosmetics

What are phthalates?

Phthalates (pronounced thay-lates) are a group of about 25 chemicals used in many consumer products. About 80% of the total volume of phthalates is used for one purpose: to

soften polyvinyl chloride (PVC or vinyl) plastics. Soft, flexible PVC plastic is used in many everyday products, including medical devices, flooring, wall coverings, furniture, baggage, footwear, clothing, toys, auto interiors, shower curtains, food wrap, cabling, garden hose; and pool liners. Non-PVC uses of phthalates include: other plastics, adhesives, dielectric fluids in electrical capacitors, insecticides for orchards, inert components in pesticide formulations, and wood finishes. For example, dibutyl phthalate is widely used in cosmetics and beauty products (e.g., nail polish and perfumes) as a skin moisturizer and skin penetration enhancer.

How do phthalates get into our children's bodies?

Unfortunately, the phthalates used in consumer products are also ending up inside our bodies and our children's bodies. For example, if a child chews on a soft PVC toy containing phthalates, the chemicals can leach out of the plastic into the child's mouth. Phthalates in intravenous tubing or bags (IVs) used in hospitals can leach into IV fluids, so a baby put on an IV can receive a large dose of phthalates in his or her first few days of life. When phthalates are used in cosmetics, we can absorb them through our skin. And children can breathe in phthalates from household products such as vinyl flooring and wall coverings.

Finally, phthalates can pass from mother into the womb.

The U.S. Centers for Disease Control (CDC) recently published data that found phthalate breakdown products widely present in human urine at various levels. The authors noted that "these data provide evidence that phthalate exposure is both higher and more common than previously expected." For example, CDC found high levels of dibutyl phthalate, which can cause reproductive problems, in the urine of women of child-bearing age.

How can phthalates affect our health?

Many studies on laboratory animals have shown that phthalates can cause a wide variety of health problems and disrupt normal sexual development. Some studies on humans suggest the potential for effects as well. Fetuses, babies, and children may be especially vulnerable to some of the health effects of phthalate exposures.

Phthalate exposures have been linked to problems in the liver, reproductive tract, kidneys, lungs, and heart. Phthalate exposures have also been linked to birth defects and

miscarriages.""
Some phthalates may act as endocrine (hormone) disrupters, imitating or blocking the human

body's natural sex hormones.
A recent study looked at baby girls in Puerto Rico who began developing breasts prematurely between the age of six months and two years. These children had elevated levels of phthalates in their blood, suggesting that phthalates could play a role in causing this condition.
Since the 1940s, scientists have known that exposure to high levels of phthalates can damage the testicles of laboratory animals. Recent studies suggest that low exposures can cause permanent damage to the testicles of immature animals. These effects occur at doses some babies and children may experience. A U.S. government panel has expressed "serious concern" about exposing newborns requiring intensive medical treatment and "concern" about exposing babies and young children to the most widely used phthalate – diethyl-hexyl phthalate (DEHP).
Phthalates can also harm the lungs. Laboratory experiments have linked some phthalates to breathing problems, bleeding and irritation of the trachea (windpipe), and fluid in the lungs, which can be fatal. Researchers think a breakdown product of DEHP may harm the lungs by

affecting specific chemical messengers in the lungs, thus increasing inflammation in the airways (Oie, et al., 1997).
One study found serious breathing problems in three premature babies exposed to DEHP through their IV tubing. Symptoms in two of the infants subsided after PVC tubing containing DEHP was substituted with DEHP-free tubing. Another study found a link between risk of bronchial obstruction in the first two years of life and the presence of PVC flooring plasticized with DEHP. The more plasticizer-containing material in the house, the greater the risk of bronchial obstruction.
Phthalates may interact with other common chemicals, increasing their ability to disrupt pregnancy.

Is it time to take action?

Phthalates are used at high volumes, resulting in human exposure, and we know they cause health problems in laboratory animals. Nonetheless, well-designed scientific studies about health effects of human exposure to phthalates are generally not available.

Health effects of phthalates can be hard to study in children because the effects may be subtle (e.g. lowered sperm production), and because most children are exposed to the chemicals, so it is hard to find an unexposed group to use for comparisons. But lack of evidence of adverse effects in humans should not be confused with evidence of safety. We have more than enough information to cause concern about the adverse impacts of some phthalate exposures. And in many cases, good alternatives to these potentially harmful chemicals are available.

Solvents

What are solvents?

Organic solvents are chemicals characterized by their ability to dissolve other substances. They are widely used in industrial products, and are a common occupational exposure. Alcohol, toluene, trichloroethylene, perchloroethylene, styrene, benzene, ethylene glycol ethers, and xylene are all solvents. Occupations involving solvent exposure include dry cleaning, auto repair, electronics, painting, printing, furniture repair, and many more. Solvents may be used in the household for painting, furniture stripping, and various hobbies.

How do solvents get into our children's bodies?

Children may be exposed to organic solvents directly at home, or indirectly through their parents' exposure at work.

If a pregnant women works with solvents, her fetus can be affected. If a nursing mother is exposed to solvents, she can pass these chemicals on to her child through breast milk.
If a parent works with solvents, his or her children may be exposed after work. For example, a father working with solvents can absorb those solvents, so that his breath contains high solvent levels even 16 hours after exposure. When he reads his child a bedtime story, he may be exposing the child to solvents carried on his breath. Solvents can damage sperm cells, so a father’s exposure years before the birth of his child could create health problems for that child.

What are the health effects of exposure to solvents?

Cancers:

Exposure to solvents may cause cancer in children. Household solvent exposure, both before

birth and during childhood has been associated with elevated rates of childhood acute lymphoblastic leukemia. Exposure of either parent to solvents at work has been associated with increased incidence childhood cancers. ' Fathers' exposure to solvents at work may increase the risk of central nervous system cancers,' ' particularly brain cancer. Fathers' exposure is also associated with childhood leukemia.' ' Exposure to paint is implicated in childhood leukemia and brain cancer. '

Other health problems:

Exposure to solvents during pregnancy increases the likelihood that a woman will have a miscarriage.'
A woman's exposure to solvents may also increase the likelihood of birth defects, such as oral clefts, digestive system defects, and defects of the nervous system, such as anencephaly (when a baby is born missing a large part of its brain).
Mothers exposed to solvents are also at increased risk for preeclampsia, a dangerous disorder of pregnancy that can be fatal.
Fathers' exposure to solvents is associated with abnormal sperm, increased time to pregnancy, decreased ability of the embryo to implant, and increased likelihood of miscarriage.

Is it time to take action?

Solvents are widely used at home and in many occupations. We know they cause health problems in children, both when children are directly exposed, and when they suffer the indirect effects of parents' exposures. The more we learn about solvents, the clearer it is that we are failing to protect our children's health.

The childhood leukemia cluster in Woburn, Massachusetts, was associated with exposure to well water contaminated with solvents. This tragedy illustrates the importance of protecting children in our communities from the dangers of solvents, on the job, in the house, and contaminating our environment.

Dioxins and Polychlorinated Biphenyls (PCBs)

What are dioxins?

The dioxins are a category of chemicals that are not intentionally produced, yet we are exposed to them from industrial processes and consumer products. They are a by-product of industrial chlorine production, use, and disposal. When products or wastes containing chlorine (or in some cases inorganic chloride) are produced or burned, especially during incineration, dioxins are released into the environment. There are various dioxins of a range of toxicity, though they are usually compared to the most dangerous one (2,3,78-tetrachlorodibenzo-p-dioxin or TCDD). PCBs, or polychlorinated biphenyls, a similar chemical (many of which are called "dioxin-like") were once used heavily in industry, particularly in electrical power transformers. They have not been produced in the United States since 1979, however, they are still in use. Over 4 billion lbs. of PCBs were produced in the United States since the early 1930s, and are probably still in the environment. Both PCBs and dioxins are considered persistent pollutants, since they are hard to break down, and collect in fat tissues of animals. They are dispersed around the world, even in Arctic populations.

How do dioxins get into our children's bodies?

Children are exposed to PCBs and dioxins from their mother's bodies, in the womb, and then through breast milk and food (particularly fatty ones). A woman accumulates these pollutants in her body just by going about her daily life, eating, drinking, and breathing. When she becomes pregnant, she exposes her child to the pollutants in the womb. Nursing infants are exposed to higher amounts of dioxin than most adults (receiving a substantial portion of their total lifetime exposure during the first few months of life), at a time of increased vulnerability. When the child is weaned, it is most exposed to dioxins and PCBs through eating dairy foods, processed foods, and meat.

What are the health effects of exposure to dioxins?

Dioxins are one of the most toxic substances known to science. A National Academy of Sciences panel examining the health effects of exposure to dioxin (a contaminant in the herbicide Agent Orange used widely as a defoliant during the Vietnam war) among Vietnam veterans found that "TCDD [the most toxic dioxin] has been shown to have a wide range of effects in laboratory animals on growth regulation, hormone systems, and other factors associated with the regulation of activities in normal cells." Single, very small doses of dioxin administered to animals on a critical day during pregnancy can cause adverse reproductive effects in offspring.

<u>Developmental disorders</u>

Dioxin is a potent developmental toxin that has been linked through animal and limited human studies to a wide range of adverse effects in offspring of exposed adults. Some of the physical deficits caused by dioxin may not be detectable at birth.

Dioxins can cause significant intellectual impairment in offspring of mothers exposed at high levels. Even exposure to the amounts of PCBs and dioxins we normally experience is associated with developmental problems. Animal studies indicate that dioxin causes learning disabilities in animals exposed before birth. Exposure in the womb to PCBs may cause lowered intellectual function and short-term memory problems in school-age children. While these neurological effects seen in children at "background" levels of exposure are rather subtle on the individual-level, they are much more worrisome on the population level.

Studies on infants exposed before birth to PCBs and dioxins found an association with reduced psychomotor development. How these effects happen is not clear, but it maybe has to do with the thyroid system. Prenatal and breast milk exposure to dioxin and PCB is associated with changes in the thyroid system in infants, which can disrupt the hormonal balance, affecting development of the brain.

Animal studies indicate that dioxin can cause a variety of birth defects in the offspring of exposed adults. Some evidence indicates these effects may occur in the offspring of human adults. For example, the National Academy of Science panel found limited/suggestive evidence between exposure to dioxin and spina bifida in offspring. The Department of Veteran's Affairs has found evidence to link exposure to dioxin among women and birth defects in offspring (sufficient to offer compensation to veterans for these effects).

<u>Cancer:</u>

Dioxin causes cancer in various laboratory animal species and a variety of sites. Dioxin likely causes its carcinogenic effects through a cellular receptor known to exist in humans. It is considered a known human carcinogen by the International Agency for Research on Cancer.

Based on human epidemiologic studies in workers, veterans, and communities where chemical accidents have taken place, a National Academy of Sciences panel found sufficient evidence of an association between dioxin and three types of cancer: Non-Hodgkin's lymphoma, Soft-tissue sarcoma, and Hodgkin's disease. The panel found limited but suggestive evidence of a link between exposure to dioxin and respiratory cancers, prostate cancer, and multiple myeloma.

Other effects:

Exposure to dioxin may alter the ratio of female and male births. After a chemical plant accident in Seveso, Italy, researchers found that for children born among the most highly dioxin exposed adults after the accident, twice as many females as would be expected were born and overall fertility was markedly reduced. No boys were born to parents with the highest levels of dioxin in their blood for seven years after the accident.

Dioxin is toxic to the immune system in animals. Mothers with higher levels in their bodies are more likely to give birth to children with immune system changes that could lead to allergies.

Babies exposed to dioxins and PCBs may be more likely to get infectious diseases in childhood.

Exposure before and shortly after birth to dioxins may be associated with low birth weight and delayed growth..

Is it time to take action?

There is adequate evidence that dioxin causes a wide range of adverse effects in laboratory animals at very low levels of exposure (amounts so small they are difficult to imagine) and evidence is growing as to its effects on humans. Even greater human evidence exists on the effects of a similar compound, PCBs, on children. Since dioxin is simply a by-product of chemical production and disposal, it provides absolutely no economic benefit – yet its potential costs on our health and that of our children is enormous. We must begin to address the root sources of dioxin contamination and find alternatives to the products and production processes that create it.

Conclusion

Lead and mercury are two well know cases where great harm was caused by lack of preventive, precautionary action. Phthalates, solvents, and dioxins are less known examples of broad classes of chemicals for which sufficient evidence exists to warrant action to prevent harm to children. Many more examples exist, other heavy metals, radionucleotides, pesticides, particulates, smog, and others. We are not protecting future generations, or even our own health, by our current methods of regulation for environmental pollution and product content. It is time for a comprehensive plan.

Our children are becoming sick, and their development is being impaired, because of our failure to protect them from toxic chemicals in common use. If we want to have healthy children who can play and learn normally, we need to prevent harm to their health when there is credible scientific evidence that harm can occur. Science can give us important early warnings of potential harm.

We need to use foresight and innovation and seek out the safest technologies and materials to meet our needs. We can, as a society, help all parents provide a safer world for children. We need to come together in Massachusetts and make an action plan to protect child health and development. We need to make Massachusetts a safe place for children.

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