Manufactured chemicals: A significant contributor to chronic childhood diseases

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Pamela J. Lein from the University of California, Davis, discusses manufactured chemicals as a significant contributor to chronic childhood diseases

Evidence linking manufactured or manmade chemicals to adverse health effects in children has been accumulating over the past half-century. This has culminated in several recent, highly visible clarion calls for action to minimize the risks that manufactured chemicals pose to children's health.

Below is a summary of key points from a commentary by the Consortium for Children's Environmental Health published in <u>the January 2025 issue of the New England Journal of</u> <u>Medicine</u> in which scientists lay forth a compelling argument of the urgent need for new laws for regulating chemical manufacturing to protect children's health.

The number of children diagnosed with noncommunicable diseases is rising

Noncommunicable diseases are the principal causes of illness and death in children today. These are a group of diseases not caused by acute infection that result in chronic or long-term adverse health conditions. The number of children affected with noncommunicable diseases has increased sharply over the past half-century. Childhood cancers have increased by 35%, while male reproductive birth defects have doubled in frequency.

Neurodevelopmental disorders affect 1 in 6 children, with autism disorder diagnosed in 1 in 36. Pediatric asthma cases have tripled, while the number of children with pediatric obesity has quadrupled. The latter is a significant factor contributing to the marked increase in type 2 diabetes among children and adolescents.

In contrast, in adults, chronic illness, disability, and death due to cardiovascular disease, stroke, and many cancers have decreased over this same time frame.

Manufactured chemicals are significant risk factors for childhood disease

Early studies of obvious injury to children from chemical exposures provided the first indication that manufactured chemicals can harm children's health: an epidemic of children born with missing limbs after their mothers took thalidomide to control pregnancy-induced nausea; the Minamata tragedy in which women who consumed fish heavily contaminated with methylmercury gave birth to infants with profound neurological deficits; and adenocarcinoma of the vagina amongst young women whose mothers had taken diethylstilbestrol (DES) to prevent miscarriage. Notably, in all these incidents, the mothers were physically unharmed.

These studies led to the realization that manufactured chemicals can cross the placenta and that children may be significantly more vulnerable than adults. Subsequent research in both humans and experimental animals has revealed that even brief, low-level exposures to manufactured chemicals during sensitive periods of development can increase the risk of disease across the lifespan.

The period of vulnerability can range from conception to early adulthood, although the prenatal period seems to be particularly susceptible to disruption by toxic chemicals. The spectrum of adverse health effects caused by developmental exposures to manufactured chemicals is broad, ranging from clinically obvious health effects to more subtle functional deficits. IQ loss in children exposed to low levels of lead is a well-studied example of the latter.

A third discovery is that diseases associated with early-life exposures can manifest at any time during the individual's life. Some, such as anatomical birth defects, are obvious early; others are not evident until later in childhood, adolescence, or adulthood. Delayed effects include altered sexual development, reduced fertility, and lifelong increased risks of asthma, obesity, diabetes, cardiovascular disease, neurologic impairment, and cancer.

The evidence linking manufactured chemicals to noncommunicable diseases in children derives mainly from epidemiological studies and experimental studies in animals. Such studies have established strong links between prenatal exposures to phthalates and disorders of male reproductive development; between the pesticide DDT and breast cancer; between prenatal and postnatal exposures to brominated flame retardants (PBDEs), polychlorinated biphenyls (PCBs) or organophosphate (OP) pesticides and lifelong deficits in cognitive function; and between early life exposures to perfluoroalkyl and polyfluoroalkyl substances (PFAS) and immune dysfunction, dyslipidemia, and thyroid disorders.

The societal impacts of diseases caused by exposure to manufactured chemicals

Numerous studies have calculated significant economic losses related to disease caused by toxic chemical exposures in childhood. Economic costs include not only healthcare expenditures but also productivity losses due to reduced cognitive abilities, physical disabilities, and premature death. The chemical industry largely passes these costs on to governments, taxpayers, and consumers. Growing recognition of the magnitude of these costs has led to multibillion-dollar legal judgments in which manufacturers have been held liable for damages caused by their products.

There is also compelling documentation that reducing exposure leads to a decrease in disease frequency. For example, in the decade after lead was removed from gasoline in the United States, children's IQs increased by 2-5 points, coinciding with a drop in their mean blood levels.

Reducing toxic chemical exposures can also produce significant economic benefits. In the case of lead, because each additional IQ point is associated with an increase of 1.8 to 2.4% in life-long earning potential, the economic benefit of removing lead from gasoline for each yearly birth cohort born after the regulation on leaded gas is estimated to be about \$200 billion, a cumulative benefit since 1980 of more than \$8 trillion.

Challenges and the path forward

There are an estimated 350,000 manufactured chemicals, chemical mixtures, and plastics currently listed in global inventories. Production has expanded 50-fold since 1950, is currently increasing by about 3% per year, and is projected to triple by 2050. However, the manufacture of synthetic chemicals and plastics is subject to few legal or policy regulations. Unlike pharmaceuticals, synthetic chemicals are brought to market with little prior assessment of their hazard and almost no postmarketing surveillance for longer-term adverse health effects. Fewer than 20% have been tested for toxicity and fewer still for toxic effects in infants and children.

Combatting the growing global crisis of chemical pollution and its negative impacts on children's health will require coordinated international efforts. A paradigm shift in how chemicals are managed and tested will require realignment of current law, major

restructuring of the chemical industry, and redirection of financial investment on a scale similar to that of the global transition to clean energy. However, because chemical exposures are modifiable risk factors and reduced exposure translates to reduced disease, there are compelling reasons to invest in this endeavor.

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