

Health effects of pesticides

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Health effects of pesticides may be acute or delayed in those who are exposed.^[1] A 2007 systematic review found that "most studies on non-Hodgkin lymphoma and leukemia showed positive associations with pesticide exposure" and thus concluded that cosmetic use of pesticides should be decreased.^[2] Strong evidence also exists for other negative outcomes from pesticide exposure including neurological problems, birth defects, fetal death,^[3] and neurodevelopmental disorder.^[4]

According to The Stockholm Convention on Persistent Organic Pollutants, 9 of the 12 most dangerous and persistent chemicals are pesticides.^{[5][6]}

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Acute effects

Acute health problems may occur in workers that handle pesticides, such as abdominal pain, dizziness, headaches, nausea, vomiting, as well as skin and eye problems.^[7] In China, an estimated half million people are poisoned by pesticides each year, 500 of whom die.^[8] Pyrethrins, insecticides commonly used in common bug killers, can cause a potentially deadly condition if breathed in.^[9]

Long-term effects

Cancer

Pesticide toxicity



A sign warning about potential pesticide exposure.

Classification and external resources

Specialty	emergency medicine
ICD-10	T60 (http://apps.who.int/classifications/icd10/browse/2016/en#/T60)
ICD-9-CM	989.4 (http://www.icd9data.com/getICD9Code.ashx?icd9=989.4)
MedlinePlus	002430 (https://medlineplus.gov/ency/article/002430.htm)
eMedicine	article/815051 (http://emedicine.medscape.com/article/815051-overview)

Many studies have examined the effects of pesticide exposure on the risk of cancer. Associations have been found with: leukemia, lymphoma, brain, kidney, breast, prostate, pancreas, liver, lung, and skin cancers.^[6] This increased risk occurs with both residential and occupational exposures.^[6] Increased rates of cancer have been found among farm workers who apply these chemicals.^[10] A mother's occupational exposure to pesticides during pregnancy is associated with an increase in her child's risk of leukemia, Wilms' tumor, and brain cancer.^{[6][11]} Exposure to insecticides within the home and herbicides outside is associated with blood cancers in children.^[12]

Neurological

Evidence links pesticide exposure to worsened neurological outcomes.^[3] The risk of developing Parkinson's disease is 70% greater in those exposed to even low levels of pesticides.^[13] People with Parkinson's were 61% more likely to report direct pesticide application than were healthy relatives. Both insecticides and herbicides significantly increased the risk of Parkinson's disease.^[14] There are also concerns that long-term exposures may increase the risk of dementia.^[15]

The United States Environmental Protection Agency finished a 10-year review of the organophosphate pesticides following the 1996 Food Quality Protection Act, but did little to account for developmental neurotoxic effects, drawing strong criticism from within the agency and from outside researchers.^{[16][17]} Comparable studies have not been done with newer pesticides that are replacing organophosphates.^[18]

Reproductive effects

Strong evidence links pesticide exposure to birth defects, fetal death and altered fetal growth.^[3] In the United States, increase in birth defects is associated with conceiving in the same period of the year when agrochemicals are in elevated concentrations in surface water.^[19] Agent Orange, a 50:50 mixture of 2,4,5-T and 2,4-D, has been associated with bad health and genetic effects in Malaya and Vietnam.^{[20][21]} It was also found that offspring that were at some point exposed to pesticides had a low birth weight and had developmental defects.^[22]

Fertility

A number of pesticides including dibromochlorophane and 2,4-D has been associated with impaired fertility in males.^[23] Pesticide exposure resulted in reduced fertility in males, genetic alterations in sperm, a reduced number of sperm, damage to germinal epithelium and altered hormone function.^[24]

Other

Some studies have found increased risks of dermatitis in those exposed.^[3]

Additionally, studies have indicated that pesticide exposure is associated with long-term health problems such as respiratory problems, including asthma,^{[25][26]} memory disorders and depression.^[27] Summaries of peer-reviewed research have examined the link between pesticide exposure and neurologic outcomes and cancer, perhaps the two most significant things resulting in organophosphate-exposed workers.^{[28][29]}

According to researchers from the National Institutes of Health (NIH), licensed pesticide applicators who used

chlorinated pesticides on more than 100 days in their lifetime were at greater risk of diabetes. One study found that associations between specific pesticides and incident diabetes ranged from a 20 percent to a 200 percent increase in risk. New cases of diabetes were reported by 3.4 percent of those in the lowest pesticide use category compared with 4.6 percent of those in the highest category. Risks were greater when users of specific pesticides were compared with applicators who never applied that chemical.^{[30][31]}

Route of exposure

People can be exposed to pesticides by a number of different routes including: occupation, in the home, at school and in their food.

There are concerns that pesticides used to control pests on food crops are dangerous to people who consume those foods. These concerns are one reason for the organic food movement. Many food crops, including fruits and vegetables, contain pesticide residues after being washed or peeled. Chemicals that are no longer used but that are resistant to breakdown for long periods may remain in soil and water and thus in food.^[32]

The United Nations Codex Alimentarius Commission has recommended international standards for maximum residue limits (MRLs), for individual pesticides in food.^[33]

In the EU, MRLs are set by DG-SANCO (http://ec.europa.eu/dgs/health_consumer/index_en.htm).

In the United States, levels of residues that remain on foods are limited to tolerance levels that are established by the U.S. Environmental Protection Agency and are considered safe.^[34] The EPA sets the tolerances based on the toxicity of the pesticide and its breakdown products, the amount and frequency of pesticide application, and how much of the pesticide (i.e., the residue) remains in or on food by the time it is marketed and prepared.^[35] Tolerance levels are obtained using scientific risk assessments that pesticide manufacturers are required to produce by conducting toxicological studies, exposure modeling and residue studies before a particular pesticide can be registered, however, the effects are tested for single pesticides, and there is little information on possible synergistic effects of exposure to multiple pesticide traces in the air, food and water.^[36]

Strawberries and tomatoes are the two crops with the most intensive use of soil fumigants. They are particularly vulnerable to several type of diseases, insects, mites, and parasitic worms. In 2003, in California alone, 3.7 million pounds (1,700 metric tons) of metham sodium were used on tomatoes. In recent years other farmers have demonstrated that it is possible to produce strawberries and tomatoes without the use of harmful chemicals and in a cost-effective way.^[37]

Exposure routes other than consuming food that contains residues, in particular pesticide drift, are potentially significant to the general public.^[38]

Some pesticides can remain in the environment for prolonged periods of time. For example, most people in the United States still have detectable levels of DDT in their bodies even though it was banned in the US in 1972.^[6]

Prevention

Pesticides exposure cannot be studied in placebo controlled trials as this would be unethical.^[3] A definitive cause effect relationship therefore cannot be established.^[3] Consistent evidence can and has been gathered

through other study designs.^[3] The precautionary principle is thus frequently used in environmental law such that absolute proof is not required before efforts to decrease exposure to potential toxins are enacted.^[39]

The American Medical Association recommend limiting exposure to pesticides.^[40] They came to this conclusion due to the fact that surveillance systems currently in place are inadequate to determine problems related to exposure.^[40] The utility of applicator certification and public notification programs are also of unknown value in their ability to prevent adverse outcomes.^[40]

Epidemiology

The World Health Organization and the UN Environment Programme estimate that each year, 3 million workers in agriculture in the developing world experience severe poisoning from pesticides, about 18,000 of whom die.^[41] According to one study, as many as 25 million workers in developing countries may suffer mild pesticide poisoning yearly.^[42] Detectable levels of 50 different pesticides were found in the blood of a representative sample of the U.S. population.^[6]

Society and culture

Concerns regarding conflict of interests regarding the research base have been raised. A number of researchers involved with pesticides have been found to have undisclosed ties to industry including: Richard Doll or the Imperial Cancer Research Fund in England and Hans-Olov Adami of the Karolinska Institute in Sweden.^[43]

Other animals

A number of pesticides including clothianidin, dinotefuran, imidacloprid are toxic to bees.^[44] Exposure to pesticides may be one of the contributory factors to colony collapse disorder.^[45] A study in North Carolina indicated that more than 30 percent of the quail tested were made sick by one aerial insecticide application. Once sick, wild birds may neglect their young, abandon their nests, and become more susceptible to predators or disease.^[46]

See also

- Environmental effects of pesticides
- Pesticide poisoning
- Chlorpyrifos#Toxicity and safety

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