

Asthma, Children and Pesticides

What you should know to protect your family



BEYOND PESTICIDES

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September 2005

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Since the mid-1980s, asthma rates in the United States have skyrocketed to epidemic levels, particularly in young children. In the U.S. alone, around 16 million people suffer from asthma. Asthma is a serious chronic disorder of the lungs characterized by recurrent attacks of bronchial constriction, which cause breathlessness, wheezing, and coughing. Asthma is a dangerous, and in some cases life-threatening disease. Researchers have found that pesticide exposure can induce a poisoning effect linked to asthma.

Children Are More Susceptible to Asthma

Asthma rates are much higher in children than adults. It is the most common

long-term childhood illness. An estimated nine million children under the age of 18 have been diagnosed with asthma at some point in their lives.

Children are more susceptible to asthma for a number of reasons. The National Academy of Sciences has found that, in general, children are more vulnerable to toxic chemicals in the environment than adults. This is because pound for pound children eat more food and drink more water and juices than adults,

Did You Know?

- Nearly 1 in 8 school-aged children have asthma. This rate is rising most rapidly in pre-school aged children.
- Asthma is the leading cause of school absenteeism due to chronic illness. Every year, asthma accounts for 14 million lost days of school.
- Asthma is the third-ranking cause of hospitalization among those younger than 15 years.
- The number of children dying from asthma increased almost threefold from 1979 to 1996.
- The estimated cost of treating asthma in those younger than 18 years is \$3.2 billion per year.
- Low-income populations, minorities, and children living in inner-cities experience disproportionately high morbidity and mortality due to asthma.

and thus they take in more pesticides and toxic chemicals relative to body weight. Children also have a more rapid respiratory rate and take in a greater volume of air per unit of body weight than adults.



At the same time, children's organ systems are still developing and therefore are more vulnerable and less able to detoxify hazardous chemicals. According to researchers at the Mount Sinai School of Medicine in New York City, children's developing organs create "early windows of great vulnerability" during which exposure to toxins can cause great damage. For example, human lungs and airways do not fully develop until the sixth to eighth year of life, making a young child vulnerable to the effects of pesticides and other pollutants on the respiratory system. During these early years, exposure to chemical irritants can have significant effects on respiratory development.

Environmental exposures during pregnancy may also be significant for children later in life. Researchers find that fetuses can become sensitized to environmental contaminants while still in the womb, resulting in a child being born with a predisposition to asthma and allergies.



"Epidemiologic studies suggest that children with asthma may breathe easier if they are exposed to fewer pesticides at home and at school. And parents and school administrators may breathe easier knowing that they are not harming the children's developing nervous systems."

- Dr. Ruth Etzel, MD, PhD, George Washington University School of Public Health and Health Services, Washington, DC.

Pesticides Can Cause Asthma

Determining the causes of a disease as common as asthma is no easy task, especially since there are so many factors to consider and so many potential pollutants that people are exposed to on a daily basis. Asthma has both genetic and environmental components. Certain people are genetically predisposed to asthma and allergies. However, the rapid increase in asthma rates in recent years cannot be explained by genetic causes alone, as genetic changes require many generations for population-wide effects to occur, and because asthma rates are increasing among people without a family history of asthma and allergies. There is clearly a significant environmental com-

ponent to the rise in the asthma rate.

Cause vs. Trigger

A good way to understand why people get asthma and sudden asthma attacks is to think in terms of causes and triggers. A cause is an underlying reason why a person gets asthma or other diseases. The exact causes of asthma are unknown, but experts have shown that exposure to cigarette smoke, air pollution, and allergens can cause increased levels of asthma in populations. A trigger, on the other hand, is something that causes an asthma attack to occur in someone already suffering from the disease. There are many known triggers of asthma attacks, including cigarette smoke, wood smoke, perfume, air pollution, pet dander, and allergens from dust mites and cockroaches. **Like cigarette smoke, pesticides have been shown to both cause asthma and trigger asthma attacks.**

Although no single study can conclusively prove that a certain pesticide causes asthma, studies have found evidence that exposure to pesticides is correlated with higher rates of asthma. One research focus has been on farmers and pesticide applicators, groups that are exposed to higher levels of pesticides than the average population. Studies have shown that this population has higher rates of asthma and other respiratory problems due to their use of pesticides. Yet occupational pesticide exposure is only one piece of the puzzle—household and

community exposure to pesticides can also lead to respiratory problems. An early study done in the 1960s in Hawaii found that frequent household use of insecticides is correlated with an increased prevalence of respiratory disorders, including asthma and chronic bronchitis. The majority of the pesticides used were insect sprays for mosquitoes, flies, and cockroaches.

A 2003 study of over 3,000 Lebanese children similarly found correlations between exposures to pesticides and respiratory diseases. Pesticide exposure includes home and garden pesticide use, occupational use by a household member, and living in proximity to a treated field. All of these exposures are associated with chronic respiratory disease and symptoms, and particularly with asthma. The researchers hypothesize that exposure to pesticides



Experts believe that asthma rates and the use of inhalers like these can be decreased significantly by reducing children's exposure to pesticides.



(which are often small, irritating molecules) aggravates the airways of those with hypersensitized lungs (such as people with asthma). In children without previous respiratory problems, pesticides may overwhelm the cells' ability to detoxify chemicals, or

cause immune and muscular effects, all of which can lead to respiratory problems.

A landmark 2004 study finds that not only do environmental exposures lead to above-average asthma rates among children, but that timing of exposure is also crucial. The researchers examined over 4,000 school-aged children in California. They discovered that children exposed to herbicides during their first year of life are four and a half times more likely to be diagnosed with asthma before the age of five; toddlers exposed to insecticides are over two times more likely to get asthma. This study further demonstrates the fact that young infants and toddlers are most susceptible to the harmful effects of pesticides on the respiratory system.



“Studies have shown that early life is crucial for the development of the immune and the respiratory systems. Our data suggest that pesticide exposure during early childhood increases asthma risk by age 5, with exposures in the first year of life having the greatest impact on childhood asthma occurrence and its persistence in school-aged children.”

- Mohammed Towhid Salam, MD, University of Southern California, Department of Preventive Medicine, Los Angeles, CA.

Pesticides Can Trigger Asthma Attacks

In addition to being an underlying cause of asthma, pesticides can also trigger asthma attacks in those who already suffer from the disease. Asthma is characterized by excessive sensitivity of the lungs to various stimuli, which can trigger asthma attacks, also called asthma episodes. The American Lung Association defines an asthma episode as “a series of events that result in narrowed airways,” which lead to breathing problems and the characteristic asthma “wheeze.” The series of events includes swelling of the lining, tightening of the muscle, and increased secretion of mucus. Asthma attacks are triggered by a number of things, including allergens, irritants, pesticides and other chemicals, air pollution, and vigorous exercise.

People with asthma are especially sensitive to pesticides and at risk of attacks when exposed to even small amounts. Many pesticides are small molecules that can exacerbate or aggravate asthma symptoms. Pesticides can trigger asthma attacks by increasing airway hyper-reactivity, which makes the airway very sensitive to any allergen or other stimulus. Hypersensitive lungs are a trademark feature of asthmatics. Subsequent exposure to a stimulus can cause an extreme reaction in a hyper-reactive airway. In these situations, researchers at Johns Hopkins Bloomberg School of Public Health have shown that pesticides somehow alter the nerve function controlling the smooth muscle lining of the airway, causing the airway to contract and restrain airflow, which is exactly what occurs during an asthma attack. Pesticides can also trigger asthma attacks by directly damaging cells that line the lungs.



Specific Pesticides Linked to Respiratory Problems

Not all pesticides are associated with asthma, but many are. Of the 30 commonly used active ingredients in lawn pesticides, 27 are sensitizers or irritants, and therefore have the potential to trigger asthma attacks, exacerbate asthma, or lead to a higher risk of developing asthma. Similarly, 39 of the 48 pesticides commonly used in schools may also contribute to asthma. The following is a list of commonly used pesticides and how they contribute to asthma:

Herbicides

■ **Glyphosate** (Roundup®): Glyphosate is one of the most commonly used pesticides on lawns and landscapes. Exposure to glyphosate can cause asthma-like symptoms and breathing difficulty. Undisclosed, or proprietary, ingredients (called “inert ingredients”) in Roundup®, a common formulation of glyphosate, have been linked to pneumonia and damage to the mucous membrane tissue and the upper respiratory tract.

■ **2,4-D and Chlorophenoxy Herbicides:** 2,4-D, a lawn herbicide commonly formulated in “weed and feed” products, is the most commonly used “home and garden” pesticide in the U.S. Chlorophenoxy compounds such as 2,4-D are moderately irritating to respiratory linings. For people with asthma, exposure should be avoided, as it may aggravate the condition and can trigger an



Many lawn chemical products have ingredients that have been linked to asthma. There are numerous manufacturers of such “weed and feed” products.

asthma attack. 2,4-D products are often formulated with the herbicides mecoprop and dicamba, which are also respiratory irritants. These products

often contain the warning, “Inhalation of product may aggravate existing chronic respiratory problems such as asthma, emphysema or bronchitis.”

■ **Atrazine:** Atrazine is used on lawns, landscapes, golf courses, and in agriculture. Use of atrazine by a large group of pesticide applicators is correlated with wheezing. In addition, exposure to atrazine may cause an increased breathing rate and lung congestion.

Insecticides

■ **Pyrethrum and Pyrethrins:** Pyrethrum and pyrethrins are insecticides made from crude plant extracts in the chrysanthemum family. These extracts contain impurities, which can be allergenic or otherwise irritating. Pyrethrum has been known since the 1930s to cause allergies, asthma, and respiratory irritation. Pyrethrins are more purified versions of these

The Cockroach Conundrum

Cockroach antigens can trigger asthma attacks in susceptible children. A study of 476 asthmatic children from eight U.S. cities found that 85% of their bedrooms have cockroach allergens. When people learn that cockroaches may aggravate asthma, their first response may be to use pesticides. However, pesticides are even more closely linked to asthma and may only make conditions worse. A University of Southern California study finds the link between herbicides and the risk of developing asthma twice as strong as the link to cockroaches.

Tips For Preventing Cockroaches and Asthma

- Remove all food waste and keep food in airtight containers.
- Limit the spread of food around the house.
- Eliminate potential water sources, such as leaky plumbing.
- Caulk and seal all cracks and crevices.
- Vacuum frequently and vigorously.
- Monitor populations using sticky-traps.
- In the event of infestation, use boric acid bait stations.

that still contain small amounts of impurities that may cause asthmatic reactions and sensitization in individuals exposed. Pyrethrum and pyrethrin products are typically formulated with piperonyl butoxide (PBO), a synergist that reduces the ability of both insects and humans to detoxify pesticides. Inhaling PBO can cause labored breathing and an accumulation of fluids in the lungs, and is also linked to cancer.

■ **Synthetic Pyrethroids** (Permethrin, Cypermethrin, Cyfluthrin, Sumithrin, Resmethrin): Synthetic pyrethroids are chemically formulated versions of pyrethrum, which are designed to be more toxic and longer lasting. They are a heavily used class of insecticides for control of cockroaches, termites, mosquitoes, fleas, and scabies. Exposure to synthetic pyrethroids can cause hypersensitization. Safety data sheets often warn that, “[P]ersons with a history of asthma, emphysema, or hyperactive airways disease may

The Dust Mite Dilemma

Dust mites are microscopic insects (and powerful allergens) that live in bedrooms, carpets and furniture and feed off of dead human skin, a major component of household dust. A study of 476 children with asthma from eight U.S. cities finds that around 50% of their bedrooms are positive for dust mites. Reducing dust mites in the home has been shown to decrease the severity of respiratory symptoms in people with asthma.

Tips For Limiting Exposure to Dust Mites

- Cover mattresses and pillows with encasings that are impermeable to mite allergens, but not to air and water vapor, often labeled “anti-allergenic.”
- Beddings should be washed frequently in hot water (at least 131 degrees). Using eucalyptus oil while washing clothing and bedding may also help to kill mites.
- Vacuum frequently and vigorously.
- Reduce indoor humidity to under 45%.

be more susceptible to overexposure.” Synthetic pyrethroids are usually formulated with PBO.

■ **Organophosphates** (Chlorpyrifos, Diazinon, Malathion, Methyl Parathion): Organophosphates (OP) are a widely used, although increasingly restricted, class of pesticides, that may have a variety of uses in community mosquito control, food production and on golf courses. OPs are neurotoxic and exposure can cause weakness of the respiratory muscles, bronchoconstriction, bronchial secretions, wheezing, and general respiratory distress. Children are especially vulnerable to their effects and reactions can occur at very low concentrations. Exposure to OPs causes both short and long-term respiratory effects.



Both agricultural and home and garden pesticides are respiratory irritants. Studies have linked living near agricultural fields to asthma.

■ **Carbamates** (Carbaryl, Bendiocarb, Aldicarb, Carbofuran): Carbamates are a class of insecticides that are widely used in homes, gardens, and agriculture. Carbaryl (Sevin®) is the most common. A study on hazardous air pollutants shows that carbaryl is “a compound that evokes asthma symptoms and has documented case reports in the medical literature associating exposure with asthma.” Like OPs, carbamates also cause respiratory problems.

Fungicides

■ **Fungicides:** A number of different fungicides have been shown to cause cases of occupational asthma among workers, including the fungicides chlorothalonil, fluazinam, and captafol. Fungicides cause hypersensitivity in the workers, resulting in their airways becoming highly sensitive and reactive to the inhaled fungicides, wheezing and breathlessness.

Demographics of Asthma

The levels of asthma prevalence varies across regions of the U.S. On average, 12.5% of U.S. children experience asthma symptoms, and 7% have been diagnosed by a doctor or nurse. In Harlem, New York City, 28.5% have been diagnosed. Trends show that people, especially children, living in urban, inner-city neighborhoods are affected the most by asthma.



Although rural and agricultural areas are assumed to have the highest levels of pesticide use, this is not always the case. A 1998 study found that in New York, the heaviest use of pesticides is in the most urban counties—Manhattan and Brooklyn. Urban areas have higher asthma

rates for a number of reasons, including higher levels of air pollution, both indoor and outdoor, heavy traffic dust and fumes, indoor pests, and higher levels of pesticide use. Children who live in poverty in inner-cities are at the highest risk, as they often live in crowded, inadequate housing where poor conditions lead to a high risk of both exposure to cockroaches and other pests as well as toxic pesticides. Additionally, most housing projects are routinely sprayed with insecticides.

In addition to being elevated in urban areas, asthma rates are also disproportionately high among people-of-color, especially in African-American and Latino communities. Studies show that African-American asthma-related hospitalization rates are four times higher and asthma death rates are double that of whites. Geography also accounts for variations in asthma rates. In 2004, the Allergy and Asthma Foundation of America developed a list of top “asthma capitals” based on prevalence, mortality rates, air quality, smoking laws, and asthma medical care. Knoxville, TN, was number one, followed by Little Rock, AR and St. Louis, MO.

What You Can Do

Asthma is a serious epidemic that is not going to disappear on its own. Parents with young children, whether they have asthma or not, should limit their exposures to pesticides in the home, school, and community. This is especially imperative for people who have been diagnosed with asthma and other respiratory problems. There are easy steps that anyone can take to avoid known asthma causes and triggers, including pesticides, and reduce the risk of getting asthma.

■ **Home:** According to EPA, around 85% of total daily exposure to airborne pesticides comes from breathing air inside the home. Avoid applying any pesticides indoors, as well as on your lawn and in the garden. If you have a pest problem, try preventive measures and non-toxic controls. Reducing indoor allergens and poisons can reduce the cost and severity of asthma treatments, and reduce the risk of developing new sensitizations and asthmatic reactions. If you have a house pet, when controlling fleas, avoid insecticide sprays and shampoos.

■ **Schools:** Children spend an average of 30 hours a week—more than 25 percent of their waking hours—at school. A 2005 study published In the Journal of the American Medical Association documents widespread pesticide use and poisoning in schools—classrooms, cafeterias, playgrounds, playing fields, and school lawns. In order to protect children’s health, schools should adopt non-toxic management methods. If pesticides are used, request that you be notified before they are applied on school grounds.



“Given the potential harm that pesticides can cause, it is worth trying to keep exposure to a minimum. There are ways to do that. Integrated pest management (IPM) is effective in reducing infestation with cockroaches and rodents in city homes. The methods of IPM include using non-toxic traps and eliminating sites of entry and food sources for pests.”

- Luz Claudio, PhD, Mount Sinai School of Medicine, Department of Community and Preventive Medicine, New York, NY.



Students suffering from asthma triggered by pesticides or uncontrolled pest populations may be able to use the Americans With Disabilities Act (ADA) to require schools to provide non-toxic, effective pest management.

■ **Office Buildings:** Children are not the only ones affected by asthma. Adults spend most of their time in office buildings, and surveys indicate that on average 40-55% of office occupants experience “sick building symptoms,” which include headache, cough, wheezing, and fatigue on a weekly basis. Talk to your em-

ployer about adopting an integrated pest management (IPM) program that relies on non-toxic practices. A case under ADA may apply to this situation as well.

■ **Public Housing:** Because of frequent pest problems, public housing buildings are often sprayed routinely with harmful pesticides. In 2003, 11 states petitioned the U.S. Department of Housing and Urban Development (HUD) to improve pest management in public housing by using non-chemical controls and integrated pest management. Cooperation and communication between public housing management staff, maintenance staff, and tenants are necessary to reduce levels of pests and pesticides and create healthy living situations.

■ **For more information on alternatives:** Because viable alternatives exist, taking a chance with toxic pesticides is never necessary. For more detailed information on alternative management strategies or a fully cited version of this brochure, contact Beyond Pesticides at 202-543-5450 or visit www.beyondpesticides.org/children/asthma.

Selected References:

Alarcon, WA, GM Calvert, JM Blondell, et al. 2005. "Acute illnesses associated with pesticide exposure at schools." *JAMA* 294 (4): 455-465.

Centers for Disease Control and Prevention. March 2005. "Summary Health Statistics for U.S. Children: National Health Interview Survey, 2003." *Vital and Health Statistics* 10 (223).

Eskanazi, B, A Bradman, and R Castorina. 1999. "Exposures of children to organophosphate pesticides and their potential adverse health effects." *Environmental Health Perspectives* 107 (Suppl 3): 409-419.

Etzel, RA. 1995. "Indoor air pollution and childhood asthma: effective environmental interventions." *Environmental Health Perspectives* 103 (Suppl 6): 55-58.

Landrigan, PJ, L Claudio, SB Markowitz, et al. 1999. "Pesticides and inner-city children: exposures, risks, and prevention." *Environmental Health Perspectives* 107 (Suppl 3): 431-437.

Salam, MT, YF Li, B Langholz, and FD Gilliland. 2004. "Early-life environmental risk factors for asthma: findings from the children's health study." *Environmental Health Perspectives* 112 (6): 760-765.

Salameh, PR, I Baldi, P Brochard, et al. 2003. "Respiratory symptoms in children and exposure to pesticides." *Eur Respir J* 22: 507-512.

Senthilselvan, A, HH McDuffie, and JA Dosman. 1992. "Association of asthma with use of pesticides. Results of a cross-sectional survey of farmers." *Am Rev Respir Dis* 146 (4): 884-7.

Weinberg EG. 2000. "Urbanization and childhood asthma: an African perspective." *J Allergy Clin Immunol* 10 (2): 224-31.

Weiner, BP and RM Worth. 1969. "Insecticides household use and respiratory impairment." *Hawaii Medical Journal* 28 (4): 283-285.

Asthma, Children and Pesticides

In the last two decades, asthma rates in the United States have skyrocketed to epidemic levels, particularly among young children. Because they are still growing and developing, children are especially susceptible to asthma. Researchers have found a strong link between pesticide exposure and asthma. Certain pesticides have been proven to cause respiratory problems, and should be avoided by people concerned about asthma. People with asthma and parents with young children, whether they have asthma or not, should work to eliminate the use of toxic pesticides in their homes, schools, and communities, and adopt non-toxic practices and products.

Beyond Pesticides, working with allies to protect public health and environment, is leading the transition to a world free of toxic pesticides. The organization is a national, community-based collection of grassroots groups and individuals, bridging environmental and health concerns to: (i) stimulate widespread education on the hazards of toxic pesticides, and the availability of effective alternative pest management approaches; (ii) influence decision makers responsible for pest management to use safe methods through grassroots action; and, (iii) encourage the adoption of local, state, and national policies that stringently restrict pesticide use and promote alternative approaches that respect health and the environment.



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