



# Asthma, Children and Pesticides

## What You Need to Know

By Aviva Glaser

Since the mid-1980s, asthma rates in the United States have skyrocketed to epidemic levels, particularly among 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 response linked to asthma. Yet, the U.S. uses millions of pounds of these pesticides, which the Centers for Disease Control finds are among the most common toxic chemicals found in the body.

### Children are more susceptible to asthma

Asthma is much more common in children than adults. Asthma is the most common long-term childhood disease; an estimated nine million children under the age 18 have been diagnosed with asthma at some point in their lives.

Children are more susceptible to asthma and other respiratory problems for a number of reasons. The National Academy of Sciences has found that in general, children are more susceptible to environmental toxins than adults. This is because pound for pound, children eat more food and drink more water than adults, 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. 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 more vulnerable to the effects of pesticides and other pollutants on the respiratory system. During these early years, exposure to even mild chemical irritants can have significant effects on respiratory development.

### Did You Know?

- Nearly one in eight 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 of age.
- 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 of age is \$3.2 billion per year.
- Low-income populations, minorities, and children living in inner cities experience disproportionately higher morbidity and mortality due to asthma.

## 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 disease. 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, 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.

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

## 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 family histories of asthma and allergies. There is clearly a significant environmental component to the rise in asthma rate.

Although no single study can conclusively prove that a certain pesticide causes asthma, numerous studies have found compelling evidence that exposure to pesticides is correlated with higher rates of asthma. One research focus has been on farmers and pesticide applicators, groups typically exposed to higher levels of pesticides than the average population. Many 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 bug sprays for mosquitoes, flies, and cockroaches.

**“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.**

A 2003 study of over 3,000 Lebanese children similarly found that pesticide exposures—including home and garden pesticide use, occupational use by a household member, and living in proximity to a treated field—were correlated with chronic respiratory disease and symptoms, and particularly with asthma. The researchers hypothesized that exposure to pesticides, which are often small, irritating molecules, aggravate the airways of those with hypersensitized lungs (such as people with asthma). In children without previous respiratory problems, pesticides overwhelm the cells’ ability to detoxify chemicals, or cause immune and muscular effects, all of which can lead to respiratory problems.

A landmark study done in 2004 shows that not only do environmental exposures lead to above-average asthma rates among children, but that timing of exposure is crucial. The researchers studied over 4000 school-aged children in California and 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 more than twice as likely to get asthma. This study further clarifies the fact that young infants and toddlers are most susceptible to the harmful effects of pesticides on the respiratory system.

## 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 in the airway. 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. Most 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 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 University believe that pesticides 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 damaging lung epithelial cells directly.

## Specific pesticides linked to respiratory problems

Not all pesticides are associated with asthma, but many are. Of 30 commonly used 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 are sensitizers or irritants. The following is a list of some commonly used pesticides and how they contribute to asthma:

### Insecticides:

- **Pyrethrum and Pyrethrins:** Pyrethrum and pyrethrins are insecticides made from crude extracts from plants in the chrysanthemum family. Crude extracts contain impurities, which can be allergenic or otherwise irritating. Pyrethrum has been known since the 1930s to cause allergies, asthma, sensitization, and respiratory irritation. Pyrethrins are more purified versions of these extracts that still contain small amounts of impurities that may cause allergic reactions, asthma symptoms, 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.
- **Synthetic pyrethroids (Permethrin, Cypermethrin, Cyfluthrin, Sumithrin, Resmethrin):** Synthetic pyrethroids are synthetic versions of pyrethrum, 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. Material safety data sheets often warn that, “persons with a history of asthma, emphysema, or hyperactive airways disease may be more susceptible to overexposure.” Synthetic pyrethroids are also commonly formulated with PBO.
- **Organophosphates (Chlorpyrifos, Diazinon, Malathion, Methyl Parathion):** Organophosphates (OP) are a widely used class of pesticides, applied in houses for termite control, in communities for mosquito spraying, in agriculture, and lawns and landscapes. Together, this class accounts for approximately half of all insecticides sold in

the U.S. OPs act as cholinesterase inhibitors, which means that exposure to these pesticides can cause weakness of the respiratory muscles, broncho-constriction, bronchial secretions, wheezing, and respiratory distress. Children are especially vulnerable to OPs, and reactions can occur at very low concentrations. Exposure to OPs causes both short and long-term respiratory health effects.

- **Carbamates (Carbaryl, Bendiocarb, Aldicarb, Carbofuran):** Carbamates are another class of insecticides widely used in homes, gardens, and agriculture. Carbaryl (Sevin) is the most common carbamate and one of the most heavily used pesticides in the country. A study on hazardous air pollutants labeled carbaryl as “a compound that evokes asthma symptoms and has documented case reports in the medical literature associating exposure with asthma.” Like OPs, carbamate exposure causes cholinesterase inhibition, which causes airway constriction and respiratory problems.

### Herbicides

- **Glyphosate (Round-up):** Glyphosate is one of the most commonly used pesticides on lawns and landscapes. Exposure to glyphosate can cause asthma-like symptoms and breathing difficulty. Studies have linked “inert” ingredients in Round-up, one of the most common formulations of glyphosate, to pneumonia, excess fluid in the lungs, and damage to mucous membrane tissues and the upper respiratory tract.
- **2,4-D and Chlorophenoxy Herbicides:** According to EPA’s latest data, 2,4-D, an herbicide used on lawns and landscapes, is the most commonly used pesticide in homes and gardens in the U.S. Chlorophenoxy compounds such as 2,4-D are moderately irritating to respiratory linings and may cause coughing. Exposure to 2,4-D may aggravate respiratory conditions and trigger an asthma attack. 2,4-D products are often formulated with the herbicides mecoprop and dicamba, which are also chlorophenoxy herbicides, and thus respiratory irritants. Products that use all three of these active ingredients 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 agriculture. Use of atrazine by a large group of pesticide applicators is correlated with wheezing. Additionally, exposure to atrazine may cause an increased respiratory rate and lung congestion.

### 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. Researchers found that these fungicides cause hypersensitivity responses in workers, causing their

airways to be highly sensitive and reactive to the inhaled fungicides, resulting in wheezing and breathlessness.

## Demographics of asthma

Not all regions of the United States have the same levels of asthma prevalence. For example, while around 12.5% of children nationwide have asthma, in New York City, the number of children who have experienced asthma symptoms is 17%. In Harlem, that number rises to over 30%.

Although rural and agricultural areas are often assumed to have the highest levels of pesticide use, this is not always the case. A 1997 study found that in New York State the heaviest use of pesticides statewide was 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, surprisingly, higher levels of pesticide use. Children who live in poverty in inner cities are the highest at risk, as they live in crowded, inadequate housing where poor conditions lead to a high risk of both exposure to cockroaches and other pests as well as to the chemical pesticides used to control the pests. Anecdotal reports show that as more people have learned of the link between cockroaches and asthma, domestic pesticide use has increased. Additionally, most housing projects are routinely sprayed with insecticides.

### The Cockroach Conundrum

High rates of childhood asthma are often attributed to exposure to cockroach allergens. 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 cause asthma, their first response is often to use toxic pesticides to kill the roaches. However, using pesticides to control cockroach infestations may only make conditions worse for someone suffering from asthma.

### 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 faucets and pipes.
- Caulk and seal all cracks and crevices.
- Vacuum frequently and intensively.
- Monitor populations using sticky-traps.
- In the event of infestation, use boric acid bait stations.

In addition to being more common in urban areas, asthma rates are also disproportionately high among people-of-color populations, especially in African-American and Latino communities. Studies show that asthma-related hospitalization rates are four times higher and the African-American asthma death rate is double that of Caucasians. Geographic differences also account for variations in asthma rates around the country.

## 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. The following are some of the things you can do to reduce the risk of asthma.

- **Home:** According to an EPA study, around 85% of total daily exposure to airborne pesticides comes from breathing air inside the home. Avoid applying pesticides indoors. If you have a pest problem, try alternative measures such as temperature treatment, biological controls, and least-toxic baits instead of those pesticides. Vacuum carpets frequently and intensively to reduce allergens. Avoid spraying lawns and gardens with pesticides. If you have a house pet, when controlling fleas, steer clear of insecticide sprays and shampoos by requesting injections or pills.
- **Schools:** Children spend an average of 30 hours a week—more than 25 percent of their waking hours—at school. Unfortunately, the use of pesticides in schools is widespread. Pesticides are used throughout schools—in classrooms, cafeterias, playgrounds, playing fields, and school lawns. In order to protect children's health, pesticide use in schools must be reduced. If your child has asthma, request that you be notified whenever pesticides will be applied on school grounds. Encourage your school to adapt management techniques that eliminate pesticide reliance. Students suffering from asthma triggered by pesticides or uncontrolled pest populations may be able to use the *Americans With Disabilities Act* (ADA) to require school to provide reduced-chemical, effective pest control.
- **Office Building:** 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 employer about non-toxic management techniques and reducing pesticide use. A case under ADA may apply if the employer or pest management company is unresponsive to your requests.

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