



Recognizing Pesticide-Related Illness and Injuries in Agricultural Workers: Information for Health Care Providers

Agricultural workers and various other occupations are at risk of exposure to pesticides. Pesticide poisonings can be difficult to diagnose because the signs and symptoms are often nonspecific and present similarly to common colds, flu, or stomach viruses. Studies have shown that pesticide exposure can also increase the risk of chronic diseases, such as cancer, learning disabilities, and birth defects. This factsheet presents information for diagnosing pesticide-related illnesses, as well as resources for educating workers on how to reduce their risk of exposure.

What are pesticides and who is at risk for exposure?

Pesticides are a category of chemicals used to kill or control insects, weeds, microbes, fungi, and rodents. They can come in various forms, including liquids, powders, granules, bait, foggers, and many others. Here are some questions to help determine if your patient may be exposed in their work:

- What kind of work do you do?
- What are your specific job duties?
- Do you handle pesticides or come in close contact with them?
- Do you use personal protective equipment (PPE) when handling pesticides?
- Do you take steps to prevent bringing pesticides from work into your home?

How are workers exposed?

Agricultural workers and landscapers who mix, load, or apply pesticides are at higher risk of exposure to pesticides. Routes of exposure include ingestion, inhalation, and dermal exposure. Workers can be exposed during their routine duties or through an accidental exposure:

- **Accidental ingestion or inhalation** during preparation or application. For example, smoking or eating without washing hands after applying pesticides.
- **Accidental contact** with residues on crops, soil, or spraying equipment.
- **Drift** from neighboring fields, i.e., spray or fumes are carried through the air away from the treatment site.
- **Early re-entry:** a worker enters an area that is being treated before the pesticide has settled onto the soil or crop.
- **Home:** workers can bring residue home on their shoes and clothing, exposing people or pets in the household. Pesticide residue can accumulate in house dust and on surfaces and can remain for long periods of time.

Clinical considerations

Symptoms can range from a mild skin irritation to coma or even death. Different classes of pesticides can cause different types of symptoms, but most commonly, patients will present with nonspecific symptoms that do not indicate a particular pesticide.

The effects of pesticide poisoning can be broadly defined as either topical or systemic. Topical effects usually develop at the site of contact and are due to the chemical's irritant properties or to the patient's allergic reaction. The most common topical effect is dermatitis. Allergic reactions can also include eye irritation and respiratory discomfort. Systemic effects develop away from the point of contact as a result of the pesticide being absorbed and distributed throughout the body. These symptoms can include nausea, vomiting, diarrhea, headache, fatigue, and intestinal distress.



More severe poisoning cases may result in altered cardiac arrhythmia, dyspnea, convulsions, or coma. It is important to remember that people vary in their sensitivity to different levels of pesticides.

Diagnosis

Many pesticide illnesses go unrecognized due to nonspecific clinical presentation. Most pesticides do not have a biological test (e.g., biomarkers in blood or urine) to indicate exposure. Laboratory testing can be considered for some pesticides that have analytical methods (see National Pesticide Information Center ([NPIC's list of pesticides](#))), but health-based guidelines may not be established for pesticides detected. Additionally, detecting pesticides in biological samples does not necessarily mean that the health complaints are related, or that a health effect will occur. Making an accurate diagnosis depends on taking a careful occupational and exposure history.

Key Questions of a Pesticide Exposure History

- Which pesticide(s) were you exposed to?
- When and for how long did the exposure occur?
- How long after exposure did the symptoms begin?
- How long have the symptoms lasted? Have they improved or worsened?
- How were you exposed (oral, dermal, inhalation)?
- Are your symptoms worse at work? Do they get better when you go home?
- Does anyone else at work have similar problems?
- Are there additional exposures or circumstances that may be relevant?

See Agency for Toxic Substances and Disease Registry's (ATSDR) [exposure history form](#) for more questions to ask your patients.

Treatment and management

Most pesticide poisonings do not have specific treatments and are managed with symptomatic and supportive care. Severe poisonings should be treated in an intensive care unit. For treatment recommendations, consult with the regional poison control center (1-800-222-1222).

This [United States Environmental Protection Agency \(U.S. EPA\) manual](#) is a good reference for toxicology and treatment information for patients with pesticide exposures. It provides information on special considerations and treatment for some pesticides that have particular effects, such as carbamates and organophosphates.

Harmful effects of commonly reported pesticide classes

Fungicides and herbicides

Fungicides and herbicides generally have low acute toxicity to humans but can cause irritation to the skin or eyes. Inhalation can cause irritation of the nose and throat, coughing, or sneezing. Ingestion can cause vomiting, stomach irritation, diarrhea, or muscle twitching. There are also adverse health effects from chronic exposure to low concentrations. Some health effects of active ingredients in common fungicides and herbicides are shown in tables 2 and 3 of [Penn State Extension's Pesticide Safety Fact Sheet](#).



Insecticides

Insecticides cause the greatest number of pesticide poisonings in the U.S., particularly carbamates and organophosphates. These two classes inhibit the enzyme cholinesterase, causing many effects on the central and peripheral nervous systems. Table 1 shows the signs and symptoms of acute exposure to carbamates, organophosphates, and the third main class of insecticide, pyrethrins/pyrethroids. More acute health effects to active ingredients are shown in table 4 of [Penn State Extension's Pesticide Safety Fact Sheet](#) and section II of the [U.S. EPA manual](#).

Table 1. Signs and symptoms of acute exposure to the three main classes of insecticides

Class	Organophosphates	Carbamate	Pyrethrins/pyrethroids
Examples	Chlorpyrifos, diazinon, disulfoton, dimethoate, malathion, parathion	Carbaryl, carbofuran, methomyl, oxymyl	Bifenthrin, cypermethrin, fenvalerate, permethrin
Acute health effects	<p><u>Nervous system effects:</u></p> <ul style="list-style-type: none">• Excessive salivation, sweating, rhinorrhea, tearing• Muscle twitching, weakness, tremor, incoordination, headache, dizziness• Pin-point pupils, sometimes with blurred or dark vision. <p><u>Gastrointestinal (GI) effects:</u></p> <ul style="list-style-type: none">• Nausea, vomiting, abdominal cramps, diarrhea <p><u>Respiratory effects:</u></p> <ul style="list-style-type: none">• Respiratory depression, chest tightness, productive cough, wheezing, pulmonary edema <p><u>Severe cases:</u></p> <ul style="list-style-type: none">• Incontinence, seizures, loss of consciousness• Cholinesterase inhibition	<p><u>Nervous system effects:</u></p> <ul style="list-style-type: none">• Weakness, dizziness, sweating, malaise, headache• Miosis with blurred vision, incoordination, muscle twitching, slurred speech <p><u>GI effects:</u></p> <ul style="list-style-type: none">• Salivation, nausea, vomiting, abdominal pain, diarrhea <p><u>Severe cases:</u></p> <ul style="list-style-type: none">• CNS depression (coma, seizures, hypotonicity), hypertension, cardiorespiratory depression• Dyspnea, bronchospasms, bronchorrhea, pulmonary edema	<p><u>External effects:</u></p> <ul style="list-style-type: none">• Irritation of skin and eyes <p><u>Nervous system effects:</u></p> <ul style="list-style-type: none">• Irritability to sound and touch, abnormal facial sensation, sensation of prickling, tingling/creeping on skin, numbness• Headache, dizziness, fatigue <p><u>GI effects:</u></p> <ul style="list-style-type: none">• Nausea, vomiting, diarrhea, increased salivation <p><u>Severe cases:</u></p> <ul style="list-style-type: none">• Pulmonary edema, muscle twitching• Seizures [more common with cyano pyrethroids]



Tips to raise awareness to limit exposure

It is important to discuss the potential adverse health effects of pesticide exposure with your patient and the importance of using PPE and reducing exposure.

At work

- Follow instructions on pesticide labels.
- Wear appropriate personal protective equipment that fits properly.
- Only mix, load, or apply restricted use pesticides if you are a certified handler or under direct supervision of a certified handler.
- Do not enter treated areas during the restricted entry interval.
- Wash your hands before eating, drinking, using the bathroom, or touching your phone.

After work

- Remove work clothes and shoes before entering your house.
- Leave work shoes outside.
- Shower immediately after returning home.
- Wash work clothes separate from family laundry.

Inform patients about their rights. Agricultural businesses that use pesticides and certified/licensed crop advisors must comply with the [EPA's Worker Protection Standard \(WPS\)](#), which aims to reduce pesticide poisonings. The [Penn State Worker Protection Standard Program](#) offers guidance on how to comply with the WPS, as well as training and assistance in the training of agricultural workers. Be sure to provide information in a language the worker understands. NPIC has additional [resources for pesticide applicators](#).

Additional Resources and Fact Sheets

[ATSDR: Exposure History Form](#)

[National Pesticide Information Center \(NPIC\): Pesticide Information for Medical Professionals](#)

[Penn State Extension: Toxicity of Pesticides Factsheet](#)

[Pennsylvania Office of Rural Health: Penn State Worker Protection Standard Program Brochure](#)

[Pennsylvania Department of Agriculture: Pesticide Programs](#)

[US EPA: Recognition and Management of Pesticide Poisonings](#)

If you have additional questions or concerns about pesticides, please contact the Division of Environmental Health Epidemiology at dehe@pa.gov or 717-787-3350.