

Diseases, Disorders and Injuries

Asthma, Work-related

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What is work-related asthma?

Asthma is a respiratory disease. It creates a narrowing of the air passages that results in difficult breathing, tightness of the chest, coughing, and breath sounds such as wheezing. When a trigger or condition at work causes asthma, it is called work-related asthma.

Work-related asthma falls into one of two main categories:

- **Occupational asthma** – refers to cases of asthma caused by specific agents in the workplace. Occupational asthma can be further divided into two groups:
 - Sensitizer-induced asthma – caused by sensitization (reaction) to a trigger.
 - Irritant-induced asthma (also called reactive airway dysfunction syndrome, or RADS) is caused by one specific, high-level exposure.
- **Work-exacerbated asthma** – those who have a worsening of their asthma symptoms while at work (e.g., factors at work may trigger, aggravate, or exacerbate existing asthma).

Not all workers will react with an asthmatic response when exposed to triggers.

Asthmatic attacks can be controlled either by ending exposure to the trigger or by medical treatment to manage asthma symptoms.

Triggers may be irritants, allergens, or physical conditions such as:

- Chemicals
 - Dust from wood, grain, flour, or metal
 - Smoke
 - Enzymes (e.g., in detergents or laboratories) and moulds
 - Proteins from animals, plants, foods, insects and fish
 - Physical exertion
 - Cold air
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How does occupational asthma develop?

Sensitizer-Induced Asthma

Sometimes, the body can develop a sensitization (an allergic-type) reaction when it is exposed continuously to a trigger. The process is usually not immediate; it evolves over a period of time and involves the body's immune system. A complex defence system protects the body from harm caused by foreign triggers. Among the most important elements of the defence mechanism are special proteins called "antibodies." Antibodies are produced when the human body contacts a foreign trigger. The role of the antibodies is to react with triggers and destroy them. Antibodies are often very selective, acting only on one particular substance or type of microbe.

But antibodies can also respond in a wrong way and cause disorders such as asthma. After a period of exposure to a trigger, either natural or synthetic, a worker may start producing too many of the antibodies called "immunoglobulin E" (IgE). These antibodies attach to specific cells in the lung in a process known as "sensitization." The sensitization may not show any symptoms of disease, or it may be associated with skin rashes (urticaria), hay fever-like symptoms, or a combination of these symptoms. When re-exposure occurs, the lung cells with attached IgE antibodies react with the trigger. This reaction results in the release of chemicals such as "leukotrienes" that are made in the body. Leukotrienes provoke the contraction of some muscles in the airways. This action causes the narrowing of air passages which is characteristic of asthma.

Irritant-Induced Asthma

In this case, the disease is caused by the direct irritating effect of certain triggers on the airways. This type of asthma is called Reactive Airway Dysfunction Syndrome (RADS).

RADS can appear after an acute, single exposure to a high level of irritating agents (e.g., chlorine, anhydrous ammonia, and smoke). There is no latency period. The symptoms develop soon after the exposure, usually within 24 hours, and may reappear after months or years, when the person is re-exposed to the irritants.

Irritant-induced asthma may also appear with lower-level exposure to an irritant over a prolonged period.

How long does asthma take to develop?

There is no fixed period of time in which asthma can develop. Asthma as a disease may develop from a few weeks to many years (the latency period) after the initial exposure. Analysis of the respiratory responses of sensitized workers has established three basic patterns of asthmatic attacks, as follows:

Immediate – typically develops within minutes of exposure

Late – can occur in different forms. It usually starts several hours after exposure and is often worse after about 4 to 8 hours with recovery within 24 hours.

Dual or Combined – is the occurrence of both immediate and late types of asthma.

What factors increase the chances of developing asthma?

Some workplace conditions seem to increase the likelihood that workers will develop asthma, but their importance is not fully known. Factors such as the properties of the triggers, and the amount and duration of exposure are important. However, because only a fraction of exposed workers are affected, factors unique to individual workers can also be important. Such factors include the ability of some people to produce abnormal amounts of IgE antibodies.

How does the doctor know if a worker has asthma?

Sufferers from work-related asthma experience attacks of difficulty breathing, tightness of the chest, coughing, and breath sounds such as wheezing, which are associated with airflow obstruction. Such symptoms should raise the suspicion of asthma. With work-related asthma, typically, these symptoms are worse on working days, often awakening the patient at night and improving when the person is away from work. While off work, sufferers of work-related asthma may still have chest symptoms when exposed to airway irritants such as dust, fumes or upon exercise. Late-pattern asthma can make it challenging to associate asthma with workplace conditions.

The health care provider may ask about your work history, including questions such as:

- Are symptoms worse at work?
- Do symptoms improve when away from work (such as on vacation or weekends)?
- Did the symptoms start as an adult, or when you changed jobs?
- What type of industry do you work in?

- Are others at work experiencing similar symptoms?

Lung function tests and skin tests can help confirm the disease. However, some patients with work-related asthma may have normal lung function (particularly when asymptomatic) and negative skin tests.

The diagnosis of work-related asthma needs to be confirmed objectively. This confirmation can be done by carrying out pulmonary function tests at work and off work. The tests include serial spirometry or peak expiratory tests, specific inhalation challenge tests, or immunologic tests.

- Serial spirometry or peak expiratory flow tests are breathing tests. Through these tests, it is determined how much air is breathed in and out and how fast a person can exhale. This technique determines the lung capacity and identifies a reduction in lung functions due to exposure. The measurements should be taken multiple times per day and throughout the week.
- Specific inhalation challenges can demonstrate the occupational origin of asthma and may identify the agents responsible when the cause is uncertain. These tests require breathing in small quantities of industrial agents that may induce an attack of asthma. The method is safe when performed by experienced physicians in specialized centres.
- The immunologic tests are used to determine if a person is sensitized by a certain sensitizer.

How can we manage work-related asthma?

Although there are medical treatments that may control the symptoms of asthma, it is important to stop exposure wherever possible. If the exposure to the trigger is not stopped, treatment will be needed continuously and the breathing problems may become permanent. People may continue to suffer from work-related asthma even after removal from exposure.

Following the [hierarchy of control](#), eliminating the trigger is the ideal way to prevent work-related asthma. If this control is not possible, try to replace the triggers with less harmful ones. Where this is not possible, exposure should be minimized through engineering controls such as ventilation and enclosures of processes. Information on a [safety data sheet \(SDS\)](#) should list any health hazards, as well as safe handling and control steps.

Preventing further exposure might involve administrative controls such as medical screening, a surveillance program for at-risk workers, and a change of jobs or tasks.

The education of workers is also very important. Proper handling procedures, avoidance of exposures such as spills, and good housekeeping reduce the occurrence of asthma.

Masks or respirators can also help to control workplace exposure. Personal protective equipment (PPE) is considered the last option for control measures. In order to be effective these protective devices must be carefully selected, properly fitted, and well maintained as part of a full [personal protective equipment \(PPE\) program](#).

What occupations are at risk for asthma?

The following tables list some of the occupations where asthma has been seen. It should be noted that these lists of occupational triggers that can cause asthma **are not complete**. New causes continue to be added, and new materials and processes introduce new exposures and create new risks.

Not specifically listed are common household and workplace triggers which include dust, mould, pollen, scents, and smoke.

Table 1 Causes of Work-related Asthma – Grains, flours, plants and gums	
Occupation	Agent
Bakers, millers, cooks	Wheat, flours, grains, nuts, eggs, spices, additives. Also: moulds, mites, crustacea, etc.
Chemists, coffee bean baggers and handlers, gardeners, millers, oil industry workers, farmers	Castor beans
Cigarette factory workers	Tobacco dust
Drug manufacturers, mold makers in sweet factories, printers	Gum acacia
Farmers, grain handlers	Grain dust
Gum manufacturers, sweet makers	Gum tragacanth
Strawberry growers	Strawberry pollen
Tea sifters and packers	Tea dust
Tobacco farmers	Tobacco leaf

Table 2 Causes of Work-related Asthma – Animals, animal substances, insects and fungi	
Occupation	Agent
Bird fanciers	Avian proteins
Cosmetic manufacturers	Carmines
Entomologists	Moths, butterflies, cockroaches
Feather pluckers	Feathers
Field contact workers	Crickets
Fish bait breeders	Bee moths
Flour mill workers, bakers, farm workers, grain handlers	Grain storage mites, alternaria, aspergillus
Laboratory workers	Locusts, cockroaches, grain weevils, rats, mice, guinea pigs, rabbits
Mushroom cultivators	Mushroom spores
Oyster farmers	Hoya (Sea squirts)
Pea sorters	Mexican bean weevils
Pigeon breeders	Pigeons
Poultry workers	Chickens
Prawn processors	Prawns
Silkworm sericulturists	Silkworms
Veterinary clinic, animal breeders	Secretions from saliva, feces, urine and skin from various animals (cats, dogs, rabbits, horses, birds, rodents, etc.)
Woollen industry workers	Wool
Zoological museum curators	Beetles

Table 3
Causes of Work-related Asthma – Chemicals/Materials

Occupation	Agent
Adhesive industry	Various agents including amines, acrylates, aldehydes, styrene, etc.
Aircraft fitters	Triethyltetramine
Aluminum cable solderers	Aminoethylethanolamine
Aluminum pot room workers	Fluorine
Autobody workers	Acrylates (resins, glues, sealants, adhesives), metals, amines, anhydrides, acrylates, urethanes, polyvinyl chloride, etc.
Brewery workers	Chloramine-T, mould
Chemical plant workers, pulp mill workers	Chlorine, formaldehyde, acid/alkaline gas, vapours, aerosols, sulphites
Dentists, dental workers	Acrylates, latex
Dye weighers	Levafix brilliant yellow, drimarene brilliant yellow and blue, cibachrome brilliant scarlet
Electronics workers	Colophony
Epoxy resin manufacturers	Tetrachlorophthalic anhydride
Foundry mold makers	Furan-based resin binder systems
Fur dyers	Para-phenylenediamine
Hairdressers	Persulphate salts, henna, formaldehyde, etc.
Health care workers	Glutaraldehyde, latex, certain drugs, sterilizing agents, disinfectants, etc.
Janitor, service, cleaning	Chloramines, amines, pine products, some fungicides and disinfectants, acetic acid, etc. Also: mixing chlorine bleach with ammonia
Laboratory workers, nurses, phenolic resin molders	Formalin/formaldehyde, detergent, enzymes
Meat wrappers	Polyvinyl chloride vapour
Paint manufacturers, plastic molders, tool setters, Paint sprayers	Phthalic anhydride, latex, diisocyanates, amines, chromium, acrylates, formaldehyde, styrene, dimethylethanolamine etc.

Table 3 Causes of Work-related Asthma – Chemicals/Materials	
Occupation	Agent
Photographic workers, shellac manufacturers	Ethylenediamine
Refrigeration industry workers	CFCs
Solderers	Polyether alcohol, polypropylene glycol

Table 4 Causes of Work-related Asthma – Isocyanates and metals	
Occupation	Agent
Boat builders, foam manufacturers, office workers, plastics factory workers, refrigerator manufacturers, TDI manufacturers/users, printers, laminators, tanners, toy makers	Toluene diisocyanate
Boiler cleaners, gas turbine cleaners	Vanadium
Car sprayers	Hexamethylene diisocyanate
Cement workers	Potassium dichromate
Chrome platers, chrome polishers	Sodium bichromate, chromic acid, potassium chromate
Machinist, mechanic, metal workers, fabricating	Cobalt, vanadium, chromium, platinum, nickel, metal working fluids, amines
Nickel platers	Nickel sulphate
Platinum chemists	Chloroplatinic acid
Platinum refiners	Platinum salts
Polyurethane foam manufacturers, printers, laminators	Diphenylmethane diisocyanate
Rubber workers	Naphthalene diisocyanate
Tungsten carbide grinders	Cobalt
Welders	Stainless steel fumes

Table 5 Causes of Work-related Asthma – Drugs and enzymes	
Occupation	Agent
Ampicillin manufacturers	Phenylglycine acid chloride
Detergent manufacturers	Bacillus subtilis
Enzyme manufacturers	Fungal alpha-amylase
Food technologists, laboratory workers	Papain
Pharmacists	Gentian powder, flaviastase
Pharmaceutical workers	Methyldopa, salbutamol, dichloramine, piperazine dihydrochloride, spiramycin, penicillins, sulphathiazole, sulphonechloramides, chloramine-T, phosdrin, pancreatic extracts
Poultry workers	Amprolium hydrochloride
Process workers, plastic polymer production workers	Trypsin, bromelin

Table 6 Causes of Work-related Asthma – Woods	
Occupation	Agent
Carpenters, timber millers, woodworkers, sawmill workers, pattern makers, wood finishers, wood machinists	Western red cedar, cedar of Lebanon, iroko, California redwood, ramin, African zebrawood, ash, African maple, Australian blackwood, beech, box tree, Brazilian walnut, ebony, Mansonia, oak, mahogany, abiruana, spruce, Cocabolla, Kejaat, etc. Also: insects, mould, lacquers, etc.

Fact sheet last revised: 2025-02-27

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