Asthma, Work-related



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 substance or condition at work causes asthma, it is called work-related asthma.

WORK-RELATED ASTHMA FALLS IN 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 substance.
- Irritant-induced asthma (also called reactive airways dysfunction syndrome, or RADS) which 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 substances.

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

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 substance. The process is usually not immediate; it evolves over a period of time and involves the body's immune system. A complex defense system protects the body from harm caused by foreign substances or microbes. Among the most important elements of the defense mechanism are special proteins called "antibodies." Antibodies are produced when the human body contacts an alien substance or microbe. The role of the antibodies is to react with substances or microbes 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 substance, 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 substance. 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. RADS may also appear with lower-level exposure to an irritant over a prolonged period.

IRRITANT INDUCED ASTHMA

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

RADS can appear after an acute, single exposure to 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.

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 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 and is at its worst after approximately 20 minutes; recovery takes about 2 hours.

Late – can occur in different forms. It usually starts several hours after exposure and is at its worst after about 4 to 8 hours with recovery within 24 hours. However, it can start 1 hour after exposure with recovery in 3 to 4 hours. In some cases, it may start at night, with a tendency to recur at the same time for a few nights following a single exposure.

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 chemicals, 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. The contribution of cigarette smoking to asthma is not known. However, smokers are more likely than nonsmokers to develop respiratory problems in general.

How does the doctor know if a worker has asthma?

Sufferers from work-related asthma experience attacks of difficult breathing, tightness of the chest, coughing, and breath sounds such as wheezing, which are associated with air-flow 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 from work-related asthma may still have chest symptoms when exposed to airway irritants such as dusts, or fumes, or upon exercise. Itchy and watery eyes, sneezing, stuffy and runny nose, and skin rashes are other symptoms often associated with asthma.

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

- Are symptoms worse at work?
- Do symptoms improve when away from work (e.g., vacation, 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 to confirm the disease. However, some patients with work-related asthma may have normal lung function as well as 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 will include serial spirometry or peak expiratory tests, specific inhalation challenge tests, or immunologic tests.

- Serial spirometry or peak expiratory tests are breathing tests. Through these tests, it is determined how much air 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 have to be taken couple of 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 control 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 substance 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.

The best way to prevent work-related asthma is to replace substances 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 and surveillance program for at-risk workers and a change of job or tasks.

Education of workers is also very important. Proper handling procedures, avoidance of spills and good housekeeping reduce the occurrence of asthma.

Masks or respirators can also help to control workplace exposure. Personal protective equipment 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?

Some of the occupations where asthma has been seen are listed in the following tables. It should be noted that the lists of occupational substances and microbes which can cause asthma are not complete. New causes continue to be added. New materials and new 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	Carmine
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
Pea sorters	Mexican bean weevils
Pigeon breeders	Pigeons
Poultry workers	Chickens
Prawn processors	Prawns

Silkworm sericulturers	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.**
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, tinners, 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.**

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