

Solvents/Inhalants

Information for Health Professionals

Introduction

Inhalants comprise a wide variety of vapours, gases, and aerosols that can be inhaled to induce psychoactive (mind-altering) effects. Unlike other drugs, inhalants are available as legal products with low costs and wide availability. Examples include commercial products such as nail polish remover, hair sprays, lighter fluid, cleaning fluids, vegetable frying pan lubricants, and spray paints. These chemicals can be sniffed or inhaled because they are gaseous at room temperature and pressure. “Inhalant” is a general term that includes all substances used in this way.

Most inhalants are volatile solvents, which are liquids that easily vaporize at room temperature and can contain many different chemicals that may be psychoactive. The majority of these solvents are produced from petroleum and natural gas. They have an enormous number of industrial, commercial and household uses, and are found in automobile fuels, cleaning fluids, toiletries, adhesives and fillers, paints, paint thinners, felt-tip markers, and many other products.

In addition to volatile solvents, aerosols (hair spray, paint spray) can be abused as inhalants. Other inhalants include the nitrites (amyl and butyl, “poppers”, “Rush”) and gases such as the anesthetics nitrous oxide (laughing gas) and ether.

Inhalants can be breathed in through the nose or mouth in a variety of ways, including spraying aerosols directly into the nose or mouth, “sniffing” or “snorting” fumes from containers, inhaling from balloons filled with nitrous oxide, “huffing” from an inhalant-soaked rag stuffed in the mouth, or “bagging”- pouring the substance over a cloth or into a plastic bag and breathing in the vapours. Fumes can also be inhaled in small, enclosed spaces like closets. In rarer cases, users may drink or inject solvents.

When inhaled, nitrites (amyl nitrite, butyl nitrite and isobutyl nitrite) dilate blood vessels and cause a brief drop in blood pressure. The effects last approximately 30 seconds and cause the user to experience a “rush” and mild euphoria. Additional effects can include severe headache and dizziness.

Like depressant drugs, the psychoactive substances found in inhalants slow down the nervous system, and are often included in the same classes of drugs as sleeping pills, alcohol, tranquilizers, and painkillers. These inhalants can cause drowsiness and, in large doses, loss of consciousness. Inhalants can have adverse effects on many systems of the body. Cardiac toxicity is pronounced. In addition, unconsciousness as a result of intoxication can result in asphyxiation.

Volatile solvent abuse (VSA), sometimes referred to as “glue sniffing”, is of special concern because of the young age of many abusers. For some, using inhalants may be their first non-medical use of drugs. In

addition to being particularly vulnerable to toxic ingredients because of their age, youth who abuse solvents may be prone to further drug use.

Chemical ingredients in common inhalants

ABUSED PRODUCTS	CHEMICAL INGREDIENTS
Correction fluid	Toluene
Cleaning fluid, spot remover	Trichloroethylene
Lighter fluid	Butane, propane
Gasoline	Toluene, benzene
Paint, lacquer and varnish thinners	Toluene, naphtha, acetates, methylene chloride
Marking pens	Toluene, naphtha
Aerosols (paint sprays, hair sprays, air fresheners, cookware coating agents)	Toluene, butane
Household cements, plastic cement, airplane glue	Toluene, acetone, ethyl acetate
Liquid shoe polish	Toluene
Nail polish remover	Acetone, ethyl & methyl acetate
Pure solvents	Toluene, acetone, ethyl ether

How solvents/inhalants work

The chemicals found in inhalants are absorbed through the lungs, and enter into the blood stream and then into the brain. These compounds have a wide range of effects on neurotransmitter release and receptors, with some cellular actions being similar to depressants such as benzodiazepines, alcohol, and barbiturates. While benzene and diethyl ether interact with GABA_a receptors to cause tranquilizing effects, not all inhalants or the chemicals they contain share the same properties or interact with the body in the same way.

Other chemicals like toluene, benzene, and ethylbenzene, commonly found in paint thinner and gasoline, have been shown to prevent glutamate stimulation of NMDA, NR1, and NR2B receptors in the brain. Chemicals that are lipophilic, meaning that they dissolve or are stored in fat, are particularly damaging to myelin and neuronal membrane, causing cortical atrophy and lesions in the brain. Organs with high blood circulation and fat tissue, like the liver and kidney, are also commonly impacted.

Nitrites dilate blood vessels and relax muscles, causing the heart to beat faster and blood to rush to the head. This creates a “rush” or “flushing” sensation that some users desire. Sniffing pure nitrous oxide can be dangerous as it may starve the body of oxygen.

Short-term effects

The effect of any drug on the user depends on the amount, how it is taken, tolerance, the physical and social setting, the user’s mental state and other drugs being used.

When the chemicals in inhalants reach the bloodstream, some are broken down and excreted through the kidneys. Many are exhaled unchanged through the lungs. As a result, the odour of inhalants may remain on the breath for several hours following inhalation.

Although the chemical substances in inhalants can produce a variety of effects, most inhalants produce symptoms similar to alcohol intoxication, but the effects have a more rapid onset that are briefer in duration. The effects of inhalant use last for 15 to 60 minutes after cessation of exposure. However, the pleasurable high usually lasts no longer than four or five minutes. The experienced user may prolong the effects for several hours by increasing the dose.

A user will usually experience an initial excitation followed by depression. Depending on the inhalant used, he or she may have feelings of euphoria, exhilaration, ringing in the ears, dizziness, and blurred vision. Physical symptoms include poor coordination, slurred speech, and impaired judgment, followed by lethargy and an increased need for sleep. Telltale signs of inhalant abuse may include chemical odours on the breath, glue or other stains on the hands and clothes, and a facial rash (“huffer’s rash”).

With increasing intoxication, the user may become agitated or disoriented, and may experience headaches, abdominal cramps, nausea, vomiting and chest pain. Extreme intoxication may cause general muscle weakness, difficulty speaking, hallucinations (visual, and less commonly, auditory), disruptive behaviour, and, rarely, convulsions. Permanent hearing loss can also occur.

Several hours after using inhalants (and especially if they have slept), the user is usually lethargic and hung over, with a mild to severe headache. Some degree of amnesia about the event is common on recovery.

The short-term effects of inhalant abuse can be serious, and may even result in death. Some users’ feelings of being very powerful may lead to reckless and bizarre behavior, such as stepping off an apartment balcony or walking into traffic. Death from suffocation can occur if the user falls asleep or passes out with a plastic bag over their nose or mouth. “Sudden sniffing death” can occur if the user is startled or engages in strenuous activity while intoxicated. Other hazards include explosions, burns, and aspiration of foreign objects into the lungs.

Long-term effects

Inhalants are among the most toxic drugs of abuse. In addition to the dangers associated with acute use, long-term use can cause irreversible damage to the body. The specific effects of inhalants have been difficult to determine because users frequently use a variety of other drugs, including alcohol and tobacco, and their lifestyles often do not include good nutrition or medical care. However, there is increasing evidence that inhalant abuse has significant toxic effects.

Rehabilitation programs for inhalant abusers are especially important, because early reversible toxic effects often become irreversible with continued inhalant use. In planning programs, more attention to medical care may improve success rates. Patients are more likely to engage in therapy if intoxication and withdrawal are recognized and managed appropriately. Also, adequate assessment of patients’ physical and mental capabilities should facilitate the treatment process and improve chances of successful outcome.

Effects on the nervous system can include brain damage resulting in movement disorders and possible intellectual impairment, and damage to the peripheral nerves causing numbness, weakness, and muscle paralysis. Inhalants have also been known to cause cognitive and sensory deficits. Although growing evidence indicates that chronic solvent abuse causes brain damage or brain shrinkage, the extent and permanence, and the influence of other factors, remain to be determined. Toluene is especially toxic to the brain.

In addition to toxicity from the inhalant ingredients like toluene and benzene, gasoline sniffing can result in lead poisoning, which in extreme cases can cause dementia and muscle paralysis. There is also evidence that even with a relatively small number of exposures, butyl nitrite can deplete the immune system and increase the risk of the development and progression of infectious diseases and tumors. Benzene, a known carcinogen affecting the bone marrow, can cause severe anemia and leukemia. In the body, methylene chloride, is converted to carbon monoxide, which prevents the normal transport of oxygen by the blood. Brain damage may result. Heart patients and cigarette smokers are at particular risk.

Chronic inhalant abuse can cause severe kidney damage resulting in acute kidney failure. Serious electrolyte imbalances can occur, and in severe cases patients have generalized muscle weakness, nausea, vomiting, and mental confusion. A more chronic form of kidney disease, glomerulonephritis, can also occur. Pregnant women may be particularly prone to kidney damage. Abnormal liver function also frequently occurs in chronic inhalant abusers. Liver function usually returns to normal after several weeks of abstinence, but abnormalities will persist if abuse continues. Heavy alcohol use, which also causes liver toxicity, may be an added problem as the users become older. Lung inflammation, pneumonia, and other infections are common and death by inhalants is often the result of asphyxiation. Abnormal rhythms of the heartbeat have also been associated with the abuse of a variety of inhalants.

Solvents/inhalants and pregnancy

Little is known about the effects of inhalants on pregnancy and the growth of the fetus. With this being said, literature has suggested that fetal solvent syndrome (FSS) can occur when inhalants are used in pregnancy, causing developmental disorders and fetal malformations similar to fetal alcohol spectrum disorder (FASD). Because of potential serious effects, pregnant women should avoid exposure to inhalants.

Tolerance and dependence

Regular, heavy users of inhalants develop tolerance (that is, they need more drug to produce the same effect). For example, after regular use for a year, a glue sniffer may use eight to 10 tubes of plastic cement to attain the high that one tube originally produced.

Both physiological and physical dependence can develop. Users who have experimented with inhalants a few times, or only used them occasionally, may not experience withdrawal when they stop using. However, chronic heavy users find it particularly difficult to stop. At least part of the problem may be a

psychological need to continue taking the drugs. Physical dependence can also develop when the body adapts to the presence of the inhalant, and withdrawal symptoms occur if use is stopped abruptly.

Withdrawal and treatment

Withdrawal generally begins within 24 hours of abstinence and can last several days. Symptoms of withdrawal include irritability, aggressive behaviour, restlessness, depression, and lethargy. In extreme cases a delirium tremens-like (DT's) syndrome has been described, and includes increased irritability, tremors, sleeping difficulties, and hallucinations.

The general treatment of withdrawal from inhalants is similar to that for alcohol: calm reassurance in an area of low-level sensory stimuli. Detoxification from inhalants, however, takes much longer than from alcohol; short-term detoxification requires two weeks to 30 days. By this time, mental function starts to return to normal and participation in conventional treatment programs may become possible. Long-term detoxification occurs over a period of about six months, during which time a major emphasis of treatment is to keep the client substance-free. Drug treatment is not usually required; however, antiarrhythmics or beta-blockers are sometimes used to stabilize heart rhythm and avoid over-stimulation.

Who uses solvents/inhalants?

In Canada, inhalant abuse occurs all across the country, in a variety of ethnic and socioeconomic groups, and in both urban and rural areas. Heavy users are often from rural areas, socially disadvantaged, do poorly in school, and come from unstable home environments. Most young people who use inhalants do so on an occasional or experimental basis.

Data on inhalant use among the general Albertan and Canadian population is limited due to inhalants being reported on in combination with various other substances or due to prevalence rates being too low to report on. Most commonly, users are young (between 10 and 16 years old), although some heavy users are in their late teens or older. Approximately 3.4% of grade 7-12 Ontario students in 2017 had used inhalants in the past 12 months. This compares to 1.2% of Canadian students who have used glue or gas to get high in the past year. Among clients receiving addiction treatment services in Alberta in 2003-2004, 1% reported using inhalants during the previous year.

Solvents/inhalants and the law

The possession or use of inhalants is not prohibited under federal law. In Alberta and some states in the U.S., recreational use is prohibited. The Alberta Public Health Act makes it an offence to use inhalants and to assist or cause another person to use inhalants. Under the act it is also an offence to give, sell, manufacture or otherwise distribute a product for this purpose. The penalty for a first offence is a fine of between \$500 and \$1500 and/or six months imprisonment.

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