Inhalant Abuse: The Hidden Dangers of Chemical Highs

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Inhalants are a broad range of drugs whose volatile vapors are taken in via the nose and trachea. Inhalants are taken by volatilization, and do not include drugs that are inhaled after burning or heating. For example, amyl nitrite and toluene are considered inhalants, but tobacco, marijuana, and crack are not.

While some inhalant drugs are used for medical purposes, as in the case of nitrous oxide (a dental anaesthetic), this article focuses on inhalant abuse as recreational drugs that are used for their intoxicating effect. Inhaling volatile substances because of their intoxicating effect is called huffing.

Classification

Inhalants can be classified by the intended function. Most inhalant drugs that are used non-medically are ingredients in household or industrial chemical products that are not intended to be concentrated and inhaled. A small number of recreational inhalant drugs are pharmaceutical products that are used illicitly.

Inhalants can also be classified by chemical structure. Classes include:

aliphatic hydrocarbons - petroleum products (gasoline and kerosene), propane, butane
aromatic hydrocarbons - toluene, xylene
ketones - acetone (nail polish remover)
haloalkanes - hydrofluorocarbons, chlorofluorocarbon, trichloroethylene, 1,1,1-Trichloroethane (including many aerosols and propellants) 1,1,1-trichloroethane-
nitrites - alkyl nitrites (poppers such as amyl nitrite), nitrous oxide

It is also possible to classify inhalants by the effect they have on the body. Many inhalants act primarily as asphyxiant gases, with their primary effect due to oxygen deprivation. Other agents may have more direct effects at receptors.

Inhalant users

The most serious inhalant abuse occurs among children and teens who "...live on the streets completely without family ties." Inhalant users inhale vapor or aerosol propellant gases using plastic bags held over the mouth or by breathing from a solvent-soaked rag or an open container. The effects of inhalants range from an alcohol-like intoxication and intense euphoria to vivid hallucinations, depending on the substance and the dosage. Some inhalant users are injured due to the harmful effects of the solvents or gases or due to other chemicals used in the products that they are inhaling. As with any recreational drug, users can be injured due to dangerous behavior while they are intoxicated, such as driving under the influence. In some cases, users have died from hypoxia (lack of oxygen), pneumonia, cardiac failure or arrest, or aspiration of vomit.

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Administration and effects

Inhalant users inhale vapors or aerosol propellant gases using plastic bags held over the mouth or by breathing from an open container of solvents, such as gasoline or paint thinner. Nitrous oxide gases from whipped cream aerosol cans, aerosol hairspray or non-stick frying spray are sprayed into plastic bags. When inhaling non-stick cooking spray or other aerosol products, some users may filter the aerosolized particles out with a rag. Some gases, such as propane and butane gases, are inhaled directly from the canister. Once these solvents or gases are inhaled, the extensive capillary surface of the lungs rapidly absorb the solvent or gas, and blood levels peak rapidly. The intoxication effects occur so quickly that the effects of inhalation can resemble the intensity of effects produced by intravenous injection of other psychoactive drugs.

The effects of solvent intoxication can vary widely depending on the dose and what type of solvent or gas is inhaled. A person who has inhaled a small amount of rubber cement or paint thinner vapor may be impaired in a manner resembling alcohol inebriation. A person who has inhaled a larger quantity of solvents or gases, or a stronger chemical, may experience stronger effects such as distortion in perceptions of time and space, hallucinations, and emotional disturbances.

In the short term, many users experience headache, nausea and vomiting, slurred speech, loss of motor coordination, and wheezing. A characteristic "glue sniffer's rash" around the nose and mouth is sometimes seen after prolonged use. An odor of paint or solvents on clothes, skin, and breath is sometimes a sign of inhalant abuse, and paint or solvent residues can sometimes emerge in sweat.

Computer-cleaning dusters are dangerous to inhale, because the gases expand and cool rapidly upon being sprayed.

Mechanisms of action

Inhalants are a large class of drugs and therefore exhibit a variety of mechanisms of action. The mechanisms of action of many non-medical inhalants have not been well elucidated. Anesthetic gases used for surgery, such as nitrous oxide or enflurane, are believed to induce anesthesia primarily by acting as NMDA receptor antagonists, open channel blockers that bind to the inside of the calcium channels on the outer surface of the neuron, and provide high levels of NMDA receptor blockade for a short period of time.

This makes inhaled anesthetic gases different from other NMDA antagonists, such as ketamine, which bind to a regulatory site on the NMDA-sensitive calcium transporter complex and provide slightly lower levels of NMDA blockade, but for a longer and much more predictable duration. This makes a deeper level of anesthesia achievable more easily using anesthetic gases but can also make them more dangerous than other drugs used for this purpose.

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Alcohol is known to act as a GABA agonist. The solvent diethyl ether has seen historical episodes of both inhalation and drinking and produces effects suggestive of both NMDA- and GABA-mediated activity.

Dangers and health problems

Statistics on deaths caused by inhalant abuse are difficult to determine. It may be severely underreported, because death is often attributed to a discrete event such as a stroke or a heart attack, even if the event happened because of inhalant abuse. Inhalant use or abuse was mentioned on 144 death certificates in Texas during the period 1988-1998 and was reported in 39 deaths in Virginia between 1987 and 1996 from acute voluntary exposure to abused inhalants.

General risks of inhalants

Regardless of which inhalant is used, improper administration can lead to death or injury. One major risk is hypoxia, which can occur due to inhaling fumes from a plastic bag, or from using proper equipment but not adding oxygen or room air. When a gas that was stored under high pressure is released, it cools abruptly and can cause frostbite if it is inhaled directly from the container. Finally, many inhalants are volatile organic chemicals and can catch fire or explode. As with many other drugs, users may also injure themselves due to loss of coordination or impaired judgment, especially if they attempt to drive.

Solvents have many potential risks in common, including pneumonia, cardiac failure or arrest, and aspiration of vomit. The inhaling of some solvents can cause hearing loss, limb spasms, and damage to the central nervous system and brain. Serious but potentially reversible effects include liver and kidney damage and blood-oxygen depletion. Death from inhalants is generally caused by a very high concentration of fumes. Deliberately inhaling solvents from an attached paper or plastic bag or in a closed area greatly increases the chances of suffocation. Brain damage is typically seen with chronic long-term use as opposed to short-term exposure.

Female inhalant users who are pregnant may have adverse effects on the fetus, and the baby may be smaller when it is born and may need additional health care (similar to those seen with alcohol - Fetal Alcohol Syndrome). There is some evidence of birth defects and disabilities in babies born to women who sniffed solvents such as gasoline.

In the short term, death from solvent abuse occurs most commonly from aspiration of vomit while unconscious or from a combination of respiratory depression and hypoxia, the second cause being especially a risk with heavier-than-air vapors such as butane or gasoline vapor. Deaths typically occur from complications related to excessive sedation and vomiting. Actual overdose from the drug does occur, however, and inhaled solvent abuse is statistically more likely to result in life-

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threatening respiratory depression than intravenous use of opiates such as heroin. Most deaths from solvent abuse could be prevented if individuals were resuscitated quickly when they stopped breathing and their airway cleared if they vomited. However, most inhalant abuse takes place when people inhale solvents by themselves or in groups of people who are intoxicated. Certain solvents are more hazardous than others, such as gasoline.

In contrast, a few inhalants like amyl nitrate and diethyl ether have medical applications and are less harmful, though they are still dangerous when used recreationally. Nitrous oxide is thought to be particularly non-toxic, though long-term use can lead to a variety of serious health problems linked to destruction of vitamin B12 and folic acid.

Risks associated with specific agents

The hypoxic effect of inhalants can cause damage to many organ systems (particularly the brain, which has a very low tolerance for oxygen deprivation), but there can also be additional toxicity resulting from either the physical properties of the compound itself or additional ingredients present in a product.

Methylene chloride, after being metabolized, can cause carbon monoxide poisoning.
Gasoline sniffing can cause lead poisoning, though this is less common where leaded gas is banned.
Ingestion of alkyl nitrites can cause methemoglobinemia, although inhalation does not.
Carbon tetrachloride can cause significant damage to multiple systems, but its association with liver damage is so strong that it is used in animal models to induce liver injury.
Use of butane and propane can create a risk of burns.
Benzene use can cause bone marrow depression.
Toluene can damage myelin.

Toxicity may also result from the pharmacological properties of the drug; excess NMDA antagonism can completely block calcium influx into neurons and provoke cell death through apoptosis, although this is more likely to be a long-term result of chronic solvent abuse than a consequence of short-term use.

"Sudden sniffing death"

Inhaling butane gas can cause drowsiness, narcosis, asphyxia, cardiac arrhythmia and frostbite. Butane is the most commonly misused volatile solvent in the UK and caused 52% of solvent-related deaths in 2000. By spraying butane directly into the throat, the jet of fluid can cool rapidly to –20°C by adiabatic expansion, causing prolonged laryngospasm. Some inhalants can also indirectly cause sudden death by cardiac arrest, in a syndrome known as "sudden sniffing death"

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The anesthetic gases present in the inhalants appear to sensitize the user to adrenaline. In this state, a sudden surge of adrenaline (e.g., from a frightening hallucination or run-in with the law), can cause a fatal cardiac arrhythmia.

Furthermore, the inhalation of any gas that is capable of displacing oxygen in the lungs (especially gasses heavier than oxygen) carries the risk of hypoxia due to the mechanism by which breathing is triggered. Since reflexive breathing results from elevated carbon dioxide levels, rather than depressed oxygen in the blood, breathing a concentrated, relatively inert gas (such as the computer-duster tetrafluoroethane or nitrous oxide) will allow for adequate elimination of carbon dioxide from the blood, meaning that there are no outward signs of suffocation even when the brain is undergoing hypoxia. By the time the full symptoms of hypoxia appear, it may be too late to breathe without assistance, especially if the gas is heavy enough to reside in the lungs for extended periods. Even completely inert gasses, such as argon, can have this effect if oxygen is largely excluded (e.g., via a mask).

Socioeconomic factors

Inhalant drugs are often used by children, teenagers, incarcerated or institutionalized people, and impoverished people, because these solvents and gases are ingredients in hundreds of legally available, inexpensive products, such as deodorant sprays, hair spray, and aerosol air fresheners. However, most users tend to be "...adolescents (between the ages of 12 and 17)." In some countries, chronic, heavy inhalant use is concentrated in marginalized, impoverished communities. Young people who become chronic, heavy inhalant abusers are also more likely to be those who are isolated from their families and community. The article "Epidemiology of Inhalant Abuse: An International Perspective" notes that "he most serious form of obsession with inhalant use probably occurs in countries other than the United States where young children live on the streets completely without family ties. These groups almost always use inhalants at very high levels (Leal et al. 1978). This isolation can make it harder to keep in touch with the sniffer and encourage him or her to stop sniffing."

The article also states that "...high rates among barrio Hispanics almost undoubtedly are related to the poverty, lack of opportunity, and social dysfunction that occur in barrios" and states that the "...same general tendency appears for Native-American youth" because "...Indian reservations are among the most disadvantaged environments in the United States; there are high rates of unemployment, little opportunity, and high rates of alcoholism and other health problems." There are a wide range of social problems associated with inhalant use, such as feelings of distress, anxiety and grief for the community; violence and damage to property; violent crime; stresses on the juvenile justice system; and stresses on youth agencies and support services.

Solvent abuse in developing countries attacks youths in their most productive years. The ease of

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access of solvents and aerosols in developing countries could have economic ties as it may be related to the introduction of Structural Adjustment Programs (SAP) in the country. Since SAPs may cause poverty, as well as education suffering financial support, this could explain why the youths in countries such as those in Latin America have an ease of access to and abuse solvents.

Patterns of non-medical usage

Africa and Asia

Glue and gasoline sniffing is also a problem in parts of Africa, especially with street children, and South Asia. Three of the most widely abused inhalants are the Dendrite brand and other forms of contact adhesives and rubber cements manufactured in Kolkata, toluenes in paint thinners, and Iodex--a muscle-stress-relieving balm. Another very common inhalant is Erase-X, a correction fluid that contains toluene. It has become very common for school and college students to use it, because it is easily available in stationery shops in India. This fluid is also used by street and working children in Delhi.

Europe and North America

In the UK, marginalized youth use a number of inhalants, such as solvents and propellants. As well, in the UK rave culture, inhalants such as nitrous oxide "whippets" and amyl nitrite poppers are used to enhance the effect of the electronic dance music. In Russia and Eastern Europe, gasoline sniffing became common on Russian ships following attempts to limit the supply of alcohol to ship crews in the 1980s. The documentary Children Underground depicts the huffing of a solvent called Aurolac (a product used in chroming) by Romanian homeless children.

In Canada, Native children in the isolated Northern Labrador community of Davis Inlet were the focus of national concern in 1993, when many were found to be sniffing gasoline. The federal Canadian and provincial Newfoundland and Labrador governments intervened on a number of occasions, sending many children away for treatment. Despite being moved to the new community of Natuashish in 2002, serious inhalant abuse problems have continued. Similar problems were also reported in Sheshatshiu in 2000. In Mexico, the inhaling of a mixture of gasoline and/or industrial solvents, known locally as "Activo" or Chemo", has risen in popularity among the homeless and among the street children of Mexico City in recent years. The mixture is poured onto a handkerchief and inhaled while held in one's fist.

In the US, ether was used as a recreational drug during the 1930s Prohibition era, when alcohol was made illegal. Ether was either sniffed or drunk and, in some towns, replaced alcohol entirely. However, the risk of death from excessive sedation or overdose is greater than that with alcohol, and ether drinking is associated with damage to the stomach and gastrointestinal tract. Use of

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glue, paint and gasoline became more common after the 1950s. Abuse of aerosol sprays became more common in the 1980s, as older propellants such as CFCs were phased out and replaced by more environmentally friendly compounds such as propane and butane. Most inhalant solvents and gases are not regulated under drug laws such as the United States' Controlled Substances Act. However, many US states and Canadian cities have placed restrictions on the sale of some solvent-containing products to minors, particularly for products widely associated with sniffing, such as model cement. The practice of inhaling such substances is sometimes colloquially referred to as huffing, sniffing (or glue sniffing), dusting, or chroming.

Australia

Australia has long faced a petrol (gasoline) sniffing problem, in isolated and impoverished aboriginal communities. Although some sources argue that sniffing was introduced by United States servicemen stationed in the nation's Top End during World War II or through experimentation by 1940s-era Cobourg Peninsula sawmill workers, other sources claim that inhalant abuse (such as glue inhalation) emerged in Australia in the late 1960s. Chronic, heavy petrol sniffing appears to occur among remote, impoverished indigenous communities, where the ready accessibility of petrol has helped to make it a common substance for abuse.

In Australia, petrol sniffing now occurs widely throughout remote Aboriginal communities in the Northern Territory, Western Australia, northern parts of South Australia and Queensland. The number of people sniffing petrol goes up and down over time as young people experiment or sniff occasionally. "Boss", or chronic, sniffers may move in and out of communities; they are often responsible for encouraging young people to take it up.

A 1983 survey of 4,165 secondary students in New Lydiate showed that solvents and aerosols ranked just after analgesics (e.g., codeine pills) and alcohol for drugs that were abused. This 1983 study did not find any common usage patterns or social class factors. The causes of death for inhalant users in Australia included pneumonia, cardiac failure/arrest, aspiration of vomit, and burns. In 1985, there were 14 communities in Central Australia reporting young people sniffing. In July 1997, it was estimated that there were around 200 young people sniffing petrol across 10 communities in Central Australia. Approximately 40 were classified as chronic sniffers. There have been reports of young Aboriginal people sniffing petrol in the urban areas around Darwin and Alice Springs.

In 2005, the Government of Australia and BP Australia began the usage of opal fuel in remote areas prone to petrol sniffing. Opal is a non-sniffable fuel (which is much less likely to cause a high) and has made a difference in some indigenous communities.

Popular culture references

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Music and musical culture

Inhalant use, especially glue sniffing, is widely associated with the late-1970s punk youth subculture in the UK and North America. Raymond Cochrane and Douglas Carroll claim that when glue sniffing became widespread in the late 1970s, it was "...adopted by punks because public perceptions of sniffing fitted in with their self-image" as rebels against societal values. While punks at first used inhalants "...experimentally and as a cheap high, adult disgust and hostility encouraged punks to use glue sniffing as a way of shocking society." As well, using inhalants was a way of expressing their anti-corporatist DIY (Do It Yourself) credo; by using inexpensive household products as inhalants, punks did not have to purchase industrially manufactured liquor or beer. One history of the punk subculture argues that "substance abuse was often referred to in the music and did become synonymous with the genre, glue sniffing especially" because the youths' "...faith in the future had died and that the youth just didn't care anymore" due to the "awareness of the threat of nuclear war and a pervasive sense of doom." In a BBC interview with a person who was a punk in the late 1970s, they said that "there was a real fear of imminent nuclear war - people were sniffing glue knowing that it could kill them, but they didn't care because they believed that very soon everybody would be dead anyway."

A number of 1970s punk rock and 1980s hardcore punk songs refer to inhalant use. The Ramones, an influential early US punk band, referred to inhalant use in several of their songs. The song "Now I Want to Sniff Some Glue" describes adolescent ennui, and the song Carbona not Glue" states, "My brain is stuck from shooting glue." An influential punk fanzine about the subculture and music took its name (Sniffin' Glue) from the Ramones song. The 1980s punk band The Dead Milkmen wrote a song, "Life is Shit" from their album Beelzebubba, about two friends hallucinating after sniffing glue. Punk band-turned hip hop group the Beastie Boys penned a song "Hold it Now - Hit It," which includes the line "cause I'm beer drinkin, breath stinkin, sniffing glue." Pop punk band Sum 41 wrote a song, "Fat Lip", which refers to a character who does not "... make sense from all the gas you be huffing..."

Inhalants are also referred to by bands from other genres, including several grunge bands--an early 1990s genre that was influenced by punk rock. The 1990s grunge band Nirvana, which was influenced by punk music, penned a song, "Dumb", in which Kurt Cobain sings "my heart is broke/But I have some glue/ help me inhale /And mend it with you". L7, an all-female grunge band, penned a song entitled "Scrap" about a skinhead who inhales spray-paint fumes until his mind "starts to gel". Also in the 1990s, the Britpop band Suede had a UK hit with their song Animal Nitrate whose title is clearly a thinly veiled reference to Amyl Nitrate. The Beck song "Fume" from his "Fresh Meat and Old Slabs" release is about inhaling nitrous oxide. Another Beck song, Cold Ass Fashion", contains the line "O.G. - Original Gluesniffer!" The band Primus's 1998 song "Lacquer Head" is about adolescents who use inhalants to get high. Hip hop performer Eminem wrote a song, "Bad Meets Evil", which refers to breathing "...ether in three lethal amounts." The

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Brian Jonestown Massacre, a retro-rock band from the 1990s, has a song entitled "Hyperventilation", which is about sniffing model-airplane cement.

Films

A number of films have depicted or referred to the use of solvent inhalants. In the 1980 comedy film Airplane!, the character of McCroskey (Lloyd Bridges) refers to his inhalant use when he states, "I picked the wrong week to quit sniffing glue." In the 1996 film Citizen Ruth, the character Ruth, a homeless drifter, is depicted inhaling patio sealant from a paper bag in an alleyway. In the tragicomedy Love Liza, the main character, played by Philip Seymour Hoffman, plays a man who takes up building remote-controlled airplanes as a hobby to give him an excuse to sniff the fuel in the wake of his wife's suicide. Harmony Korine's 1997 film Gummo depicts adolescent boys inhaling contact cement for a high. Edet Belzberg's 2001 documentary Children Underground chronicles the lives of Romanian street children addicted to inhaling paint. Yet another film that depicts the drug use is The Basketball Diaries, in which a group of boys are huffing carbona cleaning liquid at 3 minutes and 27 seconds into the movie, and, further into the movie, a boy is reading a diary describing the experience of sniffing the cleaning liquid.

In the David Lynch film Blue Velvet, the bizarre and manipulative character played by Dennis Hopper uses a mask to inhale amyl nitrite. In Little Shop of Horrors, Steve Martin's character dies from nitrous oxide inhalation. The 1999 independent film Boys Don't Cry depicts two young low-income women inhaling aerosol computer cleaner (Canned Air) for a buzz. In The Cider House Rules, Michael Caine's character is addicted to inhaling ether vapors. In Thirteen, the main character, a teen, uses a can of aerosol computer cleaner to get high. In the action movie Shooter, an ex-serviceman on the run from the law (Mark Wahlberg) inhales nitrous oxide gas from a number of Whip-It! whipped cream canisters until he becomes unconscious. The film Fear and Loathing in Las Vegas describes how the two main characters inhale diethyl ether and amyl nitrite. The South African film The Wooden Camera also depicts the use of inhalants by one of the main characters, a homeless teen, and their use in terms of socio-economic stratification. The titular characters in Samson and Delilah sniff petrol; in Samson's case, possibly causing brain damage.

In the 2004 film Taxi, Queen Latifah and Jimmy Fallon are trapped in a room with a burst tank containing nitrous oxide. Queen Latifah's character curses at Fallon while they both laugh hysterically. Fallon's character asks if it is possible to die from nitrous oxide, to which Queen Latifah's character responds with "It's laughing gas, stupid!" Neither of them suffered any side effects other than their voices becoming much deeper while in the room.

Books

The science fiction story Waterspider" by Philip K. Dick (first published in January 1964 in If

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magazine) contains a scene in which characters from the future are discussing the culture of the early 1950s. One character says: "You mean he sniffed what they called 'airplane dope'? He was a 'glue-sniffer'?, to which another character replies: "Hardly. That was a mania among adolescents and did not become widespread in fact until a decade later. No, I am speaking about imbibing alcohol."

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