Inhalants Information

Characteristics of Inhalants

Most abused solvents are central nervous system depressants, which can lead to unconsciousness and death at high concentrations and prolonged exposure. At low concentrations and short durations of exposure the user often exhibits excitation before the depressant effects (Pryor 1990). In many ways inhalant symptoms resemble those of alcohol and barbiturate intoxication, with a comparatively quicker onset (within five minutes) and a shorter duration after use. Although many solvents are depressants, they have extremely different pharmacologic and neurotoxicologic characteristics. The effects of a solvent mixture cannot be predicted simply from the pharmacology of its components or vice versa (Pryor 1990). Prolonged exposure to inhalant and volatile solvents produces toxic effects such as: (a) acute encephalopathy (brain disease); (b) cerebellar ataxia (staggering gait); and (c) peripheral neuropathy (visual and hearing impairments). A few case reports suggest effects on newborns. Chronic use of inhalants may lead to psychological dependence, or occasionally, physical dependence (WHO 1986). "Sudden sniffing death" can occur with one time use due to asphyxia or heart malfunction.

Most volatile solvents have a high affinity for lipids (fats), hence their high distribution to organs rich in lipids (e.g. brain, liver, and adrenal). These fat-soluble products are eliminated through the kidneys after several biochemical breakdown reactions that render them more water soluble (Rosenberg 1990). As a result of these reactions, additional compounds are produced, and some are more neurotoxic than the parent chemical (Goetz 1985; O=Donoghue 1985; Spencer & Schaumburg 1980; Allen 1979, Sharp & Rosenberg, in press).

Identifying the exact solvent or solvents responsible for observed effects has been very difficult because of the following conditions: (1) the commercial and industrial products used are typically mixtures; (2) the formulations and choices of the mixtures change over time; and (3) the subjects involved are often influenced by a variety of factors (e.g., use of other drugs) that might be responsible for any observed disorder (Pryor 1980).

Chemicals Found In Inhalants

There are hundreds of available household and commercial products which can be inhaled. Generally speaking the abused inhalants include volatile solvents (e.g., gasoline, glue, paint, polishes), anesthetics, nitrates, and aerosols. In addition, there are many chemical substances found in these commercial products which are responsible for the inhalation effects. Following is a list of the most common: (1) aliphatic hydrocarbons; (2) aromatic hydrocarbons (e.g., toluene); (3) halogenated hydrocarbons; (4) fluorocarbons; (5) aliphatic nitrates; (6) ketones; (7) esters; (8) alcohols; (9) glycols; (10) ethers; and (11) nitrous oxide gas.
The following table depicts the primary chemicals present in many inhalants.

Chemicals Commonly Found In Inhalants

Adhesives
Airplane Glue toluene; ethyl acetate
Rubber Cement hexane; toluene; methyl chloride; acetone; methyl ethyl ketone; methyl butyl ketone
PVC Cement trichloroethylene

Aerosols
Paint Sprays butane; propane (U.S.); fluorocarbons; hydrocarbons; toluene
Hair Sprays butane; propane (U.S.); fluorocarbons
Deodorants, butane; propane (U.S.); fluorocarbons
Air Fresheners
Analgesic Spray fluorocarbons
Asthma Spray fluorocarbons

Anesthestics
Gaseous nitrous oxide
Liquid halothane; enflurane
Local ethyl chloride

Cleaning Agents
Dry Cleaning tetrachloroethylene; trichloroethane
Spot Removers tetrachloroethylene; trichloroethane; trichloroethylene
Degreasers tetrachloroethylene; trichloroethane; trichloroethylene

Solvents & Gases
Polish Remover acetone
Paint Remover toluene; methylene chloride; methanol
Paint Thinners toluene; methylene chloride; methanol
Correction Fluid trichloroethylene; trichloroethane
Thinners
Fuel Gas butane
Lighter butane; isopropane
Fire Extinguisher bromochlorodifluoromethane

Food Products
Whipped Cream nitrous oxide
Whippets nitrous oxide

"Room Odorizers"
(Locker Room; (iso)amyl nitrite; (iso)butyl nitrate; (iso)propyl nitrate; butyl nitrate
Rush; Poppers)

B Charles Sharp, Ph.D. and Neil Rosenberg, M.D.

Common Modes Of Administration

In general, inhalation is by nose or mouth (bagging or huffing), or sometimes absorbed through the skin or stomach. More specifically, modes of administration entail:

1. sniffing/inhaling directly from containers
2. sniffing/inhaling substances sprayed inside of paper or plastic bag
3. sniffing/inhaling substances sprayed inside cola cans
4. sniffing/inhaling from cloth/clothing saturated with the substance
5. aerosol inhalation (directly spraying into nose or mouth)
6. inhaling from alternative containers (e.g., balloon filled with nitrous oxide)
7. inhalation of vapors emitted by heating volatile substances

Fetal Effects of Inhalant Use

The effects of inhalant abuse upon the unborn child are unknown. Since chronic abuse produces functional and structural damage in the mature individual, it is reasonable to expect that the developing fetus would be at particular risk. Dysmorphic features, as well as physical and neurologic impairments, have been reported, although conclusive evidence for a fetal solvent syndrome is not available (Hersh et al. 1985; Hersh 1989; Hunter et al. 1979). Anecdotal published personal observations include acute neonatal withdrawal, transient neonatal renal tubular acidosis, intrauterine growth retardation, developmental delay, and impairments of vision and hearing. Much more information is needed to characterize the consequences of solvent abuse during pregnancy in order to devise effective strategies for dealing with this problem.

- B Milton Tenenbein, M.D.

Defining Inhalant Use and Abuse

The term “inhalants”, as commonly used in the drug abuse field, has become overly generalized. There are hundreds of commercial and household products which can be inhaled, and thus have some drug abuse potential. While the generality of the term “inhalants” is appealing in its simplicity, it also has caused confusion.

Currently the terms “inhalants” and “inhalant users” are commonly defined by the method of using the substances rather than by their chemical action (Beauvais, 1990; Beauvais & Oetting, 1987). However, different classes of inhalants have their own specific effect, and are used by different types of individuals. Lumping all inhalable substances and all inhalant users together interferes with prevention, diagnosis and treatment efforts. Due to the wide range and complexity of the number of inhalable substances available, a precise categorization is difficult; the following is one attempt to bring some order to the types of chemicals that are inhaled.

Epidemiology of Use

Survey and ethnographic data can yield valuable information about the trends in use and what substances are currently being used, or what substances are in vogue in certain locales.

Volatile Solvents & Gas Products. These include glue, model airplane cement, rubber cement, pvc cement, lighter fluid, fuel gas, fire extinguisher compounds, paint thinner, paint remover, lacquer, lacquer thinner, degreasing compounds, carburetor cleaners, typing correction fluid, gasoline, gasoline additives, dry cleaning fluid, spot removers, fingernail polish remover, liquid shoepolish, wax strippers, plus many other household and commercial products. Glue sniffers typically use a form of plastic cement. Toluene, a prime constituent

of most glues and plastic cement, can also be found in some non-leaded gasolines.

Aerosols. Non-stick cooking sprays were among the first aerosols discovered by sniffers. Other aerosols are now used as well, including hair sprays, deodorants, analgesic and asthma sprays, air fresheners, fabric guard, spray paints (especially bronze, silver and gold paints), and clear spray lacquers. Freon, whether obtained from spray cans, air conditioner units or mechanical supplies, is also inhaled.

Anesthetics. The most common anesthetics are ether, chlorform, and nitrous oxide. In cold climates, ether is readily available in "quick engine starter" products. Nitrous oxide (laughing gas) is an anesthetic but is also used as a propellant for whipping cream and as an octane booster for race cars. Of historical note is the ether drinking epidemic in Ireland of the 1890's, presumably a result of the then newly-imposed and excessively high taxes on distilled spirits.

Volatile Nitrates. These primarily include (iso)amyl nitrite and (iso)butyl nitrite. Unlike many other inhalants which are taken primarily for their perceived euphoric and intoxicant effects. Amyl nitrite, a vaso-dilator, was originally used medically for the treatment of angina. Unlike other inhalants, it passed down to adolescents from older drug users. Use has been documented particularly among women (Farabee, 1994). Once demand was established, underground enterprise began to supply an over-the-counter version, namely butyl nitrite, sold under many trade names. Some are euphemistically marketed as "room odorizers", while others are openly marketed in bars and clubs as "poppers".

Powdered Stimulants and Depressants. Other powdered drugs including cocaine, methamphetamine, and heroin are inhaled. However, these are not considered "inhalants" for purposes of this report.

While these categories bring together similar types of chemicals, they do not necessarily correspond to the different types of users. Beauvais and Oetting (1987), for instance, have suggested that the term "inhalant user" be limited to those who use volatile solvents, gases and aerosols. This by far includes the majority of youth and adults who use substances. Sharp and Rosenberg (in press) would expand this category somewhat and include those who also use some forms of nitrous oxide. This is based on an emerging pattern where nitrous oxide is becoming commercially available in large tanks; thus it has become available outside of the medical field and is used by those who are also using volatile solvents and aerosols. Likewise, freon is abused by air conditioner technicians. Defined in this way, it is possible to describe a group of people who are fairly similar on a number of psychological and social dimensions as shown in the next section. In contrast, there are other groups who inhale primarily anesthetics or the volatile nitrites but who are entirely different from the typical "inhalant" user. One example of this would be medical professionals who become addicted to certain types of anesthetics.

Arriving at a Standard Definition of Inhalants

There have been several attempts to establish a convention regarding the nature of what constitutes “inhalants”. Beauvais and Oetting (1987) have argued that the term “inhalant abuse” should be restricted to the use of volatile solvents and should exclude the use of the nitrites and anesthetic gases. This is based on differences in both the neurochemical actions and on the clinical profiles of the users of these three classes of substances. This convention was also followed in the DSM-IV where the diagnoses “inhalant abuse” and “inhalant induced organic mental disorder” are restricted to the use of volatile solvents. Nitrite and anesthetic gas abuse are diagnosed separately.

The most consistent attempt to arrive at a common label has been in the journal Human Toxicology. The entire July, 1989, issue is devoted to various aspects of the abuse of volatile solvents and throughout the issue the term “Volatile Solvent Abuse” (VSA) is used to denote the behavior. This not only provides a common terminology but also restricts the issue to solvents and excludes other psychoactive substances that are inhaled, in particular the nitrites and anesthetic gases. This approach seems very reasonable as long as the label is used carefully and is not applied indiscriminately to all levels of solvent use. It is very common for many young people to have a single episode, or a short period, of inhaling substances and it would be inappropriate to refer to these as “abuse”. Perhaps another convention, “volatile solvents use”, would be appropriate for these less severe patterns.

B Fred Beauvais, Ph.D.

Observed vs. Perceived Drug Effects

Inhalant use classification can be based on the observed physical and psychological effects of the substance on the user. While it is important to note such pharmacological effects, they must be understood within the context of how the user perceives those effects. Thus, another approach is to classify effects which the user experiences or perceives experiencing, i.e., phenomenological effects. It is clear that not all users perceive (or report) the same effects from the same substance (Becker 1980), so “user categories” would not necessarily match pharmacological or toxicological ones. However, the user=s reasons for use may be the major key to developing a classificatory system (Sharp 1990). There are two aspects to user phenomenology: what the user thinks or feels, or how the pharmacological effect is interpreted) and what is verbalized as the motive for taking the drug. An examination of perceived effects may explain why some people continue and increase use of a particular while others do not. Some users, for example, say they prefer inhalants because they can carefully control the “high”. When they begin to “come down” or lose the effect, they simply have to take another sniff or two to achieve the feeling they prefer. Other drugs cannot be modulated this finely. Neither treatment nor prevention of inhalant abuse can progress without recognition of user phenomenology. For this system to be effective, however, researchers must be aware of a number of sources of bias that affect scientific conduct, such as the experimenters themselves, the research settings, unique characteristics of the clients under study, matters of cultural relevance and sensitivity of the test instruments.

For a number of reasons, inhalant use does constitute a dangerous behaviour and this danger should not be minimized:

1. Current methods of assessment may not be sensitive enough to detect injury that may persist over time. Some studies have shown that among chronic, heavy users there is an actual loss of neulral tissue (e.g. Fornazzari, 1983) so there is some reason to suspect that some neural loss is occurring among most heavy users.

2. Death can and does occur among inhalant users, (Garriot 1990; Cunningham et al. 1987; Bass, 1970; Maxwell 1994; Tenenbein 1990), some from first time use. The causes of death have already been discussed but bear repeating; asphyxia (commonly from plastic bags over the head), cardilac arrhythmias and failure, violence (both homicide and suicide), and accidents such as explosions, fires and head injury from passing out.

3. There are some inhalants that are known to cause permanent damaage (e.g. compounds containing hexanes produce irreversible peripheral nervous system damage and other compounds cause hearing loss). It is difficult for the user to know whether the compound they are using contains the chemicals leading to these problems.

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