Chapter 10

Volatile Substances

VOLATILE substances are central nervous system (CNS) depressants and are chemical compounds that rapidly change from a liquid, or semisolid state to vapour when exposed to air.

Volatile substance use is the deliberate inhalation of vapour given off from a substance at ambient temperature to alter consciousness or cause intoxication.

Volatile substance use may be:

- experimental — using out of curiosity
- recreational — frequently a group practice
- chronic — an habitual and dominant activity

COMMONLY USED VOLATILE SUBSTANCES

The most commonly used volatile substances include petrol, lacquers and varnishes containing benzene and adhesives, spray paints, glues and paint thinners containing toluene. Table 10–1 lists the major volatile substances and their sources. Also used are amyl nitrite and nitrous oxide found in canisters.

Table 10–1
Major volatile substances and their sources

Major volatile substances	Sources
• benzene	• petrol, varnish, resins, lacquer
• toluene	• adhesives, spray paints, glues, paint thinners
• xylene	• lacquer, thinner, wood glues
• propane	• bottled fuel
• butane	• cigarette lighter fluid
• acetone	• nail polish remover
• n-hexane	• model glues, rubber cement
• trichloroethane	• dry cleaning agents, degreasing agents
• trichloroethylene	• dry cleaning agents, stain removers, degreasing agents
• trichlorofluoromethane	• aerosol propellant
• dichloromethane	• paint stripper
• butyl nitrite	• room air freshener

MODES OF ADMINISTRATION

There are three major modes of volatile substance administration:

- *sniffing*: Vapours inhaled directly from a container. Lowest vapour concentration, with a significant quantity dissipated into the surrounding air
- *huffing*: A piece of saturated material (commonly a piece of clothing) held against the mouth or nose. In extreme cases may be held *in* the mouth. Spraying aerosol vapours directly into the mouth
- *bagging*: Vapours inhaled from a plastic or paper bag held firmly over the mouth and nose

Chronic users generally begin with sniffing and progress to huffing and bagging to increase vapour concentration availability and achieve and maintain euphoria (Henretig, 1996; Linden, 1990).

PREVALENCE

There is a lack of good epidemiological data on the prevalence of use amongst general community groups and subgroups. However some trends in using volatile substances are emerging:

- there is a higher prevalence amongst the 14–17 year old age group than older adults (White, 2001)
- the trend for use is greatest amongst younger teenagers, aged 12 and over (White, 2001)
- male adolescents use more than female adolescents (AIHW, 1999)
- amongst recreational drug users volatile substances and cannabis were most commonly combined with ecstasy, amphetamine or LSD at rave scenes (Boys et al., 1997)

- compared with non-Indigenous counterparts, young Indigenous users
  - show greater habitual use
  - use more frequently
  - use over a longer period

  (Carroll et al., 1998)

APPEAL

Volatile substances:

- are relatively inexpensive
- are readily available from supermarkets, hardware stores, homes, building sites, cars and offices, despite legislation in a number of Australian States to preclude their sale to minors
- can be packaged in small and discrete containers (e.g. cans or bottles) and easily concealed
- create rapid intoxication and rapid disappearance of intoxication. The user can indulge and then go home or to other venues in a sober state

PHYSICAL COMPLICATIONS

Acute Effects

Following use, blood levels peak within minutes then rapidly decrease as the drug is absorbed into fat, including the central nervous system (CNS).

Common initial effects are:

- euphoria
- excitation
- exhilaration
- a sense of invulnerability

Negative Acute Effects

Users may also experience:

- nausea
- vomiting
- headaches
- diarrhoea
- abdominal pain

These effects commonly resolve within two hours (Liira et al., 1988).

Effects at Higher Doses

Central nervous system depression leads to:

- slurred speech, disorientation, confusion, delusions, weakness, tremor, headaches, visual distortions and visual hallucinations; then
- ataxia; followed by
- stupor
- final stages associated with seizures, coma, cardiopulmonary arrest and death (Linden, 1990)

In the novice, or infrequent user, desired effects are achieved after a few breaths. However, tolerance develops rapidly and within several days of repeated use the user requires a significant increase in dose to achieve the desired effect. Withdrawal symptoms commonly include headache, nausea and muscle and abdominal cramps.

Specific Physical Effects

Central Nervous System

The majority of solvents are fat soluble and readily absorbed from the blood into high fat tissue including nerve cells. This results in generalised reduction of nerve membrane functioning, which causes CNS depression (Lolin, 1989).

Of the commonly abused substances, toluene causes the most CNS damage. White matter damage, cortical atrophy and cerebellar damage are observed in long-term chronic users. Destruction of nerve cells also results in peripheral neuropathy (Lolin, 1989), optic atrophy and hearing loss (Fornazzari et al., 1983; Williams, 1988).

Maternal and neonatal

Given their fat solubility, volatile substances readily cross the placenta. Neonatal toluene exposure is associated with malformations including:

- oral clefts and microcephaly
- spontaneous abortion
- foetal growth retardation
- low birthweight
- prematurity
- developmental delays

(Arnold et al., 1994; Jones & Balster, 1998)

Heart

Sudden death associated with ventricular fibrillation and cardiac arrhythmia is a major concern. Hydrocarbons contained, for example, in aerosols, petrol and substances containing benzene and toluene, sensitise the myocardium to adrenaline. When the user is 'startled', the resulting sudden serge of adrenaline causes ventricular fibrillation (Shepherd, 1989). Approximately 20% of those who die from 'sudden death' in these circumstances have no prior history of volatile substance use (Ramsey, Anderson et al., 1989).

Lung

Volatile substances displace oxygen and can directly damage lung tissue resulting in loss of consciousness.

It is not uncommon for asphyxiation or suffocation to occur from aspiration of vomit in plastic bags used for bagging. Asphyxiation can also be caused by material placed in the mouth during huffing (Linden, 1990).

Kidneys, liver and bone marrow

Compounds containing toluene cause renal tubular acidosis that interferes with functioning of the distal tubule and collecting ducts (Marjot & McLeod, 1989). Complete kidney and liver failure have been associated with toluene use (Dinwiddie, 1994). Chloroform and chlorinated hydrocarbon vapours result in toxic hepatitis with liver dysfunction associated with trichloroethane and trichloroethylene use (Hutchens & Kung, 1985).

Chronic use of benzene is associated with suppressed functioning of bone marrow production, aplastic anaemia and related morbidity and cancers such as myeloma, leukaemia and lymphoma (Rosner & Grunwald, 1980).

Other Morbidity and Mortality

The sense of invulnerability associated with volatile substance use results in impulsive high risk behaviours that can cause accidents, injury, brain damage, trauma and death. Morbidity and mortality are also associated with fires resulting from combustion of inhalants.

PSYCHOSOCIAL COMPLICATIONS

Adolescents who chronically use volatile substances are more likely than non-users to report poor family relations, family history of alcohol and other drug problems and unstable living environments, school absenteeism and academic problems, criminal activity, low self-esteem and associated depression and suicidal thoughts (Howard & Jenson, 1999). There are reports of violence amongst adolescent chronic volatile substance users, both towards other users and non-users (Dukarm et al., 1996).

MANAGEMENT AND INTERVENTION STRATEGIES

Detection and Assessment

To detect and assess volatile substance use:

- look for indicators of recent or chronic use
- obtain a comprehensive history
- conduct a thorough physical examination by a medical practitioner

Clinical signs and symptoms

Recent use may be indicated by the identification of solvent containers, or bags, bottles and cans with solvent residue or residual odour on breath, skin or contaminated clothing.

Mucous membrane irritation may result in increased sputum production, cough, wheeze, salivation, sneezing, or conjunctival injection (McHugh, 1987). Chronic use can lead to drying of mucous membranes and facial skin which causes irritation and may permit bacterial infections to become established. The resulting patchy redness of skin (erythematous spots) or pus producing skin lesions around the mouth and nose are commonly referred to as 'sniffer's or huffer's rash'. Recent use may also be associated with decreased reflexes and oscillatory movement of the eyes.

Excessive mood swings, disinhibition or inappropriate aggression coupled with one or more of the above physical symptoms may also indicate use.

Symptoms associated with polysubstance use may mask those of volatile substances.

Urine drug screening is not designed to detect volatile substances or metabolites.

Toluene use is confirmed by elevated levels of hippuric and benzoic acid in urine.

Intoxication

In most instances, acute volatile substance intoxication resolves spontaneously. Clothing and skin should be decontaminated, and the user placed in a well ventilated, safe environment and observed. Cardiopulmonary function should be monitored until intoxication resolves.

There is no significant way to enhance the rate of volatile substance elimination. Cardiopulmonary assessment, stabilisation and monitoring is required. Electrocardiography is indicated in the presence of cardiac abnormalities. Hydration with saline may be required. Laboratory tests include complete blood count and oxygen saturation. Urine or blood screening may be indicated where polysubstance use is suspected.

Experimental, Recreational and Chronic Use

Experimental

Volatile substance use is usually a transitory event amongst a kaleidoscope of experimental activities. It commonly resolves without intervention or major incident. Patterns of use in this group preclude the development of tolerance and associated excessive toxicity, and morbidity is low. Mortality from 'sudden death' is of concern. Education initiatives provided in early school years (late primary) as part of an integrated general curriculum may reduce the prevalence and frequency of use. However, any educational programs should be undertaken with care as they can inadvertently increase use.

Recreational

Similar to experimental use, volatile substance use is commonly an optional activity amongst recreational users. Social status, for example, in those attending rave dances, is more likely to be associated with body image and rave activities, than volatile substance use per se. Information on the relationship

between use, tolerance and morbidity and mortality will likely decrease the frequency and quantity of use in this group. Sudden death is a real possibility and information on the avoidance of use and co-activities that raise adrenaline levels (e.g. exertion and co-stimulant use), both popular activities amongst 'rave' users, is necessary. For both experimental and recreational users, the portrayal of volatile substances as a low class of drugs may reduce the prevalence and frequency of use.

Long-term management — the chronic abuser

Management is difficult and lacks rigorous empirical evaluation. The objectives here are to:

- assess and care for medical complications
- minimise harm associated with use
- move the user away from chronic use patterns and associated lifestyles

Assess and care for medical complications

Mental state, organ and neurological examination are necessary. Chest x-rays are required where there is evidence of pulmonary morbidity. Laboratory tests include complete blood count, oxygen saturation, serum electrolytes, and blood urea, nitrogen and creatinine. Additional tests may be required to assess the presence of metabolic disturbances and morbidity to other organs (e.g. kidneys).

Minimise harm associated with use

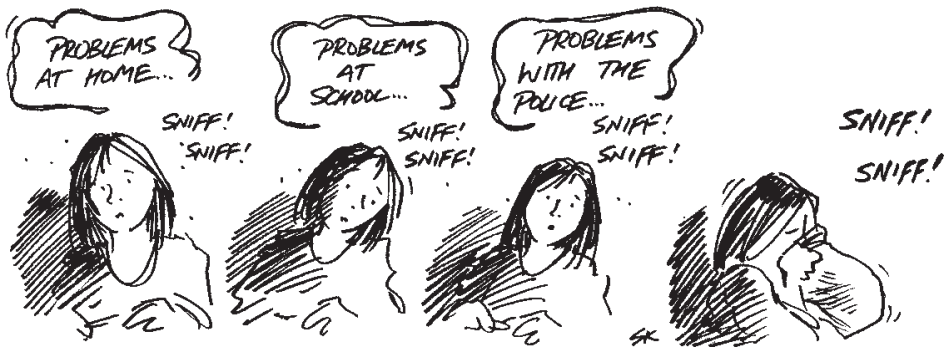
Although total abstinence may be the optimal objective, this may be initially impractical in high risk communities, short of removal of the user. Here harm minimisation to reduce morbidity and mortality is required. For example, non-use of plastic bags that cause asphyxia, removal of lead-based petrol and education about the development of tolerance to reduce overall acute and chronic tissue toxicity and damage.

Move the user away from habitual and chronic use patterns

Exposure to those with significant morbidity, resulting from volatile substance use has been identified by chronic users as a significant factor in reducing use (Carroll, Houghton et al., 1998). Overall, initiatives should focus on the community and environment in which volatile substance use takes place (e.g. urban or Indigenous communities).

Use in these environments is often closely associated with:

- a lack of alternative social activities and poor economic prospects
- the conferring of greater status within the group upon those who consume the greatest quantities of volatile substances



Providing both desirable social activities and social status outside the user group are essential. Initiatives should be acceptable to and developed in collaboration with local communities. Community and family counselling and support may be required.

Primary Prevention Strategies

Many volatile substance users commence use in early or pre-teen years, so early prevention initiatives at primary schools should be considered. Limited available information suggests that mass media, fear tactics and factual education programs are *not* hugely effective. Some modest success has been reported with programs utilising peer support initiatives and targeting social skills and healthy lifestyle acquisition (CDH, 1985).

RESOURCES

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