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Review of volatile substance use among Indigenous people

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Volatile substances are chemical compounds that give off fumes at room temperature. They are also called 'inhalants' in recognition of their route of administration [1]. They are central nervous system depressants, and their use involves deliberate inhalation to produce a state of altered consciousness or intoxication. Onset of effect occurs rapidly because the extensive capillary surface of the lungs readily absorbs the vapour, causing blood levels to peak within minutes of use [2].

There are approximately 250 household, medical and industrial products that contain potentially intoxicating volatile substances [1]. Many of these are readily available.

Volatile substances are usually classified into four groups [3]:

- solvents-liquids or semi-liquids that vaporise at room temperature, such as glues and petrol
- gases-medical anaesthetics and fuel gases, such as lighter fuels
- aerosols-sprays containing propellants and solvents
- nitrites-amyl nitrite or cyclohexyl nitrite found in room deodorisers

Nitrates, however, do not directly affect the central nervous system and their use occurs primarily for enhancement of sexual pleasure, rather than intoxication.

The volatile substances most commonly used for intoxication are aliphatic, aromatic or halogenated hydrocarbons. These include toluene (found in glues and spray paints) butane gas (in cigarette lighters, acetone (in nail polish remover), benzene (in petrol and varnish) and propane (in bottled fuel and as aerosol propellant).

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The effects of inhaling volatile substances

SHORT-TERM EFFECTS

The psychoactive effects of inhaling volatile substances occur rapidly, but only last for a short period (5-45 minutes after ceasing use). However, the fat soluble nature of volatile substances means they can be stored in neurological tissue and affect the level of consciousness of users for several hours. The short term effects of use include [1, 3]:

- feeling of wellbeing
- hallucinations
- drowsiness
- confusion
- aggression
- disinhibition
- loss of coordination
- slurred speech
- vomiting
- blurred vision

Petrol sniffers, in particular, can experience severe mood swings, and severe depression, including suicidal ideation [4].

LONG-TERM EFFECTS

The long-term use of volatile substances can produce the following effects [5]:

- chronic headache
- sinusitis
- cognitive deterioration
- ataxia (gross lack of coordination of muscle movements)
- frequent cough
- tinnitus (ringing in the ears)
- angina (temporary chest pain)
- nosebleeds
- lack of energy
- red, watery eyes
- depression
- shortness of breath
- indigestion
- dizziness
- stomach ulcers

CHRONIC EFFECTS

The chronic user is likely to experience hangover effects and withdrawal symptoms when not using. The most toxic consequence of chronic use is irreversible neurological damage, leading to cognitive impairment. The heart, lungs, liver and kidneys can also be affected [5].

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SUDDEN SNIFFING DEATH

Some inhalants can also indirectly cause sudden death by cardiac arrest in a syndrome known as *'sudden sniffing death'.* The hydrocarbon gases present in the inhalants appear to sensitise the myocardium to adrenaline. In this state, a sudden surge of adrenaline (for example, from a frightening hallucination or pursuit by police), can cause a fatal cardiac arrhythmia [6].

ASPHYXIATION

Spraying volatile substances directly into the mouth can have fatal consequences. Here the cooling agents in the aerosol propellant freeze the larynx causing death by asphyxiation [7].

PRENATAL EXPOSURE TO VOLATILE SUBSTANCES

Volatile substances readily cross the placental barrier because of their fat solubility. Prenatal exposure is associated with low birthweight, prematurity, developmental delays neurobehavioral problems and physical malformations [8].

Volatile substance use by Indigenous people

THE HISTORY AND NATURE OF USE

Volatile substance use (VSU) occurs predominantly among young people, both Indigenous and non-Indigenous [4]. In urban settings, inhalation of the vapours from spray paint, or 'chroming', is the most frequent form of VSU for both Indigenous and non-Indigenous young people. Use among the general population of young people has been recorded since the 1970s when a Queensland survey found that 6.5% of school students reported they had use a volatile substance [4]. During the 1990s, VSU in cities and towns became a matter of increasing concern and a number of studies documented use by Indigenous and non-Indigenous young people in range of locations from large cities, such as Brisbane and Perth, to small regional towns, such as Alice Springs and Mount Isa [9-12]. Indigenous young people in these settings are likely, however, to use volatile substances in greater quantity and for a longer period [1, 12, 13].

Marginalised young people, whether Indigenous or non-Indigenous, indicate they use volatile substances as a way of relieving boredom, to block hunger pains, and to cope with emotional distress [14, 15]. VSU also functions as a way of communicating identity, control and power. Volatile substances users frequently seek a non conformist reputation [14]. In Indigenous communities, sniffing can be one of the few ways a young person can express their power. In part, this is through controlling the body weight by sniffing to suppress appetite. In part, it is through provoking outrage by their behaviour [16].

There are two general risk factors – social disadvantage and family dysfunction – that are predictive of VSU [17]. In addition, Rose indicated that VSU in Indigenous communities is influenced by cultural and situational circumstances including [17]:

- degree of community cohesion
- cultural identification
- numbers engaged in use
- local patterns of use
- access to resources and supports
- other local influences

This provides a way of understanding Indigenous VSU that goes beyond individual pathology and takes account of community level stress and the wider social and cultural impact of the dispossession and dislocation that has occurred since European colonisation.

Petrol sniffing remains the most prevalent form of VSU by Indigenous people living in remote communities. This form of VSU has occurred in some Northern Territory Indigenous communities since the early 1940s and one theory ascribes its introduction to American servicemen stationed in the Territory during the Second World War. This is supported by testimony given to the Legislative Assembly of the Northern Territory Select Committee on Substance Abuse [18]. A man from the Mutitjulu community, who grew up in Eastern Arnhem Land during World War II, recalled American servicemen stationed on an airstrip there sniffing petrol. He recounted how he and others of his generation had "socially" sniffed petrol.

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Unlike much urban VSU, which tends to be experimental, transitory use by younger adolescents, petrol sniffing in remote communities starts at a younger age and continues for a longer period of time [1, 4]. Most Indigenous petrol sniffers are between eight and 30 years of age, with a concentration in the 12-19 year age range, although there have been reports of sniffers as young as five years old [19, 20]. One study reported the mean duration of use was eight years, which means Indigenous petrol sniffers are at considerable risk of becoming chronic users as they get older [1, 21].

PREVALENCE OF USE

A recurring comment from researchers and service providers concerns the lack prevalence data on volatile substance use [4]. There are two regular national surveys of drug use, the National Drug Strategy Household Survey (NDSHS) and the Australian School Students Alcohol and Drugs (ASSAD) Survey, but each has its limitations in terms of providing an accurate picture of use [22, 23]. The issue of age and Indigenous status are important factors when assessing the accuracy of survey data on volatile substance use and there are substantial deficiencies in both surveys on each count. The 2007 NDSHS indicated that 3.1% of the Australians aged 14 years or older had ever used a volatile substance (see Table 1), but it provided no breakdown as to Indigenous status [22]. The survey also only reported volatile substance by those 14 years and older. This means that use by younger adolescents, which is known to comprise a substantial portion of total use, has been omitted [1, 17].

Table 1. Table 1. Volatile substance use in 2007 for persons aged 14 years or older as a percentage of the population

	Age group				**Sex**		
Period	14-19	20-29	30-39	40+	Males	Females	Persons
percentage							
In lifetime	2.0	5.2	6.1	1.8	3.9	2.3	3.1
In the last 12 months	1.1	0.7	0.4	0.2	0.6	0.2	0.4
In the last month	0.6	0.4	0.3	0.1	0.4	0.1	0.2
In the last week	0.3	0.1	0.1	0.1	0.2	<0.1	0.1

Source: AIHW, 2008 [22]

The 2005 ASSAD survey collected information on VSU by students as young as 12 years, which was the peak age for recent use [23]. In this age group, 6.4% had used in the previous week (see Table 2). Recent use progressively dropped in older age groups such that by 17 years only 2.1% had used in the previous week. This survey collected data from a larger and younger sample than the NDSHS, but it had its own limitations in the context of this review. As with the NDSHS it did not break prevalence data down by Indigenous status. Additionally, it only surveyed young people attending school. There is good reason to believe that chronic volatile substance users would be less likely to attend school and would therefore be missed by school-based surveys.

Table 2. Table 2: Volatile substance use by 12-17 year old school students in 2005: Percentage of users, by age, sex and frequency of use

Age		**Never**	**Ever**	**Previous year**	**Previous month**	**Previous week**
12	Persons	79.2	20.8	15.7	9.9	6.4
	Male	76.5	23.5	17.7	10.6	7.4
	Female	82.0	18.0	13.7	9.1	5.4
13	Persons	80.9	19.1	15.3	9.7	6.0
	Male	81.4	18.6	14.7	9.4	6.3
	Female	80.4	19.6	15.9	10.0	5.7
14	Persons	79.0	21.0	16.6	9.2	5.5
	Male	81.1	18.9	14.7	8.6	5.4
	Female	76.7	23.3	18.6	9.9	5.5
15	Persons	83.5	16.5	12.5	7.2	3.9
	Male	83.1	16.9	12.3	7.4	4.4
	Female	83.8	16.2	12.8	6.9	3.4

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16	Person	87.7	12.3	8.3	3.6	2.5
	Male	88.2	11.8	7.4	3.4	2.6
	Female	87.2	12.8	9.3	3.7	2.5
17	Persons	90.1	9.9	5.9	3.1	2.1
	Male	88.9	11.1	6.3	3.7	2.4
	Female	91.2	8.8	5.5	2.5	1.7
12-17	Persons	82.8	17.2	12.9	7.5	4.6
	Male	82.6	17.4	12.8	7.6	5.0
	Female	83.0	17.0	13.1	7.4	4.2

Source: The Cancer Council Victoria, 2006 [23]

There is more information available about the prevalence of petrol sniffing. In the 1980s, the practice was mainly confined to Indigenous communities in Arnhem Land and central Australia [16]. By the late 1990s, petrol sniffing was being reported in previously unaffected communities, which included the Katherine region of the NT, Cape York in Qld, south-west Qld, western NSW and northern Vic. The most recent and comprehensive survey of petrol sniffing, conducted in 2006-2007 with remote Indigenous communities that had introduced non-sniffable Opal fuel, found that just over 1,000 people in these communities were currently sniffing (see Table 3). This represented 4.8% of the population aged between five and 40 years [1].

Table 3. Table 3. Estimated number of petrol sniffers in remote Indigenous communities 2006-2007

Region	Population	Number of users	Percentage of users
Anangu/Pitjantjatjara/Yankunytjatjara (APY) Lands (SA)	1,969 (10-40 yrs)	219	11.1
East Kimberley (WA	547	32	5.8
Top End (NT)	12,985	266	2.0
Far North Queensland	1,861	96	5.2
Ngaanyatjarra Lands (WA)	1,035	145	13.9
Eastern Goldfields (WA)	92	5	5.4
Central Australia (NT)	4,418	244	5.5
Alice Springs Town Camps (NT)	3,300	141	11.8
All regions	24,238	1,007	4.8

Source: d'Abbs P and Shaw G (2007) [24]

PROBLEMS ASSOCIATED WITH VOLATILE SUBSTANCE USE

The problems associated with VSU by Indigenous people are not just experienced by the users themselves; problems cascade to their families, their local community and wider society [1]. The problems experienced at these four levels are summarised in Table 4. The problems are not experienced in all cases and they may be co-occurring rather than being caused by VSU.

Table 4. Table 4. Problems associated with volatile substance use

Where the problem is experienced	Nature of the problem
Volatile substance users	Acute physiological and toxicological consequences, including intoxication, hallucinations, disinhibition, confusion, blurred vision, poor coordination, headaches, poor memory, slurred speech, vomiting,
	Chronic physiological and toxicological consequences, including neurological injury, leading to impairment in cognition, vision, hearing and movement, damage to heart, lungs liver and kidneys
	Effects on the foetus if use occurs during pregnancy
	Poor school attendance and performance
	Less cultural learning

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	Alienation from family and community
	Social stigma
	Increased likelihood of homelessness, future drug use and criminal activity
	Death
Families of volatile substance users	Disruption to family life
	Hardship and stress of caring for family members disabled by use
	Threat of violence
Local community	Inter-familial conflict and blaming
	Social disruption and damage to property
	Flouting of Indigenous and secular authority
	Loss of community contribution from the users
Wider society	Demands on health system
	Long-term care for those disabled by use
	Demands of the criminal justice system

Source: Adapted from d'Abbs P, Maclean S, 2008 [1]

In Indigenous communities, it is particularly important to look beyond the health consequences of VSU for the individual user to the broader social costs. A study of petrol sniffing in a Pitjantjatjara community found that many chronic sniffers were socially isolated [25]. They lived outside their families in gangs that perpetrated much of the crime in the community. The burden on families, many already suffering hardship, can be enormous both in emotional and financial terms. Parents typically feel helpless to stop the use, while at the same time they often have to look after a son or daughter, who is becoming increasingly debilitated [1]. VSU can create intense and unrelenting disruption in remote Indigenous communities out of all proportion to the number of users. Property crime, violence, friction between families, physical and mental health problems and youth suicides often accompany VSU [1]. Constantly coping with these problems debilitates a community, sapping its ability to function cohesively [18]. VSU is also a drain on wider Australian society in that it decreases productivity and the resultant problems require the intervention of various government services. In 2005, the estimated total cost of petrol sniffing in central Australia was $78.9 million, which included the following major component costs [26]:

- $38.1 million cost of burden of disease
- $16.2 million crime and judicial costs
- $8.3 million loss of productivity
- $4.2 million long term care
- $4.1 million health costs
- $3.7 million rehabilitation

The long-term costs calculated for all locations (except Darwin), where sniffing has traditionally occurred is much higher. The 25-year present value of petrol sniffing costs in these locations has been calculated at $1,708 million [27]. Of this, $1,014 million is the cost to sniffers, mainly in the form of morbidity and mortality costs, but also in lost earnings. $471 million is the cost to government and $223 million is the cost to the communities in which the sniffers live.

MORBIDITY AND MORTALITY

At present, there is no systematic collection of VSU-associated mortality or morbidity data in Australia at either the national or state and territory level [1]. Users typically present to health facilities with illnesses, such as pneumonia, or injuries, such as burns, which are caused by VSU, but the record only reflects the presenting problem. Similarly in the case of deaths, the practice is to list the medical explanation rather than the use of volatile substances that led to it [4]. For example, the cause of death a chronic petrol sniffer may be recorded as end stage renal failure rather than the petrol sniffing that precipitated the renal failure.

Some state-wide data estimate the morbidity associated VSU. Victoria data collected on drug use and harm in 2003-04 indicated that VSU was the main presenting drug problem in 1.5% (726) of clients undertaking courses of treatment delivered by specialist alcohol and drug services

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[28]. In the same year, 35 VSU-related hospitalisations resulted in 214 bed days. In WA, between 1994 and 2000, there was an average of 32 VSU-related hospital admissions per year [13].

The aetiological fraction methodology provides another way of calculating Indigenous hospital admissions attributable to petrol sniffing [26]. This uses epidemiological studies to determine the proportion of a health condition attributable to various risk factors. Petrol sniffing is a risk factor in the following Australian Refined Diagnosis Related Group (DRG) codes, which provides information on the diagnosis/intervention for that hospital admission.

- C91 Lymphoid Leukaemia
- C92 Myeloid Leukaemia
- F18 Mental and behavioural disorders due to use of volatile solvents
- T52 Toxic effect of organic solvents
- G92 Toxic encephalopathy
- X46 Accidental poisoning by and exposure to organic solvents and halogenated hydrocarbons and their vapours

When calculated as a fraction of all Indigenous hospital admissions in 2007-08 for these six conditions, 77.4 admissions were wholly attributable petrol sniffing [26].

Data on mortality linked to VSU of all types are scant. A national study indicated that 121 deaths from VSU occurred between 1980 and 1987, 17 of which were attributable to petrol sniffing [29]. More recent state-level morbidity data have been collected in Victoria [4]. Coronial files indicated that, between 1991 and 2000, 44 deaths were associated with VSU. However, in both instances no information was published as to Indigenous status.

There is more information available at a regional level on mortality associated with petrol sniffing, and in all cases those who died were Indigenous [1, 30]. Coronial and other evidence were used to estimate that between 1981 and 1991 63 Indigenous people died from causes related to petrol sniffing. Two-thirds (42) of those who died were from desert communities that straddled the border region of WA and SA. Twelve were from communities in the Goldfields region of WA. The remaining nine deaths occurred in the central and Top End areas of the NT. Only three of these were female. More recent research using a combination of coronial and government reports, community death registers and personal communication identified 37 petrol sniffing deaths between 1998 and 2003. The geographic distribution of these deaths is provided in Table 5.

Table 5. Table 5. Geographic distribution of petrol sniffing mortality, 1998–2003

Region	Number of deaths
Ngaanyatjarra Lands	5
Pitjantjatjara Lands	11
Central Northern Territory	16
East Kimberley	3
Top End	2

Source: Shaw G, Biven A, Gray D, Mosey A, Stearne A, Perry J, [30]

Compared with the 1981-91 data, there was decrease in deaths in the desert regions of WA and SA, and in the Goldfields region, but deaths increased in central area of the NT and in the East Kimberley region of WA [1, 30]. The immediate cause of these petrol sniffing deaths is listed in Table 6.

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Table 6. Immediate cause of petrol sniffing attributable deaths, 1998-2003

Reported cause of death	Number of deaths
Respiratory failure/asphyxia	10
Homicide	3
Cumulative impact of sniffing	3
Chronic obstructive airways disease	2
Burns	1
Suicide	9
Cardiac arrest	2
Motor vehicle crash	4
Fall from height	1
Lost in bush	1
Not reported	1

Source: The South Australian Centre for Economic Studies, 2010 [27]

Responding to VSU in Indigenous communities

SUPPLY REDUCTION

There are four methods of supply reduction designed to curb VSU: product modification; restricting physical access; statutory sales restrictions; and voluntary sales restrictions [1].

Product modification

Three ways of altering volatile substances so as to deter VSU have been identified [1]. These are: modification of packaging to reduce opportunity for misuse; addition of a deterrent chemical; and replacement of the toxic or psychoactive components to reduce harm and make use less attractive.

The first strategy of modifying packaging so as to deter use for purposes of intoxication has little support in the literature [1]. Modification to the nozzles of aerosol cans was trailed in the UK, but determined users still accessed the content to get intoxicated by puncturing the can or removing the nozzle [4]. The second strategy of adding deterrent chemicals is only viable when it cannot be circumvented and does not adversely affect legitimate users [31]. Four Indigenous communities added ethyl mercaptan, which has a strong offensive smell, to petrol, but the strategy proved unsuccessful. In one community, the residents objected to the smell; in the second, parents were distressed by their children vomiting; in the third, there was no community support for the intervention; and, in the fourth, chronic sniffers continued to sniff the petrol containing the additive after discovering that the ethyl mercaptan would evaporate if the petrol was left in the open [1].

The most effective product modification approach is replacement of harmful and psychoactive chemicals with more benign alternatives [32]. Research in the UK suggests reformulating products to reduce their intoxicating qualities has reduced deaths associated with their use [33]. In Australia, leaded petrol was phased out nationally on 1 January 2002 because of the risk it posed to health [34]. Lead affects neurological development and is therefore particularly toxic to children [35]. Sufficient exposure causes permanent learning and behaviour disorders. The introduction of unleaded petrol did not reduce petrol sniffing, but it did seem to reduce the morbidity associated with sniffing [30]. Sniffing unleaded petrol did not cause morbidity necessitating hospitalisation in the medium term. Fitting, one consequence of petrol sniffing, was only identified in three instances by the 2004 Comgas Scheme study. Eleven years earlier, when leaded petrol was being sniffed, Nganampa Health had reported 70 fitting-related consultations [36].

Introduction of non-sniffable fuels: aviation fuel (Avgas) and Opal

In the early 1990s, several Indigenous communities in the Top End of the NT started to use Avgas instead of petrol. Avgas has a higher lead content, but was not sufficiently volatile to cause intoxication. In one of these communities, Maningrida, Avgas was critical element in eliminating petrol sniffing [37]. While some sniffers tried Avgas, they did not persist. Following this initial success, more than 20 Anangu

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Pitjantjatjara Yankunytjatjara (APY) communities changed to Avgas as part of a regional prevention strategy [38]. A subsequent evaluation found there was a steep decline in sniffing in these communities following the introduction of Avgas in 1994. There was some rebound in later years, but never to the pre-Avgas levels [39].

The Australian Government subsidised Avgas for communities from 1998 under the Comgas scheme, and there were 30 participating communities in 2004 [30]. The evaluation of the scheme published in that year concluded communities that used Avgas over a sustained period had eliminated regular petrol sniffing and related harms. Where the strength of effect did vary this was associated with consistency of application and proximity to more sniffable fuels.

The scheme was popular with the participating communities because it effectively reduced sniffing [30]. However, the high lead content of Avgas eventually required its replacement for the same environmental health reasons behind the replacement of leaded petrol. The replacement Avgas had higher levels of aromatic hydrocarbons and would produce intoxication if sniffed. Initially this was cause of considerable consternation, but it also drove the development of a new fuel that could replace the old leaded Avgas in Indigenous communities.

The new fuel, known as Opal was launched in February 2005 [1]. Later in the same year, the Australian Government expanded its commitment to the prevention of petrol sniffing by enlisting the support of the WA, SA, and NT governments in an 'Eight Point Plan' committed to the following actions[1]:

- adopting consistent legislation with strong penalties for offences relating to sale or supply of volatile substances for sniffing
- appropriate levels of policing
- further rollout of Opal fuel
- developing diversionary activities for young people
- providing treatment and respite facilities
- developing communication and education strategies
- strengthening and supporting communities
- evaluating interventions

This more comprehensive approach was renamed the Petrol Sniffing Prevention Program (PSPP), but supply of non-sniffable Opal fuel remained the core component [1]. In July 2008, there were 117 sites supplying Opal fuel, predominantly located in Indigenous communities [40]. Of these sites, 72 were in the NT, 20 in WA, 18 in SA and 7 in Qld. In the APY Lands in SA, all Indigenous communities now only have diesel and Opal fuel available for retail sale.

A recent review of the PSPP noted the empirical and anecdotal evidence of substantial reductions in the prevalence of petrol sniffing following the introduction of Opal fuel [41]. A prevalence survey of petrol sniffing conducted by Nganampa Health Council on the APY Lands in 2004 found that 224 people (8.4% of the total APY Lands population) were identified as having sniffed petrol over the previous 12 months. A survey conducted by the Council in May 2007, subsequent to the introduction Opal fuel, identified only 38 people (1.3% of the total APY Lands population) as having sniffed petrol in the previous eight months, and of these only 18 were regular sniffers. The report stated that, during October 2006 to May 2007, petrol sniffing was rare and sporadic and had occurred at only two communities. It concluded that the replacement of sniffable fuels with Opal was likely to have been a significant contributor to this substantial and sustained reduction in petrol sniffing [41]. These prevalence data are supported by virtually unanimity among stakeholders as to the success of Opal in reducing petrol sniffing. The following are some of their quotes [41]:

> *"Opal has had a huge impact "*
> *"Petrol sniffing has virtually stopped in remote communities"*
> *"It's the best thing that's ever happened here "*(p. 21)

There were three key indicators as to the success of the Opal rollout [41]:

- the large number of communities to using Opal
- the high volume of Opal sales
- evidence of the reduced incidence of petrol sniffing

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The seems little doubt as to the success of Opal fuel in reducing petrol sniffing, but there is concern that unless it is complemented by programs that tackle the underlying social, educational and economic disadvantage experienced by remote Indigenous communities relapse or drug substitution will occur [41, 42].

Physical prevention of access

The strategy of physically preventing access to petrol by locking up petrol supplies has been tried in just about every location where sniffing was a problem [1]. The measures taken have included surrounding pumps with weldmesh cages and using patrol men and guard dogs, but nothing completely stopped petrol being accessed. d'Abbs and MacLean [1] indicated that this does not mean sniffable petrol should be left unsecured where VSU is a problem, but they considered physical security an inadequate prevention strategy by itself.

Statutory restrictions on sales

The benefit of legislating to restrict sales of volatile substances has not been clearly demonstrated. There is evidence from the UK that when legislation was introduced restricting the sale of certain glues containing volatile substances users switched to more dangerous products such as butane and aerosols [43]. There is also evidence that a ban on the sale of cigarette lighter refills to under 18 year olds reduced misuse deaths in this age group [44].

In most Australian jurisdictions, it is an offence to sell volatile substances where the seller could reasonably be expected to know that the product was going to be used as an intoxicant [1]. It is, however, difficult to enforce this legislation and the decision making of some retailers has been driven by concerns that refusing sale to Indigenous people could leave them vulnerable to charges of racial discrimination [45]. Some states also restrict the sale of products containing volatile substances [1]. In SA it is illegal to sell spray paint cans to under 18 year olds and such products have to be kept in locked cabinets. In 2007, the state extended these sales restrictions to wide-tip markers and required retailers to maintain a register of volatile product sales. The state also prohibits the sale of petrol to under 16 year olds. NSW and Qld are the two other states that prohibit sale of spray paint cans to under 18 year olds.

Voluntary restrictions on sales

There have been a number of local programs that have attempted to reduce supply through voluntary agreements with retailers [45, 46]. While evaluations have been scarce, the limited evidence available indicates that convincing retailers to lock up misused products, such as spray paint, and refuse sale where misuse is suspected has been effective when introduced through process involving community development and retailer education. A retailer education campaign in Alice Springs provides an example of this approach [46]. Here, a project officer visited all retail outlets that stocked spray paint. Staff were asked to keep the products in locked storage and were advised of legislation that made it an offence to knowingly sell products where misuse would occur. This intervention reduced spray can sales in Alice Springs by more than 600 a week and numbers of sniffers fell from an estimated 70 to 17. Those who persisted were generally chronic users and there was little displacement of use to other readily accessible volatile substances, such as deodorants and contact glues. These findings suggest that the strategy is likely to be effective with casual or opportunistic users who make up the majority of the using population. It is also likely to best suit smaller urban areas where all retail outlets can be included in the program.

DEMAND REDUCTION

There are a large number of products containing volatile substances, most of which are readily available and cheap to purchase. It is therefore unlikely that supply control, by itself, can ever be effective. Demand reduction measures that address the underlying causes of VSU are also needed. In the Indigenous context, this has to include measures that address the social determinants of health, such as housing, education, employment, access to services, social networks, connection with land, racism, and rates of imprisonment. Petrol sniffing, in particular, can be seen as a manifestation of social deterioration and its elimination is unlikely to be achieved without substantial commitment to the building of social capital in vulnerable communities [47].

Community–based approaches

There is a substantial body of literature on community-based approaches to Indigenous VSU, both in remote and urban settings. The Healthy Aboriginal Life team (HALT) was an early example of a community-based petrol sniffing prevention program [48]. It was based on reciprocity rather than control, and aimed to work with extended Aboriginal families to help them recover their capacity to resolve problems. In the case of petrol sniffers, it sought to reintegrate sniffers with their family systems and to promote the nurturing and controlling capacities of those

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systems. Counselling and education were used to enable communities and families to redefine petrol sniffing as a problem which could be rectified by families.

HALT had some success with its original host community of Yuendumu, but when the model was applied throughout the APY Lands it failed to have an impact [49]. This suggests that orthodox counselling and community development techniques can be effective in reducing petrol sniffing if used with skill, cultural sensitivity and community support. However, the organic nature of the program seemed to work against ready transfer to other communities. Others who have reviewed HALT have expressed concern over its uncritical acceptance of cultural revival as effective prevention and its reliance on traditional child-rearing practices, which may have discouraged parents from disciplining petrol sniffers [50, 51].

Makin' Tracks is a more recent program designed to operate across SA communities affected by petrol sniffing [52]. The objective of the program is to provide support, training and backup for individuals and agencies working with petrol sniffers and their communities. An evaluation noted the need for the program and identified the following strengths which could usefully be incorporated into other Indigenous substance programs [49]:

- the project employed well-qualified staff
- the project had clearly defined objectives based on community needs
- workers were able to respond to the changing needs of individual communities
- an evaluation framework linked to project objectives was established at the beginning of the project and supported by staff
- the project collaborated with other interventions
- staff were able to build community capacity through training and support for local workers
- Indigenous staff members were highly aware of cultural issues such as kinship relations and took these in consideration in their work

The Cairns Inhalant Action Group (CIAG) provides an example of an urban program that focussed on VSU by Indigenous young people [53]. The group was coordinated by the Wuchopperen Health Service, an Aboriginal and Torres Strait Islander community-controlled health service in Cairns. Members were drawn from the Cairns City Council, Queensland Police and non-government and government agencies; a project officer was employed to coordinate responses to VSU. The CIAG implemented the following prevention measures [53]:

- working with retailers to restrict product supply
- staff development in agencies dealing with issues arising from VSU
- interagency case management of known users
- development of an information card and other resources
- conducting needs assessments among service providers and users
- monitoring changes in VSU prevalence
- educating and supporting communities and families about responding to VSU
- advocating to improve service responses for people who use volatile substances

Since the inception of the CIAG, VSU in Cairns has reduced substantially, to the point where the group has reduced its meetings from once a month to twice a year [53].

There have been a number of other community-based programs that have targeted petrol sniffing in both remote and urban settings, with varying success [54]. All have contributed to a better understanding of what elements need to be incorporated if change is to be achieved. Mosey has identified the following three elements as necessary for an intervention strategy to be successful in dealing with VSU in Indigenous communities:

- programs need enthusiastic support from non-Indigenous institutions, such as the council, school and police
- broad community and family support is required, with active involvement in roles such as becoming wardens, taking children to outstations and teaching them about their culture
- several strategies should be implemented as part of any one campaign, including both 'sticks' and 'carrots'.

In addition, Brady [16] has suggested that, because young people in Indigenous communities have very little authority, sniffing is one way to

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be noticed and exercise power. Any response therefore needs to pay attention to young people's needs.

Education, recreation and training programs

There is little universal, school-based education about VSU in Australia on the basis that it draws attention to the practice and, in doing so, may encourage initiation [1]. There have, however, been a number of education programs that target known users and those likely to come into contact with VSU, such as parents, teachers, and health and welfare workers. In addition education programs have been provided for communities where VSU is a problem.

As with more general drug education for young people, scare tactics do not work and information based on the immediate needs and priorities of users prove most influential [1, 4, 55, 56]. In respect to what constitutes salient information for young Indigenous petrol sniffers, interviews with current and ex-sniffers in Maningrida suggested that neurological effects, such as impaired coordination, worried petrol sniffers, particularly when the point was made that such impairment would impact on their ability to play sport [56].

Education and other forms of support for parents can be useful, particularly as those who experimented with VSU in their own youth may not understand the consequences of more intensive use [57]. Programs for Indigenous parents have not been evaluated in Australia, but education campaigns in Native American communities have been linked with decreasing levels of VSU.

A resource kit *Petrol sniffing and other solvents* was published by the Aboriginal Drug and Alcohol Council (ADAC) of South Australia in 2000 [58]. Evaluation of the kit found that it was most useful to professionals and policy makers working indirectly with communities and least useful for community members and parents. The evaluators suggested that such resources would be more useful to Indigenous communities if they were designed specifically for their use and contained flipcharts, interactive games videos and CD in local language.

A number of innovative programs have been developed using Indigenous cultural practices as vehicles for combating VSU. These programs have used art, storytelling and restoration of important caring relationships to redefine the problem of petrol sniffing in Indigenous terms.

The *Sniffing and the Brain* flipchart developed by Cairney and Fitz [59] is an example of a resource that uses images and stories with identifiable cultural associations to assist health and community workers explain the effects of petrol sniffing on the body to Indigenous audiences. Evaluation of the flipchart found that it was viewed positively by stakeholders, who emphasised that the storytelling format and use of images to explain the effects of petrol sniffing on the brain made it an effective tool [60].

Overall, the impact of cultural interventions is difficult to determine, as few have been evaluated. However, such interventions do offer the potential to influence ways in which people think about VSU by harnessing perspectives to be found within indigenous culture, as well as reinforcing traditional capacity to deal with the problem through family and community care.

The Victorian 'Inquiry into Inhalation of Volatile Substances' argued that recreation programs should form part of an overall strategy to combat VSU [4]. However, such programs are difficult to maintain, particularly in remote communities with large numbers of petrol sniffers, and little research is available that systematically examines their effect in either remote or urban settings [1].

Kaltukatjara (Docker River), a remote Indigenous community in south-western NT provides an example of a recreation program that achieved positive effects [61]. Petrol sniffing increased during a period when no organised activities were provided for youth. During this activity void, 'sniffer' parties organised by an influential adult became an attractive recreational option for a proportion of the community's youth. However, when a program of recreational activities was instituted in the community, petrol sniffing declined.

In Alice Springs the 'BushMob' program adapted principles of adventure therapy to suit the needs of young marginalised, mostly Indigenous, people who find it difficult to engage with mainstream services. VSU is common among this group. Up to 10 young men or women are taken on trips which involve risk-taking activities, such as rock climbing, canoeing, and hiking. Subsequently they are provided with follow up support for up the six months. The thinking behind the program is that activities must be exciting if they are to compete with VSU [62].

Education, recreation and education programs that have been successful with Indigenous volatile substance users have: included measures to avoid stigmatising users; strengthened cultural connections; involved the community; provided alternative education opportunities; focused on the development of work skills; included a range of activities; provided opportunities for challenge and risk-taking; and have been offered on a flexible basis to suit local circumstances. Follow up is also important for maintaining change, so for example paid employment should follow from an employment program.

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Clinical treatment and management

The literature on the treatment and management of VSU is limited and typically concludes that outcomes are poor, as users do not respond treatment approaches that work with other drug users [63]. Over 80% of the 550 respondents to a survey of drug treatment practitioners in Canada assessed their volatile substance using clients' prospects of recovery as only 'poor' or 'very poor'

Counselling is the form of treatment usually provided by Australian drug and alcohol treatment services in response to VSU, although there is little research as to the efficacy of this form of intervention [64]. The Drug and Alcohol Services Association (DASA) has provided a detoxification program in Alice Springs over a number of years for volatile substance users aged 17 years and over. This program provides treatment involving negotiated case-management, and structured after-care for people. Clients receive a medical examination within 48 hours of admittance. They then receive a series of counselling sessions based around a holistic program that also involves group activities and outings, and includes nutrition information, relaxation and exercise. Out of the initial group of 20 young people who attended the program, nine were regarded as having 'very positive outcomes' [65].

The Victorian Department of Human Services has produced guidelines for managing and treating users of volatile substances [66]. These recommend that a similar approach to other drug treatment should be taken, although they also suggest that the young age of many users should be a consideration when formulating treatment plans. The guidelines advise that clients should be told about harms of VSU. Motivational interviewing, self-monitoring strategies and relapse prevention should form part of any long-term individual counselling strategy. Recommended therapeutic techniques include goal setting, developing contracts with clients as to consequences for VSU, and skill development in managing emotions, decision making and communication. Family-based interventions are recommended where possible, as is support to reduce social isolation. The Victorian guidelines stipulate that responses to VSU should be aimed at promoting abstinence and that services must not allow clients to use volatile substances on their premises.

In recognition that treatment options for other substances may not be generalisable to VSU, The Office for Aboriginal and Torres Strait Islander Health (OATSIH) in the Australian Department of Health and Ageing has commissioned the National Health and Medical Research Council to produce clinical practice guidelines specifically for volatile substance use (VSU) [67]. The guidelines will be suitable for use by health professionals including: medical practitioners; nurses; Aboriginal health workers; alcohol and other drug workers; and allied mental health workers. The guidelines will be applicable in primary health, emergency, mental health, alcohol and drug service settings. They will be based primarily on a review of existing evidence, but expert opinion will also be sought. A draft will initially be made available for public comment, with the final version planned for release in 2011.

Homeland programs

Homeland or outstation programs, have been seen as a response to petrol sniffing in Indigenous communities in two ways: first, as prevention, in that families who move to homeland centres are less likely to be plagued by substance misuse; and second, as remediation, whereby petrol sniffers get away from petrol and get involved in more constructive activities [1]. Great hopes were held in the 1980s for the homeland movement as a solution to petrol sniffing. However, these hopes were not realised, and the only outstations that did make a difference were those that incorporated treatment or rehabilitation facilities, such as Mt Theo.

The Mt Theo program is widely recognised as a success story in preventing petrol sniffing at its associated community of Yuendumu. Yuendumu had 70 petrol sniffers when the program started in 1994, but is now generally free of VSU. Mount Theo is considered a sacred healing place with strong *Jukurrpa* (dreaming) [68]. It is very isolated, making it almost impossible for young people to leave without adult assistance. Sniffers and other young people at risk are taken there and looked after by tribal elders until they have recovered from the effects of sniffing. Activities include gardening, work as part of the Community Development Employment Program (CDEP), traditional activities and training courses. After a month young people are allowed to return to their community of origin, but if they recommence sniffing they are immediately taken back to Mt Theo. While the program caters for all Walpiri young people, it has been particularly successful with children of families who were traditional owners for the area. Here, their links to the country and their care during that time by family members seemed critical. While Mount Theo has received government funding, the program has always been supported by Aboriginal people from the Yuendumu community [69, 70]. Senior Aboriginal people run the activities and the relations they forge with young people are critical to the program's success. The success of Mt Theo also depends on a range of complementary measures that have been implemented. These include working concurrently with all four Walpiri communities and Alice Springs agencies.

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Harm Reduction

Harm reduction as a response to drug use is contentious because its focus is not on stopping or reducing use, but rather on the adverse consequences associated with use. The approach rests on the premise that cessation is not always possible, and a practical response in such cases is to reduce harmful consequences [1]. The literature identifies two main strategies for reducing the harm from VSU. The first involves reducing the risks that come from the settings in which VSU occurs; the second involves changing what is used and how it is used.

There is a strong case for making inhalant users aware of harm reduction options because VSU entails such a high risk of serious consequences, including death. However, harm reduction strategies rarely feature in responses to VSU, because of the 'moral panic' such strategies, particularly supervised use, have engendered in the past [71].

A less controversial harm reduction strategy than facilitating supervised use is to educate users of strategies they can use to reduce the likelihood of death or injury. Several harm reduction practices for users are described in the literature [72, 73]. These include:

- using small containers with small surface areas allows more air to be inhaled at the same time;
- there is a risk of suffocating from the container or coverings used to concentrate the fumes, such as blankets and blankets.
- choking on vomit is a significant cause of VSU-associated death. Anyone who witnesses a person pass out as a result of VSU should ensure the person can breathe and then call an ambulance as soon as possible.
- using other drugs concurrently with volatile substances (particularly drugs such as alcohol, heroin which are also central nervous system depressants) increases the risk of overdose.
- precautions should be taken against accidental burning. For example, cigarettes should not be smoked while using volatile substances.
- anyone affected by volatile substances should not be startled, or chased, as sudden death appears more likely when a sniffer's heart rate is elevated.

Some groups of young people who use volatile substances have developed their own harm reduction strategies. Incarcerated Indigenous volatile substance users in Western Australia practised harm reduction through their choice of inhalant. Where possible, they used contact glue rather than petrol as they saw this as less harmful, and this is actually support by research evidence [74, 75]

Law Enforcement

In Australia it is generally accepted that VSU is a health and welfare, rather than a criminal justice issue. VSU is not a criminal offence in any Australian jurisdiction, but it still poses a challenge for law enforcement agencies, as users are at high risk of harming themselves and others, damaging property and threatening family and community wellbeing. Furthermore, without police support, health and welfare agencies can find it difficult to intervene with users [1].

Some Australian jurisdictions have increased police powers to intervene in cases of VSU. In the case of Queensland, an evaluation concluded that the amended powers had served a useful role [76]. On the negative side, the evaluation reported a widely held perception that, as a result of the new legislation, police had been given primary responsibility for addressing VSU. This meant that cases were often left with police and not followed-up by health and welfare agencies

A number of Aboriginal communities have imposed their own sanctions on VSU in the form of by-laws. However, in some places the effectiveness of these has been compromised by a lack of suitable places to which apprehended users can be taken, and/or by an absence of police to enforce the by-laws [1].

Community patrols are increasingly a feature of Indigenous communities, where they provide transport and care for at-risk community members, especially those intoxicated by volatile substances or alcohol [77]. Common to all of these patrol programs is a high level of local Indigenous community ownership, and a reliance on volunteer staffing, with success more likely if there was adequate community consultation at the outset, the relationship with police is clear, the duties of patrollers are well defined, and a strong management structure is in place [78, 79].

Although most of the evidence relating to law enforcement in relation to VSU is descriptive, d'Abbs &MacLean [1] identified a number of pre-conditions for effective policing of VSU. These are:

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- legislation creating appropriate and adequate police powers;
- an adequate police presence in VSU-affected areas;
- trained and supported community-based agencies, including night patrols;
- places of safety other than police cells;
- referral options;
- sentencing options; and
- clearly articulated linkages with health and welfare sectors.

Conclusion

Until about ten years ago government responses to VSU were largely uncoordinated and not that successful. Typically responses occurred in reaction to a media-driven crisis, and involved one off grants to non-government agencies dealing directly with users. Few interventions were strategic in nature or well evaluated, and the corporate sector had little involvement in preventing the misuse of products they manufactured or marketed [1]. In the last decade this had changed substantially. There has been increased commitment of government resources and in many cases these have been put into long term VSU programs. There is co-operation between governments and a commitment to a coherent VSU policy framework, which culminated in 2006 in the adoption of a new policy articulated in *National Directions on Inhalant Abuse* [13].The role of BP Australia in developing Opal fuel demonstrates the important role that industry can play in combating VSU through the provision of safer products. Affected communities are also playing a much more active role. Community patrols and outstation programs are important ways for communities themselves to manage petrol sniffing and other forms of VSU. As a result of this range of concurrent strategies that address supply, demand and to some extent harm, petrol sniffing in particular is much less of a problem.

Much remains to be done, however, as the focus of current programs has been on the proximal factors that influence use, rather than on the more distal social determinants of VSU and other health behaviours. There is little point in assisting someone to cease VSU if this is quickly replaced by other harmful practices such as use of cannabis [80]. In the long term the most effective strategies for combating VSU, are those that improve young people's lives and the health and wellbeing of their families and communities. This involves taking measures to redress the socio-economic disadvantage experienced by Indigenous communities.

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