

# Chronic Solvent Abuse: Epidemiology, Other Substance Use and Psychiatric Co-morbidity.

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**S**olvent abuse, especially in its chronic form, is a significant but often under-recognized public health problem. Although the abuse of solvents is more common among young people, the pattern of abuse in the adult population tends to be more chronic and severe. This paper reviews the epidemiology of chronic solvent abuse, along with its relationship to psychiatric disorders and the abuse of other substances. Due to a paucity of research in this area, there is limited knowledge of the natural history of chronic solvent abuse.

The abuse of organic solvents has been recognized as a public health problem in North America since the early 1960's (1). Also referred to as volatile substances or inhalants, members of this heterogeneous class of drug (eg. toluene, acetone) are found in a variety of chemical preparations, such as glue, aerosols, cleaning fluid, and paint thinner. Although inhalant abusers may prefer one particular substance because of odor or taste, individuals may use a variety of different agents, depending on the availability and price (2). In most cases, solvents may be inhaled directly from an open container, a soaked rag is held to the face and sniffed, or the substance (eg. glue) is poured into a bag and the fumes are inhaled (although methods ranging from drinking solvents to attempted intravenous injection have also been used) (1,2). Blood levels of most solvents peak within minutes and are rapidly taken up into fat stores, including lipids in the central nervous system.

Organic solvents exert an excitatory effect on the central nervous system followed by a depressive phase (3). The person intoxicated with inhalants may initially become disinhibited and euphoric.

Tinnitus, ataxia, and occasionally hallucinations (both auditory and visual) can occur (3). As the effects of the solvent wear off, usually 30 to 45 minutes after cessation of exposure, the person becomes lethargic and increasingly somnolent. Some degree of amnesia for the event is usually present on recovery (3).

The medical complications of solvent abuse include muscle weakness, gastrointestinal complaints, renal dysfunction, electrolyte abnormalities and cardiac arrhythmias (4). Neurologic sequelae of long-term solvent abuse involve cerebellar toxicity, peripheral neuropathy and a potentially irreversible encephalopathy (1). Byrne *et al.* (5) suggest an association between chronic solvent abuse and temporal lobe epilepsy.

## EPIDEMIOLOGY

The epidemiology of solvent abuse, especially in adults, has received little systematic study. Inhalant use is generally considered to be more common among younger people, as solvent abuse has been reported to be a particular problem in adolescents, especially when accompanied by conduct problems (2,6). In the United States for 1979, it was reported that 9.8% of adolescents (aged 12 to 17) had tried inhalants at least once. A decade later, it was estimated that nearly 7% of all high school seniors in the U.S. had ex-

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perimented with inhalants during the previous year (2). In Canada, the estimated rates for solvent abuse among young people tend to be lower (approximately 3 to 6%), although substantially higher rates have been reported in some Native Canadian populations (2,5). Among young solvent abusers, the practice predominates in boys between the ages of 13 to 15 and it is usually a group activity (7). However, it appears that only a minority of young people who experiment with these substances go on to use them regularly (2,3).

Much less is known of the practice among adults but there are indications that it may not be as uncommon as once thought. Recent reports of growing solvent use among adults indicate that the age of distribution of solvent abusers may be broadening (2). Case reports have demonstrated chronic solvent abuse in adults, although large scale epidemiological investigations are lacking.

The prevalence of inhalant abuse appears to be greater among those of lower socio-economic backgrounds or certain economically disadvantaged groups (8). Others at risk for abusing solvents include those whose work brings them into contact with inhalants as well as people incarcerated or living in isolated settings where other illicit drugs are not available (9). As with the use of other psychoactive substances, there also appears to be a significant gender difference in the rate of use (2). Males substantially outnumber females in cases of inhalant use which reach medical attention (eg. sudden deaths or emergency room contacts). In line with this, a retrospective study by Dinwiddie *et al.* (6) showed that chronic solvent abusers were significantly more likely to be male and of lower socio-economic status.

## OTHER DRUG USE

While epidemiologic studies indicate that a substantial number of children and adolescents have experimented with solvents, it appears that most who use inhalants at a young age do so only a few times, then abandon the practice (2). Due to its popularity among youths, solvents have been considered a "gateway" drug, potentially leading to the abuse of other substances (2).

However, in adults for whom inhalants are the intoxicant of choice, the pattern of abuse seems to be different. A retrospective study by Dinwiddie *et al.* (6) examined a sample of 130 chronic solvent abusers comprised of treated alcoholics, convicted felons and their relatives. Contrary to previous understanding, solvent use clearly did not precede other substance abuse in these adults. Rather, alcohol and cannabis use tended to occur first, followed by the use of solvents. These findings also indicate that any history of solvent use appears to be a marker for polysubstance abuse. Over 90% of the solvent abusers reported lifetime experience with three or more classes of illicit drugs and over two-thirds

used substances from every class of drug (cannabinoids, opioids, stimulants, depressants, and hallucinogens) (6). Use of cannabis and alcohol was essentially universal among these solvent abusers. On average, the subjects began to use other substances at a significantly younger age than those who used the same substances but reported no history of solvent abuse (6).

A chart review by Dinwiddie *et al.* (1) reviewed the records of eleven patients who had been admitted to psychiatric hospital for chronic solvent abuse. At the time of admission, marijuana and alcohol were the most common other drugs used. Five of the eleven patients reported concurrent use of marijuana and four others admitted to using marijuana in the past. Six patients revealed concurrent use of alcohol, although only one met the DSM criteria for alcoholism. In addition, the subjects reported previous use of many other substances, including stimulants, depressants, narcotics and hallucinogens (1).

Thus, it appears that chronic solvent abuse in adults is associated with polysubstance abuse and that the abuse of other substances (eg. alcohol, cannabis) may precede use of solvents. Perhaps one reason for this finding is that substance abusers from economically disadvantaged groups have abused industrial solvents when they were unable to purchase more expensive drugs (9).

## PSYCHIATRIC COMORBIDITIES

The question of psychiatric co-morbidity in solvent abusers has prompted few investigations. As is the case with other forms of substance abuse, the most consistent finding has been a link between solvent abuse and antisocial behaviour (2,10). In the literature, an association has been found between chronic solvent abuse and antisocial personality disorder (ASPD). Through a retrospective study that identified 130 solvent abusers, risk for diagnosis of ASPD was significantly elevated for all subjects (10). A smaller study by Dinwiddie *et al.* (1) demonstrated that seven of eleven chronic solvent abusers met criteria for ASPD. These findings agree somewhat with those of Crites and Schuckit (11) that show a relatively high frequency of ASPD diagnosis in young solvent abusers. These young subjects who had a history of solvent abuse were more likely than non-abusers to report antisocial behaviours and to merit the diagnosis of ASPD (11). However, the question of causation cannot be answered by retrospective studies in that it is difficult to conclude if chronic solvent abuse gives rise to ASPD or the personality characteristics of a person with ASPD makes him/her more susceptible to chronically abusing solvents.

It appears that the relationship between ASPD and substance abuse is complex and not fully understood (12). Dinwiddie *et al.* (10) hypothesize that given

the strong association between solvent abuse and ASPD, the two conditions may share common determinants involving personality characteristics, such as having little dependence on social reward, lack of concern for potential harm and a tendency to seek out novel experiences. Prospective research (ie. a cohort study) is necessary to answer the question of whether antisocial traits contribute to the use of solvents.

Regardless of its etiology, solvent abuse appears to be a risk factor for impulsive and socially deviant behaviour as evidenced by the markedly increased likelihood in this group meeting the DSM criteria for ASPD. Findings of Byrne *et al.* (5) suggest that the chronic inhalation of toluene-based adhesives can produce a paranoid psychosis. Twenty-two patients with long histories of solvent abuse (inhalation at least once daily for two years or more) were reviewed in the study. Eighteen developed an acute paranoid psychosis with visual and auditory hallucinations. Additionally, three patients were diagnosed as suffering from temporal lobe epilepsy, which was felt to be related to their solvent abuse, and two other patients had documented decreases in their IQ levels while they were abusing solvents (5). Similarly, other evidence indicates that chronic solvent exposure can result in an irreversible encephalopathy, with psychosis and a deteriorating course (13). Therefore, despite a relatively small amount of study on this specific topic, it appears that chronic solvent abuse may indeed have neuropsychiatric sequelae.

## CASE PRESENTATION

P.H. is a 50 year old male. He was sexually abused as a young child by a male friend of his family but denied any physical abuse. Alcohol use began at the age of 14, as he provided sexual "favors" to two men in return for alcohol. P.H. moved to Halifax in the 1960's and joined the Navy for five years. He then spent time (about two years each) as an electrician and in the coast guard before becoming a seaman for approximately 10 years (until July 1984). He was fired from this last job for not reporting to work (see below). Meanwhile, P.H. had married in 1969 ("to prove to my father my manhood") and had two children from the marriage. He divorced in 1975 because his wife discovered that he was homosexual. It was a mutual break-up and his wife departed for Ontario with their two children. He has not seen them since.

P.H. was twice convicted of sexually assaulting young boys (1983 and 1984). During his last days as a seaman, co-workers learned of the second incident. As a result, P.H. would not report to work due to his co-workers' hostile reactions ("they'd try to kill me") and was subsequently fired from the job.

His psychiatric history began in 1980, upon admission to the Nova Scotia Hospital. He was hospital-

ized because of an acute attack of anxiety and alcoholism which culminated in a suicide attempt. It was during this hospitalization that P.H. was introduced to solvents. After discharge and time at a detox center, a pattern of substance abuse developed and continued for five years, consisting of alcohol, paint thinner, glue and various street drugs.

P.H. was first seen as an outpatient at Camp Hill in February of 1985 and was admitted later that month. His presenting complaint was "...I don't want to go out...I want to be alone all the time...When I go out, men are staring at me and they all want to have sex with me..." Prior to admission, he was drinking "about 48 beers a day." He revealed that after being charged with the second sexual assault in 1984, he began feeling suspicious, more avoidant, and started to drink heavily. He felt "guilty" regarding his homosexuality and pedophile behavior.

Following discharge, he continued his pattern of marijuana, glue and alcohol abuse and experienced uncontrollable bursts of anger. In June of 1985, he married a woman who had lived next door to him in a boarding house. Their relationship quickly deteriorated. A month into the marriage, he had a heated argument with his wife (supposedly over sexual problems that he was having) and assaulted her. As a result, she left him permanently and filed a charge of assault causing bodily harm. After this incident, P.H. continued alcohol and hashish use along with glue and paint thinner sniffing, sometimes using up to half a liter per day.

In 1986, he developed a seizure disorder which was diagnosed as temporal lobe epilepsy. Over the next seven years, it appears that P.H. continued a pattern of chronic intermittent solvent abuse. This consisted of periods of sniffing a liter or more per day of solvents more or less continuously for several months interspersed with intervals of no abuse. P.H. also had a number of amnestic exploding episodes during this period. These episodes were best described as rampages or "fits of temper" in which he would strike out at others and become verbally and physically abusive. After an episode was over, he would be unable to recall anything about it.

### *Discussion of case presentation*

P.H.'s pattern of solvent abuse is a chronic one. There are times when he managed to "stay clean" and avoid solvents. However, these intervals were followed by relapses which were often for extended periods of time and the amounts of glue or paint thinner that he inhaled remained constant or increased dramatically.

This subject displays definitive characteristics of a chronic solvent abuser. Perhaps most striking is his polysubstance abuse. The solvent abuse, consisting of paint thinner inhalation and glue sniffing, began after he had become an alcoholic. In addition to the solvents, he continued to use alcohol and hashish as well as vari-

ous street drugs. The subject has also exhibited socially deviant behaviour (eg. two counts of sexual assault and a charge of spousal abuse) in addition to an acute paranoid psychosis, suggesting significant psychiatric co-morbidity. The development of temporal lobe epilepsy is most likely secondary to years of inhalant use.

### CONCLUSION

Despite a relative scarcity of information, this paper attempts to present the epidemiology, psychiatric co-morbidity and polysubstance use associated with chronic solvent abuse. Long-term inhalant users are more likely to be male and of lower socio-economic status, although large scale epidemiological studies are currently lacking. Chronic solvent use is associated with polysubstance abuse and it appears that the use of alcohol or cannabis may precede the use of solvents. In terms of psychiatric co-morbidity, there is a link between solvent abuse and ASPD. In addition, it is possible that long-term use of solvents results in a paranoid psychosis as well as other neuropsychiatric sequelae.

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