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Inhalant Use Among Child Welfare Populations: Implications for Intervention

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Abstract:

Inhalant use poses a significant threat to the health and well-being of vulnerable youth, particularly those involved in child welfare systems. This study examines the prevalence and supplements of inhalant use among adolescents in child interest populations. Data from the public Child Abuse and Neglect Data System (NCANDS) and the National Survey on Substance Abuse Treatment Services (N-SSATS) reveal intimidating rates of inhalant use among child interest youth, with 12.6 reporting lifetime use. Inhalant abuse poses a significant public health concern, particularly among vulnerable populations. This study examines the prevalence, predictors, and consequences of inhalant use. Analysis of public data reveals intimidating rates of inhalant use, with 9.5 of adolescents reporting lifetime use. Although inhalant abuse is common, it's one of the most neglected and overlooked forms of substance abuse. Inhalants relate to a wide variety of substances including unpredictable solvents, aerosols, mannas, and nitrites. The mechanism of action of inhalants has not been completely defined. Several molecular targets contribute to the pharmacology, including ion-channel proteins that control neuronal excitability. These agents interact with colorful receptors and can beget changes in cell-membrane fluidity and nerve-membrane ion channels. Three main pharmacologic categories of inhalants, videlicet, unpredictable solvents and anesthetic delights, nitrous oxide, and unpredictable alkyl nitrites, have distinct pharmacologies, mechanisms of action, and toxicities.

KEYWORDS:- adolescents; child welfare; inhalants; peers; substance abuse.

Introduction

Inhalants are dangerous volatile agents. Except for anesthetic gases that are used in surgical settings, these agents were no way designed for mortal consumption. Inhalant abuse involves the deliberate inhalation of substances to reach ecstasy and an altered internal state. Inhalants relate to a wide variety of substances including unpredictable solvents, gases, aerosols, and nitrites. Inhalant abuse is relatively current and is a problem seen around the world, especially in impoverished or marginalized artistic groups.¹ still, it's frequently not honored and is an overlooked form of substance abuse. Inhalant use is among the most current, nocuous, and inadequately understood forms of adolescent medicine use. The most generally abused inhalants among U.S. adolescents are glue, shoe polish, toluene, lighter fluid, and gasoline, although varied

mixtures of chemicals are set up in scores of commercially available and extensively crushed products. Inhalants are among the top 4 medicines most probably used by adolescents and teen agers after tobacco, alcohol, and marijuana. According to the Centers for Disease Control and Prevention (CDC),² the prevalence of lifetime inhalant use in 2003 was 13.6 for 9th, 11.1 for 10th, 11 for 11th, and 11.8 for 12th grades. These rates were slightly different from what was reported by the Monitoring the unborn study,³ which estimated (for the same time) that 17.3 of 8th, 12.4 of 10th, and 10.9 of 12th graders nation-wide used an inhalant at least formerly in their lifetime. presently, public data on inhalant use among those youngish than eighth-grade scholars is n't available. The closest estimation is from the National Survey on Drug Use and Health (NSDUH) by the Substance Abuse and Mental Health Services Administration (SAMHSA), which surveyed a sample of 12- year- oid or aged residers of house- holds, noninstitutional group quarters (eg, shelters, sheltering houses, dormitories), and civilians living on military bases. According to its year 2003 estimate, the lifetime prevalence of inhalant use was 7 for those aged 12 years and 10.6 for those aged 13 years civil.⁴

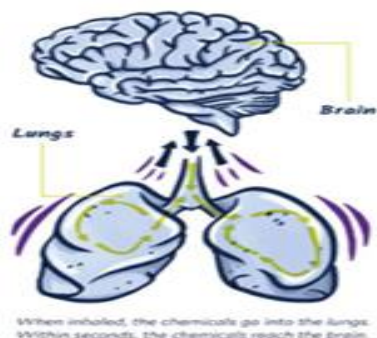


fig. 1:- The Body's Response to Inhalants

When inhaled the chemicals go into the Lungs. Within seconds the chemicals reach the Brain.

✚ Definitions:-

1. **Bagging:** gobbling fumes from impregnated cloth scattered with euphoria-converting substances and deposited inside a paper or plastic bag. Ballooning gobbling a gas generally nitrous oxide) from a balloon.
2. **Chroming:** scattering paint from an aerosol can into a plastic bag and also breathing the vapors from the bag. Dusting scattering an aerosol directly into the nose or mouth. Gladding gobbling air- freshener aerosols scattered in the proximity of face.
3. **Cohere sniffer's rash/ huffer's rash:** An eczematous dermatitis with seditious changes and pyodermas seen substantially in the perioral area extending to the midface caused by the drying effects of inhalants, especially hydrocarbons dissolving dermal lipids from skin.⁵
4. **Huffing:** gobbling a substance from a cloth or rags that have been soaked or impregnated and are held close to the face.
5. **Poppers/snappers:** Amyl nitrite packaged in small bottles that are opened to release the vapors; vended under trade names Super Rush, Locker Room, Bolt, Jungle Juice, Quick Silver, and Extreme Formula.
6. **Popper's maculopathy:** poisonous maculopathy due to the use of alkyl nitrites, which can beget structural changes in the architecture of the retinal fovea performing in loss of central vision.⁶
7. **Sniffing/ snorting:** gobbling a substance from an open container directly through the mouth or nose.
8. **Snotballs:** gobbling smoke from the combustion of rubber cement, where the tenacious is generally rolled into balls also burned to release the fumes.⁷
9. **Whippets:** vials of nitrous oxide gas, utmost generally from whipped cream aerosol canis ters. The nitrous oxide can be uprooted following whipped cream discharge, after which the released gas can be gobbled at close range or transferred to a balloon and also gobbled.⁸

Aim & Objectives

Aim:-

To understand the prevalence, risk factors, and health impacts of inhalant use among various populations.

Objectives:-

1. Determine the rate of inhalant use in different demographic groups, such as adolescents, incarcerated youth, and those involved in child welfare.
2. Examine sociodemographic, psychosocial, and behavioral factors that increase the likelihood of inhalant use.
3. Investigate the short-term and long-term health consequences of inhalant use, including physical, mental, and cognitive effects.
4. Identify factors that can mitigate the risk of inhalant use, such as school engagement and positive peer relationships.
5. Formulate effective prevention and intervention programs to reduce inhalant use and its associated harms.

Need of Study

Research Gaps:-

1. Epidemiological studies: Updated prevalence data, particularly among vulnerable populations.
2. Long-term effects: Investigations into chronic inhalant use consequences.
3. Neurobiological mechanisms: Understanding inhalant-induced brain changes.
4. Prevention and intervention: Evaluating effectiveness of programs.
5. Treatment outcomes: Assessing evidence-based treatments.

Demographic Predictors:-

1. Age: Early adolescence (12-14 years) increases risk.
2. Gender: Males are more likely to initiate inhalant use.
3. Socioeconomic status: Lower income and education levels.
4. Ethnicity: Higher prevalence among Indigenous, Hispanic, and African American youth.

Psychological Predictors:-

1. Mental health issues: Depression, anxiety, trauma.
2. Substance abuse history: Family or personal history.
3. Sensation-seeking behavior.
4. Low self-esteem.

Volatile Solvents and Anesthetic Gases¹⁰

In this suggested scheme, commonly abused inhalants are categorized into 3 main groups based on similarities in their pharmacologic properties:

- 1) volatile solvents and volatile anesthetic gases;
- 2) inorganic anesthetic gases (nitrous oxide); and
- 3) volatile alkyl nitrites, with a distinct mechanism of action as vasodilators.

Such a classification scheme for the 3 main categories of abused inhalants and common products is listed in Table 1.

table 1: Pharmacologic classification of commonly abused inhalants

Pharmacologic Class	Chemical (state)	Common Sources
1. Volatile solvents and gases		
Aliphatic hydrocarbons	Butane, propan, methane(gas)	Lighter fluid, bottled fuel, aerosol propellant
	n-Hexane (liquid)	Adhesive, gasoline, industrial solvents, rubber cement
	Kerosene (liquid)	Lighter fluid
	Isooctane (liquid)	Automotive fuel
	Naphtha (liquid)	Shoe polish, adhesive
	Turpentine(liquid)	Paint thinner, solvent
Aromatic hydrocarbons	Benzene (liquid)	Gasoline, rubber cement
	Toluene (liquid)	Adhesives, paint thinner, spray paint, rubber cement, nail polish remover
	Xylene (liquid)	Paint thinner, adhesive, degreaser
2. Halogenated hydrocarbons		
Chlorinated hydrocarbons	Carbon tetrachloride (liquid)	Cleaning solutions, aerosol propellants
	Chloroform (liquid)	Cleanser for plastic compounds, adhesive, spot remover
	Ethyl chloride (liquid)	Topical anesthetic
Ketones	Acetone (liquid) Methyl butyl ketone(liquid)	Nail polish remover, paint thinner solvent, adhesive
3. Volatile anesthetic gases		
Alkane volatile anesthetics	Halothane (gas)	Nail polish remover, paint thinner solvent, adhesive
Dinitrogen monoxide	Nitrous oxide (gas)	Canned whipped cream

(Sina Radparvar et.al. 2023)

Treatment Strategies for Volatile Solvent Abusers in the United States

Treatment for substance abuse dependence has presented a major challenge in the United States because of the complex nature of drug abuse behavior. As treatment has reached greater levels of sophistication, it is clear that there are distinct differences in the treatment methods that are needed to treat users of the various chemicals effectively. For instance, people with cocaine addiction appear to have lower relapse potential if they complete a program with specific implications for cocaine treatment. Heroin addiction represents yet another treatment modality with unique considerations, particularly concerning the use of methadone maintenance.¹³

The interviews and focus groups included 37 treatment professionals providing treatment for solvent abusers, 14 adult outpatients, and 265 youths who represent inpatient, outpatient, and experimental solvent abusers. Inhalant treatment facilities and schools reporting problems with inhalant use arranged focus groups and interviews that would provide information regarding solvent abuse and factors related to treatment and prevention. Parental and client consent was obtained to facilitate 10 focus groups with solvent abusers. In addition, numerous interviews and focus groups with treatment professionals were conducted. The focus groups for professionals centered on (1) characteristics unique to volatile solvent abusers, (2) methods used that were effective, (3) methods that proved ineffective, (4) obstacles to treatment, (5) what resources are used most often, and (6) what needs still are unmet. Focus groups for clients were more general in nature, allowing open discussion regarding first use, transition to chronic use, patterns of use, the prevention efforts they had encountered, and treatment methods that worked most effectively for them. Combining the existing research base with the experiential knowledge of treatment providers and patients has led to at least a beginning body of knowledge regarding treatment approaches to solvent abuse treatment. The comments put forth here pertain mostly to the characteristics and treatment needs of young solvent abusers, but it must be recognized that there are a substantial number of adults who also are in need of treatment. Unfortunately, very little is known about this group of adult users since they often are a “hidden population” in that few, if any, treatment centers have consistent process and outcome data from a solvent-specific treatment program

for these adult users. They can be difficult to access because they may become transient or homeless due to their using behaviors and frequently are ostracized by other drug users.

STRATEGIES IN TREATMENT:-

The strategies for treatment were developed based on information provided from the focus groups, interviews, and personal treatment and research experience of the authors. It is important to note that effective treatment strategies just now are being developed. Basic research issues regarding effective treatment assessment, intervention, and inpatient versus outpatient treatment are discussed by Jumper-Thurman and Beauvais (1992). Certainly, further collaboration between research and service provision must occur for progress in the area of volatile solvent treatment. Information from both patients and providers indicate that, when admitted for treatment, solvent-abusing children are distant and hard to reach. However, they are anxious to bond quickly to their peer group. Some treatment facilities have utilized this as an opportunity for treatment and have developed a "peer patient advocate" system. Using a peer who is further along in the treatment process provides the incoming youths with someone to "teach them the ropes" and give them support. This relationship is monitored closely by treatment staff and seems to be very effective given the remarks made by youths in those centers: "It's really scary to be away from home, I felt like I had a big brother to watch out for me"; "When you're in a new place and you don't know the rules, it helps to have someone watching out for you"; and "I didn't want to talk to an adult, so I had someone my age to listen to me." Other factors also are essential for the treatment of volatile solvent abusers. Because of the serious physical risks, assessment must ascertain physical condition, cognitive functioning, extent of neurological impairment, psychosocial supports, individual strengths, personal functioning, and legal standing. In summary, What constitutes effective treatment for solvent abusers? Recognizing the many obstacles facing youths who have abused solvents, a comprehensive treatment plan should include: (1) adequate time for detoxification or treatment readiness and physical recovery; (2) use of a peer patient advocate system; (3) thorough assessment of physical, cognitive, and neurological functioning; (4) recognition and building of existing strengths and skills; (5) development of new strengths; (6) treatment-provider training specific to solvent-abusing patients; (7) addressing of personal and family issues; and (8) cultivation of the resources necessary to initiate a healthy transition back into the home community. Often treatment, by its nature, is focused on problems and obstacles. Yet, when confronted with a solvent-abusing adolescent with multiple problems, it is essential to find and build on the existing strengths. These strengths may be family support, caring for friends, artistic skills, or writing or musical ability. It sometimes is helpful to reframe negative behavior into a strength so that there are blocks on which to build other strengths. Providers must acknowledge that volatile solvent abusing patients are not hopeless, although it is important to keep treatment expectations realistic. Inpatient treatment must include an extended period of detoxification or treatment readiness before initiating specific therapeutic interventions. In fact, effective treatment can be expected to be long term, possibly even up to 2 years. Certainly this sounds like an expensive endeavor; however, the cost of volatile solvent abuse treatment must be weighed against further costs for this population and the public, including incarceration, medical expenses, and welfare support.¹⁴

TYPES OF INHALANT USERS:-

There are three main types of inhalant users:

- (1) inhalant dependent adults,
- (2) polydrug users, and
- (3) young inhalant users.

Nearly all inhalant users in the United States fall into one of these three groups. This classification derives from an evaluation of the literature and the analysis of thousands of school-based surveys we have collected over the past 10 years. It is very interesting to note, however, how closely the types correspond to the typology presented by McSherry (this volume), who describes inhalant users from a clinical perspective.¹⁵

Inhalant-Dependent Adults:-

Membership in this group would be defined by the person's constant and heavy use of inhalants. This group consists almost entirely of long-term drug and alcohol users for whom inhalants have become the drug of choice. They get high on inhalants frequently (often every day); and they stay high for long periods of time, often 6 hours or more. Most are in their twenties or thirties, although a very few may be younger or older. Streicher et al. (1981) note that these inhalant-using adults are quite rare compared with adults dependent on

other forms of drugs, but that their inhalant use is likely to be very severe.

Adults who are inhalant dependent usually suffer from serious social and employment problems and often have legal problems as well. Inhalant users in general have a reputation for violence, for crime, and for other forms of deviance. This bad reputation of inhalant users is likely to be, at least in part, a result of the problems of these inhalant-dependent adults.¹⁶

Polydrug Users

Polydrug users are typically adolescents who use drugs frequently, whose drug use plays a major role in most of their activities, and who use more than one type of drug, most often taking stimulants and at least one form of "downer" in addition to using marijuana heavily. Along with these other drugs, a few polydrug users also use inhalants. Inhalants are hardly ever the preferred drug; they merely provide one more effective way to get high.

Young Inhalant Users

When young children are just getting started in drug use, they use one or more of three drugs: alcohol, marijuana, and/or inhalants. When a child just tries alcohol or uses a little with his or her family, it does not necessarily indicate drug involvement. On the other hand, when a child gets drunk with his or her friends, it is a mark of drug involvement. Some younger children also use marijuana, and a few use inhalants. The child who uses inhalants frequently is also likely to use alcohol and/or marijuana. When inhalants are used and no other drugs except alcohol or marijuana are used, the child would be classified as a young inhalant user.¹⁷

Inhalants: A Policy Analysis of the Problem in the United States

Inhalant abuse has been an element of the drug abuse problem for more than 30 years. Attention to the problem, if not the nature and extent of the problem, has waxed and waned over this time as the public and media repeatedly take note of and then forget the problem of inhaling or sniffing products like glues, gasoline, paints and varnishes, assorted aerosolized products, and other products containing volatile aromatic constituents. The problem has been addressed sporadically by the Federal Government, but most of the effort and attention toward inhalants has been shown by State legislatures. This chapter summarizes the findings of a comprehensive study on the nature and extent of the problem and the alternative policy approaches that have been used to address inhalants in the United States (Harwood et al. 1993).

The overall level of abuse of inhalants appears to have been refractory to most initiatives undertaken to date, although there seems to have been some limited product-specific successes. There are four general policy approaches that can be, and have been to various extents, taken to address the problems of inhalants. These are:

- Change products;
- Restrict access to abusable products;
- Implement prevention efforts targeted at inhalant abuse; and
- Develop and deliver treatment for inhalant abuse.

Such policies have been or could be enacted by several major social institutions:

- Private business;
- The Federal Government;
- State governments; and
- The educational system.

The Federal Government:-

The Federal Government has undertaken several specific actions that have limited the availability of particular abusable products over the past 25 years. These actions include:

1. A regulatory decision by the FDA in 1968 to return amyl nitrite to prescription status from over-the-counter status because it was being abused;
2. A decision by the Federal Trade Commission in 1969 to ban devices using CFCs to chill beverage glasses;
3. A decision by the FDA in 1974 to require that a warning label be affixed to pressurized cans of edible cooking oils and personal care products;

4. FDA establishment of standards for food products for purity and concentration of nitrous oxide;
5. Passage of an act of Congress in 1988 that banned use of butyl nitrites in room odorizers because they were often purchased for inhalation: and
6. An Environmental Protection Agency (EPA) regulation requiring use of CFCs to be phased out for environmental reasons; since one fabric waterproofing product was reformulated, deaths from abuse have reportedly declined.¹⁸

Effects of Inhalants

Inhalants can have severe and varied effects on the body and brain, both short-term and long term. Here's a comprehensive list:

• **Short-term effects:**

1. Euphoria or feeling "high"
2. Dizziness or light headedness
3. Confusion or disorientation
4. Slurred speech or difficulty speaking
5. Loss of coordination or balance
6. Hallucinations or distorted perceptions
7. Nausea or vomiting
8. Headaches or migraines
9. Increased heart rate or blood pressure
10. Oxygen deprivation (hypoxia)

• **Long-term effects:**

1. Brain damage or cognitive impairment
2. Memory loss or learning difficulties
3. Mood disorders (depression, anxiety)
4. Personality changes or irritability
5. Respiratory problems (bronchitis, pneumonia)
6. Liver or kidney damage
7. Heart problems (cardiomyopathy, arrhythmias)
8. Nerve damage or peripheral neuropathy
9. Reproductive issues (infertility, miscarriage)
10. Increased risk of addiction or substance abuse

• **Specific effects by inhalant type:**

1. Solvents (e.g., paint thinner, glue):
 - Brain damage
 - Liver or kidney damage
 - Respiratory problems
2. Aerosols (e.g., spray paint, hairspray):
 - Heart problems
 - Respiratory issues
 - Neurological damage
3. Gases (e.g., nitrous oxide, helium):
 - Oxygen deprivation
 - Brain damage
 - Respiratory problems
4. Volatile nitrites (e.g., poppers, snappers):
 - Headaches
 - Dizziness
 - Increased heart rate

• **Risk factors and complications:**

1. Sudden Sniffing Death (SSD) syndrome
2. Asphyxiation or suffocation
3. Choking or respiratory failure
4. Injury or accident due to impaired judgment
5. Infections or transmission of diseases (e.g., HIV, hepatitis)
6. Malnutrition or weight loss
7. Social and relationship problems
8. Increased risk of suicidal thoughts or behaviors

• **Treatment and prevention:**

1. Seek medical attention immediately if experiencing symptoms
2. Counseling or therapy for addiction or substance abuse
3. Support groups for individuals and families
4. Education and awareness programs
5. Safe storage and disposal of inhalants
6. Alternative coping mechanisms (e.g., exercise, mindfulness)¹⁹

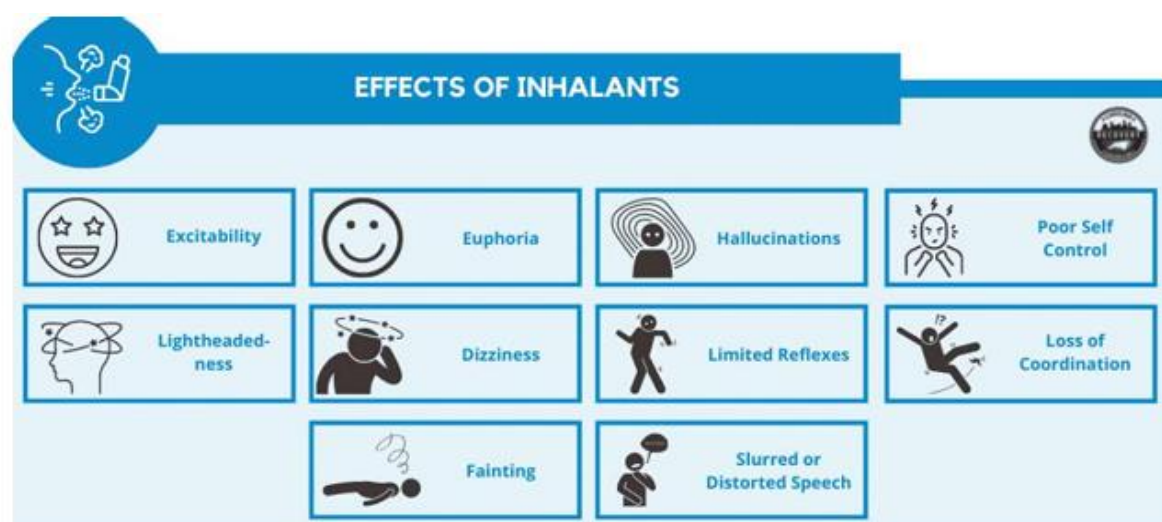


fig. 2:- Effects of Inhalants

Prevention of Inhalant Abuse:-

Prevention measures similar as educating children, parents, and preceptors and reducing the environmental force are essential in limiting inhalant abuse. Screening teenagers for inhalant abuse is also important in forestallment and early discovery. Questions regarding inhalant abuse similar as huffing or smelling cement, makeup thinner, and analogous products can be added to those that may formerly be in use for tobacco, cannabis, alcohol, and other medicines. Psychoeducation and chop training should concentrate on the troubles of inhalant use including unforeseen death, becks, flash fires and brain damage.

What do they look like?

Common ménage products similar as cement, lighter fluid, cleaning fluids, and paint all produce chemical vapors that can be gobbled.



Paint thinner

fig.3:- Paint Thinner

What's their effect on the body?

gobbled chemicals are fleetly absorbed through the lungs into the bloodstream and snappily distributed to the brain and other organs. Nearly all inhalants produce goods analogous to anesthetics, which decelerate down the body's function. Depending on the degree of abuse, the stoner can witness slight stimulation, feeling of lower inhibition, or loss of knowledge.



Highlighter markers

fig. 4:- Highlighter marks

Within twinkles of inhalation, the stoner gests intoxication along with other goods analogous to those produced by alcohol. These goods may include vocalized speech, an incapability to coordinate movements, swoon, and dizziness. After heavy use of inhalants, druggies may feel drowsy for several hours and witness a moping headache.

Symptoms displayed by long- term inhalant druggies include:

- Weight loss, muscle weakness, disorientation, inattentiveness, lack of collaboration, perversity, depression, and damage to the nervous system and other organs. Some of the dangerous goods to the body may be at least incompletely reversible when inhalant abuse is stopped; still, numerous of the goods from dragged abuse are unrecoverable. Dragged smelling of the largely concentrated chemicals in detergents or aerosol sprays can induce irregular and rapid-fire heart measures and lead to heart failure and death within twinkles. There's a common link between inhalant use and problems in academy-failing grades, habitual absences, and general apathy.

Other signs include:

- Paint or stains on body or apparel spots or blisters around the mouth; red or watery eyes or nose; chemical breath odor; drunk, dazed, or dizzy appearance; nausea; loss of appetite; anxiety; excitability; and perversity.

What are their overdose effects?

Because intoxication lasts only a many-twinkles, druggies try to protract the high by continuing to gobble constantly over the course of several hours, which is a veritably dangerous practice. With consecutive inhalations, druggies may suffer loss of knowledge and/ or death. "unforeseen smelling death" can affect from a single session of inhalant use by an else healthy youthful person. unforeseen smelling death is particularly associated with the abuse of butane, propane, and chemicals in aerosols. Inhalant abuse can also beget death by asphyxiation from repeated inhalations, which lead to high attention of gobbled smothers displacing the available oxygen in the lungs, suffocation by blocking air from entering the lungs when gobbling smothers from a plastic bag placed over the head, and choking from swallowing heave after gobbling substances.

What's their legal status in the United States?

The common ménage products that are misused as inhalants are fairly available for their intended and licit uses. Numerous state houses have tried to discourage youth who buy legal products to get high by placing restriction on the trade of these products to minors. Indeed however some substances are n't presently controlled by the Controlled Substances Act, they pose pitfalls to individualities who abuse them. The following section describes these medicines and their associated pitfalls.

Indian Youth and Inhalants: An Update

In another publication, we described the patterns of inhalant use among Indian adolescents who were living on reservations from 1975 to 1983 (Beauvais et al. 1985a). This monograph chapter updates the previous data and presents some additional analyses of inhalant use patterns. A brief summary of the findings in 1983 from the previous article will help set the stage for the subsequent discussion:

1. Lifetime prevalence of inhalant use among Indian youth increased gradually from 15 percent to 32 percent between 1975 and 1983. Inhalant use among non-Indians was much lower and did not show an increase across this period of time.
2. There were no appreciable differences between Indian males and Indian females in either lifetime prevalence or recent use. In comparison, non-Indian males used inhalants more often than non-Indian females (Johnston et al. 1985).
3. Inhalants appeared to be used more often by younger students as noted by a decreasing curve: recent use decreased as age increased.
4. Peer encouragement to use inhalants and peer sanctions against use were strongly related to levels of use.
5. Inhalant users were more likely to be also using other drugs.

Indian youth, we use data from the National High School Senior Survey (Johnston et al. 1985). For this comparison, we select only Indian 12th graders. The national survey is conducted annually among high school seniors across the country and uses a methodology very similar to ours. About 16,000 seniors are surveyed each year. The one difficulty with using the senior survey as a comparison is the relatively high dropout rate found among Indian youth. Since it is likely that dropouts have higher rates of drug use (Beauvais and Oetting 1986), the inhalant use rates reported for Indian seniors may be artificially low. To partially compensate for this, we also compare Indian 8th graders with a sample of non-Indian 8th graders that we have surveyed since 1981. The community where the non-Indian data have been collected has had drug use rates close to the national level for the past 5 years, so it should provide an adequate comparison between Indian and non-Indian youth. The sample size for non-Indian 8th grade youth each year is approximately 1,100.²⁰

Future Perspective

1. Expanded Applications: Traditionally, inhalants have been used for respiratory diseases like asthma and COPD. However, there's growing interest in using inhalation technology for systemic diseases such as diabetes, tuberculosis, and even lung cancer.
2. Technological Advances: Innovations in inhaler devices and drug formulations are crucial. Newer devices are being designed to be more user-friendly, ensuring proper dosage and reducing dependency on patient technique. For example, advancements in dry powder inhalers (DPIs) and pressurized metered-dose inhalers (pMDIs) are making treatments more effective and accessible.
3. Personalized Medicine: Future inhalation therapies are likely to be more personalized, with devices tailored to individual patient needs. This includes smart inhalers that can monitor usage and provide feedback to both patients and healthcare providers.
4. Broader Therapeutic Range: There's potential for inhalants to deliver a wider variety of therapeutic agents, including biologics and vaccines. This could revolutionize how we treat various conditions, making treatments more efficient and less invasive.
5. Environmental Considerations: With the phasing out of chlorofluorocarbon (CFC) propellants due to their environmental impact, there's a push towards more eco-friendly alternatives. This includes the development of inhalers that use hydrofluoroalkane (HFA) propellants or other sustainable materials.

Conclusion

Prevalence and Impact: Inhalant use is a significant issue among adolescents, especially those in child welfare systems, with serious health and social consequences. Despite its prevalence, inhalant abuse is often neglected and overlooked in substance abuse discussions. Inhalant use can lead to severe health issues, including brain damage, heart problems, and even death. Effective prevention and intervention programs are crucial to address and mitigate the risks associated with inhalant use.

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