Child & youth

Mental Health Series

Today's topic: Inhalant Use Disorders

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Date October 20/16

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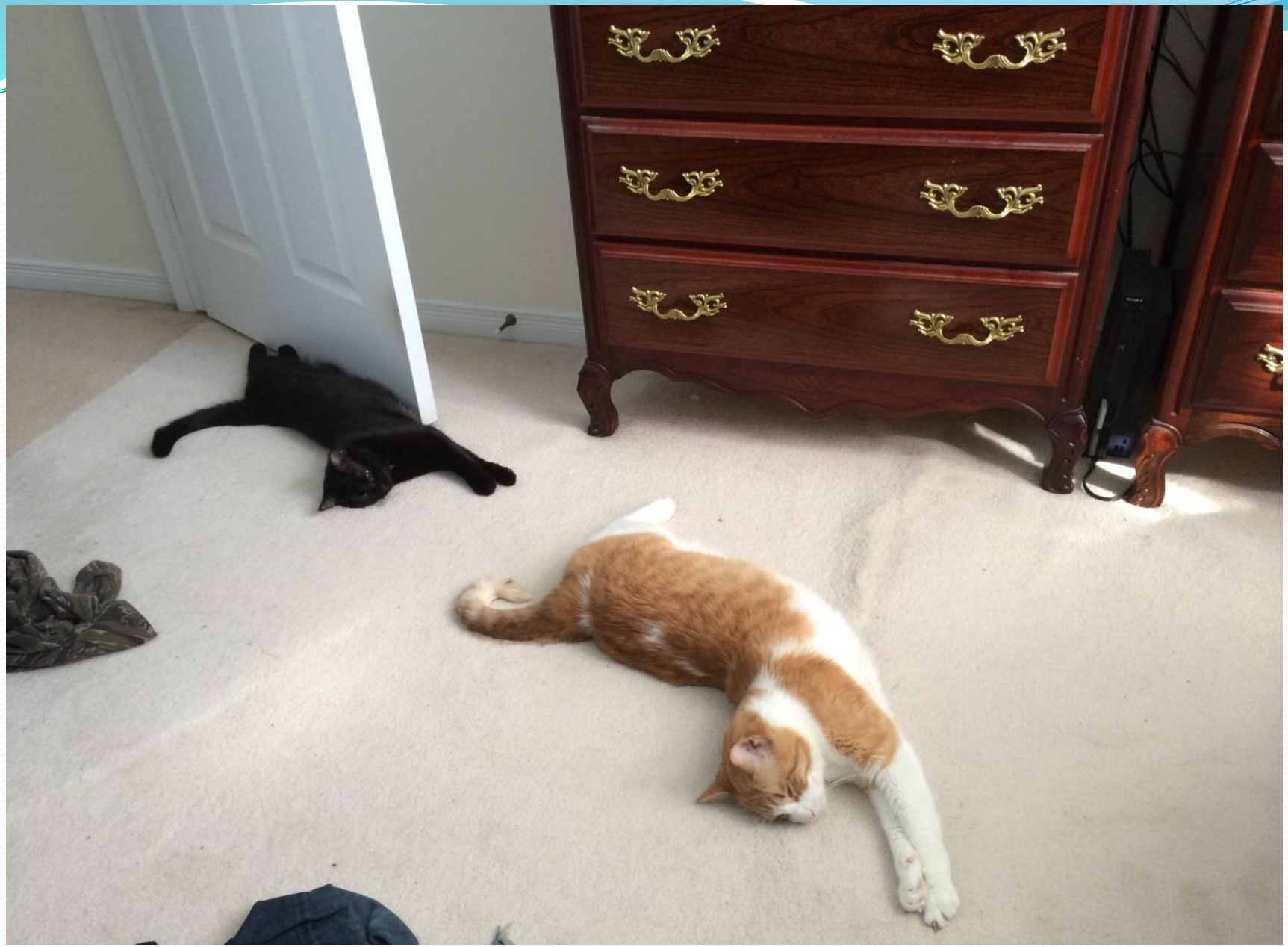

Objectives

- To review the various types of inhalants commonly abused
- To review etiology & risk factors of inhalant abuse
- To review signs & symptoms of inhalant intoxication & chronic inhalant abuse
- To review medical sequelae & complications associated with inhalant abuse
- Briefly review treatment & prevention strategies

- Focus on inhaled volatile substances
- For purpose of discussion, will not review inhaled non-volatile substances (i.e cannabis, cocaine etc.)
- Recent literature sparse. Relatively more information (still limited) from 1980s & 1990s.

it was then they realized
the catnip deal went bad.
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DSM V Criteria

Inhalant-Related Disorders

Inhalant Use Disorder
Inhalant Intoxication
Other Inhalant-Induced Disorders
Unspecified Inhalant-Related Disorder

Inhalant Use Disorder

Diagnostic Criteria

A. A problematic pattern of use of a hydrocarbon-based inhalant substance leading to clinically significant impairment or distress, as manifested by at least two of the following, occurring within a 12-month period:

1. The inhalant substance is often taken in larger amounts or over a longer period than was intended.
2. There is a persistent desire or unsuccessful efforts to cut down or control use of the inhalant substance.

3. A great deal of time is spent in activities necessary to obtain the inhalant substance, use it, or recover from its effects.
4. Craving, or a strong desire or urge to use the inhalant substance.
5. Recurrent use of the inhalant substance resulting in a failure to fulfill major role obligations at work, school, or home.
6. Continued use of the inhalant substance despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of its use.
7. Important social, occupational, or recreational activities are given up or reduced because of use of the inhalant substance.
8. Recurrent use of the inhalant substance in situations in which it is physically hazardous.
9. Use of the inhalant substance is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance.
10. Tolerance, as defined by either of the following:
    a. A need for markedly increased amounts of the inhalant substance to achieve intoxication or desired effect.
    b. A markedly diminished effect with continued use of the same amount of the inhalant substance.

Specify **the particular inhalant:** When possible, the particular substance involved should be named (e.g., "solvent use disorder").

b. A markedly diminished ...
halant substance.

Specify **the particular inhalant:** When possible, the particular substance involved should be named (e.g., "solvent use disorder").

Specify if:

In early remission: After full criteria for inhalant use disorder were previously met, none of the criteria for inhalant use disorder have been met for at least 3 months but for less than 12 months (with the exception that Criterion A4, "Craving, or a strong desire or urge to use the inhalant substance," may be met).

In sustained remission: After full criteria for inhalant use disorder were previously met, none of the criteria for inhalant use disorder have been met at any time during a period of 12 months or longer (with the exception that Criterion A4, "Craving, or a strong desire or urge to use the inhalant substance," may be met).

Specify if:

In a controlled environment: This additional specifier is used if the individual is in an environment where access to inhalant substances is restricted.

Coding based on current severity: Note for ICD-10-CM codes: If an inhalant intoxication or another inhalant-induced mental disorder is also present, do not use the codes below for inhalant use disorder. Instead, the comorbid inhalant use disorder is indicated in the 4th character of the inhalant-induced disorder code (see the coding note for inhalant intoxication or a specific inhalant-induced mental disorder). For example, if there is comorbid inhalant-induced depressive disorder and inhalant use disorder, only the inhalant-induced depressive disorder code is given, with the 4th character indicating whether the comorbid inhalant use disorder is mild, moderate, or severe: F18.14 for mild inhalant use disorder with inhalant-induced depressive disorder or F18.24 for a moderate or severe inhalant use disorder with inhalant-induced depressive disorder.

Specify current severity:

305.90 (F18.10) Mild: Presence of 2–3 symptoms.

304.60 (F18.20) Moderate: Presence of 4–5 symptoms.

304.60 (F18.20) Severe: Presence of 6 or more symptoms.

Disclaimer

- DSM V does not include Nitrous oxide or amyl-butyl/isobutyl nitrites as inhalants & considers it under “other substance use disorder”
- However most literature articles & reviews mention them, hence inclusion in this talk.

TABLE 1. Commonly Abused Inhalant Products and Their Constituents

GLUES AND ADHESIVES	
Airplane glue	Toluene, ethyl acetate
Other glues and cements	Hexane, toluene, methyl chloride, acetone, methyl ethyl ketone, methyl butyl ketone, benzene, xylene, trichloroethylene, tetrachloroethylene, chloroform
AEROSOLS	
Spray paint	Butane, propane (U.S.), fluorocarbons, toluene, hydrocarbons, xylene
Hair spray	Butane, propane (U.S.), chlorofluorocarbons
Deodorant; air freshener	Butane, propane (U.S.), chlorofluorocarbons
Analgesic spray	Chlorofluorocarbons
Asthma spray	Chlorofluorocarbons
Fabric spray	Butane, trichloroethane
PC cleaner	Dimethyl ether, hydrofluorocarbons
Video head cleaner	Ethyl chloride
ANESTHETICS	
Gaseous	Nitrous oxide
Liquid	Halothane, enflurane, desflurane, isoflurane
Local	Ethyl chloride
CLEANING AGENTS	
Dry cleaning	Tetrachloroethylene, trichloroethane
Spot remover	Xylene, petroleum distillates, chlorohydrocarbons
Degreaser	Tetrachloroethylene, trichloroethane, trichloroethylene
Lacquer; thinners	Acetone, methanol, ethyl acetate, methyl chloride, toluene
SOLVENTS AND GASES	
Nail polish remover	Acetone, ethyl acetate, toluene (rarely)
Paint remover	Toluene, methylene chloride, methanol, acetone, ethyl acetate
Paint thinner	Petroleum distillates, esters, acetone
Correction fluid and thinner	Trichloroethylene, trichloroethane, isoparaffins
Fuel gas	Butane, isopropane
Lighter fluid	Butane, isopropane
Fire extinguisher	Bromochlorodifluoromethane
Gasoline	Benzene, n-hexane, toluene, xylene

Modified from Sharp and Rosenberg (2005).

Inhalant use disproportionately afflicts the poor, mentally ill, and juvenile- and criminal-justice involved.

- Inhalant substances can be grouped pharmacologically as follows:

Group 1:Volatile solvents, fuels & Anesthetics

- AKA: air blast, discorama, hippie crack, moon gas, oz, poor man's pot
- Volatile solvents: toluene, acetone, TCE in paint thinners, paint & polish remover, correction fluid
- Glues, rubber cement
- Propellants/solvents in spray paint, computer sprays, cooking spray, air freshener sprays, deodorant &hair sprays

Group 1:Volatile solvents, fuels & Anesthetics

- Fuels
- Butane or propane lighters, gasoline, octane boosters, refrigerants

Group 1:Volatile solvents, fuels & Anesthetics

- Anesthetics
- Ether, halothane, ethyl chloride

Group 2: Nitrous Oxide

- AKA; laughing gas, buzz bomb, shoot the breeze
- Diverted medical anesthetic, whip cream can aerosol

Group 3: Volatile Alkyl Nitrites

- AKA: poppers, snappers, boppers, pearls, amys, rush, bolt, climax, locker room
- VCR head cleaner (rare by now I guess…),liquid incense air fresheners, room odorizes

Prevalence

- Decreasing in past 20 years
- Canadian Addiction Survey (2004 telephone survey): US: 9.5%, CAN: 1.3%
- MTF survey: grade 8; 2-3X more than grade 10 which is 2X less than grade 12
- MTF survey ("marking the future") is annual cross sectional survey using grade 12 students from 1975 & adding grade 8 & 10 students from 1991

Prevalence

- Increased prevalence in geographically isolated regions/populations & with lower S/E status
- NSDUH (national survey on drug use & health): cross sectional survey from ages 12+ since 1971
- One study in 2010 using above data involved 29195 adults aged 35-49 found that duration of inhalant abuse associated with increased likelihood of TB, Bronchitis, asthma & suicides.

Methods of abuse

- Main objective is to deliver highest concentration of inhalant to lungs & then brain. Tends to progress in the order below:
- **Sniffing:** inhale from open container or heated pan
- **Bagging:** inhale from bag containing substance
- **Huffing:** holding piece of cloth soaked in substance against nose & mouth

Methods of abuse: other means

- Spray directly into nose or mouth
- “glading”: inhalation of air fresheners
- “dusting”: inhalation of electronic cleaning products
- Products containing inhalants with other toxic components bubbled through water (antiperspirants)

Inhalant users tend to fall into one of three use scenarios

- Rare occasions to ”have fun”
- Use as alternative substance: regular stuff of choice not available or undergoing drug testing
- Day long binges

Natural History

- Little is known about natural Hx of inhalant abuse & associated Psychiatric & psychosocial comorbidities
- Often start quite young & D/C quickly
- Peak around grade 7-8 (age 13-14)
- “gateway substance”
- Youth using inhalants by age 12-13 5X increased risk to use other psychoactive drugs
- Increased risk for IV drug use
- Increased risk for antisocial behaviors

Natural History

- Victims of child abuse & youth with friends & relatives abusing substances increased risk
- Adult studies: increased rates of MDE, Anxiety D/O, SI & attempts & personality disorders (Antisocial PD mentioned)
- Some debate on whether there is a direct contribution to subsequent drug use & adverse psychosocial outcomes <u>versus</u> deviant innate disposition
- ?red flag for antisocial youth

Extrinsic risk factors

- Cheap, available in household, legal to possess, simple to use
- Reward effects: pharmacological action & social use
- Easily evade detection & punishment
- Can be one of the few exciting/novel experiences available to youth in impoverished & isolated communities

Risk factors: individual & peer group

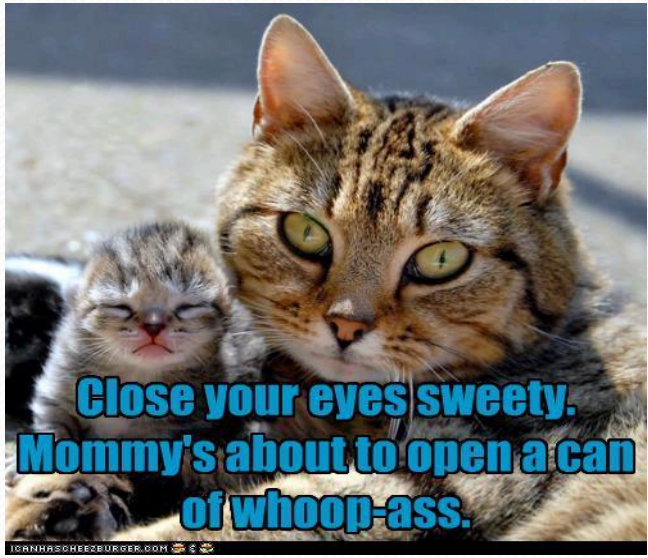
- Problem behaviors: delinquency, interpersonal violence
- Sensation seeking
- Other drugs
- Hx abuse, recent MDE
- Neuropsychiatric D/O, LD

Risk Factors: peer group

- Deviant/negative peer group
- Majority of youth reporting to use inhalants also report their friends using as well
- Use at home or in homes of friends
- Another risk factor: high levels of perceived popularity & frequency of talking about drugs
- Protective factor: high sense of drug-refusal self efficacy

Risk factors: Family

- Stronger parental monitoring, family values & parental respect <u>decrease</u> the risk



- Parental comorbidity, absence, criminality, drug use, low education <u>increase</u> the risk

Detection

- Signs & Sx often subtle
- Discover cache of inhalant or is stored in unusual locations (can of gas under the bed)
- Behavior changes:
- Apathy, malaise, poor appetite
- Change in peer group (towards negative ones)
- Unexplained drops in grades

Detection

- Chemical odor on clothes & breath
- Significant excretion of chemical via exhalation & persists for many hours
- Clothing stains or paint
- Paint or glitter on face
- “Huffers Rash” peri-oral dermatitis
- Refrigerants & some CFC propellants (computer cleaning aerosols) reported to cause frostbite on face, nose or mouth

Detection: chronic use

- Poor hygiene & grooming, weight loss
- Chronic fatigue, runny nose, nosebleed, conjunctivitis
- Confusion, irritability, hostility
- Poor concentration, depression, paranoia
- Organ system damage leading to medical attention

NEUROBIOLOGY

- Inhalants (except nitrites) are CNS depressants
- Organic solvents are positive mediators of GABA-a receptors = anxiolytic effects just like Benzodiazepines
- Butane & propane may block NMDA receptor but not totally clear
- Acetone less toxic & potent CNS depressants
- Nitrites cause vasodilatation & smooth muscle relaxation = floating, warm, throbbing; diminish in 5 min

Stages of Inhalant intoxication: initial stage

- Euphoria, exhilaration, excitation: mimics EtOH
- Acute respiratory Sx: sneeze, cough, nosebleeds, dyspnea, palpitations
- GI Sx: n/v/d
- Can resolve in 2h

Stages of Inhalant intoxication: second stage

- CNS depression, disoriented, slurred speech, delirium
- Confusion, tremors, visual changes/hallucinations

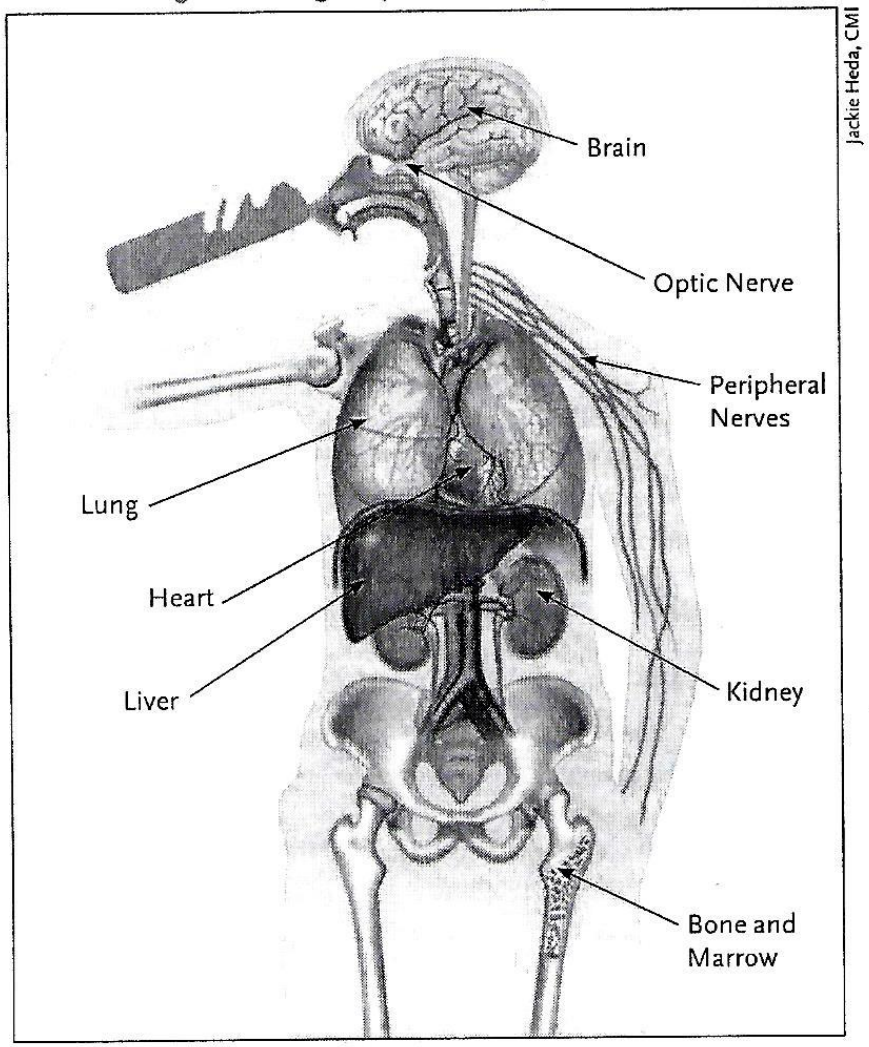
Stages of Inhalant intoxication: Third stage

- More CNS depression, obtunded
- Ataxia, nystagmus
- Decreased reflexes

Stages of Inhalant intoxication: Fourth stage

- **Most dangerous**
- Coma
- Seizures
- cardiopulmonary arrest
- death

FIGURE 2. Organs Damaged by Inhalant Exposure



Mortality

- Medical complications
- Asphyxiation/suffocation
- Fire
- High risk behaviors while intoxicated
- “Sudden sniffing death syndrome”

Sudden sniffing death syndrome

- Up to 50% of inhalant mortalities
- Acutely intoxicated
- Myocardium sensitized to epinephrine
- gets startled = catecholamine release = V-fibrillation = sudden death

Neurological toxicity of inhalants

- **REMEMBER:** volatile inhalants are very lipid soluble which means they can soak in **everywhere** in the body including the brain (cannot emphasize that enough!)
- Brain imaging: enlarged ventricles, cerebellar or brain stem atrophy
- Single occupational exposure leading to inhalant intoxication can produce long term memory problems & processing speed impairment

Neurological toxicity of inhalants

- Peripheral neuropathy
- Proximal or distil muscle weakness
- Parathesias
- Decreased/absent tendon reflexes
- Cerebellar ataxia, Parkinsonism
- Cranial neuropathy
- Optic neuropathy & visual loss

Neurological toxicity of inhalants

- Toluene most damaging to CNS
- In glues, spray paints, paint thinners
- Toluene encephalopathy: hallucinations, nystagmus, Sz, coma
- Cognitive dysfunction & dementia
- Chronic abuse of toluene causes severe white matter leukoencephalopathy with profound reduction in brain white matter regions

Neurological toxicity of inhalants: glues & paints

- Metabolized to even more toxic substances
- Cause axonal degeneration
- Leads to peripheral neuropathy in “stocking-glove” distribution

Medical complications: Cardiac

- Sudden sniffing death syndrome
- Hypotension
- Arrhythmias, tachycardia
- V-Fib: use amiodarone or lidocaine instead of epinephrine (which worsens irritable myocardium)
- Irreversible CHF
- Hypokalemia with chronic toluene inhalation

Medical complications: Pulmonary

- Asphyxiation
- Volatiles displace O_2
- Direct damage to lung tissue
- Chemical pneumonitis
- Pulmonary hypertension

Medical complications: Renal

- Renal tubular acidosis
- Renal calculi
- Glomerulonephritis
- Toluene compounds especially toxic to kidneys

Medical complications: Liver & Bone marrow

- Toxic hepatitis from chloroform & chlorinated hydrocarbons
- Damage liver cell membranes
- Liver failure from sniffing toluene glues
- Implicated bone marrow suppression & malignancies such as leukemia, lymphomas
- Benzene linked to aplastic anemia

Medical complications: Dematological

- “glue sniffers rash”: dermatitis & puritis on perioral area extending to midface. Due to drying effects of hydrocarbons
- burns

Medical complications: Teratogenicity

- Easily cross placenta
- Toluene abuse can foster fetal malformation: clefts, microcephaly, developmental delay
- **Craniofacial characteristics often similar to FAS**

Medical complications: Psychiatric

- Mood & anxiety Disorders
- Other Substance Use Disorders
- Conduct Disorders
- ADHD
- Psychosis
- Increased risk of SI & attempts

- Understanding the medical & psychological consequences important
- Unlike other drugs reasons for quitting not related to cost or availability (inhalants cheap & widely available)
- Instead main reasons for quitting related to need for a change, getting tired of inhalants, dislike of inhalants & getting concerned for health

Primary prevention

- Regulate access has mixed results
- Substitute harmful & psychoactive substances has better results
- ID & control availability of high risk products (ex cleaning products, glues, paints, fuel etc) at home <u>& school</u>
- Inventory, safer products, secure storage

Primary prevention: education

- Teach adolescents cognitive behavioral life skills & tools
- Boost self esteem & communication, mitigating pressure & anxiety & developing appropriate personal relationships
- Focus on drug resistance skills, personal & social skills

Secondary prevention

- ID & intervene with individuals at risk or are developing pre-clinical Sx
- Prevention programs in high risk populations or communities

Tertiary prevention

- Care of active illness to reduce negative effects & outcomes
- **Harm reduction**: controversial
- Alternate methods for inhalant use
- Do it under supervision, avoiding OD, burns
- Avoid butane & propane: highest risk of sudden death

Drug screening

- Not much info for consistently reliable & practical screens
- Routine urine screens for hippuric acid: major metabolite of toluene
- Can detect high levels of exposure in chronic users
- Must account for background levels from normal metabolism

Problems with lab testing

- Inhalants briefly in body=narrow detection window
- Urine metabolites can degenerate quickly before processing
- Confounding factors: Risk of false positives such as common benzoate preservatives in foods & drinks
- Solvents bind to plastic cups & collection bags which decrease concentration & detection
- Very expensive

Tx

the silent cry for help
has never been so loud
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Tx

- Very few studies around psychosocial & pharmacological interventions
- Why?

Tx

- Slow to recognize importance of inhalant abuse
- Stigma
- Socially disenfranchised users
- Geographical isolation
- Difficult to recruit & follow subjects

Acute Tx

- Medical monitoring & supportive care during intoxication
- **Possible W/D:** starts about 24h, last several days
- H/A, irritability, dry mouth, sweating
- Tics, sleep & mood disturbance
- Detox programs 2-6 weeks, focus on health first

Acute Tx: meds

- Tx withdrawals & cravings
- Tx medical complications
- Tx comorbidities
- No studies in using antidepressants in adolescents using inhalants

Tx: pharmacological

- 1999 study: case report of Risperidone used on 25 yr male using inhalants for 5 years unresponsive to other antipsychotics & a mood stabilizer
- Able to get abstinent for 12 months

Tx: pharmacological

- 1998: one randomized trial on 40 psychotic males with Hx of inhalant abuse
- Tx with haldol & carbamazepine
- Reduction in Sx severity

Tx: pharmacological

- 2007 case report
- Tx 21 yr male using inhalants for 4 yrs with Lamictal
- Decreased cravings & abstinent for 6 months

Tx: Psychosocial

- Holistic approach incorporating effects of traditional indigenous cultures
- Intervene early using interventions & approaches used in other substance use D/O: motivational enhancement, relapse prevention management
- Harm reduction: controversial :"safer" use of inhalants
- Residential Tx

Tx: psychotherapy

- Psychoeducation
- CBT
- Motivational interviewing & brief intervention: useful in marginalized adolescent populations

Tx: family therapy

- Work with dysfunctional family
- Often though, significant roadblocks
- Higher rates of attrition
- Higher rates of premature termination: so consider sessions focused on engagement early
- Better to use as part of multimodal approach

Tx: culturally specific approaches

- Incorporate elements of indigenous culture
- Emphasize stronger cultural identity
- Incorporate spirituality, community support
- Enhanced family & Elder support
- Participate in cultural ceremonies

Tx: activity & engagement programs

- Provide new skills & avenues of social expression
- Alternatives to inhalant use
- Proactive & prosocial activities
- Supervised, positive role models
- Positive non-using peers

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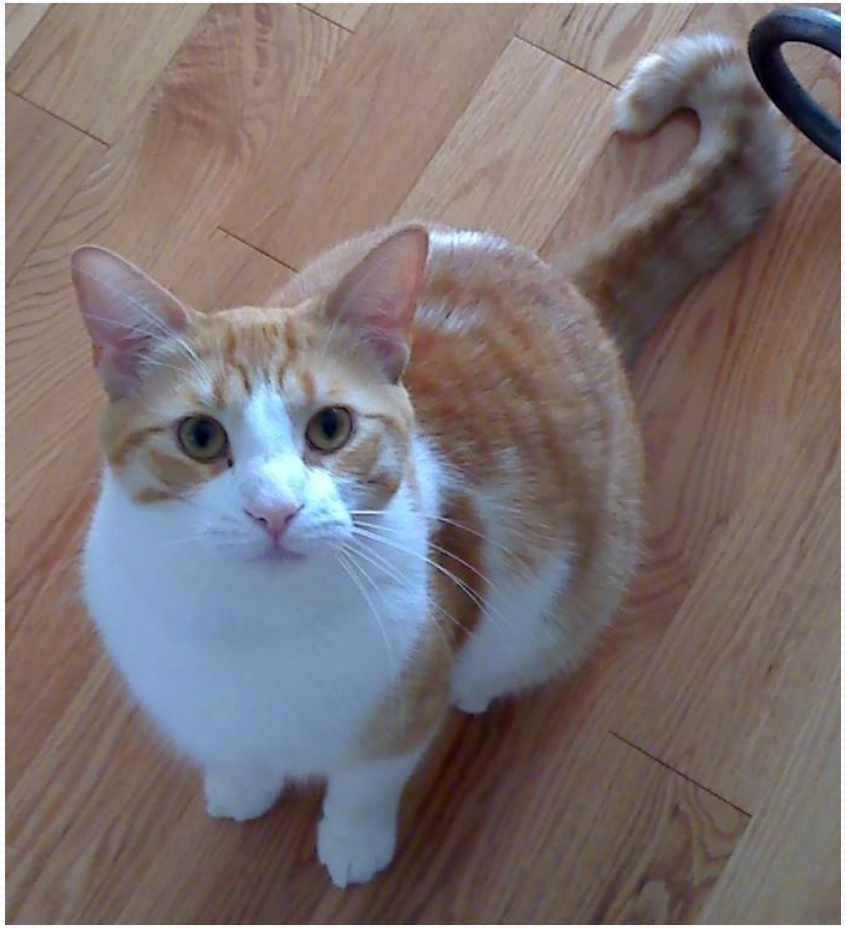

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