

Methamphetamine Exposure in Children: The Price is High

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October 2014

Outline

- * History
- * Current Trends
- * Environmental Exposure in the Home
- * Pathophysiology
- * Adverse Health Effects
 - * Adults
 - * CHILDREN
- * Testing
- * Serving Children with Meth Exposure
- * Future Projects



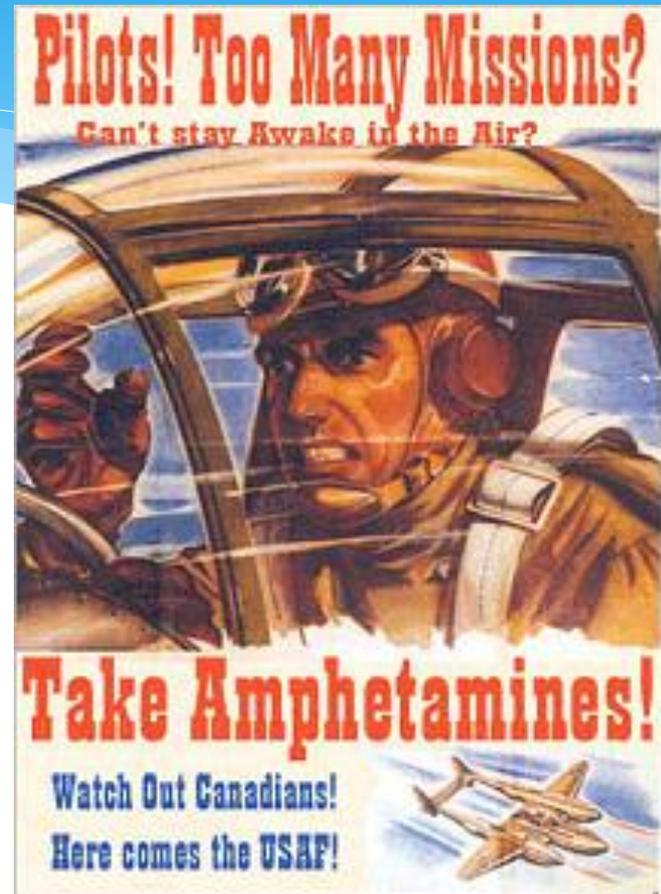
Know Your Enemy!

- * Methamphetamine was originally developed in 1919 as a synthetic alternative to ephedra, a botanic extract used in Chinese medicine as ma huang for over 5000 years.
- * It was created for purposes of CNS stimulation, bronchodilation, and nasal vasoconstriction.
- * In 1932, Smith, Kline, and French began marketing an amphetamine inhaler to decrease nasal congestion. It was available without a prescription.



History

- * Used in the US military to increase alertness, reduce fatigue, and suppress the appetite of soldiers. FYI- forms of these medications are still used for these purposes today!



History: Early Uses of Amphetamines (1940's-50's)

- * Narcolepsy
- * Exhaustion/fatigue
- * Promote weight loss
- * Schizophrenia
- * Asthma
- * Morphine and alcohol addiction
- * Migraine
- * Heart block
- * Myasthenia gravis
- * Low Blood Pressure
- * Enuresis (bed wetting)
- * Painful Periods
- * Colic
- * Meniere's Disease
- * Seasickness
- * Hiccups
- * Infantile Cerebral Palsy
- * Epilepsy
- * Parkinson's Disease
- * Pediatric Behavior Issues
- * Head Injuries

History: Misuse

- * Adverse Effects were reported as early as 1935.
- * Misuse spread quickly (ingesting inhaler contents directly or injecting them)
- * Demographics were white middle class.
- * Increase in violent crime related to use was recognized.
- * Regulations increased between 1950-1970.
- * 1970= Schedule II medication
- * Between 1960 and 1990, prescription use of amphetamines decreased by 90%.

History: Spread of Meth

- * The first illicit production of meth was in 1962 in San Francisco.
- * In the 1960-70's, meth earned the reputation of a “biker drug” as Hell's Angels spread the drug along the Pacific Coast.
- * Motorcycle gangs were responsible for 90% of meth production in the US in the 70s and 80s.



Clandestine Labs Are Born

- * In the Midwest, the illicit drug infrastructure was less established.
- * Local “cooks” began to set up in rural areas to avoid being noticed due to the strong odors associated with the process.

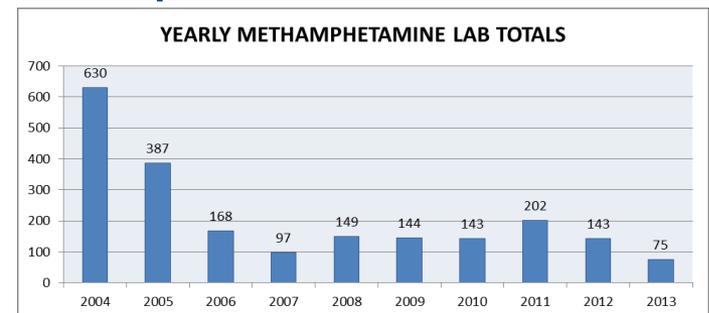


Laws to Restrict Meth Manufacture and Use

- * 1996: Methamphetamine Control Act strengthened penalties and tightened controls on precursors to meth.
- * 2005: Combat Methamphetamine Epidemic Act regulates the purchase of products containing pseudoephedrine, ephedrine, and phenylpropanolamine. These are now behind the counter, require proof of identity, and amount of purchase is limited.
- * “Smurfing”

Current Trends: Kansas Statistics

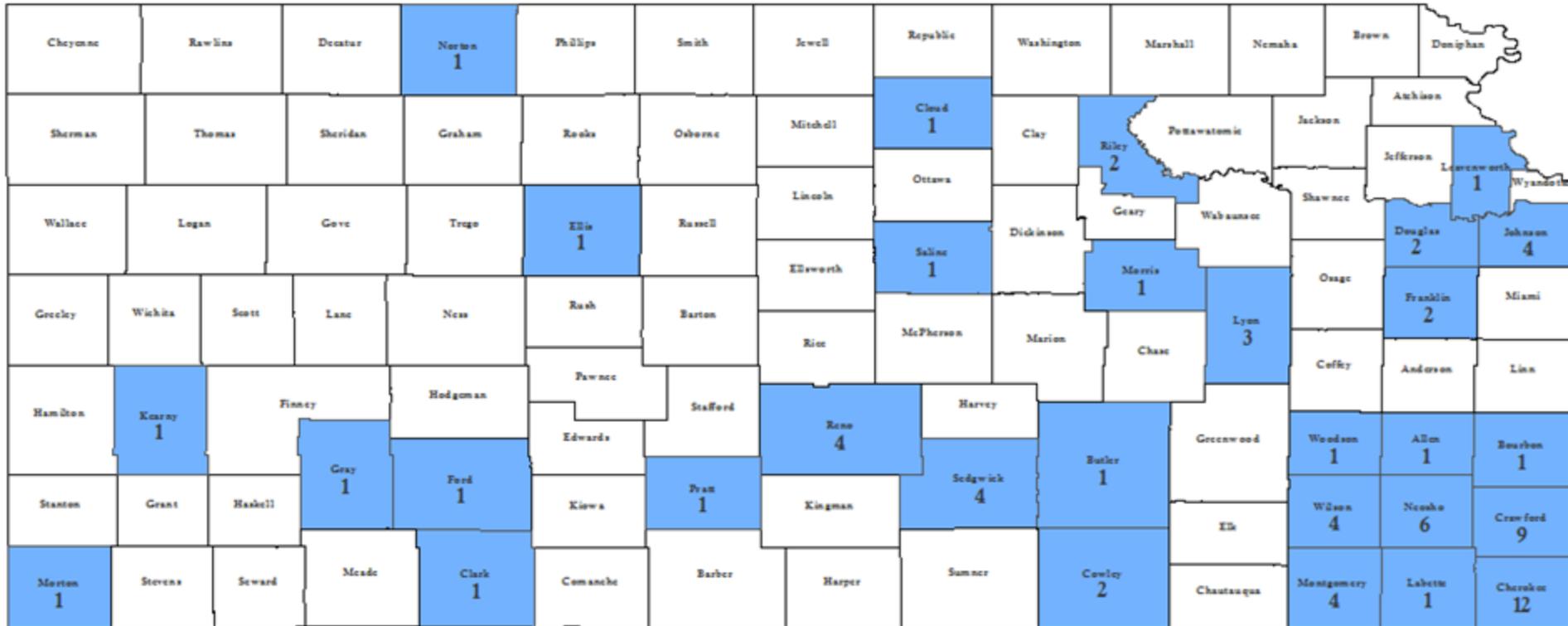
- * Although small-scale methamphetamine manufacturing persists in Kansas, the vast majority of all methamphetamine used in Kansas is imported from Mexico and Central America.
- * The increase of methamphetamine produced in Mexico and Central America has been the greatest contributor to the decrease in small-scale methamphetamine manufacturing incidents in Kansas.
- * The Drug Enforcement Administration reports this has caused a decrease in price of more than 70% along with increased purity levels.





Kansas Methamphetamine Incidents from January 1, 2013 - December 31, 2013

Incidents Include: Chemical Only, Equipment Only, Dumpsites and Lab Seizures



75 Total Incidents

Current Trends

- * The City of Parsons, the City of Fort Scott and all of Cherokee County have passed ordinances making Ephedrine and Pseudoephedrine a prescription only medication.
- * The counties continue to have the largest number of reported lab incidents in the state, but have seen a decrease in lab incidents overall, since passing the ordinances.
- * There is not enough data to determine if the reduction in incidents is a direct result of the ordinances or a result with the overall reduction that the entire state has seen.

Selected Methods of Self Administration of Methamphetamine

- * Anal Suppository (butt rocket, plugging)
- * Ingestion
- * Inhalation (chasing the white dragon)
- * Insufflation (snorting)
- * IV Injection (banging, main lining, slamming)
- * Vaginal Suppository



Methamphetamine Exposure & Cleanup



FIRST STRIKE- PRODUCTION

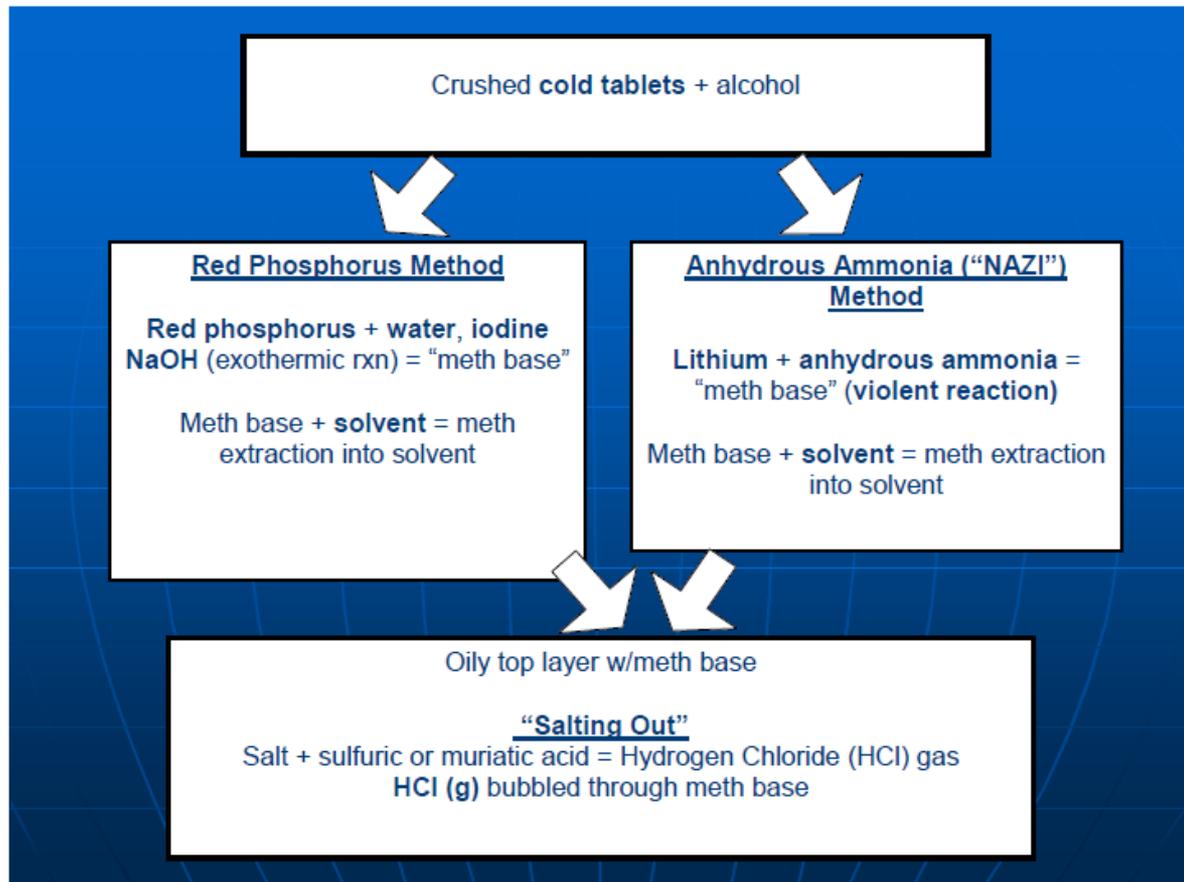


Photo from Minnesota Pollution Control Agency (Wipe Sampling Results, and Cleaning Former Meth Labs: Minnesota Studies' Impact on Meth Lab Cleanup Guidance – Gaynor, Et.Al)

SECOND STRIKE– THE WASTE

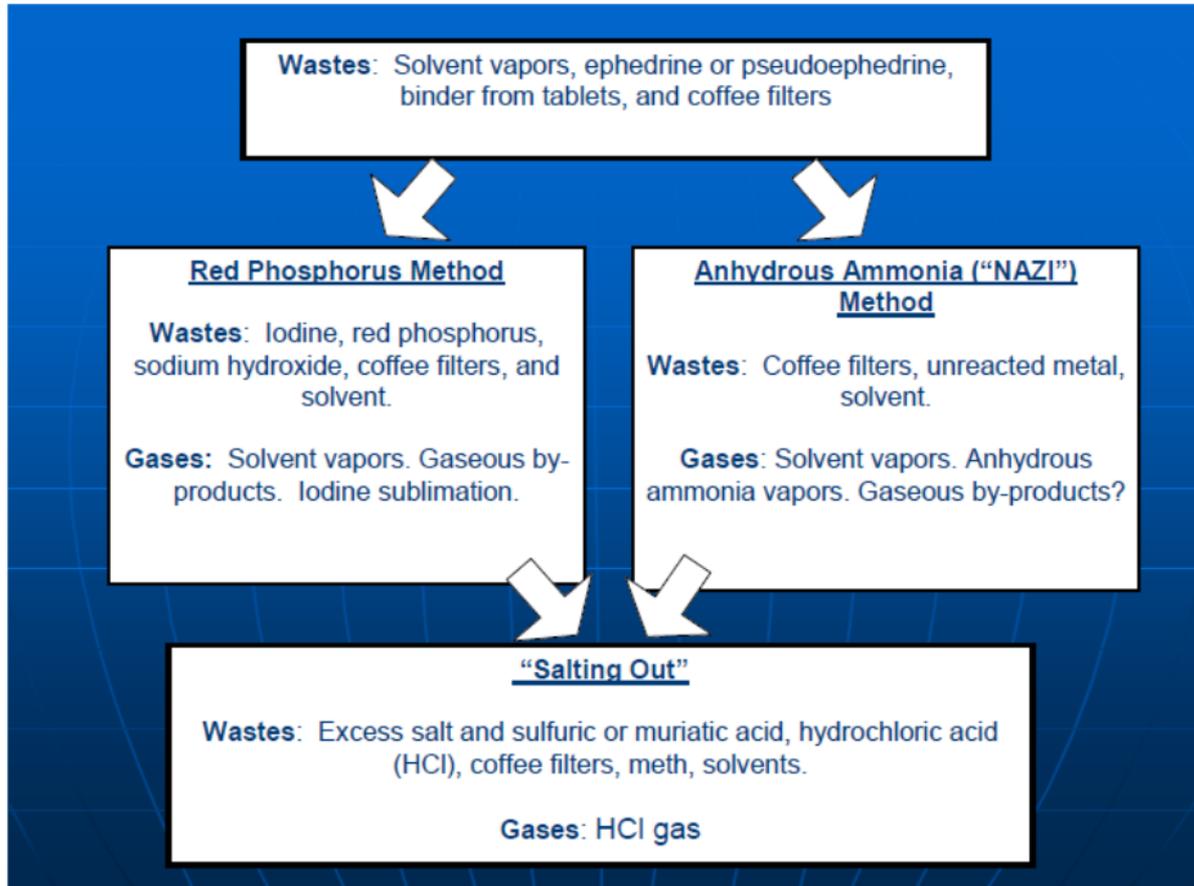


Photo from Minnesota Pollution Control Agency (Wipe Sampling Results, and Cleaning Former Meth Labs: Minnesota Studies' Impact on Meth Lab Cleanup Guidance – Gaynor, Et.Al)

Clinically Important Wastes

- * **METHAMPHETAMINE*****
- * **VOCs – Flammables!**



* **Residues/Surface Contaminants:**

- * Lead, Mercury

* **Corrosives:**

- * Hydrochloric & Hypophosphorous acid
- * Sodium hydroxide,
- * Anhydrous ammonia, phosphoric acid



A Few Facts & Figures

- * **I want you to keep two numbers in mind:
1.5mcg/100cm² & .03 mcg/kg/day.**
 - * Toxicity endpoints from a double-blind study using 88 pregnant women
 - * Appetite suppression & failure to gain weight began
 - * State of KS required level of remediation on surfaces
- * **10% of methamphetamine exposure is incidental ingestion and from meth on the hands**
- * **80% is from dermal exposure/residue on the body**

Meth Production: Surface Contamination in One Cook

- * Studies from National Jewish Medical & Research Center in Denver, CO have demonstrated the following:
- * **Surface contamination levels at the cook site:**

	Red Phosphorus Method		Anhydrous Ammonia Method
	Single Cook:		Single Cook:
Minimum	1.5 mcg/100cm ²		0.1 mcg/100cm ²
Maximum	860 mcg/100cm²		160 mcg/100cm²

- * These are 94% less to 573x greater than Kansas' limits on exposure in a household.

Additional Production Woes & Children

- * **As we've just seen – ONE COOK can create levels on surfaces >570x the accepted state standard.**
- * **Production of Methamphetamine also has the additional risk of the associated chemicals on site that are a hazard.**
- * **Speaking of children exposed to clandestine methamphetamine labs, National Jewish goes further & states:**
 - * **“... Most, if not all, children associated with clandestine methamphetamine laboratories are contaminated & have positive urine levels for methamphetamine.”**

What about 'simply' smoking meth?

- * Amount of meth inhaled & exhaled varies by the person & type of meth
- * Studies by Harris & Cook, Et. al indicate that with 40mg of smoked methamphetamine:
 - * ~ 67%-90% of the meth smoked is taken into the body
 - * ~26-36mg of methamphetamine is inhaled
- * But residue from the smoke has been found in multiple studies to 'uniformly go throughout (the living space).'
 - * A meth particle is ~0.1-1um in diameter – penetrates lung tissue easily & floats w/ the smallest breeze.

Smoking Meth: Surface & Airborne Hazards

- * **40- 100 mg of smoked methamphetamine:**
- * **Surface methamphetamine levels:**
 - * $\sim .02-.04$ mcg/100cm² surface contamination
 - * Practically: smoking this amount three-five times would get that area to most states limits of 0.1 mcg/100cm².
- * **Airborne Hazards:**
 - * Airborne levels 37 mcg/m³ to 131 mcg/m³ in the air.
 - * Equivalent to .02 - .08 mg/kg/day meth exposure
- * **But know two things:**
 - * No state or national airborne limit
 - * Daily dose limit is .03 mcg/kg/day – a 1000-fold difference in dosing if long-term exposure to those airborne amounts.

So In Review of Exposures:

- * **Two numbers in mind: $1.5\text{mcg}/100\text{cm}^2$ & $.03\text{ mcg}/\text{kg}/\text{day}$.**
- * **One Cook: Can create surface levels $>570\text{x}$ Kansas' limit**
- * **One Smoke: $.02\text{mcg}/100\text{cm}^2$, or 20% of the limit**
- * **Exposure to a 'typical' amount of meth found in a cook creates airborne amounts that vastly exceeds the $.03\text{ mcg}/\text{kg}/\text{day}$ dose limit.**
 - * But within a 24 hour period – 90% of respirable methamphetamine has settled out.
 - * Little to no 'off-gassing' of methamphetamine vapors from affected clothing/drapes/blankets.

Cleanup – The Basics

- * **Kansas Standard:**

- * **1.5 $\mu\text{g}/100 \text{ cm}^2$ of residue**

- * Most common standard

- * NO standard of allowance

- * Somewhat akin to, ‘Is



...
amphetamine
smoke?’

- * **KDHE has determined that:**

- * Most residences can be cleaned up

- * The safest way to clean up is to hire a contractor

- * Surface wipe samples are the best way to determine decontamination

- * Progressive & f/u sampling best done by a professional - @ home test kits from \$22-\$1000+

- * For DIY or in doubt - Use the EPA’s recommendations from Mar 2013

- * http://www.kdheks.gov/methlabs/ml_cleanup.html

Brief Overview of the EPA's Recommendations:

* **Recommendations:**

- * Ventilate for 3-5 days
- * Remove contaminated materials.
- * Vacuum
- * Initial washing of the walls and floors
- * Clean & seal the HVAC system.
- * Rewash wash walls/floors/ceilings
- * Encapsulating washed ceilings, walls and floors once they meet remediation requirements
- * Flush the plumbing before, during and after cleanup.
- * Ventilate the structure once more after indoor cleanup is complete.

What to Throw, What to Keep...

TOYS:

* **DISPOSE OF:**

- * Toys that can be placed in the mouth
- * Toys with visible signs of contamination
- * Stuffed Animals & Porous toys
- * Electronic toys & toys with small crevices
- * Weigh likelihood of child contacting the item

* **Child's Favorite Toy' or 'Can't sleep without it:**

- * Must weigh \$ to effectively test, clean
& re-test the item



What about CLOTHING?

- * **DISCARD:**

- * Clothing or fabric with any visible staining or contamination – including mattresses

- * If in doubt – THROW IT AWAY

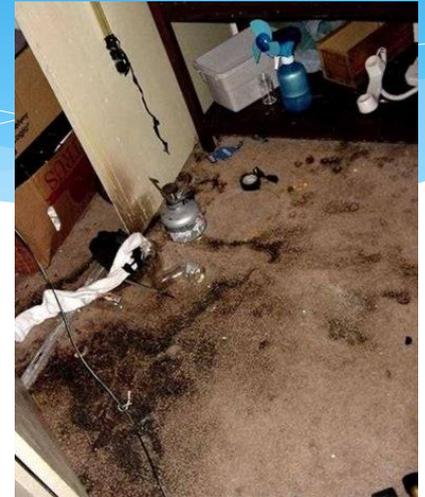
- * **Clothes to be Kept - WASH ON SITE**

- * Do an empty load first
- * Use standard laundry detergent –
- * Wash THREE TIMES
- * Don't dry b/t cycles
- * Once washed - bag items, take off-site to dry
- * Run a second empty laundry load to flush contamination



Carpet/Flooring/Countertops

- * **Remove & dispose all carpet and padding.**
 - * DO NOT shampoo, vacuum or clean the carpet
- * **Laminate flooring – vinyl tile – sheet flooring**
 - * Can be kept – if not visibly contaminated
 - * **If hi-traffic areas – DISCARD
- * **Wood Flooring:**
 - * Unfinished - DISCARD
 - * Finished Floors–Clean & Encapsulate
- * **Countertops & appliances:**
 - * If visible signs of contamination – DISCARD
 - * Stainless steel – WASH & KEEP
 - * Ceramic/Stone Tile:
 - * Clean – Reglaze – Encapsulate the Grout
- * Don't forget to vacuum the subflooring if tearing out flooring



Walls & Ceilings

- * 35-85% of Methamphetamine is recovered from the surface & paint of walls/ceilings.
- * **In a 2004 State of Minnesota study:**
 - * >75% of methamphetamine recovered from unpainted wallboard/drywall – was in the initial paper layer – not the gypsum.
- * **So what does all this mean?**
 - * Remove & replace walls & ceilings that are stained.
 - * Cleanse the remainder
 - * Be prepared to encapsulate



So We've Discarded a LOT: Now How To Wash & Vacuum

* **WHAT TO WASH?**

- * Walls
- * Floors
- * Ceilings
- * Sheet Metal
- * Glass
- * Windows
- * Metal or plastic furniture

* **What to wash with?**

- * Simple Green & other general household cleaners
- * Soap & Water works too

* **How Much to Wash?**

- * Surfaces should be cleaned until they meet the required remediation standard (**1.5 ug/100cm²**).
- * OR: A minimum of **THREE TIMES** before the walls are repainted (i.e., encapsulated) in states w/o standards.

- * **VACUUM** w/ industrial vacuum w/ HEPA Filter (Not a Dyson!)

Encapsulation

- * **Encapsulation of Walls/ Floors/ Ceilings:**
 - * Oil Based Paints
 - * Oil Based Primers (Products like Kilz come to mind)
 - * Oil-based Epoxy
 - * For Wood/Cork Floors: Oil-Based Polyurethane
- * **Keep in mind that very ‘rough’ or porous surfaces may not be able to be cleaned to the state’s standards**
 - * ‘Popcorn Ceilings’ and highly-textured drywall come to mind
- * **Encapsulation only buys ~4.5 months of time if not cleaned or not able to be cleaned to the standards.**

So What's A Safe Environment to Reintegrate the Child?

- * **Multi-faceted answer**

- * **In my opinion:**

- * BEST ANSWER: Use a Contractor

- * Meet the state's standards (1.5mcg/100cm²) – but it's costly (\$3k – \$250k).

- * **If not financially feasible:**

- * All meth use/meth production must be removed from the home

- * Follow the EPA Recommendations:

- * Appropriate 'airing out' time spans.

- * All visibly stained or altered aspects of the home – from clothing to toys to walls & appliances – must be removed

- * Vacuum with an industrial strength HEPA-filter vacuum.

- * All remaining surfaces must be cleaned & encapsulated

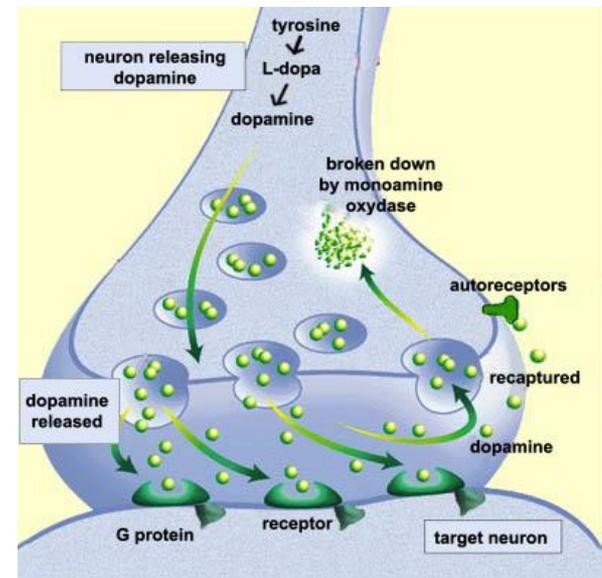
- * Plumbing & HVAC cleaned and flushed or risk re-contamination of the home.

What does Meth do – and how does it affect our patients & our society?



Pathophysiology: Desired Effects

- * Methamphetamine is a stimulant.
- * It is distinguished from amphetamines by a more rapid effect on the CNS= rapid onset of euphoria.
- * Desired effects include:
 - * Wakefulness
 - * Increased energy
 - * Sense of Well being
 - * Euphoria



Pathophysiology

- * Main mechanism of action in the short term is to *increase* levels of the neurotransmitter Dopamine.
- * Dopamine regulates movement, emotion, motivation, and feelings of pleasure.
- * Chronic meth use has been shown to cause persistent dopaminergic **deficits**. Meth inhibits the cells from storing dopamine for later. The supply is **depleted**.
- * Changes occur that also cause **brain cell death!**
- * Impairment can occur in memory, attention, abstract thinking, psychomotor speed, intelligence, and verbal fluency.
- * The changes in the brain are only partly reversible with abstinence. **Cognitive function changes can be prolonged or permanent!**

Adverse Effects of Meth: Mental Health/ Behavioral

- * **Intoxication:** restlessness, insomnia, hallucinations, paranoia, disturbance of consciousness
- * **Abstinence:** depression, irritability, poor concentration.
- * **Chronic abuse:**
 - * Depression and suicide attempts, self injury self mutilation (usually more violence and deranged means).
 - * Psychosis (11x), hallucinations, hostility, paranoia, delusions

Adverse Effects: Medical Complications

- * **Cardiac**= heart attack, hypertensive crisis, dysrhythmias, aortic dissection, endocarditis (IV drugs).
- * **Neuro**= stroke, seizure, intracranial bleeding
- * **Skin**= repetitive skin picking causing sores and infection
- * **Infection**= higher rate of HIV and STI's b/c of high risk sexual behaviors.
- * **GI**= liver injury, hepatitis, bowel infarction, pancreatitis
- * **“Meth mouth”**= dry mouth, poor dental hygiene
- * **Vision**= blindness with snorting





Public Health Concerns from Meth Abuse Epidemic

- * **Maternal Child Health**

- * Lack of Prenatal Care
- * Nutritional Neglect
- * Increased unplanned pregnancy
- * Increased Preterm births and complicated pregnancy
- * Infants born with special needs

- * **Communicable Disease**

- * Increase is hepatitis, syphilis, TB, STIs
- * Increased transmission of HIV to children



Public Health Concerns from Meth Abuse Epidemic



* **Environmental Health**

- * Risk of toxic chemical contamination to household members and professionals.
- * Increased lead exposure in homes with meth lab
- * Fire hazard and risk of burns due to combustible chemicals in labs
- * Increase in unacceptable living conditions

* **Community Health**

- * Increase in violent crime and firearm use
- * Loss of economic productivity
- * Disruption of family unit
- * Increase in Emergency room visits for trauma
- * Increase in prostitution, theft, gambling



Public Health Concerns from Meth Abuse Epidemic



- * **Child Abuse/ Domestic Violence**

- * Increase in child physical abuse
- * Increase in child malnutrition and neglect
- * Increase in child sexual abuse
- * Increase in out of home placement for children
- * Increase in domestic abuse/ exposure to violence in the home
- * Child abandonment

Young Children Exposed to Meth



Prenatal Drug Exposure

Increased muscle tone

Tremors or arms or legs (jittery)

Excessive irritability or crying

Muscle weakness

Risk of stroke or seizures

Risk of HIV, hepatitis

Poor self regulation of feeding

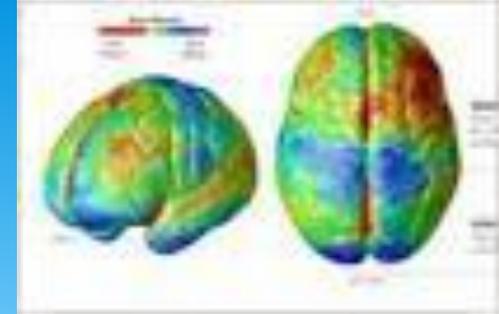
Poor regulation of sleep/wake cycle



In addition, infants may experience addiction withdrawal symptoms which can continue for months.

- * Difficulty with transitions or changes in the environment
- * Discomfort with body sensations, (bowel movements, being undressed, being bathed)
- * Their extreme sensitivity, neurological impairment, and difficulty being comforted render these children difficult to care for.

Pediatric Physiology



- * Young mobile children are at home for long hours, down on the floor exploring the environment, and putting everything in their mouths!
- * Developing brain and organs may be more susceptible to damage.
- * Children's bodies are less able to process and eliminate chemicals.
- * Can develop acute or chronic diseases—such as cancer and organ damage. (eg. Leukemia, kidney or liver failure).

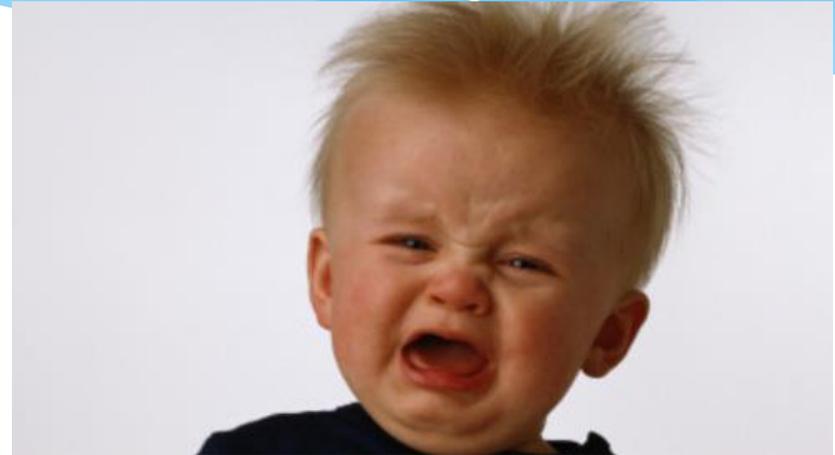
How Do Children Ingest Meth?

- * 80-97% of total exposure for a child results from dermal contact with “soft” surfaces such as carpet and hard surfaces such as linoleum.
- * Ingestion (hand-to-mouth activity), accounts for just 3% of total exposure.
- * The efficiency of dermal absorption of methamphetamine is 57%.



Acute Toxicity Associated with Meth in Toddlers and Children

- * Altered mental state
 - * Agitation
 - * Hallucinations
 - * Confusion
- * Tachycardia
- * Hypertension
- * Vomiting
- * Uncontrolled Crying
- * Seizures
- * Rapid Eye Movements



Chronic Effects of Meth Exposure in Children

These can be from lack of appropriate stimulation/ interaction and toxic insult to specific areas of the brain.

- * Physical
 - * Failure to Thrive/ Poor Growth
- * Developmental Delays
 - * Speech delays
 - * Sensory integration issues
 - * Cognitive Delays (learning problems)
- * Behavioral problems
 - * Tantrums/ aggression
 - * Attention problems (ADHD)
 - * Social Maladjustment

Effects of Neglect

- * Severe neglect can be worse than severe abuse in terms of long term psychological consequences.
- * Neglected children are more likely to become withdrawn adults with mental disorders and more likely to become perpetrators of abuse and neglect themselves.

Key Points for Diagnosis and Treatment of Drug Exposed Children

- * Symptoms exhibited by infants and children vary, and many are not specific to drug exposed kids.
- * Not all drug exposed children will have problems.
- * Treatment is based on the symptoms that the individual child is exhibiting, not solely on the fact that the child has been exposed.
- * Meth exposure does put a child at risk for problems later in life, even if problems are not immediately evident. Problems may not be clinically present until the child is school age.

Testing for Meth Exposure

- * **Meconium**

- * **Must be done at birth**
- * **Approx 6 month window**

- * **Blood Test**

- * **Approx 1 to 3 days (*if ingested*)**

- * **Urine Drug Screen**

- * **Approx 2 to 3 day window (best if < 6 hours of exposure)**
- * **Must be collected immediately**
- * **Cutoffs for drug detection are relatively high and not as sensitive to identify low levels of exposure**
- * **Need confirmatory testing to r/u other medications**

- * **Oral Fluid Testing**

- * **Up to 48 hours after exposure**

- * **Hair Follicle Testing**

- * **About 90 days (based on adult hair growth)**
- * **Does not have to be collected immediately**
- * **Gives a broader window of time and is more sensitive**

Meconium Testing



- * Tests drug levels in infants first stool after birth.
- * Meconium starts to accumulate after the first trimester, so results give about a 6 month window.
- * Testing is provider dependent.
 - * Wesley tests if the social worker suspects
 - * Susan B Allen has a protocol, but still leaves testing to doctor's discretion.

Susan B Allen: Indications for meconium drug testing of a newborn

Perinatal Risk Factors:

- * Maternal history of previous positive drug test or previous positive drug use, including history of chronic pain
- * Behavioral characteristics of drug use by mother during prenatal care or on admission
- * High risk psychosocial factors: noncustodial parent of other children, history of domestic violence, history of previous drug use, history of mental illness
- * Late or limited prenatal care
- * Presence of pregnancy complications that may be associated with drug abuse
- * Report received from outside source of drug use
- * RN discretion



Postpartum or neonatal risk factors:

- * Failure to bond
- * Neonatal characteristics consistent with drug effect: dysmorphic features consistent with fetal alcohol syndrome, microcephaly, growth retardation
- * Symptoms of neonatal abstinence syndrome: agitation, jitteriness, persistent tachypnea, diarrhea, vomiting, excessive sneezing or lack of sleep state
- * RN discretion

Susan B Anthony: Indications for meconium drug testing of a newborn

- * If one or more of the criteria in 1.1 are met, a meconium drug test **MAY** be ordered for the newborn.
- * The consent of the mother/parent is not required for meconium collection.
- * Staff will comply with Kansas law and SBAMH policies for reporting suspected child abuse.

Testing for Meth Exposure

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Hair Follicle Testing

- * Multiple mechanisms of how meth gets incorporated into the hair:
 - * Any drug in the circulating blood can be found in the growing hair
 - * Sweat and sebum resting on the hair
 - * External contamination (fumes, vapors, chemicals spilled on the hair)
- * Approximately 90 to 120 strands of hair is cut from the crown, as close to the root as possible.
- * Not influenced by hair color or hair texture
- * **Hair testing has the greatest sensitivity for identifying drug exposed children, but a negative hair test does not exclude the possibility of exposure.**
- * **Any amount of meth detected by hair sampling is considered a toxic level.**

Hair Follicle Testing

Metabolite testing: lab tests for metabolites of parent drug that have been broken down by the body. This helps eliminate the probability false positives from other drugs. These test results reveal ***only directly ingested drugs.***

Passive Exposure testing: lab tests only for the parent drug. Higher risk for false positives with other drugs.

Washing the hair before processing can help differentiate ingestion vs passive exposure

- * Butler County: Metabolite testing at Omega lab in Ohio.
- * Sedgwick County: Metabolite testing at Quest labs in Kansas City. But, passive exposure testing can be done upon request.

These drug testing companies to have cutoffs established for low, med, and high levels of use. However, they are not as reliable in children.

Hair Follicle Testing- The Reality

What we CAN say

- * The child has been exposed to a toxic level of meth.
- * If metabolite testing done, then we can say that the child *ingested* toxic levels of meth (mouth, skin, lungs)

What we CAN'T say

- * Exactly when or where the child was exposed
- * The exact time frame of exposure
- * The degree of exposure (low, medium, or high) should be interpreted with caution due to limited data on children

Evaluation for these children

- * Identify kids that need immediate medical evaluation
- * Other children need urgent medical evaluation
- * Follow-up on any conditions identified: immunizations, untreated medical problems
- * Developmental Evaluation and follow-up
- * Behavioral/ Mental Health as needed
- * Long term medical follow-up to evaluate for possible cancer (Leukemia)

Who Needs **Immediate** Medical Evaluation?

- * Needed if child has neurologic symptoms, suspected acute toxicity, visible injuries, or is found in a lab.
- * Notify ER that children from Meth lab are being transported—ER can be ready.
- * Take to Via Christi Burn Center IF ANY indication of burn, otherwise to Wesley.
- * Field officer should communicate type of lab found
- * Leave behind any blankets, stuffed animals, etc. (likely contaminated)

Long Term Treatment Goals: Advise for Caregivers

Due to the relative newness of meth abuse, and the lack of longitudinal studies of its effects on children, no exact prescriptions exist for parenting children who have been exposed to methamphetamine.

Caregivers should surround themselves with a medical and social support team.

- * A nurturing, calm, patient, parenting style is especially crucial for drug exposed children with sensory, neurological, and learning impairments.
- * Address grief and loss and the challenges of forming new attachments and integrating into a new family system.
- * Re-educate child about appropriate interactions – in the home, at school, and in the community.
- * Establish a home with clear, predictable rules and routines to reassure the child that he will be safe and needs will be met.

Future Projects

- * Unified protocol for identification of meth exposed infants in the nursery
- * Standard protocols within our MDT of evaluation for meth exposed kids coming into care
- * Handouts and information easily available to foster and kinship placements



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