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What's Cooking? Meth Use in Indiana

Methamphetamine, a derivative of amphetamine, is a synthetic stimulant that affects the central nervous system. It is commonly known as meth, speed, and chalk; in its smoked form, it is often referred to as ice, crystal, crank, and glass [1]. Due to its high potential for abuse, meth is classified as a Schedule II drug and is legally available only by prescription [2]. Abuse of the drug is a serious problem in the United States, often resulting in devastating medical, psychological, social, and legal consequences. According to estimates from the 2008 National Survey on Drug Use and Health (NSDUH), 12.6 million Americans (or 5.0 percent) ages 12 and older have tried meth at least once in their life [3].

Meth comes in many forms and can be smoked, snorted, injected, or ingested orally. The drug alters mood in different ways, depending on its route of administration. Immediately after smoking or intravenous injection, the user experiences an intense rush or "flash" that lasts only a few minutes and is described as extremely pleasurable. Snorting or oral ingestion produces euphoria, a pleasurable high. Snorting produces these effects within three to five minutes, while oral ingestion requires 15 to 20 minutes [1, 4].

The drug's mood-altering properties can be attributed to its effect on dopamine.[i] Meth increases the release and blocks the reuptake of dopamine, leading to high levels of the neurotransmitter in the brain. Dopamine is involved in reward, motivation, experience of pleasure, and motor function. Studies of meth users revealed severe structural and functional changes in areas of the brain associated with emotion and memory; these changes may account for many of the emotional and cognitive problems observed in chronic meth abuse [2, 4].

Prolonged meth use can result in tolerance, a condition in which higher doses of the drug are required to produce the same effect as experienced initially. Tolerance can lead to addiction, which is defined as a chronic, relapsing brain disease characterized by compulsive drug seeking and use [2, 4].

Methamphetamine can cause a variety of severe short- and long-term health consequences, including the following [1]:

Short-term Consequences

- Increased attention and decreased fatigue
- Increased activity and wakefulness
- Decreased appetite
- Euphoria and rush
- Increased respiration
- Rapid/irregular heartbeat
- Hyperthermia

Long-term Consequences

- Addiction
- Psychosis (including paranoia and hallucinations)
- Repetitive motor activity
- Changes in brain structure and function
- Memory loss
- Aggressive or violent behavior
- Mood disturbances
- Severe dental problems ("meth mouth")
- Weight loss

[i] Dopamine is a neurotransmitter in the brain.

Meth was first synthesized from ephedrine[ii] in 1893 by Nagayoshi Nagai. Another Japanese pharmacologist, Akira Ogata, synthesized a more potent form, crystal meth, in 1919. Methamphetamine did not become widely used until World War II, when Japan, Germany, and the United States provided the drug to military personnel to improve endurance and performance [4-6].

Therapeutically, meth has been used in nasal decongestants and bronchial inhalers. It is still indicated for limited medical use, such as the treatment of narcolepsy (a sleep disorder) and attention deficit hyperactivity disorder (ADHD); but the prescribed dosage is much lower than those typically abused [1].

Prevalence of Meth Use and Health Consequences

Prevalence rates of methamphetamine use are similar in Indiana and the United States. Among Hoosiers ages 12 and older, 4.5 percent (225,000 residents) have used meth at least once in their life (U.S.: 5.0 percent); 0.8 percent (40,000 residents) used it in the past year (U.S.: 0.3 percent); and 0.2 percent (10,000 residents) used it in the past month (U.S.: 0.1 percent) [3].[iii]

Lifetime prevalence of meth use among Indiana high school students, grades 9 through 12, was 4.1 percent in 2009 (U.S.: 4.1 percent), representing a significant drop from 8.2 percent in 2003 (U.S.: 7.6 percent) [7]. Current (past month) meth use among 8th, 10th, and 12th grade students in Indiana was documented at 0.7 percent, 1.0 percent, and 0.9 percent, respectively [8].

Meth is habit-forming, and abuse of the drug often leads to addiction and other negative health outcomes, including increased morbidity and mortality.

Abuse and Addiction

Drug addiction (dependence[iv]) is defined as a chronic, relapsing brain disease characterized by compulsive drug seeking and use, despite harmful consequences [9].

Between 2007 and 2008, the percentage of Indiana treatment episodes with reported meth use remained stable at 9.2 percent, having been as high as 10.9 percent in 2005 [10]. Based on 2008 findings, significant differences in meth use were observed by gender, race, and age group:

- Females (11.1 percent) reported higher rates of use than males (8.3 percent).
- Whites (11.1 percent) reported higher rates of use than blacks (0.8 percent) and other races (6.9 percent).
- With the exception of individuals under the age of 18, younger adults had higher rates of use than older people, with the highest rates among those ages 25 to 34 (11.9 percent) [10].

Meth dependence[v] increased from 1.5 percent in 2000 to 5.0 percent in 2008, a statistically significant jump. Patterns were similar to those identified for meth abuse in the treatment population; i.e., higher rates of meth dependence were found in women, whites, and 25- to 34-year-olds [10].

Meth is typically known as a "rural drug" for several reasons. It is easily manufactured using over-the-counter (OTC) and household ingredients, as well as certain fertilizers common to farming areas. The relative isolation of rural communities can aid in meth production, allowing noxious fumes to go unnoticed. Finally, the economic devastation of rural areas can entice residents to abuse the drug [11].

In keeping with these factors, the percentage of Indiana treatment admissions with reported meth use differed significantly by level of urbanization (as defined by Isserman's rural-urban density typology[vi] [12]). Rural counties had the highest percentage (17.4 percent), followed by mixed-rural (11.5 percent), mixed-urban (9.6 percent), and urban (1.5 percent) areas [13].

[ii] Ephedrine is the main active ingredient in ephedra (Ephedra sinica), also called ma huang, a naturally occurring herb. Ephedrine is structurally similar to amphetamine.

[iii] National rates are based on results from the 2008 National Survey on Drug Use and Health (NSDUH), while state level estimates are based on annual averages from 2002-2004.

[iv] The terms "addiction" and "dependence" are used interchangeably in this report.

[v] We defined methamphetamine dependence as "individuals in substance abuse treatment listing methamphetamine as their primary substance at admission."

[vi] Levels of Urbanization were based on the "Rural-Urban Density Typology" developed by Isserman (2005), and are categorized on four criteria: percentage of urban residents; total number of urban residents; population density (persons per square mile); and population size of the county's largest urban area (Waldorf, 2007, p. 9). Urban counties are defined as those having more than 500 persons per square mile; those with greater than 90% of residents living in urbanized areas; and those having the total number of urban residents greater than 50,000 persons (Waldorf, 2007, p. 10). Rural counties are defined as having less than 500 persons per square mile and less than 10% of residents living in urbanized areas, with the population size of the largest urban area being less than 10,000 persons (Waldorf, 2007, p. 10). Waldorf (2007) states that "Counties meeting neither the rural nor the urban criteria are classified as mixed" (p. 10). Mixed-rural counties are those possessing less than 320 persons per square mile, and mixed-urban counties are those possessing greater than 320 persons per square mile (Waldorf, 2007, p. 10).

Meth Mouth

The long-term use of methamphetamine can cause many irreversible physical and psychological problems for the user, including stroke, cardiac arrhythmia, structural and chemical changes to the brain, and severe tooth decay and tooth loss [4, 42].

The term "meth mouth" is commonly used to describe the rampant tooth decay and loss associated with long-term abuse of methamphetamine [43-44]. One of the results of methamphetamine use is xerostomia (dry mouth); users begin to crave high-calorie, sugary, carbonated beverages and candy in order to relieve the symptoms [43-45]. Dry mouth is a result of the reduction in the amount of saliva, which is critical in preventing cariogenic (cavity-inducing) bacterial growth, as well as acting as a natural buffer to the acidity produced in the mouth from consuming sugary substances [45]. Other oral symptoms from methamphetamine use include clenching or grinding of the teeth [44-46].

Methamphetamine's effect on the body usually causes users to disregard oral hygiene that is important in maintaining healthy teeth [43-45]. Improper oral hygiene, constant grinding of the teeth, and the reduction in saliva facilitate rapid cavity growth, tooth decay, and eventual loss of teeth.

It has been speculated that, because the drug is often smoked, the user breathes in the dangerous chemicals used in methamphetamine's production, such as battery acid, fertilizers, and household cleaning agents, which also affects teeth negatively [43-44].

However, tooth decay and loss associated with meth use are the result of complex processes coupled with poor oral hygiene [45].

Table 1. Indiana Hospital Discharges of Patients with a Meth-related Primary Diagnosis and Attributable Hospital Costs (Indiana Inpatient Aggregated Data, 2008)

	Total Patients	Total Charges	Patients Attributable to Meth	Charges Attributable to Meth
Abuse and dependence involving amphetamines or other stimulants	56	$295,986	51	$269,051
Drug-induced mental disorder	1,803	$15,127,801	90	$756,390
Total	1,859	$15,423,787	141	$1,025,441

Note: Of all primary diagnoses of drug abuse and dependence involving amphetamines and other stimulants, we attributed 90.9 percent to methamphetamine use. We arrived at that estimate because among all Indiana treatment episodes with reported meth, amphetamine, and other stimulant use (n=1,933), the percentage reporting meth use (n=1,757) was 90.9 percent. Similarly, we attributed 5.0 percent of all drug-induced mental disorders to meth use, because among all Indiana treatment episodes (n=19,111), 5.0 percent reported meth as their primary substance (n=951).

Source: Substance Abuse and Mental Health Data Archive, 2009 [10]; Indiana State Department of Health, n.d. [14]

Morbidity and Mortality

In 2008, 56 discharged hospital patients in Indiana had a primary diagnosis of drug abuse/dependence involving amphetamines and other stimulants. These cases resulted in hospital charges of almost $300,000. Additionally, more than 1,800 patients were diagnosed with a drug-induced mental disorder, adding up to $15.1 million [14]. Not all of these occurrences can be attributed to methamphetamine, but an estimated 141 patients and $1.03 million in hospital charges were directly related to meth use (see Table 1).

From 1999 through 2006, 165 Hoosiers died because of stimulant-related causes. Indiana's age-adjusted annual mortality rate of 0.3 per 100,000 population was significantly below the nation's rate of 0.8 per 100,000 population [15].[vii]

Clandestine Methamphetamine Laboratories

Illicit meth production is a simple process, and the drug is frequently manufactured in clandestine laboratories by people without special experience or knowledge of chemistry. Cookbook-style recipes are widely available and can easily be obtained over the Internet [6, 17].

Aside from the inherent physical and physiological dangers of the drug itself, individuals in and around meth labs can be exposed to hazardous substances used in the production of the drug. Exposure to these substances can occur from volatile air emissions, spills, fires, and explosions [18]. Those most likely to be exposed include the drug manufacturers, law enforcement officers, local health and fire personnel, residents near laboratory sites, and future occupants of discarded laboratory sites. The chemi-

[vii]ICD-10 codes for stimulant-related causes of death include: F15.0 (Mental and behavioral disorders due to use of other stimulants, including caffeine, acute intoxication), F15.1 (Mental and behavioral disorders due to use of other stimulants, including caffeine, harmful use), F15.2 (Mental and behavioral disorders due to use of other stimulants, including caffeine, dependence syndrome), F15.3 (Mental and behavioral disorders due to use of other stimulants, including caffeine, withdrawal state), F15.4 (Mental and behavioral disorders due to use of other stimulants, including caffeine, withdrawal state with delirium), F15.5 (Mental and behavioral disorders due to use of other stimulants, including caffeine, psychotic disorder), F15.6 (Mental and behavioral disorders due to use of other stimulants, including caffeine, amnesic syndrome), F15.7 (Mental and behavioral disorders due to use of other stimulants, including caffeine, residual and late-onset psychotic disorder), F15.8 (Mental and behavioral disorders due to use of other stimulants, including caffeine, other mental and behavioral disorders), F15.9 (Mental and behavioral disorders due to use of other stimulants, including caffeine, unspecified mental and behavioral disorder), X41 (Accidental poisoning by and exposure to antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs, not elsewhere classified), X61 (Intentional self-poisoning by and exposure to antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs, not elsewhere classified), Y11 (Poisoning by and exposure to antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs, not elsewhere classified, undetermined intent), Y49.7 (Psychostimulants with abuse potential).

cals used in the manufacturing process can be corrosive, explosive, flammable, toxic, and, possibly, radioactive. Exposure can occur via skin absorption, inhalation, ingestion, or injection [17].

According to a report by Chesley, the U.S. Drug Enforcement Administration (DEA) estimates that five to six pounds of hazardous waste are generated for each pound of meth. The waste products are often dumped on the ground, discarded in dumpsters or along a highway, or flushed down the sewer [16].

There are various recipes for cooking meth, but all methods are dangerous. Recently, a new approach has emerged, the so-called one-pot or "shake and bake" method. It still requires ephedrine or pseudoephedrine, but instead of anhydrous ammonia it uses ammonium nitrate from fertilizer or cold-pack compresses, which are easier to obtain. This method produces the drug in approximately 30 minutes. All ingredients are combined in one container (often a 2-liter plastic soda bottle) and then shaken, increasing the risk of explosion. This method yields smaller amounts of meth but can be done almost anywhere, even in a moving vehicle. Waste is often disposed along roadsides, with discarded plastic bottles potentially carrying toxic, explosive, or flammable residue [19-21].

> "Take a pinch of red phosphorous, a smidgen of ephedrine, a dash of iodine and a skosh of lye. Add some distilled water and simmer for a few hours and hope it doesn't explode and kill you."
>
> PAUL B. JOHNSON (POST REGISTER, IDAHO) [16]
> FROM THE BETTY CRANKER COOKBOOK

In 2008, law enforcement seized 6,783 clandestine meth labs in the United States (this figure includes all meth incidents, such as labs, "dump sites," and "chemical and glassware" seizures) [22]. Laboratory seizures can occur during any stage of meth production. This puts environmental and law enforcement personnel at high-risk of exposure, explosions, and in many cases, firearm attacks [16]. Meth producers are known to install booby traps to prevent entry by unwanted individuals and to destroy evidence should the facility be discovered. These booby traps are designed to cause serious injury. Especially when chemical booby traps are used, the potential for serious chemical exposure is significant [17].

Legal Consequences for Possession and Sale/Manufacture of Meth

Meth is listed as a Schedule II controlled substance, because of its high abuse potential [23]. In the Uniform Crime Reporting (UCR) Program, meth is classified as a synthetic drug, along with Demerol and methadone. In 2007, 1,511 Hoosiers were arrested for possession of synthetic drugs and 649 arrests were made for sale and manufacture [24].

Though the drug is available through a prescription (Desoxyn®), most meth is produced illicitly in clandestine laboratories. According to the U.S. Drug Enforcement Administration, 9.7 kg (21.4 pounds) of meth were seized in Indiana in 2008 [25]. In 2009, the Indiana State Police (ISP) seized a total of 1,343 clandestine meth labs in the state. This figure represents the highest lab seizure total for meth in the state's history; the total in 2004 was previously the highest, at 1,115 meth lab seizures [26].

Meth use also impacts children and families by contributing to increased interpersonal conflicts, financial problems, poor parenting, incarceration of parents, and placement of children in protective custody [27]. According to ISP data, the number of children who were located at meth labs in Indiana rose from 125 in 2003 to 185 in 2009 [26].

In 2005, the Indiana Department of Correction (IDOC) responded to Indiana Governor Mitch Daniels' call for a "Meth-Free Indiana" by creating a substance abuse treatment program for incarcerated methamphetamine abusers entitled *Clean Lifestyle is Freedom Forever* (CLIFF) [28]. The intensive program lasts a minimum of eight months, and involves the use of "cognitive-behavioral, evidenced-based best-practice counseling" [28]. Offenders in the treatment program receive skills to help combat meth addiction, as well as social and interviewing skills to foster successful reentry into society after incarceration. Those in good standing entering the program may become eligible for a time-reduction of their prison sentence of up to six months [29]. Recidivism rates[viii] for those completing this program are nearly half that of the corrections population (in prison for meth-related crimes) who do not complete the program [28]. In 2009, a total of 371 Indiana inmates successfully completed the CLIFF programs [28].

Meth Legislation

Numerous chemicals are associated with the illicit production of methamphetamine. Although only a few chemicals may be required for manufacture, there are multiple precursors, reagents, and solvents that can be substituted for those that are difficult to obtain legally [6]. Ephedrine, pseudoephedrine, and phenylpropanolamine are the most commonly used precursors in U.S. meth production. To monitor and reduce sale of these substances, the *Domestic Chemical Diversion and Control Act* of 1993 added a

[viii] Recidivism rates are measured by the offender repeating the same (or similar) crimes after being released from punishment and incarceration.

registration requirement for handlers (e.g., pharmacies) of "listed chemicals"[ix] and removed exemptions in order to prevent diversion of methamphetamine precursor chemicals [30].

In 1996, Congress passed the *Comprehensive Methamphetamine Control Act*, which expanded regulatory controls on all lawfully marketed drug products containing ephedrine, pseudoephedrine, and phenylpropanolamine and increased penalties for the trafficking and manufacturing of methamphetamine and listed chemicals [31].

Until 2006, pseudoephedrine could be legally purchased over-the-counter by individuals, but that changed with increased use of pseudoephedrine in the production of methamphetamine in the United States. The implementation of the *Combat Methamphetamine Epidemic Act* of 2005 made it illegal to sell large amounts of pseudoephedrine and restricted the ease-of-access to the drug [32-33]. Pharmacies are now required to keep products containing pseudoephedrine behind the counter or locked away from customers, and the pharmacist must be the direct seller of the products to the consumer [34]. Customers are limited to buying not more than 3.6 grams of pseudoephedrine per day or 9 grams per 30-day period (of which no more than 7.5 grams can be imported by private or commercial carrier or the Postal Service) [34].

Pharmacies must keep a written or electronic logbook documenting all pseudoephedrine purchases by customers, including the following information: product by name, quantity sold, name and address of purchaser, and date and time of sale [34]. Each logbook has to be kept at least for two years for law enforcement inspection [34]. Products packaged for individual sale that contain less than 60 milligrams of pseudoephedrine are exempt from the logbook requirements but must also be kept behind the counter [32].

The *Combat Methamphetamine Epidemic Act* does not preempt states' passing laws that are more stringent than the act's requirements [32]. The State of Indiana passed its pseudoephedrine reduction law, effective July 1, 2005 [35]. It limits sales to those 18 years or older, requires purchasers to show photo identification and sign a logbook, and prohibits customers from purchasing more than 100 tablets of ephedrine or pseudoephedrine products per week [36].

Kentucky is implementing the MethCheck program, which monitors the sale of pseudoephedrine electronically. This program was modeled after the Kentucky All-Schedule Prescription Electronic Reporting (KASPER) system and was initiated after the enactment of the *Combat Methamphetamine Epidemic Act* [37]. MethCheck allows law enforcement officials to check sales of pseudoephedrine in real time using a computer, thus reducing the amount of time spent going to pharmacies and inspecting the logbooks [37-38]. A consequence of the program was that some Kentucky residents crossed the border to purchase pseudoephedrine in Indiana. Therefore, in early 2009, Indiana and Kentucky announced a partnership to expand the MethCheck program into several Indiana border counties in order to curb diversion [32, 38].

Economic Burden of Methamphetamine

The RAND Drug Policy and Research Center published a study in 2009 on the economic burden of methamphetamine use in the United States. The authors employed a prevalence-based, cost-of-illness approach to identifying and measuring costs associated with meth use. The analysis was based on a wide range of meth-related consequences, including addiction, premature death, drug treatment, lost productivity, crime and criminal justice, healthcare, production and environmental hazards, and child endangerment. Based on their estimate, the direct, indirect, and intangible costs of meth use reached $23.4 billion[x] in 2005 (see Table 2) [39].

According to the National Clandestine Laboratory Database, a total of 12,619 clandestine meth lab incidences were recorded in the United States in 2005, of which 8 percent (981 incidences) occurred in Indiana [40]. Therefore, we can estimate the state's share of the costs by attributing 8 percent of the burden to Indiana. Based on these figures, Indiana's overall costs attributable to meth were an estimated $1.87 billion in 2005 (see Table 2) [41].

Table 2. Economic Costs (in Millions) of Methamphetamine Use in the United States and Indiana, 2005

Cost	U.S. Estimate	Indiana Estimate
Drug treatment	$545.50	$43.60
Healthcare	$351.30	$28.10
Intangibles/premature death	$16,624.90	$1,330.00
Productivity	$687.00	$55.00
Crime and criminal justice	$4,209.80	$336.80
Child endangerment	$904.60	$72.40
Production/environment	$61.40	$4.90
Total	**$23,384.40**	**$1,870.80**

Note: We computed Indiana's meth-related costs by multiplying the U.S. estimates by 0.08, because 8 percent of all clandestine meth lab seizures in 2005 occurred in Indiana.

Source: Nicosia, Pacula, Kilmer, Lundberg, & Chiesa, 2009 [39]; Indiana State Police, 2010 [41]

[ix] Listed chemicals are chemicals that, in addition to having legitimate uses, are being used to manufacture a controlled substance.

[x] Given the uncertainty in estimating the economic burden of meth use, the study provides both a lower-bound estimate of $16.2 billion and an upper-bound estimate of $48.3 billion.

Thoughts for Policymakers

Methamphetamine is a serious public health problem, affecting numerous sectors of society. Even though prevalence rates are fairly low within the general population, the consequences of using and producing meth can be severe and costly. An estimated $1.87 billion were spent in Indiana in 2005 due to direct, indirect, and intangible costs related to the drug [39, 41].

Certain laws are already in place to limit access to meth precursors and other chemicals essential in meth manufacture. However, more needs to be done to curtail the demand for and production of the drug. Policy recommendations to reduce consumption and consequences of meth use should be comprehensive and may include the following strategies [17, 46]:

- Implement evidence-based programs to prevent drug use before it starts.
- Identify early intervention opportunities in healthcare settings (e.g., screening and early intervention for substance use by primary care provider).
- Integrate substance abuse treatment into healthcare and expand recovery services (e.g., expanding addiction treatment in Community Health Centers).
- Break the cycle of drug use, crime, delinquency, and incarceration (e.g., promoting alternatives to incarceration, mandating treatment, and implementing court monitoring for chronic drug-using offenders).
- Disrupt drug trafficking and production (e.g., support for law enforcement drug task forces).
- Improve information systems for assessment and data analysis (e.g., enhancing current data systems to monitor trends and support data-driven decision-making).
- Increase public awareness (e.g., disseminating information and statistics on meth including tell-tale signs of clandestine labs).
- Conduct further research on meth-related topics (e.g., long-term health effects of exposure to hazardous chemicals used in the manufacture of meth; how to determine safe levels for reoccupation of a property previously used as a drug laboratory).

Methamphetamine is a complex issue that poses serious public health and law enforcement challenges. Like any other substance, meth can lead to addiction, increased morbidity and mortality, and legal troubles. What is more, legal troubles might be "exceedingly pronounced among meth drug users compared to non-meth drug users" [47]. Additionally, environmental hazards are linked to its illicit production in clandestine labs. Implementation of comprehensive evidence-based strategies will be crucial in reducing manufacture, sale, and illicit use of the drug.

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