



Pennsylvania Overdose Reduction
Technical Assistance Center (TAC) ▲

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Technical Assistance Center
Methamphetamine Background Report

INTRODUCTION AND BACKGROUND

In the United States, methamphetamine use is most common in the western states and Hawaii. However, it has spread into the Midwest, and the southern portions of the country.¹ Reports show that methamphetamine use is stabilizing, though the rate of dependence is increasing. The national rate of admissions to treatment varies depending on the region. For example, in Hawaii, the rate rose from 33 per 100,000 in 1992 to 244 per 100,000 in 2005, while in Maine, the rate rose from 1.5 to 7 per 100,000 during that same time frame.² Methamphetamine can be produced and distributed on a local level, but this is increasingly uncommon, as the costs associated with small scale operations in the United States are too great to compete with production operations in Mexico.¹

Federal regulations have been imposed by the U.S. and Mexican governments to reduce the production of methamphetamine. These regulations put limits on the products used to manufacture methamphetamine, such as pseudoephedrine.² However, the implementation of these regulations resulted in a shift in production as people started to manufacture methamphetamine with methylsulfonylmethane (MSM). The addition of this product practically doubles the amount of methamphetamine produced and significantly reduces the cost of manufacture. The reduction in price and increase in quantity of methamphetamine available has contributed to its spread from the western portions of the country.

As methamphetamine use and dependence continues to spread eastward, it is important to have the information and tools to better face this problem. The purpose of this report is to provide a brief background on methamphetamine use in the U.S., clinical indicators and symptoms, community indicators of methamphetamine use, current law enforcement, and EMS (Emergency Medical Services) protocol for treating individuals under the influence, and current treatment trends for individuals who are dependent. This report will be used to help community coalitions and treatment providers to make informed decisions to address methamphetamine use in Pennsylvania.

CLINICAL INDICATORS

Methamphetamine is a psychostimulant that increases the release of dopamine, serotonin, and noradrenaline and blocks their reuptake.³ The most common routes of administration are smoking or snorting, but it can also be injected or ingested.¹ The elevated levels that result cause a variety of physical and psychopathological symptoms that range in severity.⁴ These symptoms or indicators are listed in Table 1.

Table 1: Clinical symptoms and indicators of methamphetamine use.

Increased energy and alertness	Tightened jaw muscles	Disrupted sleep patterns	Gastrointestinal symptoms
Decreased need for sleep	Loss of appetite, which contributes to weight loss	Sweating	Dry mouth and tooth decay
Euphoria	Disorganized thinking	Grinding teeth	Hallucinations
Excessive talking	Itching	Extreme anxiety, paranoia, or panic	Irregular breathing
High blood pressure	Tremors and/or seizures	Elevated heart rate and chest pain	

The symptoms of abstinence syndrome from methamphetamine can persist for two to four weeks after cessation of use and include anhedonia, or the inability to feel pleasure, irritability, poor concentration, hyperphagia, or overeating/increased appetite, disrupted sleep, and psychomotor agitation or retardation.^{3,4}

Although there is limited research on polydrug use and its role in fatal methamphetamine toxicity, there have been studies that indicate a higher rate of methamphetamine toxicity when it is used with other drugs. Individuals who used methamphetamine and alcohol had higher blood pressure and heart rate than individuals who had just taken methamphetamine. Studies have also indicated that heroin and methamphetamine may induce cardiac failure due to heroin-induced respiratory depression compounded by increased myocardial oxygen demand induced by methamphetamine. About half of all fatal methamphetamine toxicity cases have multiple substances detected. The most common ones are alcohol (10-25%), cocaine (12-25%), and morphine (20-30%).⁴

Chronic methamphetamine use has also been associated with the development of methamphetamine-induced psychotic disorder. The symptoms of this are paranoia, persecutory delusion, and auditory, visual, and tactile hallucinations. Some studies have also linked chronic methamphetamine use to cognitive effects such as episodic memory, executive functions, information processing speed, motor skills, and language. However, the cognitive effects of methamphetamine are still being disputed, and more research is needed in this area.^{3,5}

There is a high rate of depression and comorbid psychiatric disorders in many methamphetamine users.⁴ A study of 189 patients with methamphetamine dependence revealed that 29% were diagnosed with a primary psychotic disorder, approximately 32% were diagnosed with a primary mood disorder, 27% were diagnosed with a primary anxiety disorder, and 40% were diagnosed with attention deficit hyperactivity disorder (ADHD). In a study of 214 participants with methamphetamine dependence, over 70% had depressive symptoms that were severe enough to be diagnosed with major depression.^{3,5}

Chronic methamphetamine use has been linked with a variety of cardiovascular diseases and complications. Some of the common ones include various cardiomyopathies (heart diseases), arrhythmias, and an increased risk of hemorrhagic stroke and rupture of intracranial aneurysms.⁴ Cardiomyopathy related to methamphetamine use is more severe than other cardiomyopathies. In a study of 143 participants aged 45 and younger who had cardiomyopathy, 40% were methamphetamine-dependent. The data collected during this study suggests that chronic methamphetamine users have a significantly lower left ventricular ejection fraction compared to patients with cardiomyopathy who do not use. The elevated levels of dopamine, serotonin, and noradrenaline contribute to cardiomyopathy through numerous mechanisms such as recurring hypertension.⁶

COMMUNITY INDICATORS

Prior to 2006, increased availability of methamphetamine often correlated with an increase in local or regional methamphetamine manufacturing operations. These labs ranged in size from small “mom and pop” facilities to “super labs,” which produced large quantities of methamphetamine in the Southwestern United States. However, an increase in regulations on pseudoephedrine purchases in 2006 caused a significant decline in domestic production operations, especially for smaller producers.² While this did cause a temporary decrease in methamphetamine availability, trends in recent years suggest a new rise in methamphetamine prevalence. This rise has not been correlated with an increase in local manufacturing, but rather product being trafficked from other countries, while domestic production continues to decrease.^{4,5} In Pennsylvania,

much of the increase in methamphetamine availability has been attributed to the trafficking efforts of Mexican cartels. Though only speculative, this increase in methamphetamine trafficking may be the result of decreased profit margins for marijuana trafficking as it is now legal in a number of states.⁶ Therefore, the physical environment indicator of manufacturing operations is now a less reliable measure of methamphetamine presence in Pennsylvania and the rest of the United States.

Social disorganization theory is typically the foundation for research into the connection of community and methamphetamine use. Social disorganization theory suggests that communities with disempowered residents who do not have control over their surroundings will typically experience higher levels of crime and delinquency. This theory points to community indicators such as high ethnic diversity, poverty, high population density, and little residential or family stability as drivers of social disorganization.^{7,8} Most analyses of correlation between community indicators and methamphetamine rely on interpretation of youth survey data or post-arrest data. Though these are convenience samples, the community indicators analyzed are predominately the same and measured across multiple age groups. Interestingly, the impact of each community indicator on methamphetamine use varies across the available literature.^{2,7,8}

According to social disorganization theory, ethnic and racial heterogeneity should have a positive correlation with methamphetamine use. In other words, an individual is more likely to use methamphetamine if s/he resides in a community with a high level of heterogeneity.⁷ However, in the case of methamphetamine use, the opposite appears to be true. Racial and ethnic heterogeneity have either no impact or a negative correlation with methamphetamines use when analyzing youth survey data or post-arrest data from rural and/or urban communities. This suggests that greater racial and ethnic heterogeneity may decrease the likelihood of methamphetamine use in a community.^{7,8} Unfortunately, the literature does not explicitly identify the cause of this difference in methamphetamine use compared to other illicit substances such as cocaine and marijuana. Limited research suggests this variation may be caused by the difference in distribution of methamphetamine. While other illicit substances are often sold on the street and in public places, methamphetamine is often sold out of homes, frequently in rural areas where populations are more likely to demonstrate racial and ethnic homogeneity.⁸

In social disorganization theory, poverty is suggested as being positively correlated with the misuse of methamphetamine and other illicit substances. In analysis of youth survey data, this correlation proved to be true, as the likelihood of self-reported youth methamphetamine use increased with lowering household income.⁷ However, in two studies analyzing post-arrest data, researchers found methamphetamine use to be negatively correlated with unemployment in one sample, but positively correlated in the second.^{8,9}

According to social disorganization theory, the likelihood of illicit substance use should increase with population density.⁸ While this holds true for the use of most illicit substances, including other stimulants such as cocaine, methamphetamine use does not display such a trend. Two studies suggest population density has a neutral or negative correlation with methamphetamine use, indicating that the likelihood of methamphetamine use may be greater in more rural areas.^{7,8} This aligns with the negative correlation between racial/ethnic heterogeneity and methamphetamine use, as rural areas tend to have lower racial/ethnic heterogeneity.⁸

Social disorganization theory connects familial and residential instability with an increased likelihood of substance misuse. However, possibly due to the difference in distribution and user demographics, some research indicates an increase or similar likelihood of methamphetamine use in tighter-knit communities.^{7,9}

LAW ENFORCEMENT/EMS PROTOCOL

First responders are seeing an increase in patients under the influence of methamphetamine. Robert Evans, Director of Continuous Quality Improvement for Butler Ambulance Service, reported that not only are they seeing an increase in stimulant use but also that the patients who are identified as being under the influence of methamphetamine are often in a heightened state of psychosis or aggression. This finding is consistent with symptoms commonly associated with methamphetamine misuse, such as anxiety, depression, and psychosis.¹⁰ Moreover, methamphetamine-induced psychotic symptoms often mimic symptoms of schizophrenia, including paranoid ideation, delusions, and auditory/visual hallucinations.¹⁰

There are currently no direct protocols for first responders to follow when interacting with patients who are suspected of being under the influence of methamphetamine. However, policymakers have identified a course of action when dealing with patients in an aggressive or psychotic state (whether under the influence of methamphetamine or not). The Pennsylvania Statewide Advanced Life Support Protocols, developed by the Pennsylvania Department of Health (DOH), Bureau of Emergency Medical Services details processes to follow should EMS personnel encounter a patient with agitated/psychiatric behavior, or suspected to be in a state of excited delirium.¹¹ For a patient who is at immediate risk of self-injury, or injury to others, agitated delirium, or a medical condition causing agitation, EMS personnel are instructed to restrain the patient to prevent injury to self or others. In cases of aggression or continued struggling, EMS personnel can administer a sedative, either Lorazepam (1-2mg), Diazepam (5-10mg), or Midazolam (1-5mg), to the patient.¹¹

For a patient suspected of being in a state of excited delirium, EMS personnel can administer Ketamine after evaluation so long as the patient meets inclusion criteria. The protocol document notes that there is no universally accepted definition of excited delirium; however, the American College of Emergency Physicians published a description of common characteristics and behaviors in a white paper.¹² The protocol also notes that for the purpose of the protocol, a patient must meet one or more of the following criteria: exceptional/abnormal pain tolerance, tachypnea, tactile hyperthermia, unusual strength, police noncompliance, lack of tiring against restraint, inappropriate clothing for environmental temperature, violent and paranoid behavior, rapid development of symptoms, or rapidly fluctuating periods of calm and then delirium.¹¹ Other inclusion criteria include the patient being less than 65 years old and have an Improved Montgomery County Richmond Agitation Sedation Scale (IMCRASS) score of >2. The Advanced Life Support provider must have successfully completed the Excited Delirium education module to administer Ketamine, and the director of the EMS agency must perform a QI audit anytime the drug is administered. Ketamine must be ordered by a medical command, and EMS may not administer it without their approval. The proper dosage used is 4mg/kg through intramuscular administration.¹¹

TREATMENT

Methamphetamine dependence is particularly difficult to treat. Many of the patients who engage in treatment have comorbid psychiatric disorders and experience significant physiological and psychological problems due to the drug's impact on neural pathways.¹⁰

However, some risk factors have specifically been identified in individuals who have had poor treatment outcomes. Those risk factors are continued methamphetamine use during treatment, injection use, low education level, young age at treatment admission, having a disability, polydrug use, childhood trauma and

abuse, and having an underlying psychiatric condition.¹⁰ Some of the protective factors are lower use at admission, shorter histories of methamphetamine use, longer retention in treatment, and longer periods of abstinence.¹⁰

There are no approved pharmacological treatments for methamphetamine currently. Although several have preliminarily been identified as promising, such as selective serotonin reuptake inhibitors, research showed that they failed to have an effect.¹³ There is also no pharmacological solution to reversing a methamphetamine overdose. This barrier mainly affects first responders and emergency department staff since there is no approved pharmacological method to safely reverse an individual who is under the influence of methamphetamine or at risk of overdosing.¹³ Treatment routes rely heavily on behavioral therapy and contingency management to increase rates of success.¹⁴

The matrix model is commonly used as a template for treatment for methamphetamine users. It combines group therapy sessions and individual therapy sessions focused on behavioral therapy with contingency management programs. These programs include therapy sessions with family to help increase understanding within the family and strengthen familial support as well as social groups that encourage those in treatment to create stronger bonds with others who are in recovery and to help prevent them from returning to the same activities. All of this is overseen by a therapist and ideally with an individual who has been in recovery for longer than six months.^{14,15}

Exercise programs were identified as a potential addition to a behavioral therapy program or a program such as the matrix model that would increase the success rate of treatment.¹⁴ A study was done to measure the effects of an exercise program on the striatal dopamine receptors in participants. All participants in this study were in a recovery program and participated in behavioral therapy in addition to an exercise program. Participants who participated in behavioral therapy, as well as the exercise program, had a higher rate of repletion of their striatal dopamine receptors than the control group that did not partake in the exercise program.¹⁵ Exercise programs have the potential along with behavioral therapy to accelerate the process of recovery from methamphetamine addiction by helping to restore levels of striatal dopamine receptors.

DISCUSSION

This report provides an overview of important factors surrounding methamphetamine use and treatment options for individuals using methamphetamine. Additionally, this report should be used to inform the creation of resources and initiatives to support law enforcement, EMS, and treatment providers as the landscape surrounding illicit substance use continues to evolve. However, consumers of this information should stay vigilant in efforts addressing both stimulants and depressants, as illicit opioids such as fentanyl do not appear to be decreasing in presence across Pennsylvania.

Though some aspects differ from theory, the community indicators identified by social disorganization theory offer a number of characteristics to monitor related to methamphetamine use in a community. Across all literature reviewed, the likelihood of methamphetamine use was higher in communities with low levels of ethnic and racial heterogeneity. Specifically, predominantly white communities expressed the greatest level of methamphetamine use.^{2,7,9} Additionally, familial and residential disruption indicated elevated methamphetamine use at the community level. Population density may impact methamphetamine use, with lower density suburban and rural areas having higher levels of methamphetamine use.^{7,8} However, the level of poverty in a community appears to be a poor indicator of methamphetamine use, as at least one study contradicted the idea of higher poverty indicating a higher presence of methamphetamine.⁹ Therefore, law enforcement and first responders in low-density population areas with high percentages of white individuals with inconsistent or disrupted housing may see increased levels of methamphetamine use.

The protocol for the treatment of individuals under the influence of methamphetamine is quite loose. The main concern when addressing these individuals is to reduce the likelihood of that individual harming themselves or others in their state of heightened agitation and paranoia. However, there are limited tools to treat methamphetamine highs in emergency situations. This can pose many threats to first responders and to the individuals under the influence. Another barrier is the increased difficulty of treating individuals with methamphetamine dependence. There is limited access to methamphetamine treatment, and success rates are highly dependent on characteristics such as length of use history and level of use. Individuals who have been dependent on methamphetamine the longest and use more frequently are not as likely to complete treatment as those who have used it less frequently and for less time. Medication-assisted therapy is also not an option for those with methamphetamine dependence since no medication has been approved for treatment.

The misuse of amphetamines is a continuing problem in the U.S. as it is a relatively inexpensive substance and has a longer-lasting effect than other stimulants, such as cocaine. Its spread across the U.S. from the western regions of the country has been a cause of alarm in the Northeastern region of the country. However, data do not show a significant increase in the number of methamphetamine-related overdose deaths or drug seizures in Pennsylvania. Cocaine remains the stimulant of choice in Pennsylvania, though this contradicts the observations of first responders and treatment providers in rural and suburban counties, who are seeing an increase in the number of individuals under the influence of methamphetamine. Therefore, it is important to be aware of current procedures for treating individuals under the influence of methamphetamine in emergency situations and to ensure appropriate treatment and non-treatment resources are available for individuals who are dependent.

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