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General
Drugs
of Abuse

Frequently Asked Questions About Amphetamines

Answers for life.

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This brochure is one in a series designed to inform Siemens' customers on a variety of relevant topics. Frequently Asked Questions About Amphetamines gives an overview of the uses, effects, and abuse of amphetamines.

What are amphetamines and why are they abused?

Amphetamines are a group of synthetically produced drugs that are classed as central nervous system (CNS) stimulants. The most common drugs of abuse within this group are: amphetamine, dextroamphetamine, and methamphetamine. Amphetamines were introduced in the 1930s and used in the treatment of a variety of conditions including nasal congestion, obesity, narcolepsy, and attention deficit disorder with hyperactivity in children. Because amphetamines produce feelings of alertness, self-confidence, increased energy, and general well-being, their abuse followed shortly after their introduction.

During World War II, pilots used amphetamines to increase their endurance,[1] and the Japanese military supplied liquid methamphetamine to their soldiers and some factory workers to increase their output.[2] After the war, methamphetamine abuse was an epidemic in Japan.[1] Amphetamine abuse also evolved from the misuse of over-the-counter and prescription products, such as nasal decongestants and diet pills, which were prized for the amphetamine-induced euphoria they could produce.

The abuse of amphetamines, which can be ingested, injected intravenously, snorted, or smoked, became an epidemic in the United States during the 1960s and 1970s. Japan, Great Britain, and Sweden have also experienced amphetamine epidemics.[3] In the United States, the extreme danger of amphetamine abuse became evident in the late 1960s when "speed," methamphetamine

usually injected intravenously, became popular in San Francisco and other big cities.[1] The violent behavior and unhealthy lifestyle associated with the use of speed led to a decrease in the legal production of amphetamines, which, in 1971, reached a high of about 12 billion tablets.[1]

Because of the decrease in legal production, the efforts of law enforcement, and the declining quality of the illegally produced drug, amphetamine abuse decreased during the mid to late 1970s.[1] However, according to the executive summary of the FY 1988 Report on Drug Control from the Bureau of Justice Assistance, the use of amphetamines in the United States increased again during the 1980s.[4] The increase was seen mainly in the west, where methamphetamine production in clandestine laboratories scattered throughout Southern California and Texas constitutes a $3 billion industry.[5] In San Diego, a university medical center reported an increase in the number of urine toxicology tests that were positive for amphetamines during a one-year period between 1986 and 1987 as compared to a similar study in 1978.[6] In addition, the smoking of "ice," pure crystalline methamphetamine, has become a major drug problem in Hawaii.[2] Because amphetamines have a high potential for abuse, detecting amphetamines in urine continues to be an important part of any drug-screening program.

What are the effects of amphetamines?

Amphetamines, as stimulants, produce a variety of effects. Those sought by drug abusers include feelings of euphoria, alertness, wakefulness, increased energy, loss of appetite, and general well-being. During the 1960s, students, truck drivers, and athletes used amphetamines because their stimulant properties increased endurance.[7] However, in addition to these desired effects, amphetamines also constrict blood vessels; dilate pupils; and increase heart rate, respiration rate, and blood pressure. They can also cause anxiety, agitation, tension, and insomnia.[1] Large doses of amphetamines can cause stimulant psychosis, which is similar to paranoid schizophrenia.[1] This state of psychosis is characterized by paranoia, suspicion, hallucinations, hostility, and violent behavior.[1] Users may also exhibit repetitive behavior such as repeatedly shining shoes or stringing beads.[3] Although reported deaths due to overdoses are rare, extremely high doses of amphetamines can cause high fever, cerebral hemorrhage, convulsions, and coma.[1]

How long do the effects of amphetamines last?

The effects of amphetamines usually last from four to 24 hours; however, amphetamine psychosis may occur up to two days after a single large dose is ingested.[8]

Amphetamines can be detected in the urine about three hours after an oral dose, and it may take from five to seven days for a large oral dose to be excreted.[8] (Detection times vary depending on the drug dose, drug metabolism, and detection method.) Amphetamine excretion in the urine is pH dependent. When the urine is acidic, a large proportion of the amphetamine dose will be excreted unchanged. When the urine is alkaline, most of the drug dose will be reabsorbed by the kidneys. Therefore, treatment for amphetamine overdose entails the administration of ammonium chloride to acidify the urine and facilitate excretion of the drug.[8]

What are the medical uses of amphetamines?

Amphetamines are used to treat narcolepsy (a relatively rare disease characterized by uncontrollable sleeping spells), attention deficit disorders with hyperactivity in children, Parkinsonism, and obesity. They are also used as an adjunct in the management of some types of epilepsy.[1]

The therapeutic daily dosage of amphetamines may be as low as 2.5 mg for children with attention deficit disorders or as high as 60 mg for those suffering from narcolepsy.[1] Prolonged use of amphetamines does not seem to decrease the drug's effectiveness for these two conditions; however, the effectiveness of amphetamines in treating obesity is short-lived.

Do users develop tolerance to the effects of amphetamines?

Tolerance is the decreasing ability of a drug to produce the desired effects at a particular dosage. Users can develop tolerance to the euphoric, appetite suppressing, and cardiovascular effects of amphetamines.[9] They may need to continually increase the amount of drug they take to obtain the desired effects. Chronic, heavy abusers may take as much as 300 mg per day,[1] and the dosage can increase drastically during a "run" when amphetamines are repeatedly injected intravenously over a period of several days. Tolerance to the appetite-suppressing effects of amphetamines may develop in a few weeks; therefore, their usefulness in treating most cases of obesity is limited. Tolerance to the cardiovascular effects of amphetamines is evidenced by the ability of heavy users to inject single doses of 1000 mg without catastrophic results.[9] Abstaining from the drug seems to reverse the tolerance developed. Apparently, tolerance to amphetamine-induced wakefulness does not develop.

In addition to developing tolerance to their effects, users may become psychologically dependent on amphetamines. The feelings of euphoria that amphetamines produce are so great that strong cravings can develop, and users may become preoccupied with obtaining and using the drug. Even therapeutically prescribed amphetamines can lead to drug abuse. For example, before the potential for their abuse was widely recognized, amphetamines were often prescribed for the treatment of obesity. Patients taking prescribed diet pills occasionally became so enamored with the euphoric effects of the drug that they sought increasing supplies, as their tolerance to the drug developed. Some would visit additional physicians to obtain more of the prescription medication.[1]

What is speed?

Speed is a street name for methamphetamine. Speed became popular in the 1960s because of the intense euphoria that IV injection of the drug produces. During a speed run, users repeatedly inject themselves with methamphetamine over a period of days. Since tolerance to the drug develops, larger and larger doses are needed to produce the desired euphoria. Such high tolerance can develop during a run, that no amount of the drug will produce the desired effects.[1] As much as 15 grams of methamphetamine may be injected during 24 hours of a speed run.[10] (Therapeutic doses of amphetamines go up to 60 mg per day.[1])

During a run, users neither eat nor sleep, and they can suffer from paranoia, hallucinations, and agitation, and display the violent behavior of amphetamine psychosis. Typically, the run continues as long as the drugs are available or until the users ("speed freaks") are exhausted. At this point, they "crash" and can sleep for several days. On awakening, they are hungry and depressed. The depression may lead users to seek more speed, or it may be so severe that they become suicidal.[1] The lifestyle of speed freaks includes the additional hazards of poor nutrition and dirty needles.

The chronic abusers' dependence on amphetamines demands that they spend much of their time obtaining the drug. This precludes permanent, full-time employment and, in some cases, leads abusers to support their habit through criminal activity.[7] Chronic abuse can also lead to dependence on other drugs. Opiates, barbiturates, marijuana, or alcohol may be used to counteract the agitation and insomnia generated by amphetamines.

What is "ice"?

Ice is the potent, smokable, crystalline form of dmethamphetamine. This strongly addictive drug gets its name from its crystal-like appearance. When ice is smoked, it quickly enters the bloodstream and goes directly to the brain. This route of

administration is similar in effect to intravenous injection and much more potent than an oral dose.[10] Ice is an especially potent form of methamphetamine, because the manufacturing which is process produces the stereochemically pure d-isomer; the most active form of the drug.[10]

Ice is popular among workaholics and people in high-stress jobs because it produces feelings of increased alertness and intense euphoria.[2] Its effects are similar to those of crack cocaine. However, with ice, the high lasts from eight to 24 hours, which is much longer than the 20-minute high experienced from crack.[10]

Besides the stimulant effects sought by users, ice may also produce paranoia, hallucinations, and violent behavior. It can cause acute pulmonary edema (a potentially fatal lung problem),[11] kidney problems, and long-term psychological damage.[2] Babies born to women who use ice may have more problems than cocaine babies.[10]

In addition to Korea and Taiwan, crystalline methamphetamine is manufactured in clandestine laboratories in Southern California, Texas, and other states. Some of these laboratories use the same manufacturing process that is used in Asia to produce ice. Many use a manufacturing process that produces a less potent mixture of methamphetamine.

What are designer drugs?

Designer drugs are compounds that are synthesized by slightly altering the structure of a known drug in an attempt to enhance its desirable effects and eliminate its undesirable effects. In this way, new, abusable drugs can be produced that may be difficult to detect, or that are not yet legally restricted.[12]

Two well known designer drugs are MDA (3,4-methylenedioxyamphetamine) and MDMA (3,4-methylenedioxymethamphetamine). MDA and MDMA are similar in structure to methamphetamine and to the hallucinogen mescaline. They both produce feelings of euphoria. In addition, they are both restricted under the Controlled Substances Act of 1970 as drugs with abuse potential and no therapeutic uses.

MDA was first synthesized in the early 1900s[13] and was popular as a street drug during the 1960s. It became known as the "love drug" because of the pleasant feelings it produced. At moderate doses, MDA produces effects that are similar to those of LSD. At high doses, MDA produces effects that are similar to those seen with high doses of amphetamines.[1]

MDMA was developed in 1914 as an appetite suppressant, but it was never used as such.[14] In the 1970s, it was thought by some to be effective in psychotherapy. In the mid 1980s, it became popular, particularly among college students, as a recreational drug. Though believed by some to be safe, MDMA was suspected of producing a fatal cardiac arrhythmia in a case reported by Dowling, et al.[14] MDMA, which is known by the street name "ecstasy," became a restricted substance in 1985.

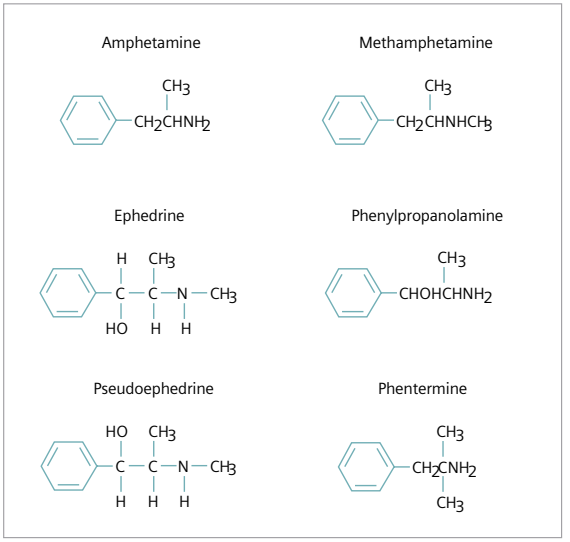
Recently, MDMA use has become popular among young people in the United Kingdom, who use it at all-night dance sessions called raves. As of this writing, at least 15 deaths have been attributed to fatal hyperthermia, apparently caused by the combination of MDMA and prolonged, vigorous dancing. The MDMA was not taken in large enough doses to cause toxicity by itself. Ironically, users of MDMA may be more apt to engage in prolonged, vigorous dancing. MDMA has been shown to increase body temperature in rats. The hot ambient temperatures of some night clubs, together with insufficient fluid replacement may be enough to cause fatal hyperthermia.[15]

Literature indicates that the use of these and other amphetamine-like "designer drugs" may be increasing,[12] as the rave culture is being exported to the United States and other countries.[15]

How are some over-the-counter preparations related to amphetamines? Amphetamines make up a class of compounds that include amphetamines and sympathomimetic amines.

d-Amphetamine and l-amphetamine are stereoisomers (compounds that contain identical chemical components but vary slightly in their three-dimensional arrangement). The d-isomer, or dextroamphetamine, produces 3 to 4 times more CNS stimulant effect than the l-isomer; therefore, a mixture of d,l-amphetamine would be less potent than pure d-amphetamine.[13] d-Methamphetamine and l-methamphetamine are also stereoisomers with the d-isomer being the more potent compound.

The amphetamine class also includes a number of amphetamine-like compounds. Ephedrine, phenylpropanolamine, pseudoephedrine, and phentermine (compounds found in some OTC and prescription products) are very similar to amphetamines in chemical structure.



Besides being structurally similar to amphetamines, these compounds can also produce similar pharmacological effects. Ephedrine, for example, is used as a nasal decongestant and a bronchodilator. It can be chronically abused.[13] Phenylpropanolamine is used in a number of over-the-counter cold medications and diet aids. Like amphetamines, it constricts blood vessels, and can produce high blood pressure in cases of overdose.[1] Pseudoephedrine is also found in over-the-counter cold medications and has been determined by to be abused by some.[16] Phentermine is used in prescription diet aids, and tolerance to its appetite-suppressing effects can develop within several weeks.[16]

Do the EMIT Monoclonal Amphetamine/ Methamphetamine Assays cross-react with amphetamine-like compounds?

High concentrations of a few amphetamine-like compounds can cause positive assay results. This could occur, for example, if a person was taking a combination of over-the-counter products. Generally, a much higher concentration of these compounds is needed to cause a positive reaction with a monoclonal antibody assay, than with a polyclonal antibody assay. Additional information on a number of amphetamine-like compounds is given in the EMIT II and EMIT d.a.u. Monoclonal Amphetamine/ Methamphetamine Assay package inserts.

Do the EMIT d.a.u. and EMIT II Monoclonal Amphetamine/Methamphetamine Assays meet SAMHSA guidelines for determining urine samples positive for amphetamines?

According to the Substance Abuse and Mental Health Services Administration's (SAMHSA) guidelines for federal workplace drug testing, the initial screening method for amphetamines shall be an immunoassay with a cutoff level of 1000 ng/mL. The SAMHSA guidelines do not specify the form of amphetamines to be used for this cutoff. The calibrator for both EMIT monoclonal amphetamine/

methamphetamine assays contains 1000 ng/mL d-methamphetamine. Therefore, the assays' cutoffs are at 1000 ng/mL d-methamphetamine, which meeting the SAMHSA guidelines for an initial amphetamine screening method.

Syva chose to calibrate its assays with d-methamphetamine because it is the most commonly abused drug of the amphetamines group. The EMIT d.a.u. Monoclonal Amphetamine/ Methamphetamine Assay cross-reacts with d-amphetamine in amounts ≤400 ng/mL. The EMIT II Assay cross-reacts with d-amphetamine at 1000 ng/mL. If both d-amphetamine and d-methamphetamine are present in a urine sample, they may have a cumulative effect.

The SAMHSA guidelines further state that samples determined positive for amphetamines by the screening method shall be confirmed by GC/MS. GC/MS measures amphetamine and methamphetamine individually. According to the guidelines for confirmation of amphetamines (revised October 1990), a sample must contain at least 500 ng/mL amphetamine or at least 500 ng/mL methamphetamine plus at least 200 ng/mL amphetamine to be considered positive by GC/MS. A sample testing positive with the monoclonal assay may contain amphetamine or methamphetamine plus amphetamine, but if the drugs are present in concentrations less than the SAMHSA GC/MS cutoffs, the sample will not be confirmed positive according to the SAMHSA guidelines.

An initial drug-screening method should quickly separate negative samples from presumptive positive samples. Samples that screen positive should be confirmed by a more specific, alternative chemical method such as GC/MS.

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