NIDA InfoFacts
www.drugabuse.gov
National Institute on Drug Abuse • National Institutes of Health • U.S. Department of Health & Human Services

MDMA (Ecstasy)

MDMA (3,4-methylenedioxymethamphetamine) is a synthetic, psychoactive drug that is chemically similar to the stimulant methamphetamine and the hallucinogen mescaline. MDMA produces feelings of increased energy, euphoria, emotional warmth, and distortions in time, perception, and tactile experiences.

How Is MDMA Abused?

MDMA is taken orally, usually as a capsule or tablet. It was initially popular among Caucasian adolescents and young adults in the nightclub scene or at weekend-long dance parties known as raves. More recently, the profile of the typical MDMA user has changed, with the drug now affecting a broader range of ethnic groups. MDMA is also popular among urban gay males—some report using MDMA as part of a multiple-drug experience that includes marijuana, cocaine, methamphetamine, ketamine, sildenafil (Viagra), and other legal and illegal substances.

How Does MDMA Affect the Brain?

MDMA exerts its primary effects in the brain on neurons that use the chemical (or neurotransmitter) serotonin to communicate with other neurons. The serotonin system plays an important role in regulating mood, aggression, sexual activity, sleep, and sensitivity to pain. MDMA binds to the serotonin transporter, which is responsible for removing serotonin from the synapse (or space between adjacent neurons) to terminate the signal between neurons; thus MDMA increases and prolongs the serotonin signal. MDMA also enters the serotonergic neurons via the transporter (because MDMA resembles serotonin in chemical structure) where it causes excessive release of serotonin from the neurons. MDMA has similar effects on another neurotransmitter—norepinephrine, which can cause increases in heart rate and blood pressure. MDMA also releases dopamine, but to a much lesser extent.

MDMA can produce confusion, depression, sleep problems, drug craving, and severe anxiety. These problems can occur soon after taking the drug or, sometimes, even days or weeks after taking MDMA. In addition, chronic users of MDMA perform more poorly than nonusers on certain types of cognitive or memory tasks, although some of these effects may be due to the use of other drugs in combination with MDMA. Research in animals indicates that MDMA can be harmful to the brain—one study in nonhuman primates

showed that exposure to MDMA for only 4 days caused damage to serotonin nerve terminals that was still evident 6 to 7 years later.[1] Although similar neurotoxicity has not been shown definitively in humans, the wealth of animal research indicating MDMA's damaging properties strongly suggests that MDMA is not a safe drug for human consumption.

Addictive Potential

For some people, MDMA can be addictive.[2] A survey of young adult and adolescent MDMA users found that 43 percent of those who reported ecstasy use met the accepted diagnostic criteria for dependence, as evidenced by continued use despite knowledge of physical or psychological harm, withdrawal effects, and tolerance (or diminished response).[3] These results are consistent with those from similar studies in other countries that suggest a high rate of MDMA dependence among users.[4] MDMA abstinence-associated withdrawal symptoms include fatigue, loss of appetite, depressed feelings, and trouble concentrating.[2]

What Other Adverse Effects Does MDMA Have on Health?

MDMA can also be dangerous to overall health and, on rare occasions, lethal. MDMA can have many of the same physical effects as other stimulants, such as cocaine and amphetamines. These include increases in heart rate and blood pressure—which present risks of particular concern for people with circulatory problems or heart disease—and other symptoms such as muscle tension, involuntary teeth clenching, nausea, blurred vision, faintness, and chills or sweating.

In high doses, MDMA can interfere with the body's ability to regulate temperature. On rare but unpredictable occasions, this can lead to a sharp increase in body temperature (hyperthermia), which can result in liver, kidney, cardiovascular system failure, or death. MDMA can interfere with its own metabolism (breakdown within the body); therefore, potentially harmful levels can be reached by repeated MDMA administration within short periods of time. Other drugs that are chemically similar to MDMA, such as MDA (methylenedioxyamphetamine, the parent drug of MDMA) and PMA (paramethoxyamphetamine, associated with fatalities in the United States and Australia),[5] are sometimes sold as ecstasy. These drugs can be neurotoxic or create additional health risks to the user. Furthermore, ecstasy tablets may contain other substances, such as ephedrine (a stimulant); dextromethorphan (DXM, a cough suppressant); ketamine (an anesthetic used mostly by veterinarians); caffeine; cocaine; and methamphetamine. Although

the combination of MDMA with one or more of these drugs may be inherently dangerous, users who also combine these with additional substances such as marijuana and alcohol may be putting themselves at even higher risk for adverse health effects.

What Treatment Options Exist?

There are no specific treatments for MDMA abuse and addiction. The most effective treatments for drug abuse and addiction in general are cognitive-behavioral interventions that are designed to help modify the patient's thinking, expectancies, and behaviors related to their drug use and to increase skills in coping with life stressors. Drug abuse recovery support groups may also be effective in combination with behavioral interventions to support long-term, drug-free recovery. There are currently no pharmacological treatments for addiction to MDMA.

How Widespread Is MDMA Abuse?

Monitoring the Future Survey[†]

After sharp declines in ecstasy use since its peak in 2000/2001, current and past-year use of MDMA has risen among 8th and 10th graders. This follows several years of decreases in the perceived risk and disapproval of using MDMA.

Use of MDMA by Students 2010 Monitoring the Future Survey

	8th Grade	10th Grade	12th Grade
Lifetime[††]	3.3%	6.4%	7.3%
Past Year	2.4%	4.7%	4.5%
Past Month	1.1%	1.9%	1.4%

National Survey on Drug Use and Health (NSDUH)[†††]

In 2009, an estimated 760,000 people (0.3 percent of the population) in the United States aged 12 or older used MDMA in the month prior to being surveyed. Lifetime use increased significantly among individuals aged 12 years or older, from 4.3 percent (10.2 million) in 2002 to 5.7 percent (14.2 million) in 2009; however, past-year use of ecstasy decreased from 1.3 percent to 1.1 percent during the same period. Approximately 1.1 million Americans used ecstasy for the first time in 2009, which is a significant increase from the 894,000 first-time users reported in 2008.

Other Information Sources

For more information on MDMA, please visit **www.clubdrugs.org** and **www.teens.drugabuse.gov.**

For street terms searchable by drug name, cost and quantities, drug trade, and drug use, visit **www.whitehousedrugpolicy.gov/streetterms/default.asp.**

Data Sources

† These data are from the 2010 Monitoring the Future survey, funded by the National Institute on Drug Abuse, National Institutes of Health, Department of Health and Human Services, and conducted annually by the University of Michigan's Institute for Social Research. The survey has tracked 12th-graders' illicit drug use and related attitudes since 1975; in 1991, 8th- and 10th-graders were added to the study. The latest data are on line at www.drugabuse.gov.

†† "Lifetime" refers to use at least once during a respondent's lifetime. "Past year" refers to use at least once during the year preceding an individual's response to the survey. "Past month" refers to use at least once during the 30 days preceding an individual's response to the survey.

††† NSDUH (formerly known as the National Household Survey on Drug Abuse) is an annual survey of Americans aged 12 and older conducted by the Substance Abuse and Mental Health Services Administration, Department of Health and Human Services. This survey is available on line at www.samhsa.gov and can be ordered by phone from NIDA at 877–643–2644.

References

[1] Ricaurte GA and McCann UD. Experimental studies on 3,4-methylenedioxymethamphetamine (MDMA, "ecstasy") and its potential to damage brain serotonin neurons. *Neurotox Res* 3(1):85–99, 2001.

[2] Stone AL, Storr CL, and Anthony JC. Evidence for a hallucinogen dependence syndrome developing soon after onset of hallucinogen use during adolescence. *Int J Methods Psychiatr Res* 15:116–130, 2006.

[3] Cottler LB, Womack SB, Compton WM, Ben-Abdallah A. Ecstasy abuse and dependence among adolescents and young adults: Applicability and reliability of DSM-IV criteria. *Human Psychopharmacol* 16:599–606, 2001.

[4] Leung KS, Cottler LB. Ecstasy and other club drugs: A review of recent epidemiological studies. *Curr Opin Psychiatry* 21:234–241, 2008.

[5] Kraner JC, McCoy DJ, Evans MA, Evans LE, Sweeney BJ. Fatalities caused by the MDMA-related drug paramethoxyamphetamine (PMA). *J Anal Toxicol* 25(7):645–648, 2001.

NIDA NATIONAL INSTITUTE ON DRUG ABUSE

National Institutes of Health – U.S. Department of Health and Human Services