MDMA Misrepresentation: An Unresolved Problem for Ecstasy Users

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Abstract—The demand for MDMA (methylenedioxymethamphetamine) has increased, especially among teenagers 12 to 18 years old. It is estimated that approximately 2.8 million teens have at least tried this drug. Coincident with this trend has been an increasing body of literature that questions the safety of MDMA consumption in terms of possibly permanent neurological damage, associated with behavioral and functional deficits. Whatever the likelihood of those risks, there have been well-documented problems with dehydration, hyperthermia, rhabdomyolysis, disseminated intravascular coagulation, and multiple organ failure. In addition, there have been tablets sold which either contain no MDMA, and may be comprised of more dangerous chemicals, or may contain a mixture of both. The current response has been the emergence of several harm reduction strategies, including the publishing of pamphlets warning Ecstasy users to hydrate and cool themselves. Another has been the utilization of chemical tests of tablet shavings to observe color changes purported to help distinguish MDMA-containing tablets from substitutes. The utility of these tests and the consequences of their shortcomings are examined.

Keywords—drug testing, Ecstasy, harm reduction, methylenedioxymethamphetamine

Among the drugs most likely to be abused by young adults, Ecstasy stands out as an increasingly common choice. Used at parties and clubs primarily, it has seemingly caught the imagination of this age group as the newest "love drug." Indeed, users report that while under the influence of Ecstasy, they experience enhanced communication with others, lower inhibitions, elevated mood, and increased intimacy, both mentally and physically (Solowij, Hall & Lee 1992). With such a reputation, one is lured into an impression that Ecstasy use is relatively benign. Much as with marijuana for children of the sixties, Ecstasy has been characterized by its users as a drug which has been unjustly maligned by "the establishment."

Commensurate with this attitude, Ecstasy use has continued to rise. This increase is graphically illustrated in the results of the 2001 Partnership Attitude Tracking Survey conducted by the Partnership for a Drugfree America. They found that an estimated 12% of teens aged 12 to 18 reported trying Ecstasy at least once, a 71% increase since 1999. In all, they estimate that approximately 2.8 million teens have tried this drug (Roper 2002).

Meanwhile, some researchers continue to warn of mounting evidence that permanent neurological damage may result from even moderate Ecstasy use. In addition, they warn of the possibility of behavioral and functional deficits becoming evident in Ecstasy users in the future. Readers are warned about such problems as cognitive

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deficits, altered sleep architecture, increased impulsivity, and depression (McCann, Eligulaashi & Ricuarte 2000; Ricaurte, Yuan & McCann 2000).

On the other side, several authors question the validity of this research and its claims of serotonergic damage on the basis of methodological problems (Sprague, Everman & Nichols 1998; Grob et al. 1992) or possible problems in extrapolating from animal models (Hegadoren, Baker & Bornin 1999; Pellerin 1998; Sprague, Everman & Nichols 1998).

The controversy continues, with the answer having huge implications for a vast number of young adults now lending themselves to a vast, uncontrolled experiment.

In addition to the question of neurological damage in Ecstasy users, there are unquestionably liabilities in the acute neurological toxicity that may be produced by MDMA (3,4-methylenedioxymethamphetamine). Possible consequences of MDMA use, especially at high doses, in crowded, hot clubs, may include dehydration, hyperthermia, rhabdomyolysis, disseminated intravascular coagulation, and multiple organ failure, leading to death (Pentney 2001; Hayner & McKinney 1986). As a result of this, pamphlets designed to warn club attendees to beware of overheating and dehydration have been developed. Adherence to the guidelines in these pamphlets have made serious injury rare, given the number of doses taken annually, but not unheard of by any means (Burke 2001; Climko et al. 1987).

Amidst all of the controversy over acute and chronic toxicity, the problem of recreational drug users determining what is in a capsule or tablet of Ecstasy has been much less well publicized. This has been a continuing problem since the mid-1980s, when MDMA first made a strong showing on the illicit market. To begin with, the problem boiled down to two questions: (a) "What is the dose of MDMA present?", and (b) "Is the substance actually MDMA or something else?". In the beginning, when MDA (3,4-methylenedioxyamphetamine) was the only alternative substance to MDMA found in purported MDMA samples, only the question of dose was of major concern. Nevertheless, the possibility for harm was definitely present in that doses analyzed at that time for MDMA content ranged from 18-150 mg., a potential problem if more than one of the more potent doses was consumed (Hayner & McKinney 1986).

More recently, however, other substances have been showing up in tablets and capsules being sold as Ecstasy. Some of these substances are very different from MDMA, both in effects and toxicities. The most dangerous of these, from a strictly toxicological point of view, is PMA (paramethoxyamphetamine or 4-methoxyamphetamine). This compound has been responsible for several deaths in users who ingested it thinking they were taking MDMA (Martin 2001).

Other substances, such as MDE (3,4-methylenedioxyethylamphetamine), MBDB (N-Methyl-1-(3,4-methylenedioxyphenyl)-2-butamine, ketamine, amphetamine, methamphetamine, caffeine, LSD, and 2CB (4-Bromo-2,5dimethoxyphenethylamine), have been sold as Ecstasy either by themselves, or in combination with other drugs. At other times, just as in the past, there may be widely varying amounts of MDMA present, or MDMA may be mixed with some other drug. This situation obviously increases the chances of harm to the user, regardless of adherence to behaviors designed to reduce toxic effects of MDMA. Looking at this list, one finds both very strong hallucinogens such as LSD, 2CB and ketamine, and substances such as amphetamines which may increase the toxicity of MDMA if combined with it (Pentney 2001).

In response to the problem of misrepresentation of MDMA, two things have been done by those calling themselves harm reduction organizations. One has been to analyze samples of drugs which are submitted for this purpose, and publish the results on their web sites. Notably, a site called EcstasyData.org has been launched by a consortium of organizations including Dancesafe, the Multidisciplinary Association for Psychedelic Studies, and Erowid.com. Data from the analysis of tablets from across the United States are reported along with their pictures, data submitted, analyzed contents, dimensions, and reaction with Marquis reagent, which will be discussed later (analyses are found at dancesafe.org and EcstasyData.org). Analyses are conducted qualitatively by Drug Detection Laboratories in Sacramento, California using gas chromatography/mass spectometry (GC/MS).

Analysis of the data collected through laboratory testing of Ecstasy samples provides an objective, if limited, look at what is being sold on the illicit market. A paper by the director of Drug Detection Laboratories (among others) reveals that in the 13 months between February 1999 and March 2000, 107 tablets were submitted for testing. Of these, 63% contained at least some MDMA or an analog (either MDA or MDEA); 29% contained drugs other than MDMA. Of the tablets not containing MDMA, 21% contained dextromethorphan in concentrations likely to cause adverse reactions, including a phencyclidine-like psychosis. The rest of the samples mostly contained mixtures of caffeine, ephedrine, pseudoephedrine, and salicylates, with 8% containing no identifiable drug at all (Baggott et al. 2000).

A more recent look at published data from EcstasyData.org extending from December 2001 to February 2002 revealed a similar picture. In this series of 50 samples, 60% contained MDMA or an analog, and 10% contained unidentified substances. Only one sample contained dextromethorphan, but 2% to 4% of the samples contained 5-MeO-DIPT (N,N-diisopropyl-5-methoxytryptamine, a strong hallucinogen; see Shulgin & Shulgin 1997) and one contained ketamine.

Clearly, given the chemical analyses of the submitted tablets, users are not at all assured that they will actually

get the drug they set out to buy. At best, they may get a benign, unscheduled drug substituted for MDMA; at worst, they may get a much stronger drug than they intended to take. The latter eventuality in and of itself would tend to precipitate an undesirable high or "bad trip" with potentially disastrous psychological results. Alternatively, if one assumes a low MDMA content and ingests more than one tablet, one might either ingest an overdose of MDMA or by combining tablets from different batches get a dangerous interaction from the contents of the tablets purchased. The chances of mishap are all the more likely given the trend for the contents of the pills on the market to change over time, and for almost identical tablets to contain different substances (see EcstasyData.org).

In acknowledgment of the limitations of a program of mailing in drug samples for analysis in its ability to impact user safety, kits are offered for sale on the Internet which purport to be able to distinguish tablets containing MDMA from those containing other substances. They offer the advantages of being inexpensive compared to the $100 analysis fee charged by Drug Detection Laboratories, and the ability to yield a result within a few minutes, at the venue in which they are purchased. The first generation of these tests utilize Marquis reagent, a mixture of sulfuric acid and formaldehyde. More recently, test kits containing Mecke reagent, (selenious acid plus sulfuric acid) Simons's reagent (sodium nitroprusside, acetaldehyde and sodium carbonate), and "Robadope" reagent (Simon's reagent plus a fixer reagent) have appeared and are offered as an improved method of identifying the contents of purchased tablets. To perform the tests, one is instructed to scrape a tiny bit of material from a tablet or empty a small amount from a capsule onto a large white ceramic plate, add reagents to this material, and interpret subsequent color changes with color charts supplied with the kit (see the dancesafe.org and eztest.com websites).

Unfortunately, these tests present their own set of problems. First, the ability to tell anything about the content of a tablet requires a source of strong white light and a white ceramic dish—items which may be hard to find at a dance club or party. Secondly, tests which rely on the interpretation of color changes are subjective (i.e. open to interpretation by the observer) by their very nature. Secondly, not all substances result in obviously distinct color changes; multiple drugs can produce very similar color changes (Winstock, Wolff & Ramsey 2001).

Even if one were to suppose that these tests are performed properly, which may be almost impossible in the setting of a dance club, the venders themselves caution that their tests do not indicate either strength or purity of the contents of tested substances. In other words, a positive test for MDMA can only be construed as an indication that MDMA is presumptively present in *some* concentration. It may be present in very high concentrations or in trace amounts, and may be mixed with other drugs. A definitive answer is still only available through the use of sophisticated laboratory equipment operated by qualified technicians.

The possibility of error even with trained personnel operating sophisticated equipment under ideal conditions has also been raised. Sonderman and Kovar (1999) found that testing confiscated tablets, with both a near infrared spectrometer and high-pressure liquid chromatography, was most accurate if they were first crushed, due to a lack of care in mixing ingredients prior to pressing them into tablets. In some cases, the lack of heterogeneity of the tablets in their study was evident to the naked eye. Lack of tablet heterogeneity would thus make any testing method involving intact tablets inaccurate. Analysis of a small amount of a tablet would be far from adequate in assessing the true contents of a clandestinely manufactured tablet.

CONCLUSION

Much effort has been put into trying to quantify the toxicological risks of MDMA use, and to reduce the risks to the consumer of Ecstasy tablets. While the former task may at some point be achieved, it may be done at the expense of observing some sort of neurological deficits in long-term users. The task of eliminating risks associated with the consumption of illicitly manufactured tablets, however, may not be realistic due to the limitations inherent in screening tests that are at once quick, inexpensive, and portable. Ultimately, it may turn out that the best form of harm reduction will be to attempt to modify behavior such that people dancing at clubs and parties choose some other method of enhancing the experience than the consumption of Ecstasy.

REFERENCES

Baggott, M.; Heifits, B.; Jones, R.T.; Mendelson, J.; Sferios, E. & Zender, J. 2000. Chemical analysis of Ecstasy pills. *Journal of the American Medical Association* 284 : 2190.

Burke, J. 2001. Ecstasy's death toll "set to go rising." On http://society.guardian.co.uk, July 1.

Climko, R.P.; Roehrich, H.; Sweeney, D.R. & Al-Razi, J. 1987. Ecstasy: A review of MDMA and MDA. *International J ournal of Psychiatry in Medicine* 16 (4): 1986-87.

Grob, J.A.; Gurd, M.R.; Walsh, R.N.& Leister, M.B. 1992. The MDMA-neurotoxicity controversy: implications for clinical research with newer psychoactive drugs. *Journal of Neurons and Mental Disease* 180: 355-6.

Hayner, G.N. & McKinney, H. 1986. MDMA: The dark side of Ecstasy. *Journal of Psychoactive Drugs* 18: 341-47.

Hegadoren, K.M.; Baker, G.B. & Bornin, M. 1999. 3,4-methylenedioxy analogs of amphetamines: Defining the risks to humans. *Neuroscience and Behavioral Review* 23: 539-55.

Martin, T.L. 2001 Three cases of fatal paramethoxyamphetamine overdose. *Journal of Analytical Toxicology* 25: 649-51.

McCann, U.D; Eligulaashi, V. & Ricuarte, G.A. 2000. (+/-) 3,4-methylenedioxymethamphetamine ("Ecstasy") induced serotonin neurotoxicity: Clinical studies. *Neuropsychobiology* 42: 11-6.

Pellerin, C. 1998. *Trips: How Hallucinogens Work in Your Brain.* New York: Seven Stories Press.

Pentney, A.R. 2001. An exploration of the history and controversies surrounding MDMA and MDA. *Journal of Psychoactive Drugs* 33 (3): 213-21.

Ricaurte, G.A., Yuan, J. & McCann, U.D. 2000. (+/-) 3,4-methylenedioxymethamphetamine ("Ecstasy") induced serotonin neurotoxicity: Studies in animals. *Neuropsychobiology* 42: 5-10.

Roper, A.S.W. 2002. National survey: Ecstasy use continues rising among teens. Available at www.drugfreeanmerica.com.

Solowij, N.; Hall, W. & Lee, N.1992. Recreational MDMA use in Sidney: A profile of "Ecstasy" users and their experiences with the drug. *British Journal of Addiction* 87 (8): 1161-72.

Shulgin A. & Shulgin, A. 1997. *TIKAL. The Continuation.* Berkeley, California: Transform Press.

Sonderman, N. & Kovar, K. 1999. Screening experiments of Ecstasy street samples using near infrared spectroscopy. *Forensic Science International* 106: 147-56.

Sprague, J.E.; Everman, S.L & Nichols, D.E. 1998. An integrated hypothesis for the serotonergic axonal loss induced by 3,4-methylenedioxymethamphetamine. *Neurotoxicology* 19: 427-42.

Winstock, A.R.; Wolff, K. & Ramsey, J. 2001. Ecstasy pill testing: Harm minimization gone too far? *Addiction* 96: 1139-48.