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to develop better measures of MDMA toxicity, and to more accurately determine how much drug is used and in what circumstances.

If conducted with large enough groups of MDMA users and control subjects, both drug naïve and matched for poly-drug use, longitudinal studies could also help identify risk and protective factors for drug use and the deficits that result from continuing exposure to MDMA. The identification of significant risk and protective factors would greatly aid the development of efficacious prevention and rehabilitation approaches. Data from longitudinal studies would also help establish associations between MDMA use and behavioral impairments that researchers have observed in the majority of studies.

Longitudinal designs may enable researchers to determine how long such impairments last, whether they are progressive, and if deficits become more evident as MDMA users move into middle and late adulthood or experience other age-related neurologic disorders. Questions about the reversibility of impairments, a concern given the data seen in animal studies and even in some human studies, could also be addressed by such designs. Longitudinal studies should also provide data on critical patterns of MDMA use that may be more or less likely to cause impairments, and can help to determine whether simultaneous abuse of other drugs plays a role in causing behavioral and cognitive damage.

Along with such studies, researchers need better tools to assess neurotoxicity in human MDMA users and to measure changes of neuronal integrity and possible recovery over time. With such tools, investigators may also be able to address important mechanistic questions, such as how damage to the serotonin system leads to behavioral and cognitive changes, how the brain responds to and compensates for serotonergic damage, and why the dopaminergic system seems to escape lasting damage from MDMA. Such studies might then lead to the development and validation of methods for promoting recovery from MDMA-induced neurotoxicity.

There is also a need for more studies looking at the long-term effects of poly-drug abuse. Such studies will require new analytical tools for detecting multiple drugs of abuse simultaneously in biological samples and for more accurately assessing drug use histories, including the combination and sequencing of drugs used.

There are little data available on whether addiction, dependence or tolerance develops with continued use of MDMA. Though the data from animal studies support this possibility, more studies are needed in humans to determine the degree of abuse liability for this drug and to help develop treatments specific for reducing MDMA addiction. Along the same lines, researchers at this meeting stressed again that there are little data on numbers of drug treatment patients who have used MDMA or who have sought treatment because of MDMA abuse.

Another scientific gap identified at the scientific conference concerns the development of methods for tracking so-called hidden populations of MDMA users; that is, those who don't go to dance clubs or raves, where the majority of volunteer recruiting occurs. At the same time, researchers also stressed the need to better understand the youth party culture that seems to actively promote MDMA use through the use of in-house drug dealers and marketing messages delivered through music and by pop icons.

There is a need to foster interdisciplinary research and dialogue that links epidemiological, ethnographic, clinical and laboratory studies. As this report shows, there is much overlap between these separate fields, and undoubtedly, this area of investigation could benefit from better coordination between disciplines. There is also a need to link local, regional, national, and international supply-side intelligence with demand-side epidemiological and ethnographic research.

Prevention efforts cannot be universal but must be targeted at different groups that use MDMA, particularly since MDMA appears to be a drug whose use is sensitive to and intimately linked with social context and networks. In particular, there is a need to integrate local research, services, prevention and intervention efforts to provide targeted, shared messages. The conference speakers recommended that there be a new focus within youth networks and adult education programs to counter the perception that MDMA is much safer than other drugs. The use of youth-led advocacy and drug prevention programs seems particularly promising for reducing MDMA use among adolescents and young adults.

SOURCE: Much of this report is based on a scientific conference—*MDMA/Ecstasy Research: Advances, Challenges, Future Directions*—that was sponsored by the *National Institute on Drug Abuse (NIDA)* and the *National Institutes of Health* and held July 19-20, 2001. Information in this report was supplemented by an exhaustive review of the extensive published scientific literature on MDMA, particularly that which has appeared in scientific and medical journals during the past five years.