

*25 Years
of Discovery
to Advance the
Health of the
Public*

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National Institute on Drug Abuse
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Foreword

This *Sixth Triennial Report to Congress* on drug use and drug use research clearly demonstrates that we are continuing to make important progress in better understanding the consequences of illicit drug use through research supported by the National Institute on Drug Abuse (NIDA). Drug use and drug addiction are among the largest and most challenging problems facing society today. Scientific advances have contributed greatly to our understanding of drug use and addiction, but there will never be a “magic bullet” capable of making these problems disappear. Drug use and addiction are complex social *and* public health issues, and they require multifaceted approaches.

As we celebrate NIDA’s 25th anniversary in 1999, numerous research accomplishments discovered throughout the years will be remembered. We recognize that research is the linchpin of our effort to develop more effective drug use prevention and treatment. We now understand clearly that drug addiction is a treatable brain disease, although there still exists a tremendous gap between what science tells us about the nature of addiction and the application of these findings by people in a wide variety of communities. We must bridge this disconnect to change the perception of many health professionals and the general public that addiction is a simple social problem or a failure of will. To do this, we must capitalize on the variety of effective addiction treatments that have been developed as part of NIDA-sponsored research. Both behavioral and pharmacological treatments have been shown to reduce drug use, crime and delinquency, and the spread of HIV/AIDS and other infectious diseases that are associated with drug use and addiction.

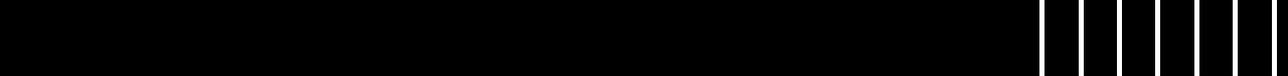
Now is the time to capitalize on these discoveries. In response to the development of a host of new treatment methods, NIDA has launched what is perhaps its most important effort ever—a national Treatment Initiative designed to improve the quality of drug addiction treatment programs in the United States. The Initiative has both a research emphasis and a communications thrust. The research emphasis will stimulate additional work to improve current treatments and to develop new treatments and will transfer them to community-based drug addiction treatment clinics. The communications thrust will increase the exchange of useful information about drug addiction and its treatment among the research and treatment communities and the general public. By spurring additional drug addiction treatment research and speeding the evaluation and application of research-tested treatments in the real world, NIDA’s Treatment Initiative can have a significant impact on the Nation’s public health.

NIDA has also launched a Methamphetamine Initiative to expand scientific research on methamphetamine and to apply the findings to the prevention and treatment of methamphetamine use before methamphetamine use reaches the scale and scope of

other illicit drugs. Specifically, the Methamphetamine Initiative builds on the substantial body of knowledge yielded by previous NIDA-supported methamphetamine research, which shows that smoking, snorting, ingesting orally, or injecting methamphetamine produces euphoria by stimulating production of excessive levels of the neurotransmitter dopamine. More important, this research in animals has shown that even at low levels, methamphetamine can destroy substantial numbers of these dopamine-producing nerve cells, which can lead to permanent serious physical and behavioral effects. With a sense of urgency, the Institute has used supplemental funding from the White House Office of National Drug Control Policy and the Office of the Director, National Institutes of Health, to increase funding for efforts to develop new behavioral and pharmacological treatments to treat methamphetamine use.

Since describing the state of drug use and drug addiction research in the *Fifth Triennial Report to Congress*, NIDA's continuing support of more than 85 percent of the world's research on drug use and drug addiction had generated important new findings on the effects of drugs on the structure and function of the brain. This work is now leading investigators to develop the next generation of treatments and preventive methods to combat drug use and addiction. Scientists have identified neural circuits that subsume the actions of every known drug of abuse, and they have specified common pathways that are affected by almost all such drugs. Researchers have also identified and cloned the major receptors for virtually every abusable drug as well as the natural molecules within the brain that interact with these receptors. In addition, they have elaborated many of the biochemical cascades within nerve cells that follow receptor activation by drugs. Research has also begun to reveal major differences between the brains of addicted and nonaddicted individuals and to indicate some common brain elements of addiction, regardless of the substance.

We have also discovered more about how a person's external milieu can affect brain function and, therefore, the addiction process. One of the most significant breakthroughs in this area has been the identification of areas of the brain that are specifically involved in the phenomenon of craving. Research converging from many laboratories using modern neuroimaging technologies has laid out in detail the brain circuits that are activated when addicts experience craving for drugs. Because craving is probably the single most important factor that can lead to relapse, understanding the systems that mediate this phenomenon provides the foundation for developing much more effective therapies to prevent or reverse the addiction process.



With drug use beginning at an earlier age than ever before, NIDA is now dedicating a large portion of its research portfolio to study the effects that drug use and addiction have on infants, children, and adolescents. Prevention serves as the cornerstone of this Initiative, although NIDA's research portfolio also addresses other important issues, including the study of the consequences of prenatal drug exposure, the etiology and epidemiology of drug use among our youth, and drug use aspects of child and adolescent HIV/AIDS.

Drug addiction, like other health conditions, such as high blood pressure and depression, is a chronic, relapsing disease of the brain that is treatable. The NIDA-supported research described in this report chronicles our progress toward more effective prevention and treatment of drug addiction.

Alan I. Leshner, Ph.D.
Director
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Preface

Dramatic scientific advances over the past 2½ decades have revolutionized our understanding of drug use and addiction. Foremost among these advances is a clear understanding that drug use is a preventable behavior and that drug addiction is a treatable disease of the brain. This paradigm shift in our understanding of drug use and addiction has come in large part because of the comprehensive research portfolio supported by the National Institute on Drug Abuse (NIDA), part of the National Institutes of Health.

Research has shown that drug use is a double-edged health issue as well as a societal issue. It affects both the health of the individual and the health of the public. The use of drugs has well-known and severe negative consequences for both mental and physical health. However, drug use and addiction also have tremendous negative implications for the health of the public because drug use, directly or indirectly, is a major factor in violent crimes and is a vector for the transmission of serious infectious diseases, particularly AIDS, hepatitis, and tuberculosis. Because addiction is such a complex and pervasive health issue, we must include in our overall strategies a committed public health approach that includes extensive education and prevention efforts, treatment, and research.

Science is providing the basis for such public health approaches. For example, two large sets of multisite studies have demonstrated the effectiveness of well-delineated outreach strategies in modifying the behaviors of addicted individuals that put them at risk for acquiring HIV, even if they continue to use drugs and do not want to enter treatment. This approach runs counter to the broadly held view that addicts are so incapacitated by drugs that they are unable to modify any of their behaviors. It also suggests a basis for improved strategies to reduce the negative health consequences of injection drug use in the individual and for society.

NIDA, which supports more than 85 percent of the world's research on drug use and addiction, continues to identify and seize on new technologies and avenues for developing prevention and treatment approaches to reduce significantly the devastating health and societal effects of drug use and addiction. In addition to vigorously pursuing basic and emerging research opportunities, NIDA also ensures the rapid and effective transfer of its scientific findings to policymakers, drug addiction practitioners, other health care practitioners, and the general public. The Institute also seeks input from the users of its findings about the information that they need to do their jobs. NIDA accomplishes this in part by holding town meetings across the country and by hosting national conferences on topics such as heroin addiction, drug addiction treatment research, and addiction to nicotine.

At the policy level, understanding the importance of drug use and addiction for the health of both individuals and the public affects many of our overall public health strategies. An accurate understanding of the nature of drug use and addiction should also be reflected in our criminal justice strategies. For example, if we know that criminals are drug addicted, it is no longer reasonable to simply incarcerate them. If they have a brain disease, imprisoning them without treatment is futile, for if they are left untreated, their recidivism to crime and drug use are frighteningly high. However, NIDA-sponsored studies have shown that when addicted criminals are treated while in prison, both types of recidivism can be reduced dramatically.

At a more general level, understanding addiction as a brain disease also affects how society approaches and deals with addicted individuals. We need to face the fact that even if the condition initially comes about because of voluntary behavior—drug use—an addict's brain is different from a nonaddict's brain, and we must learn to deal with the addicted individual as if he or she is in a different or diseased brain state. For example, we have learned to deal with people in different brain states for schizophrenia and Alzheimer's disease. Recall that as recently as the beginning of this century we were putting individuals with schizophrenia in prisonlike asylums, whereas we know now that they require medical treatment. We now need to see the addict as someone whose brain has been altered fundamentally by drugs. Treatment is required to deal with the altered brain function and the concomitant behavioral and social functioning components of this illness.

Understanding addiction as a brain disease explains in part why historic policy strategies that focused solely on the social or criminal justice aspects of drug use and addiction have been unsuccessful. Research now shows why: They are missing at least half the issue. If the brain is at the core of the problem, attending to and treating the diseased brain needs to be the core solution.

As we move into the 21st century, everchanging drug use patterns, the continuing transmission of HIV infection among drug users, and the need to develop effective treatment and preventive interventions underscore the importance of research in finding new and better ways to alleviate the pain and devastation of addiction. Never before has there existed a greater need to increase our knowledge about drug use. I believe that science will continue to offer our best hope for solving the Nation's drug problems. Our continued commitment to medical research will help all Americans live healthier lives.

Donna E. Shalala
Secretary of Health and Human Services

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Research on the Nature and Extent of Drug Use in the United States

Understanding the scope and scale of drug use and addiction in the United States, determining their prevalence among various populations, and learning about their many health and social consequences are critical if we are to solve this complex problem in the most efficient and timely manner possible. It is through epidemiological research that we are able to identify and examine trends in both drug use and in the attitudes that Americans have toward drug use. Many epidemiological studies, including a variety of surveys, experimental studies, and field investigations, are conducted on a continuing basis, and these studies provide long-term data trends that can help measure our successes in preventing and treating drug use. Other studies occur but once, shedding light on particular issues or emerging drug problems.

This chapter presents some of the most recent findings from three major sources of epidemiologic data on drug use. It also provides a perspective on patterns and trends in drug use. The Monitoring the Future (MTF) Study and the Community Epidemiology Work Group (CEWG) Study are sponsored by the National Institute on Drug Abuse (NIDA), whereas the National Household Survey on Drug Abuse (NHSDA) is administered by the Substance Abuse and Mental Health Services Administration (SAMHSA), U.S. Department of Health and Human Services.

DATA SOURCES

Monitoring the Future Study¹

NIDA's Monitoring the Future Study is a national survey that tracks drug use trends and attitudes about drugs among America's adolescents. The University of Michigan's Institute for Social Research has conducted the survey each year since 1975 among 12th graders; 8th and 10th graders were surveyed for the first time in 1991. Each spring, students from all three grades in a representative sample of public and private schools are asked anonymously via a questionnaire if they have used any of a wide range of drugs, including tobacco. In 1997 approximately 51,000 students in 429 public and private secondary schools were surveyed.

National Household Survey on Drug Abuse²

The National Household Survey on Drug Abuse regularly produces estimates of drug use among members of the civilian, noninstitutionalized population of the United States age 12 and older. The survey, using trained interviewers to visit respondents in their homes, has been conducted since 1971. In the 1997 sampling, 24,505 interviews were conducted, with the subjects selected to represent a cross-section of race, gender, region of the country, population density, education level, and current employment.

Community Epidemiology Work Group³

The Community Epidemiology Work Group is a NIDA-sponsored network of researchers from 20 major U.S. metropolitan areas who monitor community-level trends in drug use and abuse, primarily through collection and analysis of epidemiologic and ethnographic research data. Data collected by the working group include drug-related deaths reported by medical examiner/local coroner offices or State public health agencies; drug-related emergency department citations reported to SAMHSA's Drug Abuse Warning Network; primary substance use reports given by clients on admission to treatment programs; urinalysis results from those arrested by local police departments; and seizure, price, purity, prescription/ distribution, and arrest data from the Drug Enforcement Agency and from State and local enforcement agencies. These quantitative data are enhanced with information obtained through field reports, focus groups, interviews, and other qualitative methods.

PREVALENCE OF DRUG USE

Data from the three major surveys paint a mixed picture of the Nation's drug use problem. There is a continued high rate of drug use among all age groups, but there are also indications that drug use is leveling off, particularly among younger age groups (e.g., eighth graders), and that the use of certain drugs among younger age groups may finally be decreasing. There also appears to be a resurgence of antidrug attitudes among all grades, although there remain mixed perceptions about marijuana use.

The 1997 NHSDA found that an estimated 13.9 million Americans 12 years and older had used an illicit drug in the month prior to interview. This finding represents no significant change from 1996. Among youth 12 to 17 years old, however, past-month illicit drug use increased from 9.0 percent in 1996 to 11.4 percent in 1997, primarily due to an increase among those 12 to 13 years old. In the history of this survey, the highest rate of the past-month illicit drug use among persons 12 to 17 years old was 16.3 percent, and the lowest was 5.3 percent in 1992. From 1996 to 1997, drugs that increased in use among this age group were marijuana (from 7.1 percent to 9.4 percent) and tranquilizers (from 0.2 percent to 0.5 percent). Among persons 18 to 25 years old, cocaine use decreased from 2.0 percent in 1996 to 1.2 percent in 1997; heroin use decreased from 0.4 percent to 0.1 percent; and misuse of analgesics declined from 2.0 percent to 1.3 percent. Past-month cocaine use also declined among persons 25 to 34 years old.

Results from the 1997 MTF Study paint a similar picture. Lifetime use of marijuana, cocaine, and opiates other than heroin increased from 1996 to 1997 among high school seniors, and lifetime marijuana use increased among 10th graders. However, more recent use—within the past year and past month—remained stable with few exceptions. Results for eighth graders provided a glimmer of hope, with no increases and even decreases in a few categories. Attitudes

toward substance use were mostly stable between 1996 and 1997. Perceived risk of harm was mostly stable for students in all three grades. Encouraging results were found for eighth graders, with disapproval increasing for selected marijuana, cocaine, and cigarette use indicators.

The CEWG reports that indicators of marijuana use continued to escalate across the country and that so-called "club drugs" have appeared in increasing numbers on the drug scene in several cities. Indicators of cocaine use have remained level or have even declined, whereas heroin use is stable in some cities but is rising in others, particularly in the northeastern region of the country.

In the Western United States, methamphetamine use appears to be rising, and its use has spread beyond its traditional user base—white, male, blue-collar workers—into diverse groups in all regions of the country. Methamphetamine use is increasing among men who have sex with men and who use other drugs, making this population more vulnerable to contracting and spreading sexually transmitted diseases, particularly AIDS. There has also been a notable increase in methamphetamine use among homeless and runaway youth and among male and female commercial sex workers who also trade sex for drugs. People in occupations that demand long hours, mental alertness, and physical endurance have also been increasing their use of this drug.

Many more people try drugs than go on to become regular users. Although NHSDA survey results show that nearly 36 percent of all Americans older than age 11 have tried any illicit drug during their lifetime, only 11 percent have used any illicit drug during the past year, and only 6 percent have used any illicit drug during the past month. This same finding holds true for specific illicit drugs. In their lifetime, 33 percent of Americans age 12 or older have smoked marijuana at least once, but only 5.1 percent used marijuana during the past month. Although the overall numbers are higher, the same trend holds true for cigarette use, with nearly 71 percent of Americans reporting that they had smoked a cigarette at some time in their life, but only 30 percent reported having smoked a cigarette during the past month. These findings show the importance of identifying both the factors that place people at risk for drug use and the protective factors that keep many people from becoming regular users. (The results of such studies are discussed in the next chapter.)

Rates of illicit drug use vary by ethnicity and gender.⁴ Most current illicit drug users are white non-Hispanics, a group that accounts for 74 percent of all users. However, the rate of current illicit drug use for blacks (7.5 percent of the black population) remains somewhat higher than for whites (6.4 percent of the white non-Hispanic population) and Hispanics (5.9 percent of the Hispanic population). However, among youth the rates of use are about the same for the three ethnic groups. As has been true for some time now, in 1997 men continued to have a higher rate of current illicit drug use than women (8.5 percent of men versus 4.5 percent of women). However, among 12- to 17-year-old drug users, there was little difference

in the rate of drug use between adolescent males and females (9.2 percent for males versus 8.9 percent for females).

Rates of illicit drug use in 1997 also show substantial variation by age and educational status. Among youths ages 12 to 13, 3.8 percent were current illicit drug users. The highest rates were found among young people ages 16 to 17 (19.2 percent) and ages 18 to 20 (17.3 percent). Rates of use were lower in each successive age group, with only about 1 percent of people age 50 and older reporting current illicit use. Among young adults ages 18 to 34, those who had not completed high school had the highest rate of current use (14.1 percent), whereas college graduates had the lowest rate of use (5.9 percent). This is despite the fact that young adults at different educational levels are equally as likely to have tried illicit drugs in their lifetime.

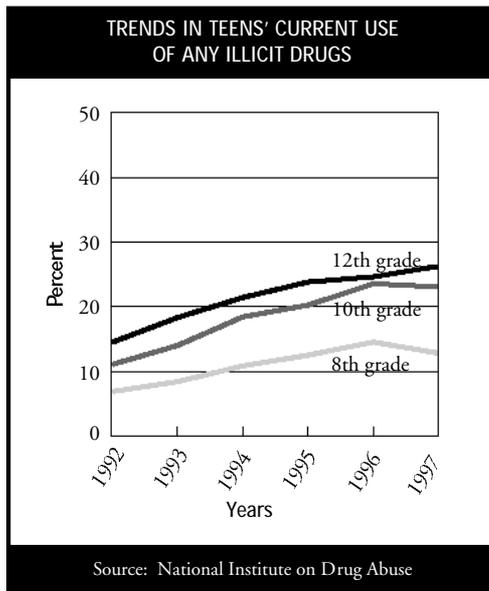
Illicit drug use also varies by geographic location. In 1997 the current illicit drug use rate was 8.1 percent in the West, 7.3 percent in the North Central, 5.8 percent in the South, and 4.7 percent in the Northeast. Rates were higher in metropolitan areas than in nonmetropolitan areas.

MAJOR FORMS OF DRUG USE

The following sections offer a brief look at the extent of drug use and abuse among the U.S. population. NIDA InfoFax factsheets that describe the drugs' origins, methods of use, and health consequences are available from the National Clearinghouse for Alcohol and Drug Information at 1-800-729-6686, through the NIDA InfoFax service (toll free, 24 hours a day, at 1-888-644-6432 [TTY: 1-888-889-6432]), or at the NIDA World Wide Web site (www.nida.nih.gov).

Marijuana Use

Marijuana remains the most commonly used illegal drug: Approximately 80 percent of current illicit drug users are marijuana or hashish users. Males ages 18 to 25 reported the highest rates of past-year and current use compared with all other age and gender



groups. More than one in six males in the 18- to 25-year-old age group are current marijuana users. In 1997 approximately 11 million Americans used marijuana during the past month. Race and ethnicity were associated with marijuana use, but the relationships varied by age. Overall and among persons 18 to 34 years old, whites reported higher levels of lifetime use than blacks and Hispanics. Past-year and current rates for Hispanic adults were significantly lower than for whites and blacks. But among adults age 26 and older, blacks reported a higher level of past-month use than whites.

After 6 years of steady increases, in 1997 marijuana use remained level among eighth graders. Among 10th graders the rate of increase has decelerated, although the proportion of 10th graders reporting any marijuana use in the prior 12 months still showed some increase. There is some evidence of deceleration among 12th graders, with observed increases in 1996 and 1997 considerably lower than those observed in 1993, 1994, and 1995.

The most promising data showed that for the first time in 6 years, eighth graders reported an increase in disapproval of marijuana. There was no change in the reported availability of marijuana at any grade level.

However, marijuana-related emergency room usage continues to increase in many U.S. cities. In addition, primary marijuana use as a percentage of treatment admissions increased slightly to moderately among the Nation's cities. According to the CEWG, in many U.S. cities marijuana now exceeds cocaine as the drug most frequently detected by urinalysis among adult males arrested for any reason.⁵ The percentage of positive urinalysis for marijuana is much higher for juveniles than it is for adults.

Cocaine Use

In 1997 an estimated 1.5 million Americans, or 0.7 percent of the population age 12 and older, were current cocaine users, a significant decline from the 5.7 million cocaine users reported in 1985. An estimated 682,000 Americans (0.3 percent of the population) were frequent cocaine users, defined as those who use cocaine on 51 or more days during the past year. Since this measure of frequent cocaine use was first estimated in 1985, no significant increases or decreases have been detected. The estimated number of current crack users was about 604,000 in 1997, and there have been no statistically significant changes since 1988.

These estimates of the extent of cocaine use based on the NHSDA may be conservative because many of the most frequent users belong to population subgroups not well represented in household surveys. Based on additional data sources that take account of users underrepresented in the NHSDA, the Office on National Drug Control Policy (ONDCP) estimates the number of chronic cocaine users at 3.6 million.⁶

The use of cocaine powder rose steadily in 8th, 10th, and 12th graders throughout

the first half of the 1990s, but rates of cocaine use in these groups remained level in 1996 and 1997. Among eighth graders, perceived risk remained constant this year, and disapproval of use actually increased, both after an earlier period of erosion in these attitudes. The use of crack cocaine was level for all grades.

Many indicators also show that cocaine use is leveling off among the general population. Cocaine-related deaths were stable in the majority of U.S. cities reporting, and the percentage of treatment admissions for primary cocaine problems declined slightly or remained stable in most urban areas. However, supplies of cocaine remain abundant.

As in the past, the rate of current cocaine use in 1997 was highest among those ages 18 to 25 years (1.2 percent). Rates were 1.0 percent for youth ages 12 to 17 years, 0.9 percent for adults 26 to 34 years, and 0.5 percent for adults age 35 and older. The rate for young adults ages 18 to 34 was significantly lower in 1997 than in 1996. Rates of past-month cocaine use were 1.4 percent for blacks, 0.8 percent for Hispanic whites, and 0.6 percent for non-Hispanic whites. Cocaine use among men was almost twice that among women.

Heroin Use

Estimates of lifetime heroin prevalence have ranged from 2.3 million in 1979 to 1.5 million in 1990, 2.4 million in 1996, and 2.0 million in 1997. The estimated number of current heroin users was 68,000 in 1993, 117,000 in 1994, 196,000 in 1995, 216,000 in 1996, and 325,000 in 1997, representing a statistically significant increase from 1993 to 1997.

Estimates of heroin use from the NHSDA, like estimates of cocaine use, are considered conservative due to underrepresentation of the population of users and failure to access many of the heaviest users in the sampling frame. ONDCP estimates that adjusting for this underrepresentation by use of additional data indicates that there were approximately 810,000 chronic heroin users in the United States in 1995.⁷

Among lifetime heroin users, the proportion that had ever smoked, sniffed, or snorted heroin increased from 55 percent in 1994 to 71 percent in 1997. At the same time, the proportion that had ever used heroin with a needle remained unchanged at approximately 55 percent in 1997. There is little difference among heroin users in terms of race or ethnicity. Males are more likely than females to report heroin use during their lifetimes.

The rates of heroin use in the student population remain quite low, but they have risen significantly among 8th, 10th, and 12th graders. It appears that snorting or smoking heroin, rather than injecting it, has played a role in heroin use. Despite this rise, more students over the past 2 years have been reporting heroin use as dangerous, a contrast to the erosion in those beliefs through the first half of the decade.

By some measures, heroin use is growing as a problem in many cities. Rates of emergency room use related to heroin have increased significantly in eight cities participating in the CEWG network. Higher quality, lower priced heroin is available throughout the Nation.

Methamphetamine Use

The abuse of methamphetamine—a potent psychostimulant—is an extremely serious and growing problem. Known as "speed" or "ice," methamphetamine has a high potential for abuse and dependence. Because its mood-elevating effects can vary in intensity from a few minutes to many hours, depending on the route of administration and dosage, users escalate the frequency and the size of doses to maintain their "high."

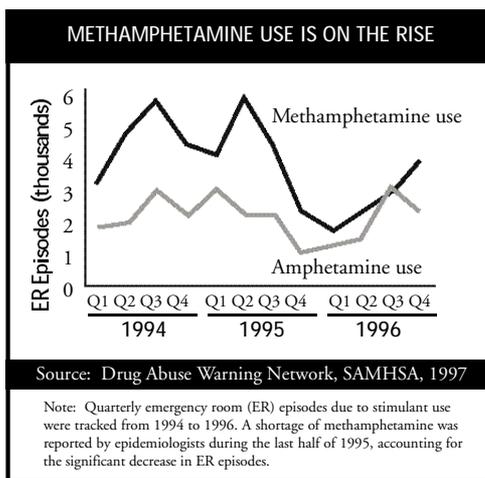
Although the drug was first used primarily in selected urban areas in the western and southwestern regions of the United States, we now are seeing high levels of methamphetamine abuse in many areas of the Midwest, in both urban and rural settings and by diverse segments of the population.

Methamphetamine continues to be a problem in Hawaii and in major

western cities, such as Denver, Los Angeles, and San Francisco. Increased methamphetamine availability and production are being reported in diverse areas of the country, particularly rural areas, prompting concern about more widespread use.

In 1997 an estimated 5.3 million people (2.5 percent of the population) had tried methamphetamine at some time in their lives. In 1994, the estimate was 3.8 million (1.8 percent), and in 1996 it was 4.9 million (2.3 percent). Methamphetamine-related emergency room episodes decreased by 39 percent between 1994 and 1996, after a 237-percent increase between 1990 and 1994. There was a statistically significant decrease in methamphetamine-related episodes between 1995 (16,200) and 1996 (10,800). However, there was a significant increase of 71 percent between the first half of 1996 and the second half of 1996 (from 4,000 to 6,800).

Among 12th graders, past-year methamphetamine use remained constant at 2.3 percent in 1997 after increasing the previous 4 years. Perceived risk levels and availability also remained constant.



Nicotine Use (Cigarettes and Smokeless Tobacco)

The use of tobacco products may be the Nation's most critical public health problem, largely because of the addictive properties of nicotine, a major component of tobacco. Cigarette smoking is the most prevalent form of nicotine addiction in the United States, although smokeless tobacco is also an important contributor to nicotine addiction. Most adults in the United States have had some experience with nicotine, by either smoking cigarettes or using smokeless tobacco products. In 1997 approximately 71 percent of the population age 12 or older had tried at least a few puffs of a cigarette some time in their lives.

Approximately 33 percent of the population had smoked a cigarette during the past year, and 30 percent—64 million Americans—are current smokers. These rates remained constant between 1996 and 1997. However, the use of smokeless tobacco dropped among young adults ages 18 to 25. In every age group, people who had used cigarettes in the past month were more likely to have used other illicit drugs as well.

Among adults, males are more likely than females to have ever used any nicotine products or to have used them within the past year or past month. However, the rates for adolescent males and females do not differ significantly. Whites are more likely to have ever smoked than blacks or Hispanics, and whites and blacks were more likely than Hispanics to be current smokers. Cigarette smoking is more common in nonmetropolitan areas than in metropolitan areas and is more common in southern and north central States than in States in the Northeast or West.

The MTF Study found that after 6 years of steady increase, cigarette smoking among eighth graders has leveled and may even have begun to decline. There is also evidence that smoking rates among 10th graders may be leveling. Only among 12th graders is there clear evidence of a further increase in smoking, continuing an upward march that began 5 years ago. In one encouraging sign, there has been an upward shift over the past 2 years in the proportion of students in all three grades who see great risk associated with being a pack-a-day smoker. However, cigarettes remain readily available to our youth, with 76 percent of 8th graders and 90 percent of 10th graders reporting easy access.

The impact of nicotine addiction in terms of morbidity, mortality, and economic costs to society is staggering. Tobacco kills more than 430,000 U.S. citizens each year—more than alcohol, cocaine, heroin, homicide, suicide, car accidents, fire, and AIDS combined. Tobacco use is the leading preventable cause of death in the United States. Economically, smoking is responsible for approximately 7 percent of total U.S. health care costs, an estimated \$50 billion yearly. However, this cost is well below the total cost to society because it does not include burn care from smoking-related fires, perinatal care for low birth-weight infants of mothers who smoke, and medical care costs associated with diseases caused by secondhand smoke. Taken together, the direct and indirect costs of smoking are estimated at more than \$100 billion per year.

Inhalant Use

Inhalants are breathable chemical vapors that produce a high when inhaled. They include solvents; gases such as butane and other spray-can propellants; and nitrites such as cyclohexyl nitrite—available to the public—amyl nitrite—available only by prescription—and butyl nitrite—now an illegal substance.

According to the 1997 NHSDA, approximately 12 million Americans (5.7 percent) reported use of inhalants at least once in their lifetime, and 883,000 people (0.4 percent) were current users. The rate of current inhalant use has remained constant since 1994. The highest current use of inhalants was among 12- to 17-year-olds.

With so many substances lumped together as inhalants, research data describing frequency and trends of inhalant abuse are uneven and sometimes contradictory. However, evidence indicates that inhalant abuse is more common among all socioeconomic levels of American youth than is typically recognized by parents and the public. For instance, the 1997 Monitoring the Future Study showed that more than one in five eighth graders had used inhalants at least once in his or her lifetime. Inhalants are most commonly used by adolescents in their early teens, with usage dropping off as students grow older. Inhalants were used by equally high percentages of 10th and 12th graders according to the NIDA survey, but 8th graders had the highest rate of use. For example, although 5.4 percent of eighth graders reported using inhalants within the past 30 days, known as "current" use, only 2.5 percent of seniors reported current use of inhalants.

A major roadblock to recognizing the size of the inhalant problem is the ready availability of products that are inhaled. Inhalants are cheap and can be purchased legally in retail stores in a variety of seemingly harmless products. As a result, adolescents who sniff inhalants to get high do not face the drug procurement obstacles that confront abusers of other drugs.

Hallucinogen Use

The two most commonly abused hallucinogens are PCP (phencyclidine) and LSD (lysergic acid diethylamide), also known as acid. In 1997 nearly 10 percent of the population age 12 and older reported using hallucinogens at least once during their lifetime, unchanged from the previous year. Current use and past-year use also remained unchanged. On a longer term basis, current hallucinogen use increased from 1992 to 1995 but has remained stable since then. In the aggregate population and in every adult age group, whites had higher levels of lifetime hallucinogen use than blacks and Hispanics. Most hallucinogen users are young, suburban, and middle class.

Among 8th, 10th, and 12th graders, hallucinogen use remained constant in 1997 according to the MTF Study. Consistent with this finding, the degree of risk young people reported to be associated with these drugs began to level a year earlier in all grades. Similarly, the proportion of students expressing disapproval of the use of

these drugs has been level since 1996, compared with the decline in disapproval seen earlier in the 1990s.

LSD remains widely available in many U.S. cities, and prices are falling. However, indicators show declines in use in most areas. Rates of LSD- and PCP-related emergency room incidents declined throughout most of the United States, and primary hallucinogen users generally continue to constitute a small percentage of total treatment admissions.

Anabolic Steroid Use

Anabolic steroids are synthetic derivatives of testosterone that promote growth of skeletal muscle and increase lean body mass. Athletes and others who use steroids to enhance performance and improve physical appearance place themselves at risk for numerous health hazards, including liver tumors, jaundice, fluid retention, severe acne, trembling, high blood pressure, and psychiatric disorders.

Between 1989 and 1997, lifetime prevalence of anabolic steroid use among 12th graders fluctuated between a 3-percent high in 1989 and a 1.9-percent low in 1996. Annual prevalence rates for this period remained relatively stable. Among the class of 1997, 2.4 percent of high school seniors had used anabolic steroids at least once in their lifetimes—up from the class of 1996 rate of 1.9-percent lifetime use. Past-year use among seniors has been stable at 1.4 percent from 1991 to 1997. In 1997, 1.8 percent of 8th graders and 2.0 percent of 10th graders had used anabolic steroids at least once in their lifetimes, and 1.0 percent of 8th graders and 1.2 percent of 10th graders had used anabolic steroids within the past year. In all age groups, students' perceptions about the harmfulness of taking steroids and the trends in their disapproval of the use of steroids have remained relatively stable in the 1990s. However, 12th graders reported a drop in availability of steroids.

DRUG USE AND INFECTIOUS DISEASES

The use of illicit drugs is associated with the transmission of HIV/AIDS and other infectious diseases, such as hepatitis B and C and tuberculosis. Furthermore, drug use can result in many other health problems. With the establishment of NIDA's new Center for AIDS and Other Medical Consequences of Drug Abuse, NIDA has the unique opportunity to assess both short- and long-term medical consequences associated with drug use. It has long been known that injection drug use is related to a significant percentage of new AIDS cases each year. More recently, research has indicated that hepatitis C is spreading rapidly among injection drug users, with current estimates indicating infection rates of 65 to 90 percent among this population.

Since AIDS was first identified in 1981, more than 1 million Americans have become infected with HIV. According to the Centers for Disease Control and Prevention, drug use remains the second most common mode of exposure among

AIDS cases nationwide. Through June 1997, injection-related AIDS cases accounted for 32 percent of total diagnoses.

Overall and in each age group surveyed, respondents who had used illicit drugs in the past year were more likely than those who had not to have had a blood test for HIV. In addition, illicit drug users were more likely than nonusers to be sexually active and to have had two or more sexual partners within the past year. At the same time, those illicit drug users who reported having two or more sexual partners within the past year were less likely to say that they always used a condom.

Approximately 170,000 new acute hepatitis C virus (HCV) infections occur annually, of which approximately 36 percent are estimated to be related to intravenous drug use. In 1992, the last year for which data are available, the estimated cost of drug use associated with HCV treatment was \$429.8 million. HCV is most commonly transmitted through intravenous drug use and blood transfusions and is rarely acquired through sexual contact. In contrast to the epidemiological trends of hepatitis B virus (HBV), the proportion of reported HCV cases acquired through intravenous drug use remains high (12 percent versus 36 percent, respectively). The risk of acquiring HCV through intravenous drug use also increases as the duration and frequency of drug use increases. According to an Australian study, approximately 66 percent of intravenous drug users acquire HBV within 2 years of regular intravenous drug use, and virtually 100 percent of intravenous drug users acquire HCV within 8 years of regular use. However, the results of this study should be used with caution because characteristics of intravenous-drug-user populations (such as needle-sharing) have been shown to vary across and within countries.

Intravenous drug users contract both HBV and HCV by sharing contaminated needles. Studies have shown that intravenous drug users are at high risk to acquire HBV and HCV, as seroprevalence rates range from 65 to 90 percent. During 1993, 12 percent of HBV infections and 36 percent of HCV infections were attributed to persons who used intravenous drugs. These estimates may be conservative because at least 30 percent of adults who reported HBV and HCV cases did not specify a risk factor. It is possible that some persons with unidentifiable risk factors were reluctant to identify intravenous drug use as a risk factor.

As in HIV infection, intravenous drug users can infect not only other intravenous drug users but also their sexual partners. Transmission of HBV through heterosexual activity has been increasing each year, and perinatal transmission of HBV by mothers who use intravenous drugs or have sexual intercourse with an intravenous drug user is common, with transmission rates reaching 90 percent. However, sexual and perinatal transmission of HCV is rare.

NIDA Research Priorities and Highlights

ROLE OF RESEARCH

During these historic times for scientific advancement, NIDA-funded investigators have had another 3 years of exceptional accomplishment. NIDA-supported researchers have made enormous strides toward understanding, preventing, and treating one of our Nation's most serious public health problems—drug use and addiction. Today we know more about the effects of abused drugs on the brain than is known about almost any other aspect of brain function.

Research on drug use and addiction crosses many scientific, social, and cultural boundaries, and it must be transferred from the laboratory to the clinic to the community and back again. For example, our ability to improve the effectiveness of drug use prevention and treatment depends on our understanding the underlying neurobiology of addiction as well as the biological, genetic, social, psychological, and environmental factors that predispose individuals to drug addiction.

The NIDA research portfolio is paying dividends to society in at least two major ways. First, there are the specific accomplishments, some of which are detailed in the following pages, that are generating new insights into drug use and addiction, producing new treatments for drug addiction, developing prevention methods that work, and enabling us to disseminate this information into the clinical community and general public. However, just as important, scientific research and clinical experience have taught us much about what really matters in addiction and where we need to concentrate both our clinical and policy efforts.

One of the best examples of this payoff can be seen in how we have now come to define addiction. Research has shown that differentiating between physical and psychological addiction is outdated. Twenty years of scientific research, coupled with even longer clinical experience, has taught us that focusing on this physical vs. psychological distinction is off the mark, and a distraction from the real issues. From both clinical and policy perspectives, it actually does not matter very much what physical withdrawal symptoms occur. Other aspects of addiction are far more important.

Physical dependence is not that important because, first, even the florid withdrawal symptoms of heroin and alcohol addiction can now be easily managed with appropriate medications. Therefore, their physical withdrawal symptoms should not be at the core of our concerns about these substances.

Second, and more important, many of the most addicting and dangerous drugs do not even produce very severe physical symptoms and withdrawal. Crack cocaine and methamphetamine are clear examples. Both are highly addicting, but stopping their

use produces very few physical withdrawal symptoms, certainly nothing like the physical symptoms of alcohol or heroin withdrawal.

What does matter is whether a drug causes what research has now shown convincingly to be the essence of addiction: compulsive drug-seeking behavior and use, even in the face of negative health consequences. These characteristics ultimately matter most to the patient and are where treatment efforts must be directed. These behaviors are also the elements responsible for the massive health and social problems that drug addiction brings in its wake.

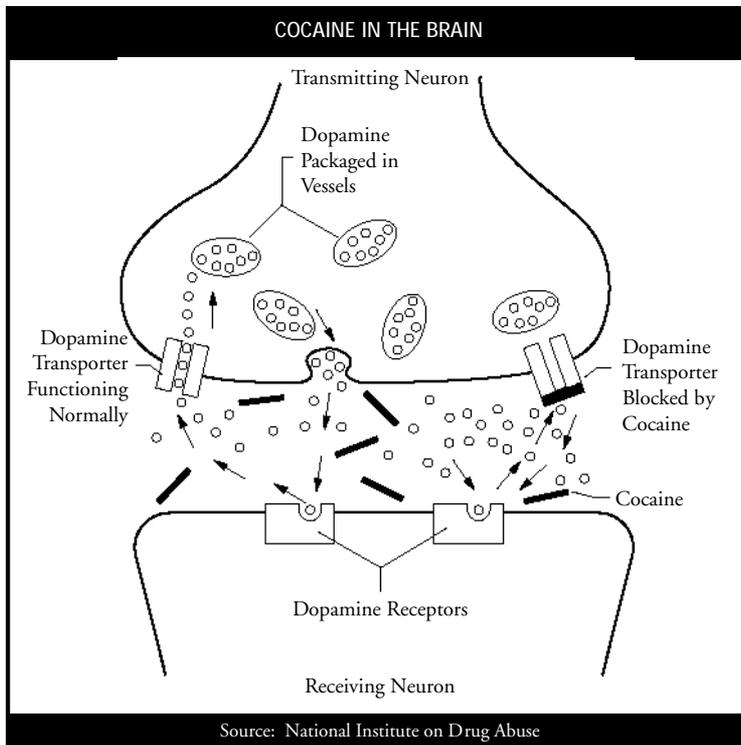
To ensure that NIDA-sponsored research continues to provide valuable insights into the nature of addiction, the Institute has continued to work closely with the research, treatment, and health services communities, as well as with other Federal agencies and the States, to develop long-range research plans for several high-priority areas. The following sections of this chapter describe the progress that NIDA has made in addressing these areas of research priority.

Neurobiology, Genetics, and Behavior

All drugs of abuse act in the brain by altering normal biological processes, which in turn cause changes in behavior and thinking. Understanding the relationship between brain mechanisms that underlie behavior and drug-related changes in these mechanisms is critical for developing more effective treatments for drug addiction and its consequences. So, too, is understanding how genetic differences, and environmental influences on these differences, among members of the population can make some people either more or less vulnerable to addiction to both licit and illicit drugs.

During this decade, we have learned much about the neurobiological, genetic, and behavioral aspects of drug addiction. Scientists have identified neural circuits that subsume the actions of every known drug of abuse, and they have specified common pathways that are affected by almost all such drugs. Researchers have also identified and cloned the major receptors for virtually every abused drug, identified their natural ligands, developed methods to directly manipulate receptor systems, and begun linking the neurobiology of these receptors to behaviors seen during drug use and addiction. In addition, they have elaborated many of the biochemical cascades within the cell that follow receptor activation by drugs. Research also has begun to reveal major differences between the brains of those at risk for addiction and among those without risk factors.

Research also has identified differences between the brains of those at risk for addiction and indicated some common brain elements of addiction, regardless of the substance involved. Genetic studies have been useful in identifying inherited traits that are strongly linked to substance abuse and its risk factors and in suggesting neurobiological and behavioral connections.



Below are descriptions of a few of the most significant research accomplishments since 1995 in the areas of the neurobiological, genetic, and behavioral aspects of addiction.

Cocaine Addiction

During the past 3 years, our knowledge about how cocaine affects the brain has reached a critical mass. For the first time, we have important insights into the amazingly complex neurotransmission system involved in cocaine addiction. These advances have opened new doors for potential therapeutic intervention. For example, neurochemical studies of cocaine's effects on the brain's reward system have teased out some of the details of how this drug interacts with the dopamine system. Repeated self-administration of cocaine appears to be tied to the D1 receptor type, whereas three dopamine receptor types—D1, D2, and D3—are involved in cocaine-seeking behaviors.⁸ Another study⁹ found that activating the D1 receptor system can suppress cocaine seeking in drug-experienced animals. In contrast, activating the D2 receptor system can trigger cocaine seeking. This makes D1 receptor stimulation a potential target for the development of medications to treat cocaine addiction. In fact, formerly addicted rats pretreated with a chemical known to activate only the D1 receptor system were completely resistant to cocaine's ability to prime or restart drug use.

Until recently, most of what we have known about the relationship between cocaine and dopamine came from animal models. During the past 3 years in particular, imaging studies that used positron emission tomography (PET) and functional magnetic resonance imaging have for the first time shown that dopamine neurotransmitter systems in the human brain respond to cocaine in a manner similar to that seen in laboratory animals. In one study, PET imaging showed that there was a significant relationship between the intensity and duration of a cocaine high and the degree to which cocaine was able to increase the amount of dopamine available in the brain. In this instance, cocaine was seen blocking the dopamine reuptake system that removes dopamine from the synapse between neurons—that keeps more dopamine in the synapse and has the effect of allowing these neurons to propagate nerve signals for a longer period than normal.¹⁰ The same group of investigators also used PET to identify some of the unique properties of cocaine that account for the binge pattern of use exhibited by cocaine addicts. Their studies showed that repeated and frequent activation of the dopamine system by cocaine results in an abnormal state in one of the brain's neural circuits.¹¹ This altered brain circuit may be responsible for the dramatic difference in brain functioning that exists between the nonaddicted and addicted individual.

Investigators have used PET to see changes in the brain triggered by environmental cues that are associated with past experiences of using drugs and that lead to drug craving, even when no drug is available. The brain regions activated during exposure to the drug-related stimuli were those involved in integrating the emotional and cognitive aspects of memory. As a result, researchers now have the first evidence that the mechanisms of memory processing are as important to the understanding of cocaine craving as the direct effects of the drug on the nervous system.

Although it is clear that the dopamine system is intimately involved in cocaine addiction, as it is with all drugs of abuse, other brain systems must also come into play. Evidence compiled over the past 3 years has shown that the serotonin system is certainly involved in cocaine addiction. Investigators have now shown, for example, that blocking cocaine's effects on the serotonin 5-HT₃ receptor prevents the occurrence of tolerance and sensitization to cocaine. Further research on this neurotransmitter system found that continuous cocaine administration decreases the number of 5-HT₃ receptors in the nucleus accumbens. Because the nucleus accumbens is thought to be critical in mediating reinforcement processes in general, this decrease may be critical in our understanding of the consequences of cocaine use.¹²

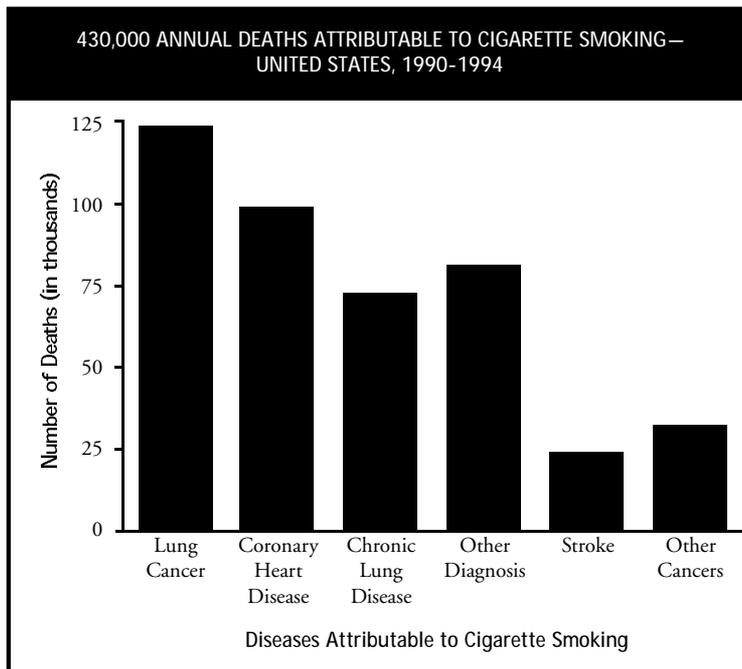
Researchers have also found that mice lacking the gene for another serotonin receptor, known as 5-HT(1b), were more responsive to cocaine and were therefore more susceptible to cocaine addiction than mice having that gene. Further work with these mice showed that they were also more susceptible to the effects of alcohol. Finally, investigators have identified, in the brains of humans, monkeys, and guinea pigs, a new serotonin receptor, named SERTsite2, that binds only cocaine and not other drugs that interact with the serotonin system. This finding suggests

that this new receptor may be involved in behaviors caused specifically by cocaine and that this receptor might be a good target for the development of drugs to treat cocaine abuse or addiction.

Additional genetic studies have shown that still other brain neurotransmitter systems are involved in cocaine addiction. This conclusion was determined by using the genetic technique known as "knockouts." Using this method, strains of mice can be developed that lack parts of the serotonin and dopamine systems known to interact directly with cocaine. Even missing these components, specifically the serotonin and dopamine transporters, these mice remained sensitive to the rewarding effects of cocaine.¹³ As a result, investigators are now searching for the other neurotransmitter systems involved in cocaine addiction.

Nicotine Addiction

In a landmark study, investigators using a strain of mice lacking a specific region of the nicotine receptor have identified the first neurochemical step in the pathway toward nicotine addiction.¹⁴ Using sophisticated bioengineering tools, the researchers developed a strain of mice lacking the beta-2 subunit, one of the 10 proteins that form the brain's nicotine receptor. These mice fail to self-administer nicotine, implying that without the beta-2 subunit the mice do not experience the positive reinforcing properties of nicotine. Importantly, in this study both the normal and the genetically altered mice did self-administer cocaine, indicating that even without



this beta-2 subunit, the brain reward pathway thought to be common to all addictions remains intact even though nicotine loses its effect. In addition, nicotine injections given to these mice did not increase levels of the neurotransmitter dopamine, something that is typically seen following nicotine administration.

PET imaging studies with human smokers and nonsmokers have found that cigarette smoking was associated with a significant reduction in brain levels of the enzyme monoamine oxidase-A (MAO-A). These findings are similar to earlier experiments that showed a reduction of brain monoamine oxidase-B levels in smokers. Because drugs that inhibit MAO-A are effective antidepressants, these results suggest that MAO-A inhibition should be considered as a potential contributing factor in the high rate of smoking among depressed individuals as well as in the development of more effective strategies for smoking cessation.¹⁵

Other avenues of research are also elucidating brain changes following long-term smoking. For example, postmortem studies comparing the brains of human smokers and nonsmokers found that lifelong smokers had far more nicotine receptors than nonsmokers did in key brain regions. Furthermore, the amount of increase correlated with the degree of smoking as measured by the average number of packs smoked per day, a finding that agrees with those from animal studies. One important finding from this study was that nicotine receptor levels fell to normal in lifetime smokers who had quit at least 2 months prior to death, suggesting that nicotine tolerance and addiction produce changes in brain neurochemistry that may be reversible with time.

Investigators have also found that there are dramatic changes in the brain's pleasure circuits during withdrawal from chronic nicotine use that rival the magnitude and duration of similar changes observed during withdrawal from other abused drugs, such as cocaine, opiates, amphetamines, and alcohol. These changes were seen as decreases in the sensitivity of the brains of laboratory rats to pleasurable stimulation after nicotine administration was abruptly stopped. These changes also lasted several days and may correspond to the anxiety and depression experienced by humans for several days after quitting smoking "cold turkey." The results of this research indicate that we have a good animal model in which to study the neurobiology of nicotine abstinence and thus to assist with the development of behavioral and pharmacological treatments for nicotine addiction.¹⁶

However, new evidence suggests that nicotine is not the only drug in tobacco responsible for the addictive potential of cigarette smoking. In a recent experiment, investigators compared the mood effects in humans produced by a standard 1-mg nicotine cigarette versus a cigarette with all nicotine removed. As other studies have shown, subjects reported feeling calmer and less irritable after smoking the cigarette containing nicotine. However, subjects reported many positive subjective effects after smoking the cigarette lacking nicotine, effects that were comparable in magnitude to the nicotine cigarette. These results raise the possibility that the airway sensory effects of cigarette smoke alone contribute to the positive subjective effects

of smoking. These results further suggest that airway sensory replacement therapy may be useful for smoking cessation.¹⁷

Opiate Addiction

It has been known since the 1970s that the body has a natural opioid system that acts in much the same way as opiate drugs like heroin and morphine. Not only are there receptors throughout the body that respond to opiate substances, but the body produces natural opioids that are released during strenuous exercise and in response to stress or pain. These natural substances are involved in the body's control of pain reactions and play a role in many other behaviors, such as the experience of pleasure. Now researchers have discovered that the body's natural opioid system is far more important and has broader effects than ever thought. In addition to being essential to responses to pain and for the euphoria from such drugs as morphine, codeine, and heroin, the mu opioid receptor, the cellular target of these drugs, also appears to be involved in regulating the immune and reproductive systems. Mice without the gene for the mu opioid receptor show reduced sexual and reproductive function and altered immune systems. These observations in the mouse model track well with anecdotal accounts that humans using heroin and morphine experience both reduced immune function and reduced sex drive. Not only do opiates affect mood states and produce addiction, but it also appears that their effects on natural opioid receptors lead to changes in the ability of the affected mice to reproduce and to resist infection and disease.

Another important finding regarding opiate addiction is the discovery of a neuronal system in the brain that modulates and opposes the action of the brain's opioid system. The discovery of the actions of orphanin FQ (OFQ), a natural brain chemical, could provide the foundation for the development of effective painkilling drugs without some of their negative side effects.¹⁸ Indeed, new evidence that OFQ and its receptor may play a role in opioid function will lead to new research exploring the balance or homeostasis of the opioid system to determine whether an imbalance or overactivity in one part of the brain usually leads to a compensatory change that counterbalances it. These findings raise interesting possibilities for developing therapeutic agents that act to compensate for the effects of the OFQ receptor because blocking it may decrease the irritability, anxiety, and nausea characteristic of heroin withdrawal.

Investigators have also uncovered the first direct evidence that long-term, chronic opiate exposure is associated with structural changes in both the size and shape of specific neurons in the brain. In previous animal studies, scientists have shown that chronic exposure to opiates causes dramatic biochemical changes in brain cells that could contribute to the intense craving for these drugs during withdrawal states. The physical changes seen in this new study occur in the dopamine system within a specific region of the brain known as the ventral tegmental area. This brain area is activated during the use or self-administration of virtually all drugs of abuse. The next step is to determine exactly what these changes mean and how they might be addressed in the development of new medications for the treatment of the long-term

consequences of opiate use. Given the prominence of these changes, effective treatment of addictive disorders for most people would have to include treatments to undo or compensate for these biological changes.

As is the case with cocaine abuse, slight variations in key metabolic enzymes can afford some protection against opiate addiction. Oral opiates, such as codeine and oxycodone, are metabolized by an enzyme called cytochrome CYP2D6 to metabolites of increased activity—morphine and oxymorphone, respectively. Between 4 and 10 percent of Caucasians lack this enzyme; they would be considered poor metabolizers. A study of individuals addicted to opiates found that none of them was a poor metabolizer. This underrepresentation of poor metabolizers in people dependent on oral opiates suggests that the CYP2D6 defective genotype is a pharmacogenetic protection factor for oral opiate dependence.¹⁹

Marijuana Abuse

Given that marijuana is the Nation's most commonly abused illicit drug, understanding its mechanism of action will be a critical step in developing new therapies for preventing and treating marijuana use. For example, researchers now know that genetic factors may play a larger role than originally thought in how an individual responds to a drug such as marijuana.

Investigators have now determined that heredity strongly influences whether an individual has positive or negative sensations after smoking marijuana. This study demonstrated that identical male twins were more likely than nonidentical male twins to report similar responses to marijuana use, indicating a genetic basis for their sensations. The finding that genetic factors contribute to how an individual feels after using marijuana opens new avenues for prevention and treatment research; it further emphasizes that drug use and addiction are not simply social problems but are health issues affected by an individual's biological state. Environmental factors may lead to an individual's experimenting with a drug, but heredity appears to hold a key to whether an individual will continue to use or abuse the drug.

One study of long-term use of marijuana showed that marijuana produces changes in the brain that are similar to those seen after long-term use of other major drugs of abuse, such as cocaine, heroin, and alcohol. Moreover, these changes may increase a user's vulnerability to addiction to other abusable drugs by "priming" the brain to be more easily changed by drugs. Importantly, the study also showed that the specific brain areas that were activated during marijuana withdrawal are quite active during withdrawal from other drugs of abuse and play a key role in stress responses in general.

Another study of long-term marijuana users found that many individuals continued to smoke heavily into middle adulthood because they felt that marijuana relieved unpleasant feeling states, such as anxiety or depression. A subsequent review of the medical literature found a series of cases in which marijuana was used because it reportedly produced a direct antidepressant effect in those who had mood disorder.

These observations argue the point that many patients may use marijuana to "self-medicate" depressive symptoms.

Exploring the Links Between Drug Abuse and Other Behavioral Disorders

Numerous epidemiological studies have shown that drug use disorders are frequently associated with mental disorders. For example, data from the Epidemiologic Catchment Area study showed that 53 percent of individuals who have a lifetime diagnosis of a drug use disorder also have a lifetime diagnosis of a mental disorder. Approximately two-thirds of individuals with a cocaine use or opiate use disorder have, at some point in their lives, had a mental disorder. For those with a lifetime diagnosis of any mental disorder, 15 percent have had a drug use disorder. Twenty-eight percent of people with schizophrenia and 42 percent of those diagnosed with antisocial personality disorder (ASPD) have had a drug use disorder.

With the strength of the association between drug use and mental health disorders well established, investigators have sought to better understand how other behavioral disorders might contribute to substance use and addiction. One group has been studying the prevalence of attention deficit/hyperactivity disorder (ADHD) in a cross-section sample of adults seeking substance abuse treatment. ADHD is considered to be a genetic and neurobiological disorder with a 5-percent prevalence rate in all U.S. children. In this study, 24 percent of adult substance users met the clinical criteria for ADHD, both as a child and as an adult. The study also found that substance users with ADHD were more likely to have conduct disorder and ASPD and more motor vehicle accidents than substance users without ADHD. Although the use of specific types of drugs was not significantly different between the groups of substance users with and without ADHD, female substance users with ADHD had an increased number of treatments for alcohol abuse and dependence.²⁰

In a prospective longitudinal study of substance-using adolescents who met the clinical criteria for conduct disorder, investigators found that 61 percent of the study group met the clinical criteria for ASPD 4 years after entering the study. Pretreatment clinical characteristics that predicted posttreatment ASPD included deviant behavior at or before age 10, greater diversity of deviant behaviors independent of substance use during childhood and early adolescence, and more extensive drug, but not alcohol, use during the 30 days before admission to the program. These findings suggest a poorer prognosis for adolescents when conduct disorder is diagnosed independent of drug use, whereas more favorable drug treatment outcomes might be achieved with adolescents whose pretreatment diagnosis of conduct disorder occurred primarily in the context of or subsequent to their use of illicit substances.²¹

In the case of marijuana use, investigators have found that conduct disorder, ADHD, and major depression correlate with dependence in a population of adolescents referred for substance abuse problems. The subjects reported that progression from first use of marijuana to regular use was as rapid as tobacco progression and more rapid than that of alcohol, suggesting that marijuana is a potent reinforcer. Data from this study indicate that for adolescents with conduct problems marijuana use can be particularly hazardous. The drug potently reinforces marijuana smoking, producing both dependence and withdrawal.

Indications of just how ADHD might be tied to drug use are coming from several completed and ongoing genetic studies involving the dopamine system. One group of investigators has found, for example, that individuals who possess rarer variants of three different genes for dopamine system components had a significantly higher incidence of ADHD symptoms. Individuals with two of the variants had fewer symptoms but still met clinical criteria for this behavioral disorder, whereas those with one variant gene were considered borderline for ADHD. These findings, along with several others nearing completion, contribute to the notion of a genetic basis for a syndrome, characterized by a deficiency in the brain's reward systems, that consists of addictive, impulsive, and compulsive behavior and personality disorders.²²

Treatment Advances

Drug addiction, like heart disease, can be a serious, life-threatening disease treatable by a combination of medications and behavioral therapies. One goal of drug addiction treatment is no different from the goal of treating heart disease: to prolong and improve the patient's quality of life. Over the years, researchers have amassed an impressive amount of scientific knowledge about the treatment of drug use and addiction. This research has clearly shown us that drug abuse treatment can reduce drug use, drug-related criminal behavior, and the health and social costs of drug use and addiction.

Modern approaches to treating addiction have benefited from two types of studies. Longitudinal studies of large populations have helped us identify behavioral and social antecedents to drug use that can be targets for therapeutic intervention. At the same time, neurobiological studies have elucidated the molecular underpinnings of addictive behavior and, in doing so, have identified numerous targets for drug development efforts. The result of this concerted effort is a host of new therapies, both behavioral and pharmacological, that can effectively treat many aspects of drug use and addiction.

In addition, research has helped develop more effective methods for delivering drug use and addiction treatments to affected populations. Research findings are driving changes in the health services delivery system and benefit increasing numbers of patients.

Despite the advances that we have seen in recent years, we need to do more. Therefore, NIDA has launched a major Treatment Initiative to further improve the effectiveness of drug abuse treatment. This Institutewide effort is being coordinated by NIDA's Division of Clinical and Services Research. A special subcommittee of NIDA's National Advisory Council on Drug Abuse is helping NIDA focus the Initiative's priorities. Over the next few years, the Treatment Initiative will increase NIDA's treatment research and will dramatically expand the dissemination of information about research-proven drug use treatments.

To increase the usefulness of NIDA's existing base of treatment knowledge, our comprehensive Initiative is sponsoring a series of research workshops to bring together experts in different areas of treatment. These experts are evaluating existing addiction treatments and are determining which treatments work best and how they work. They also will recommend additional research to develop new and more effective behavioral and pharmacological therapies. Ultimately, these efforts should expand the treatment options available to practitioners and should enable them to select the right combination for their patients.

To ensure that treatment providers apply the most current science-based approaches to their patients, NIDA has supported the development of the "Therapy Manuals for Drug Addiction" series. This series reflects NIDA's commitment to rapidly applying basic findings in real-life settings. The manuals are based on therapies with demonstrated efficacy from NIDA-supported drug use treatment studies. They are intended for use by drug abuse treatment practitioners, mental health professionals, and all others concerned with the treatment of drug addiction. The manuals present clear, helpful information to aid drug treatment practitioners in providing the best possible care that science has to offer. They describe scientifically supported therapies for addiction and give specific guidance on session content and on how to implement therapeutic techniques. Of course, there is no substitute for training and supervision, and these manuals may not be applicable to all types of patients nor compatible with all clinical programs or treatment approaches. These manuals should be viewed as a supplement to, but not a replacement for, careful assessment of each patient, appropriate case formulation, ongoing monitoring of clinical status, and clinical judgment.

Recent advances in drug use treatment are good news. Many studies have shown the effectiveness of drug use treatment, and our investment in basic research on the causes of addiction has given us the knowledge and the tools to develop drug use treatments that will work even better tomorrow. We believe that NIDA's comprehensive Treatment Initiative will be the catalyst for more effective drug use treatments that will substantially alleviate the heavy individual, family, and societal costs and consequences of this terrible disease. In fact, to dramatically improve treatment in this country, NIDA is about to establish a National Drug Treatment Clinical Trials Network. The Network will serve as the major mechanism for moving science-based treatments into practice. Some of the most promising discoveries of the past 3 years are described below.

Cocaine Addiction

Developing both medications and behavioral therapies to treat cocaine addiction remains one of NIDA's highest priorities. Truly outstanding work, some of which was discussed in earlier sections of this report, has provided at least a partial explanation for cocaine-induced behavioral and physiological effects, and epidemiological and treatment research to date has elucidated many of the clinical challenges yet to be met. The lag between an understanding of molecular, cellular, and neurobiological effects of cocaine and their relationship to behavioral responses induced by cocaine has resulted in the testing of pharmacological agents aimed at reducing cocaine use based on rationales limited by the scientific and clinical understanding of the disease at that time. However, the evolution of clinical trial methodologies that will yield more useful clinical information and will effectively test underlying hypotheses continues. The gaps in scientists' knowledge and limits in clinical methodology have restricted the clinical application of many studies.

The current situation may soon change as several compounds are showing promise in animal studies and in the early stages of human clinical trials. Because cocaine has potent effects on the brain's dopamine neurotransmitter system, investigators are testing several compounds that might block cocaine's interactions with this key brain system. In fact, numerous studies in laboratory animals have shown that a family of compounds known as dopamine reuptake inhibitors can decrease cocaine self-administration at doses that do not interfere with behaviors rewarded by food.

In one study involving baboons and rhesus monkeys, investigators administered the drug GBR, a potent, long-acting inhibitor of dopamine uptake, and found that it eliminated cocaine self-administration. The animals tolerated the drug well with only minimal side effects. Human clinical trials of this drug are in the planning stage. Additional work with a chemically modified analog of GBR found that within several days of dosing rhesus monkeys with this compound, cocaine-maintained responding had decreased more than 80 percent without any change in food-maintained responding. Moreover, this selective effect lasted almost 30 days following a single injection of the GBR analog.

Rapid progress also is being made in the development of improved behavioral therapies. In 1998 NIDA published two volumes in its "Therapy Manuals for Drug Addiction" series that deals with cocaine addiction. "Manual 1, A Cognitive-Behavioral Approach: Treating Cocaine Addiction" focuses on using this well-established and well-tested short-term therapeutic approach to help cocaine-addicted individuals become abstinent from cocaine and other substances. The underlying assumption is that learning processes play an important role in the development and continuation of cocaine use and dependence. These same learning processes can be used to help individuals reduce their drug use. The emphasis of cognitive-behavior therapy is to teach patients to recognize the situations in which they are most likely to use cocaine, avoid these situations when appropriate, and cope more effectively with a range of problems and problematic behaviors associated with substance use. "Manual 2, A Community Reinforcement Approach: Treating Cocaine Addiction"

focuses on the Community Reinforcement Approach (CRA), which is an intensive, behavioral treatment for drug use where the patients earn points redeemable for retail items for remaining in treatment and abstinent from cocaine. The general approach taken to achieve this goal is perhaps best described as individualized, empirically based, and behavioral. Although patients are expected to be extremely active participants in the treatment process, this manual prepares therapists for difficulties and noncompliance with therapeutic activities. The therapist is taught to recognize these problems for what they are—problem behaviors in need of therapy, not as a reason to discharge patients from treatment.

Opiate Addiction

A variety of effective treatments are available for heroin addiction, although treatment tends to be more effective when heroin abuse is identified early. Methadone, a synthetic opiate that blocks the effects of heroin and eliminates withdrawal symptoms, has a proven 30-year record of success for people addicted to heroin. In fact, recent data show that only 27 percent of former heroin users were still using heroin a year after participating in an outpatient methadone therapy program. When prescribed properly, methadone is not intoxicating or sedating, and its effects do not interfere with ordinary activities, such as driving a car. The medication is taken orally, and it suppresses narcotic withdrawal for 24 hours. Patients are able to perceive pain and have emotional reactions. Most important, methadone relieves the craving associated with heroin addiction; craving is a major reason for relapse. Among methadone patients, normal street doses of heroin have been found ineffective at producing euphoria, thus making the use of heroin more easily extinguishable.

Methadone's effects last for about 24 hours—four to six times as long as those of heroin—so people in treatment need to take it only once a day. Also, methadone is medically safe even when used continuously for 10 years or more. Combined with behavioral therapies or counseling and other supportive services, methadone enables patients to stop using heroin (and other opiates) and to return to more stable and productive lives.

Indeed, research is showing how to more effectively use this agent in a variety of treatment settings. For example, one study evaluated the relative efficacy of two strategies for reducing illicit substance use in a methadone maintenance setting: urinalysis-contingent reinforcement versus participation in Training in Interpersonal Problem Solving groups, an 8-week therapy designed to promote problem solving skills. This study found that the urinalysis-contingent group showed greater improvement in rates of abstinence from illicit drugs and better met criteria for clinical improvement than the psychoeducational group. It appears that reinforcement of the psychoeducational group attendance is not as effective for reducing illicit drug use among methadone maintenance patients as urinalysis-contingent reinforcement.²³ The same research group found that a task-oriented behavioral intervention lasting 12 weeks was more effective than a urinalysis-contingent approach. In addition, only the task-oriented treatment group

demonstrated improvement in abstinence rates that were maintained after the intervention was discontinued. The results from this study suggest that reinforcement of clearly defined behavioral tasks targeted to treatment plan goals increases involvement in behaviors inconsistent with drug use among methadone maintenance patients.

A newer drug, l-alpha-acetyl-methadol (LAAM) resembles methadone; it is a synthetic opiate that can be used to treat heroin addiction. LAAM can block the effects of heroin for up to 72 hours with minimal side effects when taken orally. In 1993 the Food and Drug Administration (FDA) approved the use of LAAM for treating patients addicted to heroin. Its long duration of action permits dosing just three times per week, thereby eliminating the need for daily dosing and take-home doses for weekends. Although adoption of LAAM has been relatively slow, it has become increasingly available in clinics that already dispense methadone.

Naloxone and naltrexone are medications that also block the effects of morphine, heroin, and other opiates. As antagonists, they are especially useful as antidotes. Naltrexone has long-lasting effects, ranging from 1 to 3 days, depending on the dose, blocks the pleasurable effects of heroin, and is useful in treating some highly motivated individuals, such as professionals who do not want to lose their jobs. Naltrexone has also been found to be successful in preventing relapse by former opiate addicts released from prison on probation.

Although not yet approved for the treatment of opioid addiction, buprenorphine is another medication being studied by NIDA as a treatment for heroin addiction. Buprenorphine is a particularly attractive treatment because it does not produce the same level of physical dependence as other opiate medications, such as methadone. Discontinuing buprenorphine is easier than stopping methadone treatment because there are fewer withdrawal symptoms.

In early 1998 NIDA completed a large multicenter clinical trial on buprenorphine and the combination dosage buprenorphine/naloxone in the United States and Puerto Rico to determine the drug's efficacy and safety as a treatment for heroin addiction. Although data from the study are still being analyzed, NIDA officials are encouraged by buprenorphine's performance. A preliminary analysis has shown that buprenorphine-based products significantly reduced patients' craving for heroin. As the leading Federal agency responsible for bringing new treatment medications and approaches to the national forefront, NIDA is supportive of activities that would expand access to treatment, such as having newly approved medications made available to treatment providers, including those in general practice settings.

The severe nature of opiate withdrawal symptoms can be an impediment to opiate addiction therapy. Investigators have now tested several inhibitors of the enzyme nitric oxide synthase (NOS) for their effectiveness in attenuating signs of opiate withdrawal and affecting blood pressure in rats. Several signs of opiate withdrawal reduced by the NOS inhibitors were similarly attenuated by clonidine, which is used

clinically to treat heroin withdrawal. One of the NOS inhibitors tested—7-nitroindazole, a selective inhibitor of neuronal NOS—did not elevate blood pressure and attenuated more withdrawal signs than other NOS inhibitors. Because hypertension is a component of opioid withdrawal in humans, the effectiveness of 7-nitroindazole to attenuate signs of morphine withdrawal without affecting blood pressure suggests that this drug may have human therapeutic potential.²⁴

Meanwhile, researchers are still working to improve behavioral approaches that can be used alone or in combination with pharmacological treatments to increase the likelihood of therapeutic success. For example, one group of investigators has shown that a relatively low-cost visual enhancement to drug use counseling, called node-link mapping, leads to better treatment outcomes than counseling-as-usual for patients in outpatient methadone treatment. "Mapping" is associated with greater patient commitment to treatment in terms of session attendance, improved relationships with the counselor, and fewer urine samples positive for opioid and cocaine metabolites. A followup study also shows patients assigned randomly to mapping counseling reported less criminal activity and exposure to HIV risks due to the reduced use of needles in the 12 months after treatment than did patients in the standard counseling condition. Among patients staying less than 6 months in treatment, those in the mapping group had fewer urines that tested positive for opiates at followup and were also significantly lower in dirty-needle risks than standard counseling patients. Thus, mapping-enhanced counseling may be especially beneficial for patients who leave treatment prematurely. The cumulative evidence from this and previous studies indicates that mapping represents a tool that has promise for improving the effectiveness and efficiency of drug use counseling programs.²⁵

Treating Substance Use in the Context of Psychiatric Disorders

Drug use disorders are frequently associated with psychiatric disorders; more than half of those with a lifetime diagnosis of a drug use disorder also have a lifetime diagnosis of a mental disorder. Despite the common co-occurrence of drug use disorders and psychiatric disorders, many people who have both of these problems tend to fall through the cracks of service delivery systems.

Research on the treatment of individuals with comorbid mental and addictive disorders holds promise for a greater understanding of the relationship among these disorders and the potential for better treatments. One important thrust of this research centers on the observation that some people who use illicit drugs do so as a form of self-medication for psychiatric disorders, such as depression. One group of investigators, for example, studied the use of imipramine, a common antidepressant medication, to treat opiate-dependent patients who were also diagnosed with a depressive disorder and who were receiving treatment at community-based methadone maintenance clinics. In this patient population, 57 percent of those who received imipramine reduced their substance use, reported reduced craving, and experienced improved mood compared with only 7 percent who received the placebo instead of imipramine.²⁶ Another group of researchers treated adolescents in

a residential treatment setting with fluoxetine, which is also an effective antidepressant. Nearly 90 percent of the adolescents in this trial showed marked improvement in mood and wished to continue taking fluoxetine after the study was completed.²⁷

A group of adolescents with both drug dependency disorder and bipolar illness were treated with lithium, the standard therapy for bipolar disorder. Results of this trial showed lithium therapy to significantly reduce symptoms of both the psychiatric and substance abuse disorders.²⁸

Nicotine Addiction

An improved overall understanding of addiction, coupled with the identification and acceptance of nicotine as an addictive drug, have been instrumental in the development of medications and behavioral treatments for nicotine addiction. In essence, science-driven treatment development has provided to consumers the option to easily purchase effective treatments, such as the nicotine patch and nicotine gum, in their local drugstores and supermarkets. Science has also shown that treating addiction with medications alone is not nearly as effective as when the medication is coupled with a behavioral treatment. Although substantial progress has been made in developing both pharmacological and behavioral treatments that have proven effective for many people, much more remains to be done.

Since the introduction of nicotine gum and the transdermal patch, estimates based on FDA and pharmaceutical industry data indicate that more than 1 million individuals have been successfully treated for nicotine addiction. In 1996 a nicotine nasal spray, along with a nicotine inhaler in 1998, became available by prescription. All the nicotine replacement products—gum, patch, spray, and inhaler—appear to be equally effective. In fact, the over-the-counter availability of many of these medications, combined with increased public service announcements in the media about the dangers of smoking, has produced a marked increase in successful quitting each year.

Some innovative research has shown that computerized scheduling of nicotine gum use can help increase the number of smokers who remain abstinent once they stop smoking. Using a credit card-sized computer that prompts the user when to begin and stop chewing each piece of nicotine gum, investigators showed that nearly three times as many computer-scheduled users, compared with those who just used nicotine gum, were abstinent after treatment. Computer-scheduled users reported chewing more gum than noncomputer users during the first week of abstinence, and the amount of gum chewed was related to success rate. A 1-year followup showed that those who had used the computer while quitting smoking were three times more likely to still be abstinent compared with those who had just used nicotine gum alone.

Although the major focus of pharmacological treatments of nicotine addiction has

been nicotine replacement, other treatments are being developed for relief of nicotine withdrawal symptoms. For example, the first nonnicotine prescription drug, bupropion, an antidepressant marketed as Zyban®, has been approved for use as a pharmacological treatment for nicotine addiction. In December 1996, a Federal advisory committee recommended that FDA approve bupropion to become the first drug that could be taken in pill form to help people quit smoking and the first to be nicotine-free.

Behavioral interventions can play an integral role in nicotine addiction treatment. Over the past decade, this approach has spread from primarily clinic-based, formal smoking cessation programs to application in numerous community and public health settings, and now by telephone and in written formats as well. In general, behavioral methods are employed to identify high-risk relapse situations, create an aversion to smoking, develop self-monitoring of smoking behavior, and establish competing coping responses. Other key factors in successful treatment include avoiding smokers and smoking environments and receiving support from family and friends. The single most important factor, however, may be the learning and use of coping skills for both short- and long-term prevention of relapse. Smokers not only must learn behavioral and cognitive tools for relapse prevention but also must be ready to apply those skills in a crisis.

One study of two behavioral treatments for tobacco dependence in women with heart disease—a coping-skills relapse prevention (RP) intervention and an educational intervention based on the health belief model (HBM)—found a significant reduction in mean smoking rate in both treatment conditions across sessions, with a nonsignificant trend favoring RP treatment over HBM. However, there was evidence of important differential treatment effects that depended on patient characteristics, such as age and baseline level of self-esteem. For older subjects, the probability of quitting smoking was higher when receiving RP rather than HBM. For younger subjects, the probability of quitting smoking was relatively equal for the two treatments. Subjects with high self-esteem responded better with RP, and those with low self-esteem responded relatively equally to the two treatments.²⁹

Another study examined the effects of four different smoking schedules on cessation outcome to determine which had the highest abstinence rate after a year following treatment. The highest abstinence rates—44 percent and 32 percent—were found in the two groups that were allowed to smoke at prescheduled times only. For example, in the group that had gradually reduced smoking at prescheduled times, abstinence was 44 percent, a remarkably high rate considering that the nicotine patch was not used. In contrast, the worst results—18 percent abstinence—occurred in the group that reduced smoking by lighting up at self-selected times. Apparently, these smokers were choosing optimal times and situations for enjoyment—and subsequently had a high relapse rate. In comparison, the prescheduling of cigarettes meant that smoking occurred at times unrelated to critical events, such as a cup of coffee, meal, or period of boredom. As a result, much of the enjoyment was taken

out of smoking, the stimulus control by critical events was disrupted, and the opportunity to learn how to cope with smoking urges was increased. The results of this research are particularly important because many smokers who try to quit choose the “common sense” procedure of cutting down at self-selected times—one of the worst procedures they could devise.³⁰

The treatment of smokeless tobacco addiction presents yet another challenge to the research community. One group studied the effects of group behavioral treatment versus minimal contact and of nicotine versus placebo gum on efforts to stop using smokeless tobacco. Study results showed that nicotine gum is not more successful than placebo gum with either minimal intervention or as an adjunct to behavioral treatment, although nicotine gum did reduce withdrawal symptoms. The ineffectiveness of nicotine gum on treatment outcome may be attributed to the relatively low level of nicotine in the gum or its similarity to smokeless tobacco. The study also found that behavioral treatment produced greater success than minimal contact, both during and shortly after treatment. It may be that smokeless tobacco users are more likely to be able to return to abstinence after a lapse if they are involved with a more intensive treatment approach.³¹

Health Services Research

The successful prevention and treatment of drug dependence and addiction depend on coordination of professional and material resources in a rational, systematic, and cost-effective manner. Preventive interventions that have been demonstrated to work must be replicated in less controlled environments to assess their effectiveness with various populations and in various contexts. Treatment outcomes also must be assessed to determine the most effective clinical approaches to treatment. Such studies fall under the rubric of health services research, and NIDA continues to expand its efforts in this area to determine appropriate mechanisms to maximize the linkages among existing school, community, and other service delivery systems and drug abuse prevention efforts and between primary medical care and drug use treatment. These efforts should permit effective expansion of the quantity and quality of available preventive interventions and treatments. Furthermore, they should make possible the development of new methods, diagnostics, and preventive and therapeutic measures for use in prevention service delivery and primary care settings.

The importance of this research is underscored by the latest data on the cost of drug use. Figures released in May 1998 show that drug use cost the Nation approximately \$98 billion in 1992. This is a 50-percent increase over the \$65 billion national drug use cost in 1985. More than 80 percent of the increase in estimated costs of drug use are due to real changes in drug-related emergency room episodes, criminal justice expenditures, and service delivery patterns. With an economic burden of this magnitude, the importance of health services research cannot be underestimated. Little research has been conducted on the costs and benefits of preventive interventions. However, results of the Midwestern Prevention Project indicate that every dollar spent on prevention programming saved \$67 per affected family in

health and social costs.³²

A large study tracking more than 10,000 drug users enrolled in nearly 100 treatment programs in 11 cities found that at least four major types of drug use treatment can be effective in reducing drug use. The study, known as the Drug Abuse Treatment Outcome Study (DATOS), also found that most drug use treatment modalities produced decreases in illegal acts and increases in full-time work.³³

DATOS investigators studied patients in the four most common kinds of treatment programs: outpatient methadone programs, long-term residential programs, outpatient drug-free programs, and short-term inpatient programs. The researchers found that methadone treatment reduced heroin use by 70 percent. In the followup year, 27.8 percent of patients in outpatient methadone treatment reported weekly or more frequent heroin use, down from 89.4 percent reporting heroin use prior to admission. The team also found that both long-term residential and outpatient drug-free treatment resulted in 50-percent reductions in weekly or more frequent cocaine use at the 1-year followup point. Reductions in drug use were significantly greater for patients in treatment for 3 months or more.

The studies found that the major predictors for staying in treatment were high motivation; legal pressure to stay in treatment; no prior trouble with the law; psychological counseling while in treatment; and a lack of other psychological problems, especially ASPD.

The knowledge gained from DATOS will focus future research on studies designed to further refine and strengthen treatments for drug use and addiction. The study will also be used to examine treatment outcomes and the cost-effectiveness of drug use treatment, describe the evolving treatment system, research relationships between patient and program factors, and identify research gaps that will inform future research agendas.

Despite the positive findings for the effectiveness of treatment, DATOS found that many drug use treatment patients admitted to treatment in the early 1990s received a decreasing number of services compared with patients admitted to treatment a decade earlier. More than half of patients in all four types of treatment reported that they received no services specifically for medical, psychological, vocational, family, social, or legal problems. There is some evidence that core services, such as counseling and prescribing appropriate dosages of medications, have improved, ameliorating to some degree the erosion of treatment support services.

There is a significant co-occurrence of mental health and drug use problems, and approaches to treating both conditions simultaneously have a significant rate of success. However, a survey of 45 administrators from randomly selected drug treatment programs in Los Angeles County about the adequacy of mental health services within their program and the drug treatment system found that approximately half agreed that dually diagnosed clients are not served within the

system. In fact, nearly 70 percent noted that their programs restrict admission of such clients. Administrators of outpatient drug-free programs and methadone maintenance programs were more likely to characterize their mental health services as inadequate or unavailable than were administrators of other types of programs. Yet, despite this poor assessment, administrators expressed only mild support for providing additional training in this area either for themselves or for their counselors. Administrators may not perceive a need to enhance their mental health services if severely mentally ill clients are restricted from entering their programs.³⁴

The dynamic nature of managed care organizations (MCOs) creates both problems and opportunities for generalist physicians who see substance-using patients. A study of MCOs indicated that problems include fiscal incentives that may run counter to the physician role and more fragmented communication between physicians and other addiction service providers when psychiatrists, mental health nonphysician clinicians, and other specialty programs are carved out into separate delivery systems.

Opportunities include the potential for psychiatric consultation liaison, expanded physician intervention and case management roles, more health plan resources focused on prevention and treatment, and profiling to achieve overall improvements in service delivery. MCOs may rely more heavily on generalist physician involvement with substance-using patients if potential benefits of linking substance use treatment and primary care can be realized.³⁵

Along those lines, researchers have conducted a study to identify specific patient problems and to match professional services to those problems in four drug abuse treatment programs. Patients from an employee assistance program entered treatment and were randomly assigned to either standard treatment—patients were treated in the usual manner—or matched services— patients received at least three professional sessions directed at their significant employment, family, or psychiatric problems. Matched patients stayed in treatment longer, were more likely to complete treatment, and had better posttreatment outcomes than patients who received treatment as usual in these programs. The strategy of matching appropriate services to patients' specific treatment problems was clinically and administratively practical, attractive to patients, and responsible for a 20- to 30-percent increase in effectiveness.³⁶

Drug Use, HIV, and Other Infectious Diseases

There is little doubt today about the connection between drug use and HIV infection, which leads to AIDS. What might be less well appreciated, but just as true, is the strong connection between drug use and other infectious diseases, particularly hepatitis C and tuberculosis. Drug use is now the major risk factor identified in new cases of AIDS, hepatitis C, and tuberculosis in the United States, and a growing number of cases of these infectious diseases are now reported among the partners of intravenous drug users. In addition, the majority of HIV-infected newborns have mothers who were infected through their own drug use or through

sexual activity with a drug user.

The urgency of the problem comes from statistics such as these: One study of street-recruited intravenous drug users and crack cocaine smokers found that among the intravenous drug users, HIV seroprevalence was 12.7 percent, and among crack smokers, HIV seroprevalence was 7.5 percent.³⁷ Therefore, NIDA's top priorities in dealing with this issue continue to be to

understand the behaviors that put drug users at risk for contracting HIV and other infectious diseases, expand outreach to educate populations at risk about the relationship between drug use and AIDS as well as other infectious diseases, and fund research on drug use behaviors that lead to the transmission of HIV and other infectious diseases.

Because of the magnitude of this problem, NIDA has established a Center for AIDS and Other Medical Consequences of Drug Abuse. This office is spearheading the Institute's efforts to expand outreach to educate populations at risk about the relationship between drug use and serious infectious diseases. Research has repeatedly shown that even small amounts of education and counseling can help drug users modify those behaviors that put them at risk for acquiring and transmitting HIV, hepatitis, or tuberculosis, even without total abstinence.

With the establishment of this Center, NIDA has the unique opportunity to assess both short- and long-term consequences associated with drug use, many of which are not well understood. In addition to studying infectious diseases, the Center will also assess other health consequences associated with continued exposure to various illicit drugs, such as the respiratory and pulmonary effects of long-term marijuana smoking.

Identifying AIDS Prevention Guidelines Among Drug Users

Recently, NIDA sponsored the first national Research Synthesis Symposium on the Prevention of HIV in Drug Abuse. Discussions centered on approaches to stem the trend that more drug users, and not just those that inject drugs, are becoming infected with HIV and other infectious diseases, such as hepatitis and tuberculosis. Participants identified several HIV prevention principles that would be effective for

HIVINFECTIONS AMONG AT-RISK POPULATIONS IN AMERICA'S 96 LARGEST CITIES			
Risk Group	Estimated Number in Risk Group	Estimated Percent HIV Positive	Estimated New HIV Infections Each Year Per 100 Group Members
Injecting Drug Users	1.5 million	14.0	1.5
Men Who Have Sex With Men	1.7 million	18.3	0.7
At-Risk Heterosexuals*	2.1 million	2.3	0.5

Source: National Institute on Drug Abuse

* Men and women who are at risk because they have sex with injecting drug users and/or bisexual or gay men. Estimates were compiled in 1996.

guiding practitioners and policymakers. For example, the symposium recommended that NIDA implement multiple intervention strategies, such as outreach to active drug users, recruitment and referral to treatment, and risk behavior reduction. The symposium also recommended that such intervention programs should include other elements of comprehensive HIV programs, including the use of sterile injection equipment by those who will not stop drug use and drug use treatments that have been shown to be effective in reducing risk behaviors for injection drug users and in preventing the spread of HIV.

Symposium participants also recommended that any efforts should create opportunities for increased exposure to interventions through booster sessions to reinforce skills and knowledge learned in the initial intervention to increase the effectiveness of interventions. At the same time, successful programs have to recognize that populations at risk for HIV are in various stages of readiness to participate in an intervention and need to be engaged appropriately to maintain them in the interventions by, for example, using motivational techniques, contingency management, cognitive strategies, and/or peer-driven interventions.

Characterizing HIV Risk Behaviors

One of the most important areas of research involves understanding the behaviors that drug users engage in that put them at risk for contracting life-threatening diseases. A group of investigators in Seattle, where methamphetamine abuse is a growing problem, have characterized drug use and sexual risk behaviors, social and ecological contexts, and service needs of men who use drugs and have sex with men. Three methods were used for this research: unobtrusive observations, focus group interviews, and individual interviews. Nearly all the men interviewed were HIV positive or had an AIDS diagnosis, and almost all identified themselves as gay or bisexual. A number of common themes emerged from the interviews: Almost all those interviewed injected methamphetamine and used other drugs (e.g., cocaine, MDMA, alcohol, marijuana, heroin); almost all described an intense association between methamphetamine use and sex; and some of the men said they had moved to Seattle specifically because it had a reputation as "the hot spot" for men who use drugs and have sex with men. Although some respondents had completed treatment and remained abstinent from methamphetamine for a period of time, most had also relapsed, explaining that they were unable to enjoy sex without methamphetamine. Abstaining from methamphetamine use was perceived as equivalent to abstaining from sex and therefore made treatment entry and compliance options of last resort. The researchers learned that methamphetamine was sometimes used by respondents to manage the depression they felt from being HIV positive or having AIDS. At the same time, they learned that needle-sharing and unprotected sex were common among the men who reported being HIV seropositive or having AIDS, either because they assumed their injecting drug and sexual partners were also HIV positive or because they would become so intoxicated that they would forget that they were HIV positive.³⁸

Another group of researchers in Dayton, Ohio, conducted a study to determine factors that affect the self-reported use of condoms among heterosexual injection drug users and crack cocaine smokers. More than 70 percent of the participants reported that they frequently used drugs when having sex. Persons who were high when they had sex were significantly less likely to use condoms than persons who were not high, but those whose partners got high when having sex were more likely to report condom use. Individuals said that they were less likely to use condoms when they had sex with a main partner. Those who believed it was important to use condoms were more likely to use them, whereas persons who believed condoms reduced sexual pleasure were significantly less likely to use them. A key result of this research is that drug users frequently use substances before and during sex, presenting a significant impediment to employing safer sex techniques that rely on condoms. This study shows that it is also critical that sexual risk-reduction interventions targeting heterosexual users of injection drugs or crack address the widespread practice of simultaneous use of psychoactive drugs. Until such dually focused interventions are in place, access to drug use treatment will continue to play a critical role in preventing the spread of HIV and other sexually transmitted diseases in this population.³⁹

Outreach and Intervention Strategies To Reduce Drug Use and AIDS

NIDA-funded research has found that through drug use treatment, prevention, and community-based outreach programs, drug users, even those who refuse treatment, can still change their behaviors to reduce or eliminate drug use or drug-related HIV risk behaviors, such as needle-sharing and unsafe sex practices. Not surprisingly, drug use treatment has been shown to be highly effective in preventing the spread of HIV and other infectious diseases. Unfortunately, for a wide variety of reasons, only a small percentage of those who actually need drug use treatment receive it. To reach the almost 85 percent of chronic drug users who are not in treatment, NIDA has been conducting extensive research to develop community-based outreach interventions to reduce the spread of HIV and other infectious diseases among drug users.

The National AIDS Demonstration Research (NADR) program, for example, was the first multisite research program to deliver and evaluate HIV risk-reduction outreach programs to drug users not in treatment. As part of the interventions, outreach staff indigenous to the selected communities met with intravenous drug users in their natural settings to distribute HIV risk-reduction information and to offer additional counseling and HIV testing. The outreach workers acted as credible messengers, provided risk-reduction materials and education, and arranged for intravenous drug users to receive free, confidential HIV testing and counseling. The ongoing Cooperative Agreement for AIDS Community-Based Outreach/ Intervention Research Program uses similar manualized behavioral interventions to reduce HIV risk-taking and to increase protective behaviors.

As part of an HIV risk-reduction intervention for out-of-treatment drug injectors and crack smokers, one group of investigators has instituted regularly scheduled social gatherings in the Long Beach, California, community as a means to provide social support for modifications of HIV risk behaviors. These events are one component of a 4- to 6-month HIV risk-reduction intervention that also includes HIV counseling and testing, individual and group risk-reduction sessions, "support buddies," and followup by outreach workers. The monthly HIV-focused social gatherings provide peer support and opportunities for social modeling by staff and peers, influence perceived social norms, and increase personal self-efficacy for reducing HIV risks. The socials last about 2 hours and include lunch. They are structured around risk-reduction activities, including highly effective role model panels in which outreach workers, staff with prior drug experience, and clients who have successfully reduced their risk behaviors discuss a variety of topics. Discussions have focused on such issues as the role of social support in modifying risk behaviors, techniques for dealing with relapse and backsliding, and techniques for quitting drugs and maintaining sobriety. Over a 3-year period, 68 percent of the active clients in the intervention program attended at least one social event, and 66 percent attended more than one. At followup, significant differences were found between clients who attended social events and those who did not; the former were more likely to report that the program helped them get off drugs, that they had discussed staying safe from AIDS with friends and family members, that they had asked an outreach worker for assistance with a personal problem, and that they were acquainted with other program participants. The popularity of these social events, which are relatively cost-effective and easily implemented, makes this intervention mechanism especially valuable for maintaining the participation of active drug users in programs of this type.⁴⁰

Another group of researchers compared the efficacy of three HIV and drug use intervention approaches in two midsized towns: an intensive outreach program using indigenous outreach workers providing reinforcement of an HIV risk-reduction program and a low-intensity outreach program combined with a more intensive office-based HIV risk-reduction program, and the NADR intervention discussed above. Each of the enhanced interventions was effective in reducing both drug-related and sexual risks for HIV transmission in active drug users. However, the intensive outreach combined with office intervention and the intensive office intervention without outreach reinforcement each produced significant reductions in sexual risk-taking among active drug users, beyond the reductions found in the standard intervention. One important finding was that intensive outreach had a significant effect on the reduction of sexual risk behaviors of men, but not of women, whereas the more intensive, office-based risk-reduction program significantly related to improvement in the sexual risk behavior of women, but not of men.⁴¹

In Detroit, investigators compared the effectiveness of two outreach interventions in decreasing the AIDS-related high-risk behaviors of active intravenous drug users and crack cocaine users not in treatment. Half the drug users were assigned to the

NADR intervention, and another half to a nursing intervention developed by the investigators. An optional component of this intervention was a weekly "Tuesday Group," when caregivers and clients would meet as a group to discuss client concerns and provide peer support and encouragement. Followup evaluations indicated a dose-response relationship, with participants in the enhanced intervention plus weekly Tuesday Group showing significantly more improvement in reducing their use of drugs and in engaging in unprotected sex, followed by clients in the enhanced only, then by clients in the standard intervention. The findings show the importance of positive peer support and encouragement; group counseling; and consistent, planned opportunities to participate in group sessions for reducing drug use and sexual risk behaviors and for preventing relapse.⁴²

The collective findings from NIDA-funded drug use and HIV research suggest that a range of HIV intervention strategies should be introduced early to control the spread of the HIV epidemic. Interventions have to be introduced in a variety of settings to reach at-risk and drug-using populations and to provide them with the means for changing their drug use, needle practices, and sexual behaviors simultaneously. The empirical data reported from the NIDA-funded research studies consistently demonstrate that among those participating in interventions, decreases in the prevalence of risk behaviors and increases in protective behaviors are linked to declines in incident HIV infections.⁴³

A comprehensive approach must be taken when one is simultaneously addressing the public health problems of drug use and HIV/AIDS. We know that HIV infections can come from direct transmission of the virus through the sharing of contaminated needles and paraphernalia among injecting drug users (IDUs) or from indirect transmission, such as when a mother who has HIV as a result of her own drug use or through sex with an IDU transmits the virus perinatally to her child. "Sex for crack" is viewed as a major cause of the spread of HIV in the heterosexual population. In addition, we know that that drug use can interfere with judgment about risk-taking behavior and can potentially lead to reduced precautions about having sex and sharing needles and injection paraphernalia.

For these reasons, research shows that needle-exchange programs can play a significant role in a comprehensive approach to reduce HIV infections.

Meta-analytic techniques were used to examine whether participation in syringe-exchange programs leads to individual-level protection against incident HIV infection. HIV incidence data from injecting drug users were combined for three studies: the Syringe Exchange Evaluation, the Vaccine Preparedness Initiative Cohort, and a study involving very-high-seroprevalence cities in the NADR program. HIV incidence among continuing exchangers in the Syringe Exchange Evaluation was 1.58 per 100 person-years at risk; among continuing exchange users in the Vaccine Preparedness Initiative, it was 1.38 per 100 person-years at risk. Incidence among nonusers of the exchange in the Vaccine Preparedness Initiative was 5.26 per 100 person-years at risk and in the NADR cities, 6.23 per 100 person-

years at risk. When the data were pooled, not using the syringe exchanges was associated with a hazard ratio of 3.35 for incident HIV infection compared with using the exchanges, indicating that a significant protective effect against HIV infection is associated with participation in syringe-exchange programs.⁴⁴

Findings from a national survey indicate that there has been an expansion in the number of syringe-exchange programs and in the scope of activities since 1994. From 1994 to 1996, there were increases in the number of syringe-exchange programs participating in the surveys and in the numbers of cities and States with syringe-exchange programs. The number of syringes exchanged increased by 75 percent, from 8 to 14 million, between 1994 and 1996. The 10 most active syringe-exchange programs exchanged 500,000 syringes each, approximately 9.4 million of all syringes exchanged. The syringe-exchange program in San Francisco reported exchanging the largest number of syringes in 1996 (1,461,096). All syringe-exchange programs provided intravenous drug users with information about safer injection techniques and/or use of bleach to disinfect injection equipment. Other services included referral of clients to substance use treatment programs, instruction in the use of condoms and dental dams to prevent sexual transmission of HIV and other sexually transmitted diseases, and sexually transmitted disease prevention education. Health services offered on site included HIV counseling and testing, primary health care, tuberculosis skin testing, and screening for sexually transmitted diseases.⁴⁵

Despite our best efforts, many intravenous drug users continue to share syringes. To understand the factors influencing this risky behavior, investigators examined the psychosocial correlates of needle-sharing behavior at two points in time by use of a prospective longitudinal design. The results supported a mediational model, in which personality and peer factors predicted needle-sharing at the beginning of the study, which served as the mediator for needle-sharing at the end of the study. These findings have important implications for intervention; an intervention earlier in the sequence might focus on the personality and friendship networks, whereas an intervention a little later in the developmental sequence would focus on altering needle-sharing behavior. The study also showed that earlier therapeutic interventions focusing on personality disposition, family alienation, or peer group affiliations should reduce the risk of later needle-sharing behavior.⁴⁶

HIV transmission in drug-using populations is preventable. The challenge for prevention researchers is to anticipate the changing dynamics of the co-occurring and interrelated epidemics of drug use and HIV/AIDS and to respond rapidly and effectively to prevent increasing drug use and further spreading of HIV. Early in the epidemic, behavioral interventions were the only means available to prevent HIV infection. Comprehensive programs that include community-based outreach, needle-exchange programs, and drug treatment as HIV prevention remain, in the absence of an AIDS vaccine or a cure, the most cost-effective and reliable strategies for averting new HIV infections.

Drug Use and Other Infectious Diseases

In addition to its role in the spread of AIDS, illicit drug injection is becoming an increasingly more important niche for the transmission of other diseases, such as tuberculosis, that have significant interactions with HIV-related immunosuppression. For many emerging and re-emerging infectious diseases, protecting the health of the community as a whole will depend on protecting the health of intravenous drug users. Therefore, it is important to learn more about the incidence of infectious diseases in the population of those who abuse drugs.

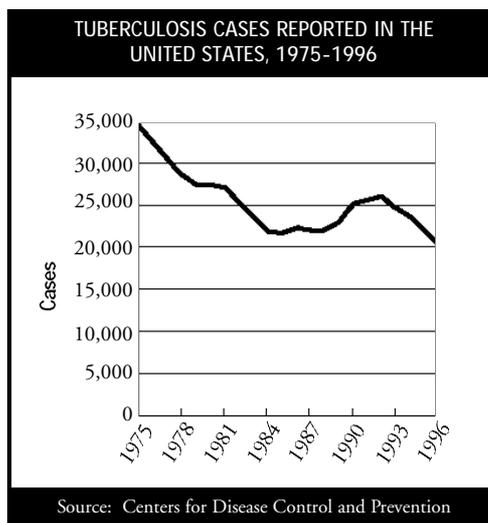
One study of intravenous drug users found that this population is an important reservoir for hepatitis A infection. The data indicated that intravenous drug users are at increased risk for hepatitis A infection but that factors related to low socioeconomic status, such as poor hygiene or overcrowding, contribute more to the occurrence of hepatitis A infection than does injection drug use. The findings from this study indicate the need for hepatitis A vaccination of intravenous drug users and persons at risk for injection drug use.⁴⁷

Another investigation examined the prevalence and correlates of four blood-borne viral infections among illicit drug users with up to 6 years of injecting history, and data were analyzed for hepatitis C, hepatitis B, and HIV. Overall seroprevalence of hepatitis C, hepatitis B, and HIV was 76.9 percent, 65.7 percent, and 20.5 percent, respectively, for those injecting for up to 6 years. Among those injecting for 1 year or less, rates were 64.7 percent for hepatitis C, 49.8 percent for hepatitis B, and 13.9 percent for HIV. The high rates of viral infections among even short-term injectors emphasize the need to target both parenteral and sexual risk-reduction interventions early.⁴⁸

The danger of these viral infections does not stop with the infected individual. A study from the Women and Infant Transmission Study demonstrated that maternal infection with hepatitis C virus is associated with increased HIV maternal-infant transmission. Among women infected with HIV either heterosexually or through injection drug use, 33 percent were found to be infected with hepatitis C, and HIV transmission to infants occurred in 26 percent of the HIV/hepatitis C-infected mothers versus 16 percent of mothers not infected with hepatitis C virus. These data suggest that maternal HCV infection either enhances HIV transmission to the fetus directly or is a marker for another cofactor, such as maternal drug use. Further study is needed to confirm the findings of this study and to determine whether the association represents a biologic effect of hepatitis C infection or is due to a confounding interaction with drug use or other factors.⁴⁹

Tuberculosis and other diseases caused by mycobacteria are growing problems among intravenous drug users. A study of tuberculosis screening at a syringe exchange found a high success rate of consent and return rates for skin-test reading and followup. Tuberculosis screening was conducted during syringe-exchange sessions, at which skin-test reading, tuberculosis education, and HIV testing and counseling were offered. Of the exchange participants approached, 96.5 percent

consented to tuberculosis screening. Of these, 91.5 percent returned for their skin-test reading, and 78 percent completed followup tuberculosis screening, including chest radiographs if indicated. Of those who consented to screening, 39 percent were homeless or unstably housed, 35 percent had no health insurance, and 60 percent were not in drug treatment. Data indicate that participating intravenous drug users were aware of their tuberculosis risk, frequently confused tuberculosis infection with active tuberculosis, and were receptive to the availability of tuberculosis services at a syringe exchange. More than 60 percent reported using the syringe exchange two or more times per week, and 52 percent reported using the exchange for 6 months or more, suggesting that the population of intravenous drug users at this syringe exchange may be sufficiently stable to allow administration of twice weekly directly observed therapy for those identified with tuberculosis infection.⁵⁰



In fact, a study of directly observed prophylaxis and treatment among drug users ongoing in a methadone program in New York City found that this setting worked well for providing tuberculosis therapy and for monitoring that patients completed their therapy. This is particularly important because not completing tuberculosis therapy is the main factor for the resurgence of tuberculosis among intravenous drug users. In this study, 88 percent of eligible patients agreed to directly observed therapy, and there was an 80-percent adherence rate to completion. These results indicate that successful adherence to and completion of tuberculosis therapy can be attained by drug users in drug treatment, despite ongoing substance use and lack of material incentives.⁵¹

Fetal and Childhood Development

The impact of drug abuse and addiction on our Nation's children is particularly onerous. Today, NIDA estimates that 5.5 percent of women use some illicit drug during pregnancy, translating into approximately 221,000 babies who have the potential to be born drug exposed. The full extent of the effects of prenatal drug exposure on a child is still not known completely, but science has shown that babies born to mothers who use drugs during pregnancy are often delivered prematurely, have low birth weights and smaller head circumferences, and are often shorter in

length than infants not exposed in utero to drugs. Estimating the full extent of the consequences of maternal drug use is difficult, and determining the specific hazard of a particular drug to the unborn child is even more problematic given that typically more than one substance is used.

Although it is difficult, researchers are making progress in resolving these questions. For example, one group of investigators has demonstrated that there are cocaine receptors in the brains of fetal rats and that cocaine will bind to these brain sites. Such binding could be a mechanism by which cocaine could modify brain development and later behavior through modification of brain activity during fetal development. With this new information, researchers may be able to pinpoint the specific sites in the developing brain that are most vulnerable to cocaine and to develop better treatment strategies for prenatal cocaine exposure.

Drug use can also have a significant negative impact on the health of children who are exposed to nicotine or illegal drugs by growing up in a household where drugs and tobacco are abused. In addition, the use of drugs during childhood and adolescence can be particularly damaging to the child's developing body and psyche.

Participants at a NIDA-sponsored conference recently concluded that many childhood psychiatric disorders are strongly associated with subsequent substance use, although a causal role remains to be established. Furthermore, the meeting participants stressed that because other biological and environmental influences can increase or reduce the risk of drug use, the mere existence of a specific psychiatric disorder does not predestine a child to later drug use. However, research has shown that conduct disorder and anxiety disorders are more clearly associated than other disorders with later drug use. Bipolar (manic-depressive) disorder may constitute a risk factor, depression in the presence of another disorder may increase risk, and some subtypes of ADHD may also increase risk. The coexistence of more than one childhood psychiatric disorder has been found to greatly increase the risk for later drug use.

Effects of Maternal Drug Use

Recent results from a longitudinal study add to the growing body of evidence for the importance of studying the amount of exposure when examining developmental outcomes associated with use of drugs during pregnancy. Although there were no overall differences between mothers who used drugs and those who did not on gestational age, birth weight, or birth length, there was a significant relationship between the amount of cocaine used in the third trimester and newborn length and head circumference. Similarly, the reported amount of cocaine use in the third trimester was negatively associated with measures of state regulation, alertness, and the ability of the infant to orient to the environment. These findings raise concerns about later developmental abilities of these infants.⁵²

Another study examined the effects of maternal substance use on the costs to neonatal care. The findings from this investigation suggest that exposure to drugs

in newborns resulted in total hospital charges almost double those of nonexposed newborns. The results demonstrated a consistent pattern of effects on charges, mortality, and resource use in the hospital of drug-exposed newborns due, in part, to longer lengths of stay and higher intensity care per day. The investigators suggest that their results confirm the policy concern that maternal substance use has severe consequences for the baby's health and that these costs are often borne by others.⁵³

What might be the effect of prenatal drug exposure on the child's development? Children with histories of prenatal polydrug exposure that included cocaine scored significantly lower on standardized test measures of language development than nonexposed children, according to one group of investigators. Nearly half of the children in the drug-exposed group qualified for early intervention services. Significant differences between groups were also noted on measures of infant development. All the children studied were living in stable, drug-free environments at the time of the study. Nevertheless, the results indicate that, due to the cumulative effects of prenatal history, children with histories of prenatal drug exposure should be considered at risk for language delay.⁵⁴

Cocaine's Effects on the Developing Brain

In September 1997, the New York Academy of Sciences, with support from NIDA, held a landmark conference titled "Cocaine: Effects on the Developing Brain." This was the first time that basic and clinical investigators had come together to discuss what is and is not known about the developmental consequences of prenatal cocaine exposure. Much of the research reported at this meeting came from longitudinal studies that NIDA has been supporting. For example, since 1991 NIDA has been a cosponsor, with the National Institute on Child Health and Human Development, Center for Substance Abuse Treatment, and Administration for Children and Families, of the Maternal Lifestyles Study (MLS), which has been examining the health and developmental consequences of illicit drug exposure during pregnancy in 1,400 children, who will be followed into their school years, when problems of learning disabilities, hyperactivity, and emotional disorders tend to emerge.

So far, analysis of the data from the MLS has shown that exposure to cocaine during fetal development may lead to subtle but significant deficits later on, especially with behaviors that are crucial to success in the classroom, such as blocking out distractions and concentrating for long periods. Other studies are also showing subtle cognitive and learning problems in some middle school children who were exposed to cocaine before birth.

Childhood and Adolescent Development

NIDA has spent, and continues to spend, significant effort studying the factors that put children at risk for later drug use to develop new interventions. One recent study, for example, attempted to identify developmental correlates of alcohol and tobacco use among elementary school children. Children's current alcohol and tobacco use was strongly related to low scores of several measures of child

competence, both self-report and teacher rated. Use of these substances was also associated with less effective parenting behaviors and with parental use of alcohol and tobacco. The researchers conclude that children's early experiences with tobacco and alcohol are associated with weak competence development and exposure to socializing factors that promote risk taking.⁵⁵

Another group of investigators examined the childhood, early adolescent, and late adolescent predictors of young adult drug use and delinquency to explore the effects of drug use on delinquent behavior. Data on childhood aggression, early and late adolescent drug use and delinquency, and young adult drug use and delinquency were gathered during the course of a 20-year longitudinal study of children. Overall, the results were consistent, with drug use and delinquency during early and late adolescence serving as the mediator between childhood aggression and young adult drug use. Adolescent drug use was associated with later delinquency. The findings indicated that childhood aggression was related to both young adult drug use and delinquency. In addition, there was stability of drug use and delinquency between early adolescence and young adulthood, and drug use during early adolescence had an impact on delinquency not only in early adolescence but also in late adolescence and young adulthood. The findings suggest that a decrease in drug use during adolescence should decrease delinquency in early and late adolescence and in young adulthood.⁵⁶

Previous research has noted that schools vary in substance use prevalence rates, but explanations for school differences have received little empirical attention. To examine this issue, investigators assessed variability across 36 elementary schools in rates of early adolescent alcohol, cigarette, and marijuana use. Characteristics of neighborhoods and schools were measured using student, parent, and archival data. The findings of this study show substantial variation across schools in substance use. Contrary to expectations, lifetime alcohol and cigarette use rates were higher in schools located in neighborhoods having greater social advantages as indicated by the perceptions of residents and archival data.⁵⁷ Perhaps not surprisingly, a recent study examining factors mediating the effects of parental emotional and instrumental support on adolescents' use of tobacco, alcohol, and marijuana found that parental support was inversely related to substance use. Further analysis of the data from this study indicated that the effect of parental support was mediated through multiple pathways, although in general, the major mediators were higher levels of behavioral coping and academic competence and less tolerance for deviance and behavioral undercontrol. Multiple-group analysis suggested buffering effects occurred because high support reduced the effect of risk factors and increased the effect of protective factors. Results of this study support the position that enhanced coping ability is an important mechanism through which social support contributes to adjustment.⁵⁸

A child's level of cognitive skills may also be a factor in early drug use. A longitudinal study of the relationships between several cognitive skills and drug use over time found a small but significant association between drug use and weak

cognitive and affective self-management strategies in early adolescence; this relationship became stronger over time. The exacerbation of these cognitive weaknesses with increased drug use may contribute to impaired social, emotional, and psychological growth in late adolescence. The investigators note that deficits in cognitive efficacy may actually precede and perhaps predispose to problematic drug use. Weaknesses in cognitive skills and learning disabilities may be undetected factors that underlie recognized risk factors such as low self-esteem, academic failure, and school dropout.⁵⁹

Of course, not all children who try drugs continue to use them. To assess risk factors for escalation of substance use once it begins, researchers grouped adolescents according to substance use patterns over three assessments and then examined variables differentiating the groups. The four groups—nonusers, minimal experimenters, late starters, and escalators—were identified through analysis of changes in cigarette, alcohol, and marijuana use among a cohort of eighth and ninth graders enrolled in public schools. By modeling group differences based on variables from stress-coping theory, problem behavior theory, and peer-association theory, the researchers identified measures predictive of subsequent escalation in substance use. Compared with nonusers and minimal experimenters, late starters and escalators had higher life stress, lower parental support, lower academic competence, more deviant attitudes, and more nonadaptive modes of coping; they also were higher in measures of parental and peer substance use. This study also found, in contrast with earlier work, that substance use experimenters, compared with nonusers, had higher stress, more maladaptive coping, more deviance-prone attitudes, lower levels of parental support, and lower levels of self-control. The findings support the idea that some people enter adolescence with less parental support and more life stress, have less adaptive patterns of coping and competence, and tend to gravitate to groups of peer substance users. To the extent that these factors prevail and are not offset, these adolescents become involved in a network of active users. The experience-regulating function of substance use becomes more salient, and they are primed to continue substance use at increasing rates.⁶⁰

The effect of a parent's drug use on the child is well documented. However, a recent study suggests that the sensitive period for the influence of a father's substance use disorder on a son's behavioral problems starts when the son is about 6 years old. These results suggest the importance of early intervention to reduce paternal substance use to prevent intergenerational transmission of behavioral problems and of substance use, given that externalizing behavioral problems in male children and adolescents are among the best predictors of subsequent substance use in early and late adolescence.⁶¹

Prevention of Drug Use and Addiction

Understanding what determines vulnerability to substance use is crucial to developing effective prevention programming. However, there are no unique factors that determine which individuals will use drugs; rather, drug use develops as the result of a variety of genetic, biological, emotional, cognitive, and social risk factors

that interact with features of the social context. Thus, both individual-level factors and social context-level factors make an individual more or less at risk for drug use.

Researchers have identified many risk factors associated with the development of drug problems. These factors typically have been organized into categories that represent individual risks and risks presented within the social context. For example, identified individual-level risks include shy, aggressive, and impulsive personality traits and poor academic achievement; family-level risks include poor parental monitoring and exposure to substance use by parents and siblings; school-level risk factors include a pro-drug use school norm and availability of drugs on or near the school campus; and community-level risks include lack of positive academic and recreational programming for children and adolescents during the afterschool and weekend hours and low levels of enforcement of laws pertaining to the use of licit and illicit substances by minors. This incomplete list of risk factors illustrates the breadth and complexity of the risks to which an individual may be exposed.

However, this list does not give much insight into how risk factors operate for individuals or groups because it does not consider the embeddedness of individuals in contexts that may place them at risk, the active role that individuals play in their own development through interactions and transactions within the social environment, developmental stages of individuals, and individual differences in the susceptibility to type and number of risks. Moreover, for many years the risk factor focus did not consider the influence of protective or resiliency factors—factors that protect individuals from developing problems such as substance use and that also operate at the individual and contextual levels through the family, peer group, school, community, workplace, and media, among others. Examples of protective or resiliency factors can include a stable temperament, a high degree of motivation, a strong parent-child bond, consistent parental supervision and discipline, bonding to prosocial institutions, association with peers who hold conventional attitudes, and consistent, communitywide anti-drug use messages and norms. An accumulation of protective factors may counteract the negative influences of a few risk factors. However, for most individuals, an accumulation of risk factors appears to have a more powerful effect than an accumulation of protective factors.⁶²

Based on an understanding of risk and protective factors and social contexts that place individuals at more or less risk of drug use and addiction, several drug use preventive interventions have been developed. Studies funded by NIDA indicate that many of these preventive interventions demonstrate both short- and long-term positive outcomes in preventing the initiation of drug use, interrupting the progression to drug abuse, and reducing the likelihood of relapse. These prevention programs serve to reduce the health and social consequences of drug use. Although the bulk of the etiologic data that informs the development of the theories on which these programs have been built comes from the work of etiologic researchers, most prevention research also provides some information on the etiology of drug use initiation and progression. The next four sections of this chapter explore, first, some recent etiologic findings that have emerged from drug use prevention research;

second, some results that have led to a better understanding of why programs are effective; third, descriptions of some prevention programs that have been shown to be effective; and fourth, some principles of prevention that have been derived through applying empirical tests to theory in the form of intervention studies.

Etiology

Individual

Many individual-level factors that may place youth at risk for or protect them from substance use initiation and abuse or addiction have been identified. However, ongoing research continues to uncover other such factors and to refine what is known about those that have been identified. Recent research indicates that personality and behavioral traits and styles that are evident in early childhood may have implications for later substance use behaviors. One such trait is aggressiveness. One study that examined children classified into reactive and proactive aggressive behavior types found that those in the reactive aggressive group had histories of physical abuse, early onset of behavior problems, adjustment problems in peer relations, and deficits in problem-solving processes around situations that provoked aggressive responses. On the other hand, those who were proactively aggressive anticipated positive outcomes from being aggressive.⁶³ These findings suggest differential prevention programming for these two groups of aggressive children.

Gender may also play a risk or protective role in substance abuse. In general, females are less likely to use illicit substances than males. However, some subgroups of females may be at heightened risk. For example, Latino girls are at greater risk of receiving drug offers than females from other ethnic groups.⁶⁴ In another study in which middle school and high school girls were compared on several risk behaviors, the younger girls displayed less knowledge of the adverse consequences of drug use behaviors and perceived less prevalence of these behaviors among their peers. On the other hand, they also expressed less belief in the media, which may serve as a protective factor.⁶⁵

Early initiation of drug use has also been identified as a strong predictor of later abuse. New evidence shows a strong association between low levels of competency in multiple areas, as reported by both the child and the child's teacher, and tobacco and alcohol use among elementary school children.⁶⁶ Although initial use of alcohol may be driven more by social influences, later stages of problem drinking appear to be linked developmentally to intrapersonal deficits. Over time, high school students who were more susceptible to social influences and displayed lower levels of competency were more likely to exhibit increased drinking behavior.⁶⁷ Thus, there appears to be some stability in individual factors that relate to the initiation and progression of substance use over the course of development.

A small but significant relationship has been found between drug use and cognitive and affective self-management strategies in early adolescence. This relationship becomes stronger over time, and by late adolescence, increased drug use may contribute to impaired social, emotional, and psychological development. As a further complication, memory associations with drug cues and drug use outcomes may influence future drug use decisions.⁶⁸ One group of investigators speculates that cognitive deficits may actually precede and predispose some individuals to drug use initiation. Thus, weaknesses in cognitive skills and learning disabilities may be undetected risk factors that underlie other identified risk factors, such as low self-esteem and academic failure.⁶⁹

Family

Parenting practices are central to children's development of risk for drug use. To enhance understanding of developmental patterns leading to adolescent drug use, researchers have focused extensively on the role of parenting in establishing, maintaining, or exacerbating risk trajectories in children and adolescents. Early onset is not random. Rather, it is often a predictable and identifiable outcome of a developmental progression that begins in early childhood and involves the interaction of characteristics of the child in the context of the family. It is not so much who the parents are but what skills they bring to the socialization of the child that is the most important factor.⁷⁰ A number of studies have shown that poor parental monitoring and parent-child conflict predict the initial level and trajectory of drug use, and these levels and trajectories were similar for alcohol, tobacco, and marijuana.⁷¹ In fact, parental monitoring is linked both directly and indirectly to early onset drug use—directly, through the lack of actual supervision, and indirectly, through the additional time spent with peers. Children who are not well monitored tend to loiter in the community, freely selecting places to spend time where drug use and other delinquent activities might occur.⁷² Thus, parenting practices can serve a protective role in the face of adverse, risky environments.

The social model of childhood development hypothesizes that strong emotional bonds to adults and to institutions associated with antisocial behavior contribute to the development of antisocial behavior in children. Consistent with this perspective, previous research has indicated that children who bond strongly to substance-using parents are at risk of developing substance use problems themselves. Recent work has now examined the interactive relationship between a parent's drug use, the process of bonding to parents, and substance use by children in a longitudinal study of families headed by substance users in methadone treatment for opiate addiction. Bonding to parents and child substance use are moderately negatively correlated in children whose parents ceased using drugs but are weakly positively correlated in children whose parents continued using drugs. These results support the social development model and suggest that family interventions for preventing substance use in children of substance users should focus on reducing parental drug use and promoting bonding to parents who are abstinent.⁷³

Unlike families in the general population, positive family management practices showed little effect on reducing problem behaviors among children of methadone clients. This was especially true for older children for whom the effects of maternal attachment were relatively weak.⁷⁴ However, retrospective reports of addicts on family experiences during adolescence compared relationships with mothers and fathers. In general, mothers were viewed as more functional than fathers in the areas of involvement, responsibility, and attachment.⁷⁵

Parental substance use has also been indicated as a risk factor for child substance use. Among children in grades three and five, early onset smoking was associated with exposure to parental smoking. Interestingly, it did not matter whether the parent had quit smoking. What did matter was the parent, smoking or not, taking a strong antismoking stance with the child.⁷⁶ Among adolescents, substance use by an important adult was a potential risk for substance use experimentation. Data indicated that the risk is least for tobacco, intermediate for alcohol, and greatest for marijuana. Adolescents who reported exposure to adult use of alcohol, tobacco, or marijuana were likely to be further advanced in the onset process than other students at each of the junior high school years, grades seven through nine.⁷⁷

Integrating children's individual differences with parenting models enhances our understanding of childhood markers of later substance use. For example, fourth- and sixth-grade boys who were classified as either active or fearful were assessed relative to the parenting practices they experienced. Active boys who were poorly monitored and fearful boys who were exposed to harsh discipline exhibited higher levels of aggressive behavior, a precursor of later substance use.⁷⁸

Peers

Peers play a major role in the development of deviant behaviors, including the use of drugs, and their influence increases during the adolescent years. In one study, researchers observed 13- to 14-, 15- to 16-, and 17- to 18-year-old male, close-friend pairs discussing problem solving situations. Although the close friends who came to the sessions changed over time, the topics, which typically included deviant and violent talk, remained essentially the same. These findings suggest that adolescent violence and antisocial behavior are embedded in the patterns of social interactions in friendships.⁷⁹

Association with deviant peers has also been found to be predictive of the initial level and trajectory of drug use, and these levels and trajectories were similar for alcohol, tobacco, and marijuana.⁸⁰ Among fourth- and sixth-grade students, modeling of use by best friends and a high level of perceived prevalence of use among same-age peers were strongly related to the initiation and experimentation stages of tobacco and alcohol use. However, family and individual factors, such as offers from parents, adjustment to school, and behavioral regulation, were also associated with use. Among these younger children, the initiation and experimentation stages were not as highly differentiated as they were among adolescents.⁸¹

School

Recent findings showed substantial variation across 36 elementary schools in rates of lifetime alcohol use, lifetime cigarette use, and current cigarette use. However, contrary to expectations, lifetime alcohol and cigarette use rates were higher in schools located in neighborhoods having greater, rather than lesser, social advantages.⁸² Additional findings indicate that schools with greater tobacco problems are more likely to adopt more restrictive policies on their own, regardless of whether an intervention is in place. Schools also appear to target youth at risk for school failure and other problem behaviors with tobacco policy sanctions.⁸³

Workplace

Relatively little research has been conducted on preventive interventions for the workplace. An essential step is a clear definition of the problem through preintervention research. In an effort to get the most reliable data on drug use among an intervention sample of 928 steel mill workers, a combination of self-report, urinalysis, and hair analysis was used. Use of the biological assays resulted in a prevalence rate approximately 50 percent higher than that achieved with self-report only.⁸⁴ Additional research has found that employees are often unaware of or ambivalent toward workplace substance use policies. Five attitude categories about workplace policies emerged from a survey of municipal employees: (1) dissatisfied with efforts to control employee abuse, (2) satisfied, (3) antipolicy, (4) propolicy, and (5) uninformed. Different profiles were identified for each of the attitude groups. For example, dissatisfied employees reported low personal alcohol use, high coworker use, and low self-referral, whereas antipolicy employees reported high personal drug use, high coworker use, and low job identity.⁸⁵

Special Populations

Preventive interventions appear to be most effective when they consider characteristics and risk and protective factors associated with the target group. Thus, efforts are being made to understand what risk and protective factors may be salient for specific racial and ethnic groups and subgroups. For example, although the level of tobacco use among Mexican-American 10th and 12th graders was the same for children in migrant and nonmigrant families, several risk and protective factors were identified. For example, risk factors for tobacco use included peer and family use of tobacco, whereas protective factors included close parental supervision and caring, good school adjustment, and strong religious identification.⁸⁶ Among middle school children, Latino males and females were more likely to experience drug offers than other students. However, there were no differences in the type or setting of drug offers. For all groups, offers were simple, rather than complex and pressure filled, and could be resisted with simple refusals. Drugs tended to be offered to all groups most frequently at home and in public settings rather than at school or at parties.⁸⁷

In another sample of 448 Latino young adolescents, increased interaction with non-Latino peers was positively related to attitudes and perceived peer norms against substance use. Moreover, for youth with both high and low levels of acculturation,

perceived normative expectations and negative attitudes toward substance use were deterrents of future use.⁸⁸

Findings on Prevention Methodology

In addition to knowledge about the etiology of drug use, prevention research also results in a greater understanding of how to encourage program participation, why programs are more or less effective, and what insights into the processes that occur through intervention can have positive or negative effects on outcome. Research aimed at gaining higher participation rates by families in family interventions indicated that barriers to participation included intervention-related time demands, logistic requirements, negative beliefs and attitudes about interventions, and the influence of family members.⁸⁹ To gain participation, program planners and implementers must find ways to minimize these barriers, such as flexibility in intervention scheduling; minimizing of initial time commitments; contacts from parents and peers; and multiple incentives, such as free food coupons, refreshments, and child care. The reasons for program effectiveness are many and varied, and much more research needs to be conducted to fully understand these processes. However, some headway is being made in understanding what constitutes both effective prevention message presentation and prevention content. For example, in a meta-analysis of 120 school-based preventive interventions for 5th- through 12th-grade students, two major program types were identified: interactive and noninteractive. Results of the meta-analysis indicated that the interactive programs changed drug knowledge, attitudes, and behaviors, whereas the noninteractive programs changed only knowledge.⁹⁰ Similarly, the effectiveness of classroom and self-instruction versions of 16 theory-based prevention activities was tested with students in continuation high schools. The students who received the health educator-led activities in the classroom consistently reported higher levels of perceived quality than did those who completed the self-instruction activities only.⁹¹

Evidence about the effects of memory associations and drug use decisions suggests that prevention programming should concentrate on making program information, such as drug refusal strategies and awareness of potential negative consequences, highly accessible from memory in high-risk situations.⁹² For example, in a yearlong intervention that exposed 7th- through 12th-grade students in experimental communities to local antidrug media messages, exposed students with low to moderate levels of drug use who recalled the messages showed beneficial effects on targeted variables compared with both the students who were exposed to the message but did not remember them and the students who were not exposed. The researchers suggest that the weight of antidrug media messages would be strengthened by combining them with interpersonal or school-based interventions.

Some findings that have emerged from analysis of prevention trials are helping to illuminate the interaction processes within interventions that either enhance positive effects or provoke negative outcomes. For example, analysis of videotaped interactions between 13- to 14-year-old boys and their friends identified a pattern of interaction that reinforces antisocial behavior. Specifically, a sequence of interactions

that began with rule-breaking talk and followed with laughter was more evident in pairs where both boys were delinquent and had been arrested than in either mixed pairs in which one friend had been arrested but the other had not or in nondelinquent pairs. In the mixed and nondelinquent pairs, interactions centered on normative talk and laughter. Over a 2-year period, interactions between the delinquent boys were prognostic of increases in self-reported delinquent behavior. Thus, aggregating high-risk youth into homogeneous groups should be avoided in preventive interventions.⁹³

Programs

Over the past 20 years, NIDA has sponsored research on numerous substance use preventive intervention programs. To demonstrate the programs' long-term effectiveness, the research must follow subjects for years after the completion of the intervention. The programs listed in this section are in various phases of followup, but all have demonstrated effectiveness in at least one population over at least 3 years. Three types of programs are included: (1) universal programs that target the general population, such as all students in a school; (2) selective programs that target at-risk groups or other subsets of the general population, such as children of drug users or poor school achievers; and (3) indicated programs that are designed for people who are already experimenting with drugs or who exhibit other risk-related behaviors.

Adolescents Training and Learning To Avoid Steroids

Adolescents Training and Learning To Avoid Steroids (ATLAS) is a multicomponent universal program for male high school athletes, designed to reduce risk factors for use of anabolic steroids and other drugs while providing healthy sports nutrition and strength-training alternatives to illicit use of athletics-enhancing substances. Coaches and peer teammates facilitate curriculum delivery with scripted manuals in small cooperative learning groups, taking advantage of an influential coaching staff and the team atmosphere where peers share common goals.⁹⁴

The ATLAS program has been shown to be extremely effective in preventing the use of anabolic steroids in high school athletes. Compared with student athletes who were not exposed to ATLAS, participants had increased understanding of the effects of steroids, greater belief in personal vulnerability and the consequences of steroid use, improved drug-refusal skills, less belief in steroid-promoting media images, increased belief in the team as an information source, improved perception of athletic abilities and strength training self-efficacy, improved nutrition and exercise behaviors, reduced intentions to use steroids, and more certainty that their parents and coaches were intolerant of drug use. In addition, ATLAS students had a greater understanding of the effects of marijuana and alcohol than did student athletes not enrolled in the program.⁹⁵

Project STAR

Project STAR is a universal drug abuse prevention program that reaches the entire community population with a comprehensive school program, mass media efforts, a parent program, community organization, and health policy changes. The school-based component is a social influence curriculum that is incorporated into regular classroom instruction by trained teachers over a 2-year period.⁹⁶

Research results on this project have shown positive long-term effects: Students who began the program in junior high, and whose results were measured in their senior year of high school, showed significantly less use of marijuana (approximately 30 percent less), cigarettes (about 25 percent less), and alcohol (about 20 percent less) than children in schools that did not offer the program.

The most important factor found to have affected drug use among the students was increased perceptions of their friends' intolerance of drug use.

Life Skills Training Program

The Life Skills Training universal classroom program is designed to address a wide range of risk and protective factors by teaching general personal and social skills in combination with drug resistance skills and normative education. The program consists of a 3-year prevention curriculum intended for middle school or junior high school students. It contains 15 periods during the first year, 10 booster sessions during the second, and 5 sessions during the third. Three major content areas are covered by the Life Skills Training program: (1) drug resistance skills and information, (2) self-management skills, and (3) general social skills.⁹⁷

The Life Skills Training program has been extensively studied over the past 16 years. Results indicate that this prevention approach can produce a 59- to 75-percent lower level, relative to controls, of tobacco, alcohol, and marijuana use. Booster sessions can help maintain program effects. Long-term followup data from a randomized field trial involving nearly 6,000 students from 56 schools found significantly lower tobacco, alcohol, and marijuana use 6 years after the initial baseline assessment. The prevalence of cigarette smoking, alcohol use, and marijuana use for the students who received the Life Skills Training program was 44 percent lower than for control students, and the weekly use of multiple drugs was 66 percent lower. Early research on the Life Skills Training program was conducted with white populations; several recent studies show that it is also effective with inner-city minority youth when implemented under different scheduling formats and with different levels of project staff involvement. Finally, evaluation studies indicate that this prevention program is effective whether the program providers are adults or peer leaders.

Adolescent Alcohol Prevention Trial

The Adolescent Alcohol Prevention Trial (AAPT) is a universal classroom program designed for fifth-grade students, with booster sessions conducted in the seventh grade. It includes two primary strategies. Resistance skills training is designed to give

children the social and behavioral skills they need to refuse explicit drug offers. Normative education is specifically designed to combat the influences of passive social pressures and social modeling effects, and it focuses on correcting erroneous perceptions about the prevalence and acceptability of substance use and on establishing conservative group norms.⁹⁸

In the research design, the students received either information about the consequences of drug use only, resistance skills only, normative education only, or resistance skills training in combination with normative education. Results showed that the combination of resistance skills training and normative education prevented drug use; resistance skills training alone was not sufficient.

Seattle Social Development Project

A universal program, the Seattle project is a school-based intervention for grades one through six that seeks to reduce shared childhood risks for delinquency and drug abuse by enhancing protective factors. The multicomponent intervention trains elementary school teachers to use active classroom management, interactive teaching strategies, and cooperative learning in their classrooms. From grades one through six, parents are provided a training session called "How To Help Your Child Succeed in School," a family management skills training curriculum called "Catch 'Em Being Good," and the "Preparing for the Drug-Free Years" curriculum. The interventions are designed to enhance opportunities, skills, and rewards for children's prosocial involvement in both school and family settings, thereby increasing their bonds to school and family and their commitment to the norm of not using drugs.⁹⁹

Long-term results indicate positive outcomes for students who participated in the program, including reductions in antisocial behavior, improved academic skills, greater commitment to school, reduced levels of alienation and better bonding to prosocial others, less misbehavior in school, and fewer incidents of drug use in school.

Project Family

Project Family is a series of interrelated investigations with the following goals: (1) evaluating universal family and youth competency-training interventions to examine the process of positive change in families, (2) testing the factors that influence parent participation in family programs, and (3) conducting statewide needs assessment surveys to determine family and community needs throughout Iowa. The preventive interventions evaluated through Project Family are Preparing for the Drug-Free Years (PDFY) and the Iowa Strengthening Families Program (ISFP), a revision of the University of Utah Strengthening Families program discussed below. The PDFY has five competency-training sessions for parents; one session includes the young adolescents. The ISFP has seven sessions, each attended jointly by youth and their parents. The Iowa State University Cooperative Extension Service has been instrumental in the implementation and evaluation of both

programs. It also aided in the adaptation of project methods for Native American populations.¹⁰⁰

Comparisons of both interventions with control group families show positive effects on parents' child management practices and on parent-child affective quality. In addition, a recent evaluation of ISFP youth outcomes at the 1-year followup shows improved youth resistance to peer pressure to use alcohol, reduced affiliation with antisocial peers, and reduced levels of problem behaviors. Importantly, intervention posttest outcome models demonstrate that positive parenting effects were significantly associated with reductions in children's problem behaviors. Study results are guiding efforts to evaluate whether addition of a family intervention to a school intervention is significantly better than use of a school intervention alone.

Strengthening Families Program

The Strengthening Families Program is a selective, multicomponent, family-focused prevention program that provides programming for 6- to 10-year-old children of substance users. The program, which began as an effort to help substance-using parents improve their parenting skills and reduce their children's risk for substance use, has been culturally modified and found effective (through independent evaluation) with African-American, Asian/Pacific Islander, and Hispanic families. The program contains three elements: (1) a parent training program, (2) a children's skills training program, and (3) a family skills training program. In each of 14 weekly sessions, parents and children are trained separately in the first hour. During the second hour, parents and children come together for family skills training. Afterward, the families share dinner and a film or other entertainment.¹⁰¹

Results indicate that the parent training improves parenting skills and reduces substance use by parents, children's skills training decreases children's negative behaviors and increases their socially acceptable behaviors through work with a program therapist, and family skills training improves the family environment by involving both generations in learning and practicing their new behaviors. This intervention approach has been evaluated in a variety of settings and with several racial and ethnic groups. The primary outcomes of the program include reductions in family conflict; improvement in family communication and organization; and reductions in youth conduct disorders, aggressiveness, and substance use.

Focus On Families

A selective program for parents receiving methadone treatment and for their children, Focus On Families' primary goal is the reduction of parents' use of illegal drugs by teaching them skills for relapse prevention and coping. Parents are also taught how to manage their families better. The parent training consists of a 5-hour family retreat and 32 parent training sessions of 1.5 hours each. Children attend 12 of the sessions to practice developmentally appropriate skills with their parents. Session topics include family goal-setting, relapse prevention, family communication, family management, creation of family expectations about alcohol

and other drugs, teaching of various skills to children (such as problem solving and resisting drug offers), and help for children to succeed in school. Booster sessions and case-management services also are provided.¹⁰² Early results indicate that parents' drug use is dramatically lowered and their parenting skills significantly improved over that of the control groups; the program's effects on children have not yet been assessed.

Reconnecting Youth Program

Reconnecting Youth is a school-based indicated prevention program that targets young people in grades 9 through 12 who show poor school achievement and the potential for dropping out of high school. Many also show signs of multiple problem behaviors, such as substance use, depression, and suicidal ideation. The program teaches skills to build resiliency with respect to risk factors and to moderate the early signs of substance use. The program incorporates social support and life skills training components, including a semester-long personal growth class, social and school bonding activities, and a school system crisis-response plan to address suicide prevention.¹⁰³

Research shows that this program improves school performance; reduces drug involvement; decreases deviant peer bonding; increases self-esteem, personal control, school bonding, and social support; and decreases depression, anger and aggression, hopelessness, stress, and suicidal behaviors. Further analysis indicates that the support of the personal growth class teachers contributes to decreases in drug involvement and suicide risk behaviors.

Adolescent Transitions Program

The Adolescent Transitions Program (ATP) is a school-based program that focuses on parenting practices and integrates the universal, selective, and indicated approaches for middle school and junior high school interventions within a comprehensive framework. The universal level of the ATP is directed to the parents of all students in a school through the establishment of a Family Resource Room. The goal is to engage parents, establish norms for positive parenting practices, and disseminate information about risks for problem behavior and substance use. The selective level of intervention offers family assessment and professional support to identify those families at risk for problem behavior and substance use. The indicated level provides direct professional support to parents for making the indicated changes. Services may include behavioral family therapy, parenting groups, or case management services.¹⁰⁴ This program is based on a series of intervention trials, which constitute the Parent Focus curriculum and other intervention strategies, including working with high-risk teens in groups using a Teen Focus curriculum and directed strategies involving videotapes and newsletters. The findings from these studies indicate that parent interventions are needed for youth at high risk to reduce escalation of drug use, and repeated booster sessions are needed throughout the period of risk. These interventions were especially important because youth at high risk should not be placed together in groups because it can worsen problem behaviors, including those related to school and drug use.

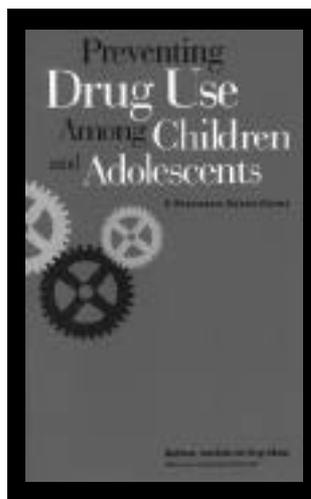
Jump Start

Jump Start is a recently developed preventive intervention program with two components that are aimed at helping economically disadvantaged, high-sensation-seeking African-American teens avoid drug use. Over two implementations of the program, 289 adolescents were recruited. For the first implementation, participants were randomly selected from a summer youth employment program. For the second, a media campaign was used to recruit participants. Participants evaluated the program extremely positively, but more important, the early data on this selective intervention show that a significant pretest difference in alcohol and marijuana use between high and low sensation-seekers was neutralized in both years of the program. Attitudes toward drugs were also changed in a positive way during the first year of the program. These results suggest that sensation-seeking is a useful message design and audience-targeting variable for substance use prevention program design.¹⁰⁵

Principles of Prevention

NIDA's comprehensive, multidisciplinary prevention research program examines multiple factors that contribute to drug abuse and how these factors interact. The Institute has also taken a strong role in synthesizing and disseminating findings. Recently, the Institute released a set of Prevention Principles that enumerate what has been learned through 20 years of research on what works in keeping children and adolescents from using illicit drugs. The principles that follow can be found in NIDA's *Preventing Drug Use Among Children and Adolescents* research-based guide:

- Prevention programs should be designed to enhance "protective factors" and to move toward reversing or reducing known "risk factors."
- Prevention programs should target all forms of drug use, including the use of tobacco, alcohol, marijuana, and inhalants.
- Prevention programs should include skills to resist drugs when offered, strengthen personal commitments against drug use, and increase social competency (e.g., in communications, peer relationships, self-efficacy, and assertiveness) in conjunction with reinforcement of attitudes against drug use.
- Prevention programs for adolescents should include interactive methods, such as peer discussion groups, rather than didactic teaching techniques alone.



- Prevention programs should include a parents' or caregivers' component that reinforces what the children are learning, such as facts about drugs and their harmful effects. Moreover, the intervention should promote opportunities for family discussions about use of legal and illegal substances and family policies about their use.
- Prevention programs should be long term and should continue over the school career, with repeated interventions to reinforce the original prevention goals. For example, school-based efforts directed at elementary school and middle school students should include booster sessions to help with critical transitions from middle school to high school.
- Family-focused prevention efforts have a greater impact than strategies that focus on parents only or children only.
- Community programs that include media campaigns and policy changes, such as new regulations that restrict access to alcohol, tobacco, or other drugs, are more effective when they are accompanied by school and family interventions.
- Community programs need to strengthen norms against drug use in all drug use prevention settings, including the family, school, and community.
- Schools offer opportunities to reach all populations and also serve as important settings for specific subpopulations at risk for drug use, such as children with behavior problems or learning disabilities and those who are potential dropouts.
- Prevention programming should be adapted to address the specific nature of the drug use problem in the local community.
- The higher the level of risk for the target population, the more intensive the prevention effort must be, and the earlier it must begin.
- Prevention programs should be age-specific, developmentally appropriate, and culturally sensitive.
- Effective prevention programs are cost-effective.

Women's Health and Gender Differences

Historically, in drug use research, as in other fields of public health research, test subjects have been almost exclusively male; as a result, little data have been available on the specific problems and issues concerning the effects of drug use on women. In recent years, however, NIDA has vigorously promoted drug use research focusing on the study of women and gender differences, and such research is now supported in all of NIDA's programmatic branches. Data from NIDA-supported laboratory, field, and clinical research are beginning to show gender differences in virtually all areas of drug research, including research on biological factors in drug use, the antecedents and consequences of drug use and abuse, and prevention and treatment. Some of the findings, emerging in the past few years, are described below.

Gender Differences in the Impact and Consequences of Drug Use

There is growing evidence that the effects of drug use and addiction do not always affect men and women in the same manner, and the rate of any drug use among men is nearly twice that of women (8.1 percent vs. 4.2 percent). Data also indicate that for several illicit drugs, women may proceed more rapidly to drug dependence than do men, which may have to do with the way the body responds to drugs.

Preliminary data from several studies using varying clinical end points are beginning to suggest that drugs of abuse may produce biologic impairment in males different from that in females. In a study of cerebral perfusion abnormalities in dependent cocaine users, for example, males were far more likely than females to exhibit abnormalities, perhaps because of a protective role of estrogen.¹⁰⁶ In addition, a magnetic resonance spectroscopy study of chronic cocaine users found that in the white matter of the brain, males had elevations in three of five naturally occurring metabolites, whereas female subjects had no elevations.¹⁰⁷

A study of cocaine users found that male occasional cocaine users achieved significantly faster peak plasma cocaine levels after snorting cocaine than did women. Men also reported a greater number of intense effects. However, heart rates did not differ between males and females despite differences in peak plasma levels between genders. This suggests that the female cardiovascular system may be more sensitive than that of males to cocaine's effects.¹⁰⁸

A study of neuropsychological functioning in cocaine abuse also points to a possible protective factor with regard to women. In a study of the effects of chronic cocaine use following sustained abstinence, both males and females exhibited impairment on measures of attention-concentration, memory, and academic achievement. Visual-spatial, motor, language, and executive functioning measures were less consistently impaired among females. Interestingly, although the female subjects had a substantially greater exposure to cocaine, they were no more impaired than the men on neuropsychological measures.¹⁰⁹

Two recent studies dealing with the genetics of cigarette smoking have revealed interesting gender differences. The first study demonstrates a role for genetically variable nicotine metabolism that varies by gender. Among a group of tobacco-dependent subjects, individuals having one defective and one active copy of the gene CYP2A6 smoked significantly fewer cigarettes per day and per week than did smokers without an impaired copy of the CYP2A6 gene. Although it appears that individuals with this defective gene have reduced nicotine metabolism and are therefore protected, the manner in which this protection is imparted has not yet been clarified.¹¹⁰ In a second study, data from large national samples of Scandinavian, Australian, and U.S. adult twins have demonstrated that genetic factors play an important role in predicting who among cigarette smokers will progress to being long-term persistent smokers. The association was much stronger for males than for females, however.¹¹¹

The two studies above that point to a stronger genetic factor in cigarette smoking for males than for females are consistent with the behavioral literature indicating that nicotine dependence in females, compared with males, is controlled less by nicotine and more by other influences, such as the pleasurable social situations in which smoking occurs. Although women smoke fewer cigarettes per day, have a tendency to smoke cigarettes with lower nicotine content, and do not inhale as deeply as men, women have more difficulty achieving and maintaining abstinence than do men. Unfortunately, for females, nicotine replacement using nicotine gum or the nicotine patch is less effective than for males despite equal compliance with the regimen.

One of the most devastating consequences of drug use for females is the risk of HIV/AIDS. AIDS is now the fourth leading cause of death among women ages 15 to 44 years, and approximately two-thirds of the AIDS cases among women are related to injection drug use. One study has examined the influences of various psychological and social risk factors on needle-sharing among female intravenous drug users. The investigators found that although there were similarities between males and females, the role of the family, particularly the significant other, was more important in its effect on needle-sharing behavior in women than in men. The data from this study suggest that women's resilience and resistance to self-destructive behavior are closely related to ties with others. There was a main effect as well as mediating effects of protective family factors in women, buffering the risk factors leading to needle-sharing.¹¹²

Considerable research efforts are being devoted to HIV prevention among drug users. A recent study demonstrated that the effectiveness of HIV preventive interventions differs by gender. Sexual risks of HIV infection were more likely to decrease for drug-dependent men if the risk-reduction information was provided on the street, whereas counseling in an office setting was more conducive to risk reduction for drug-dependent women.

An aspect of drug use by women that is of particular concern is the use of drugs during pregnancy. Research indicates that pregnant drug users are at increased risk for miscarriage, ectopic (tubal) pregnancy, stillbirth, low weight gain, anemia, thrombocytopenia, hypertension, and other medical problems. In addition, their newborns may have lower birth weight and smaller head size than babies born to non-drug-using mothers. Of particular concern is that HIV can cross the placental barrier; in fact, among the total cases of pediatric AIDS in the United States, 54 percent are related to either maternal injection drug use or maternal sex with an injecting drug user. New data from a study of pregnant drug users suggest that a mother can also transmit hepatitis C virus to her unborn child and that this also increases the risk of maternal transmission of HIV to the fetus. In this study, drug use during pregnancy was highly correlated with hepatitis C infection, and the data suggest that maternal hepatitis C infection either enhances HIV transmission directly or is a marker for another cofactor, such as maternal drug use. Further study

is needed to confirm the findings of this study and to determine whether the association represents a biologic effect of hepatitis C infection or results from a confounding interaction with drug use or other factors.¹¹³

Several studies are ongoing to determine the effects of maternal cocaine use on a child's development. One study has now gathered data on a poorly categorized group of women, namely, those from a rural population with little access to drug treatment. These data show that rural cocaine users were found more likely than their urban counterparts to be older, use other drugs, begin their drug use at an earlier age, have more depressive symptoms, have an external locus of control, have lower self-esteem, have a more simplistic understanding of child development, and have higher positive life event impact scores. However, both groups exhibited a very low level of reading skills, a finding that led to having to read the interviews and measures to each participant. This finding has important implications for health care and drug treatment programs.¹¹⁴

Initiation and Progression of Drug Abuse Among Women

Research is beginning to show that the progression or developmental stages of drug involvement are not identical for males and females. In the progression from legal drug use to illicit drug use, for example, cigarettes have a relatively larger role for females than for males, and alcohol has a relatively larger role for males than for females. With regard to initiation into illicit drugs, data suggest that women are more likely to begin or maintain cocaine use to develop more intimate relationships, whereas men are more likely to use the drugs with male friends and in relation to the drug trade. The onset of drug abuse occurs later for females, and the paths are more complex than for males. For females, there is typically a pattern of breakdown of individual, familial, and environmental protective factors and an increase in childhood fears, anxieties, phobias, and failed relationships; the etiology of female drug use often lies in predisposing psychiatric disorders prior to using drugs.

Childhood sexual abuse has been associated with drug use in females in several studies. Some studies indicate that up to 70 percent of women in drug use treatment report histories of physical and sexual abuse, with victimization beginning before 11 years of age and occurring repeatedly. A study of drug use among young women who became pregnant before reaching 18 years of age reported that 32 percent had a history of early forced sexual intercourse (rape or incest). These adolescents, compared with nonvictims, used more crack, cocaine, and other drugs (except marijuana); had lower self-esteem; and engaged in a higher number of delinquent activities.

Furthermore, female drug users may have greater vulnerability to victimization than males. For example, in a recent study of homicide in New York City, 59 percent of white women and 72 percent of African-American women had been using cocaine prior to death compared with 38 percent of white men and 44 percent of African-American men. Thus, although more males than females use cocaine, its use is a far greater risk factor for victimization for women than for men. Therefore, it is critical

that the factors involved in the relationship between drug use and dependence among females and physical and sexual victimization (including partner violence) be identified and understood.

The rate of co-occurring substance use disorder and other psychiatric disorders is relatively high for females. Data from a study on female crime victims, for example, indicate that those suffering from posttraumatic stress disorder (PTSD) were 17 times more likely to have major drug use problems than nonvictims. In addition, individuals with a trauma history and PTSD use substance use inpatient services more frequently than do their non-PTSD counterparts. This fact has led researchers to speculate that the co-occurrence of substance use and PTSD may predict a more severe course than would ordinarily be present with either disorder alone. For females, a high correlation appears to exist between eating disorders and substance use. For example, as many as 55 percent of bulimic patients are reported to have drug and alcohol abuse problems. Conversely, as many as 40 percent of females with drug use or alcohol problems have been reported to have eating disorder syndromes, usually involving binge eating.

In one recent study, psychiatric and substance use comorbidity was assessed in opiate abusers seeking methadone maintenance. Rates of co-occurring mental disorders and personality traits were compared by gender, and the results showed that women were more likely than men to have a mood disorder and were seven times more likely than men to have a borderline personality disorder. Although all patients had at least one substance use diagnosis beyond opiate dependence, most often cocaine dependence, women were less likely than men to have a lifetime marijuana, alcohol, or hallucinogen disorder or current marijuana or alcohol dependence.¹¹⁵

Treatment Programs for Women

Women who abuse drugs face a variety of barriers, including barriers to treatment entry, treatment engagement, and long-term recovery. Barriers to entry include a lack of economic resources, referral networks, women-oriented services, and conflicting child-related responsibilities. Because women have many specific needs, a number of components of treatment have been found to be important in attracting and retaining women in treatment. These components include the availability of female-sensitive services; nonpunitive and noncoercive treatment that incorporates supportive behavioral change approaches; and treatment for a wide range of medical problems, mental disorders, and psychosocial problems.

One research study showed that treatment of drug-dependent women was more likely to be successful if treatment was provided in a mutually supportive therapeutic environment and addressed the following issues: psychopathology, such as depression; a woman's role as mother; interpersonal relationships; and the need for parenting education. Another study found that cocaine-using women whose children were living with them during residential treatment remained in the programs significantly longer than women whose children were not living with them at the facility. In this study, approximately 77 percent of the women with their children living in the

treatment facility were still in the program at 3 months, compared with 45 percent of the group that did not have their children with them. At 6 months, the corresponding figures were 65 percent compared with 18 percent. The clear implication of this study is that providing facilities to accommodate children is a major factor in improving retention and outcome for drug-using mothers in treatment. In addition, having the children in the facility provides opportunities to assess and meet their needs, which may, in turn, affect the mother's prognosis.¹¹⁶

A recent national study of individuals in drug use treatment programs between 1991 and 1993 (DATOS) showed that women who had at least 28 days of treatment, with at least 14 days in short-term inpatient care, had sharp reductions in their use of illicit drugs, HIV risk behavior, and illegal activities. For instance, 84 percent of the women who were admitted to long-term residential treatment programs admitted at intake using illegal drugs every day or at least once a week. Twelve months after treatment, only 28 percent continued to abuse drugs. Women in short-term inpatient treatment also showed significant reductions in illegal drug use 1 year after their treatment, with 86 percent admitting use at intake and 32 percent reporting use after 1 year.

Minority Population Studies

Drug use is a major health problem among racial and ethnic minority populations in the United States. NHSDA data show that Hispanics and African Americans are more likely than whites to have tried cocaine at least once and to use cocaine weekly. Moreover, the consequences of drug use are often more severe for racial and ethnic minorities than for other populations; they are more likely to die, suffer from severe drug-related illnesses, receive inadequate treatment, and be involved in disputes and crimes. As minority groups grow and become an increasingly larger proportion of the U.S. population, it becomes more critical to understand the medical and social consequences of drug use among these populations.

The special needs of these communities were highlighted by a recent comprehensive NIDA-funded survey of 294 drug treatment programs in an inner city environment. Special populations were grouped by health status, ethnic background, language needs, and gender-related needs. Survey results indicated a generally high proportion of programs capable of meeting the unique needs of a variety of special population clients, and most programs have some mix of special population clients in their current caseload. About 62 percent of programs reported being able to serve clients who were primarily Spanish speakers; clients using American Sign Language could be served by only 11 percent of programs; and about 40 percent of the programs reported not being able to serve pregnant women, including almost half of the hospital inpatient programs and one-quarter of the outpatient drug-free programs. Although almost 70 percent of programs reported being able to serve clients with mobility impairments, only 26 percent of the residential programs reported this capacity.¹¹⁷

Preventing AIDS in Communities of Color

Working in predominantly Puerto Rican and African-American communities of the inner cities, researchers are witness to a widening divide between the spread of HIV among non-Hispanic whites—generally white men who have sex with men—and the spread of HIV in communities of color. A recent study describes the dramatic and increasing overrepresentation of AIDS cases diagnosed each year in the United States among communities of color, despite the work of public health and community-based educators. The investigators suggest that the increases in HIV and AIDS among persons of color reflect specific shortcomings in current AIDS prevention work. For example, risk group categories may have a role in tracking and predicting the course of the epidemic, but they have little utility when used to lump individuals of differing ethnicities, cultures, and experiences into the same social category because they share a common potential route of infection. In addition, the theoretical models of motivation and behavioral change that predominate in AIDS prevention tend to focus on the individual level, with little consideration of family, communities, and the broader society. The researchers propose that the lessons learned from their work in AIDS prevention serve as guideposts for the development of new approaches to combat the epidemic in communities of color, particularly the need to refocus AIDS prevention as social prevention, with decreased attention on individual-level prevention models and epidemiologic risk exposure categories, and much greater emphasis on three emergent contexts of AIDS risk reduction: networks, neighborhoods, and natural social groups.¹¹⁸

As part of a NIDA Cooperative Agreement, a study was conducted to identify variables associated with HIV seropositivity among migrant workers in rural southern Florida. Researchers studied male and female migrant workers, of whom more than half were born in the United States. All the migrant workers surveyed currently used drugs, primarily crack cocaine, and 11.2 percent of the participants were HIV positive, including 18 percent of African Americans born in the United States and 8.0 percent of U.S. born non-Hispanic whites. The investigators identified race/ethnicity, gender, and age as significantly associated with being HIV positive. Immigration status, current drug use, and current sexual activity were not related to HIV seropositivity. These findings indicate that HIV prevention programs must address risks associated with heterosexual transmission of HIV as well as drug use both locally and where migrants travel and work.¹¹⁹

Risk Factors for Substance Use in African-American Children

Investigators have now developed and tested a model of parental and family influences on risks for substance use in inner-city African-American primary grade children and their adolescent siblings. The risk factors investigated were conceptually grouped into three broad domains of family influences and the respective indexes computed: (1) parental risk attributes, (2) family risk attributes, and (3) parenting styles. Parenting styles were captured as indicators of a latent construct, "poor parenting." In the first of two studies, the investigators hypothesized that the

parental and family risk variables would be mediated through parenting styles to predict intentions to use drugs, actual drug use, positive drug attitudes, and negative drug attitudes. In a second study, the substance use risk model was tested on a sample of adolescent siblings to determine whether the pattern of parental and family factors that contributed to early high-risk attitudes and behaviors in children would predict drug attitudes and behaviors in teen siblings. The results confirmed expectations that parental and family risks were important predictors of children's negative drug attitudes and intentions to use drugs in the future and that positive parental and family characteristics would protect against future risk by enhancing negative drug attitudes. Also, substance use attitudes and behaviors in teen siblings were predicted primarily by family risk characteristics. The family risk index also predicted frequency of use of hard drugs but only when mediated through poor parenting.¹²⁰

Trends Among American Indian Youth

Drug use among American Indian youth residing on reservations continues to be much more common than among their non-Indian peers. Although overall drug use has decreased from its high levels of the 1970s and 1980s, heavy involvement with drugs is reported by about 20 percent of Indian adolescents, a proportion that has not changed since 1980. The investigator concludes that Indian youth, particularly dropouts, remain at high risk for drug use and abuse. Similar trends for these youth and their non-Indian counterparts suggest that prevention strategies effective with other youth can be effective with Indian youth.¹²¹

Outreach and International Programs

A critical component of NIDA's mission has to include efforts to make the results of the Institute's research programs available to as wide an audience as possible. During the past 3 years, the Institute has not only increased the number of publications issued each year but has also broadened the audience for information on drug use and addiction and made all its current publications available for review and downloading via the Institute's Web site at www.nida.nih.gov.

Science education plays an important role in NIDA's outreach efforts, and three new teaching resources—"The Neurobiology of Addiction," "The Brain & the Actions of Cocaine, Opiates, and Marijuana," and the "Mind Over Matter" series—represent important contributions to the science education field. The Mind Over Matter series recently won a Silver Certificate in the Astrid Awards given by MerComm, Inc. The series was developed by NIDA to teach middle school students about how drugs of abuse act in the brain. The series consists of six full-color glossy magazines—one each on marijuana, opiates, stimulants, hallucinogens, inhalants, and steroids—that unfold into posters, along with a teacher's guide that provides additional information on the brain and the effects of drugs.

The Institute also added three new titles to its series of Research Reports, bringing the series total to five. The reports in this series aim to simplify the science of

research findings for the educated lay public, legislators, educational groups, and clinical practitioners. The new reports cover heroin use and addiction, methamphetamine use and addiction, and nicotine addiction. Each report defines in clear language what the drug is, why it is addictive, the extent of use in this country, and the medical consequences of drug use, all based on the latest scientific findings. The reports also provide lists of further reading and Web sites that contain additional information.

A highlight of the past year's outreach effort was including the publication of two new Therapy Manuals for Drug Addiction. Manual 1, "A Cognitive-Behavioral Approach: Treating Cocaine Addiction," and Manual 2, "A Community Reinforcement Approach: Treating Cocaine Addiction," have received widespread praise from the medical and treatment communities. These manuals present clear, helpful information to aid drug treatment practitioners in providing the best possible care that science has to offer. They describe scientifically supported therapies for addiction and give guidance on session content and on how to implement scientific techniques.

NIDA has also sponsored a continuing series of meetings and symposia for the medical and research community. For example, in 1998 NIDA sponsored the National Conference on Drug Addiction Treatment: From Research to Practice. This meeting brought together more than 800 leaders of national professional organizations, treatment practitioners and providers, criminal justice and law enforcement personnel, constituent organizations, policymakers, and the media. The meeting allowed researchers and service providers to exchange findings about what treatments work; what aspects of individual programs are transferable to other sites; and how treatment programs can be tailored for specific populations, such as women, children, and adolescents. NIDA's "Addicted to Nicotine" Conference held in July was also well received.

The Institute has also sponsored a series of public "Town Meetings" around the country to confront local drug use and addiction issues. To date, NIDA-sponsored town meetings have taken place in Boston, Dallas, Philadelphia, and most recently, Des Moines. For example, the Boston Town Meeting, "Understanding Drug Abuse and Addiction: Myths vs. Reality," was coordinated by the Institute following the outrage that followed the heroin overdose death of a popular Boston firefighter. Attendees included scientists, civic leaders, policymakers, public officials, and drug use prevention and treatment professionals. Key drug use researchers discussed trends and patterns of drug use in the Boston area, community attitudes toward alcohol and drug use, effective drug prevention and treatment strategies, and the impact of managed care. In addition, participants considered how the results of research could be used to improve local responses to the problem and to shape local and statewide policy. The general public was invited and encouraged to participate in an open discussion on the problem of drug use in the State of Massachusetts and in the Boston area.

NIDA also published a new guide to help communities determine the nature of their local drug problems. The guide, titled "Assessing Drug Abuse Within and Across Communities," is an 80-page tool for communities to use to detect, quantify, and categorize the local drug use problem. It explains the use of community epidemiology surveillance networks for drug use and why they are needed and describes how a community can establish such a network. It then provides extensive information about organizing and interpreting data from different sources, including drug use treatment data, medical examiner and coroner data, law enforcement data, HIV/AIDS data, and data from State and local drug use surveys. It also provides several exhibits of data collection efforts done by various States and cities as well as an appendix of resources to assist with the local assessment. Information generated through this assessment can be used to alert prevention, treatment, and public health officials, as well as the general public, so that timely action can be taken.

The Institute also sponsored a 1-day seminar with the Ohio Department of Alcohol and Drug Addiction Services titled "Strengthening Communities Through Prevention: Applying Research to Policies and Programs." The event, which brought together local and State policymakers, focused on state-of-the-art approaches to preventing drug and alcohol use.

NIDA has also started several new outreach programs. The NIDA InfoFax service makes information on drug use and addiction available 24 hours a day by fax or the Internet. The documents, available in Spanish and English, provide information that the public can understand on every drug of abuse as well as on research, treatment, and prevention issues.

NIDA has also continued its well-regarded international program to disseminate the latest research findings beyond our Nation's borders and to benefit from the work of leading scholars from outside the United States. The Institute has continued funding two fellowship programs, INVEST (International Visiting Scholars and Technical Exchange Program) Research Fellowship and the NIDA Hubert H. Humphrey Drug Abuse Research Fellowship. In addition, NIDA funds a travel awards program to enable meetings between NIDA-sponsored investigators and their international colleagues.

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Appendix: Commonly Abused Drugs

COMMONLY ABUSED DRUGS

Substance	Examples of Proprietary or Street Names	Medical Uses	Route of Administration	DEA Schedule*	Period of Detection
Stimulants					
Amphetamine	Biphetamine, Dexedrine; Black Beauties, Crosses, Hearts	Attention deficit/hyperactivity disorder (ADHD), obesity, narcolepsy	Injected, oral, smoked, sniffed	II	1-2 days
Cocaine	Coke, Crack, Flake, Rocks, Snow	Local anesthetic, vasoconstrictor	Injected, smoked, sniffed	II	1-4 days
Methamphetamine	Desoxyn; Crank, Crystal, Glass, Ice, Speed	ADHD, obesity, narcolepsy	Injected, oral, smoked, sniffed	II	1-2 days
Methylphenidate	Ritalin	ADHD, narcolepsy	Injected, oral	II	1-2 days
Nicotine	Habitrol patch, Nicorette gum, Nicotrol spray, Prostep patch; Cigars, Cigarettes, Smokeless Tobacco, Snuff, Spit Tobacco	Treatment for nicotine dependence	Smoked, sniffed, oral, transdermal	Not scheduled	1-2 days
Hallucinogens and Other Compounds					
LSD	Acid, Microdot	None	Oral	I	8 hours
Mescaline	Buttons, Cactus, Mesc, Peyote	None	Oral	I	2-3 days
Phencyclidine and Analogs	PCP; Angel Dust, Boat, Hog, Love Boat	Anesthetic (veterinary)	Injected, oral, smoked	I, II	2-8 days
Psilocybin	Magic Mushroom, Purple Passion, Shrooms	None	Oral	I	8 hours
Amphetamine Variants	DOB, DOM, MDA, MDMA; Adam, Ecstasy, STP, XTC	None	Oral	I	1-2 days
Marijuana	Blunt, Grass, Herb, Pot, Reefer, Sinsemilla, Smoke, Weed	None	Oral, smoked	I	1 day - 5 weeks
Hashish	Hash	None	Oral, smoked	I	1 day - 5 weeks
Tetrahydrocannabinol	Marinol, THC	Antiemetic	Oral, smoked	I, II	1 day - 5 weeks

COMMONLY ABUSED DRUGS (CONTINUED)

Substance	Examples of Proprietary or Street Names	Medical Uses	Route of Administration	DEA Schedule*	Period of Detection
Hallucinogens and Other Compounds (continued)					
Anabolic Steroids	Testosterone (T/E ratio), Stanozolol, Nandrolene	Hormone replacement therapy	Oral, injected	III	Oral: up to 3 weeks (for testosterone and others); injected: up to 3 months (Nandrolene; up to 9 months)
Opioids and Morphine Derivatives					
Codeine	Tylenol with codeine, Robitussin A-C, Empirin with codeine, Fiorinal with codeine	Analgesic, antitussive	Injected, oral	II, III, IV	1-2 days
Heroin	Diacetylmorphine; Horse, Smack	None	Injected, smoked, sniffed	I	1-2 days
Methadone	Amidone, Dolophine, Methadose	Analgesic, treatment for opiate dependence	Injected, oral	II	1 day - 1 week
Morphine	Roxanol, Duramorph	Analgesic	Injected, oral, smoked	II, III	1-2 days
Opium	Laudanum, Paregoric; Dover's Powder	Analgesic, antidiarrheal	Oral, smoked	II, III, V	1-2 days
Depressants					
Alcohol	Beer, Wine, Liquor	Antidote for methanol poisoning	Oral	Not scheduled	6-10 hours
Barbiturates	Amytal, Nembutal, Seconal, Phenobarbital; Barbs	Anesthetic, anticonvulsant, hypnotic, sedative	Injected, oral	II, III, IV	2-10 days
Benzodiazepines	Activan, Halcion, Librium, Rohypnol, Valium; Roofies, Tranks, Xanax	Antianxiety, anticonvulsant, hypnotic, sedative	Injected, oral	IV	1-6 weeks
Methaqualone	Quaalude, Ludes	None	Oral	I	2 weeks

* Drug Enforcement Administration (DEA) Schedule I and II drugs have a high potential for abuse. They require greater storage security and have a quota on manufacture among other restrictions. Schedule I drugs are available for research only and have no approved medical use. Schedule II drugs are available only through prescription, cannot have refills, and require a form for ordering. Schedule III and IV drugs are available with prescription, may have five refills in 6 months, and may be ordered orally. Most Schedule V drugs are available over the counter.