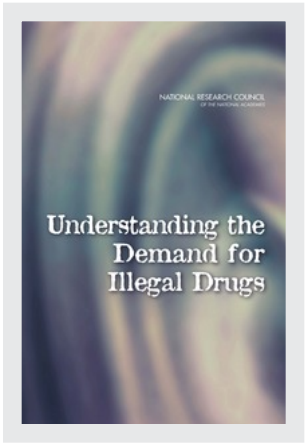
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Understanding the Demand for Illegal Drugs

Committee on Understanding and Controlling the Demand for Illegal Drugs

Peter Reuter, *Editor*

Committee on Law and Justice

Division of Behavioral and Social Sciences and Education

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COMMITTEE ON UNDERSTANDING AND CONTROLLING THE DEMAND FOR ILLEGAL DRUGS
2007

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COMMITTEE ON LAW AND JUSTICE
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Preface

Almost 10 years ago, a National Research Council committee surveyed the data and research supporting the nation's drug policy. The subtitle of the report, *What We Don't Know Keeps Hurting Us*, accurately summarized the committee's pessimistic assessment. The available datasets, though numerous, provided inadequate coverage and the existing research in many areas was thin in quantity and weak in quality.

This more modest report, focused on just research needs to better understand the demand for drugs, unfortunately reinforces that pessimistic message. None of the major recommendations of the earlier report has been implemented. Though some data sets have been strengthened, particularly the National Survey on Drug Use and Health, others have deteriorated, notably the Arrestee Drug Abuse Monitoring and the Drug Abuse Warning Network. There has been no expansion of research on the effects of enforcement, the major approach by which the United States attempts to control both the supply and demand for drugs.

The starting point for the current project is that, despite continued heavy investment in drug control, the demand for illegal drugs continues to be substantial. Within the bounds of very limited resources, the current committee has set out to identify what we do know about the sources of the continued demand and about how to improve that knowledge. It identifies what should be done to improve that knowledge. The commitment of the director of the Office of National Drug Control Policy to strengthening the science base for policy making and the designation of

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drug-related morbidity and mortality as principal targets for policy making, give hope that the situation can be improved in the future.

This project would not have been possible without the cooperation and assistance of many individuals. The committee extends its appreciation and thanks especially to all the presenters and discussants who participated in our workshop: see the Appendix at the end of this report.

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the Report Review Committee of the National Research Council (NRC). The purpose of this independent review is to provide candid and critical comments that assist the institution in making the published report as sound as possible and ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process.

We thank the following individuals for their participation in the review of the report: Linda B. Cottler, Epidemiology and Prevention Research Group, Department of Psychiatry, Washington University School of Medicine, St. Louis, MO; Louisa Degenhardt, National Drug and Alcohol Research Centre, University of New South Wales, Australia; Lee D. Hoffer, Department of Anthropology, Case Western Reserve University; Robert MacCoun, Goldman School of Public Policy, University of California, Berkeley; Charles P. O'Brien, Department of Psychiatry, University of Pennsylvania; Maureen O'Connor, Department of Psychology, John Jay College, and Doctoral Programs in Psychology, Graduate Center, City University of New York; and William Rhodes, Principal Scientist, Abt Associates.

Although the reviewers listed above provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations nor did they see the final draft of the report before its release. The review of this report was overseen by Charles E. Phelps, University of Rochester (emeritus). Appointed by the NRC, he was responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring panel and the institution.

Peter Reuter, *Chair*
Committee on Understanding and
Controlling the Demand for Illegal Drugs

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Summary

A great deal has been done to try to reduce drug consumption in the United States over the past 35 years, but drugs are just as cheap and available as they have ever been. Cocaine, heroin, and methamphetamines continue to cause great harm in the country, particularly in minority communities in the major cities. Marijuana use remains a part of adolescent development for about half of the country's young people, although there is controversy about the extent of its harm.

In light of the continued problems with illegal drug use, the National Institute of Justice asked the National Research Council (NRC) to undertake a study of current research on the demand for drugs. The statement of task for this project is as follows:

> An ad hoc committee will conduct a workshop-based study that will identify and describe what is known about the nature and scope of markets for illegal drugs and the characteristics of drug users. The study will include exploration of research issues associated with drug demand and what is needed to learn more about what drives demand in the United States. The committee will specifically address the following issues:
>
> 1. What is known about the nature and scope of illegal drug markets and differences in various markets for popular drugs?
> 2. What is known about the characteristics of consumers in different markets and why the market remains robust despite the risks associated with buying and selling?
> 3. What issues can be identified for future research? Possibilities include the respective roles of dependence, heavy use, and recreational use in fueling the market; responses that could be developed to address

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> different types of users; the dynamics associated with the apparent failure of policy interventions to delay or inhibit the onset of illegal drug use for a large proportion of the population; and the effects of enforcement on demand reduction.
>
> Drawing on commissioned papers and presentations and discussions at a public workshop that it will plan and hold, the committee will prepare a report on the nature and operations of the illegal drug market in the United States and the research issues identified as having potential for informing policies to reduce the demand for illegal drugs.

This charge was extremely broad. It could have included literature reviews on such topics as characteristics of substance users, etiology of initiation of use, etiology of dependence, drug use prevention programs, and drug treatments. Two considerations led to narrowing the focus of our work. The first was substantive. Each of the topics just noted involves very large fields of well-developed research, and each has been reviewed elsewhere. Moreover, each of those areas of inquiry is currently expanding as a result of new research initiatives (such as the National Epidemiologic Survey on Alcohol and Related Conditions and the Community Epidemiology Work Group of the National Institute on Drug Abuse) and new technologies (e.g., neuroimaging, genetics). The second consideration was practical: given the available resources, we could not undertake a complete review of the entire field.

Thus, this report focuses tightly on demand models in the field of economics and on evaluating the data needs for advancing this relatively undeveloped area of investigation. Although this area has a relatively shorter history of accumulated findings than the more clinical, biological, and epidemiological areas of drug research, it is arguably better situated to inform government policy at the national level. A report on economic models and supporting data seemed to us more timely than a report on drug consumers and drug interventions.

The committee drew on economic models and their supporting data, as well as related research, as one part of the evidentiary base for this report. In addition, the committee's workshop provided the context for and contributed to the content of this report.

The committee was not able to fully address task 2 in our statement of work because research in that area is not strong enough to give an accurate description of consumers across different markets nor to address the question of why markets remain robust despite the risks associated with buying and selling drugs. The discussion at the workshop underscored the point that the available ethnographic research and the limited longitudinal research on drug-seeking behavior are not strong enough to inform those questions.

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The study is intended to complement the 2001 NRC volume, *Informing America's Policy on Illegal Drugs: What We Don't Know Keeps Hurting Us* (Washington, DC, National Academy Press), by giving more attention specifically to the sources of demand and assessing the potential of treatment to make a substantial difference in the use of illegal drugs.

FINDINGS

Drug Markets

Illegal drug markets have several distinctive features as markets:

- imperfect information: uncertainty by both sellers and buyers about the quality and quantity of drugs in a transaction;
- the phenomena of epidemics and contagion: drug use can increase with great speed and can spread through social contact; and
- law enforcement: a nonmarket factor that affects the price of drugs and the manner in which they are distributed.

Prevention and Treatment

The measured effectiveness of programs at the population level is discouraging, while the evidence on treatment is encouraging. However, there are difficulties inherent in measuring individual illegal drug use—a covert behavior that occurs outside the framework of legal markets. The problem is further complicated by the heterogeneity of drug use: there are major differences between a large number of occasional users who do not satisfy formal diagnostic criteria for abuse or dependence and smaller groups of regular and frequent users of heroin, cocaine, and amphetamine who meet dependence criteria.

Available Data and Research

The data on prevalence, which come from nationally representative population and treatment surveys (covering, respectively, the noninstitutionalized and treatment populations), are of limited value in understanding the full extent of drug use. Because of limitations in both their sampling frames and the high nonresponse rates, they fail to capture information about the respective roles of heavy use and recreational use in drug markets, the dynamics associated with the apparent failure of policy interventions to delay or inhibit the onset of illegal drug use for a large proportion of the population, and the effects of enforcement on demand reduction.

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The largest of the population surveys, the National Survey of Drug Use and Health (NSDUH) of the U.S. Department of Health and Human Services (HHS), has implemented several methodological improvements over its predecessor, the National Household Survey of Drug Abuse, to increase response rates and improve data quality, but it continues to miss a large fraction of those with the most serious drug abuse problems.

Increasingly, new methodologies are being used to reach and survey hidden populations. Yet there has been little research on the strengths, weaknesses, and best practices of the methodologies. There are important questions about the impact of respondent incentive payments on research participation that would be valuable. Also missing in current work is attention to explicitly coordinating the NSDUH with other high-quality datasets in areas important to substance abuse.

Monitoring the Future (MTF), the long-term and ongoing study of the behaviors, attitudes, and values of U.S. secondary school students, college students, and young adults, supported by the National Institute on Drug Abuse, continues to collect potentially valuable longitudinal data each year. The committee endorses the recommendation of a previous NRC committee for the National Institute on Drug Abuse to find ways to provide wider research access to the MTF data.

Indicator Systems

There have been major losses of indicator systems in recent years, especially the Arrestee Drug Abuse and Monitoring (ADAM) system of the U.S. Department of Justice, which studied criminally active drug offenders and was ended in 2003. ADAM was restarted by the Office of National Drug Control Policy, but only in 10 cities. It is less important for the data it provides on the levels of drug use among arrestees than it is as a platform for studying the behavior of the population that may account for a very large proportion of cocaine, heroin, and methamphetamine used in the United States. It appears impossible to develop estimates of the quantities used and expenditures on illegal drugs without data from these populations.

HHS's Treatment Episode Data System (TEDS), originally developed as an administrative dataset, has become an increasingly valuable research tool in understanding changing patterns of illegal drug use. It provides a large-sample dataset on the circumstances of individuals entering substance abuse treatment. The recent addition of a discharge dataset to supplement the admissions dataset may provide an important new source of information for understanding drug use.

TEDS might be made more valuable through the inclusion of individual identifiers, including specific sociodemographic identifiers, or by

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adding supplementary surveys conducted on a subsample of clients. Such additions would provide a richer body of information on the characteristics of noncriminal drug users. In addition, better principles and procedures for epidemiological surveillance about emerging forms of substance abuse and emerging patterns of drug-related harms to human health are needed.

RECOMMENDATIONS

To increase the data available and strengthen the research base for understanding illegal drug use, the committee offers recommendations on the following topics:

- Conduct longitudinal research to examine the effects of treatment participation on long-term trajectories of drug use and desistence.
- Coordinate with the criminal justice system to evaluate treatment diversion programs that may increase treatment participation and improve outcomes.
- Continue to adopt and study improved treatment methods that may produce more reliable long-term desistence from drugs with consequent demand reduction.
- Take advantage of natural experiments to examine the effects of treatment expansion on drug use outcomes and demand reduction.
- Conduct systematic research or demonstration projects on treatment expansion to understand its effects on drug use outcomes and demand reduction.

The United States has developed strong data systems that shed light on illegal drug markets, but they are incomplete. Given the tens of billions of dollars spent annually to address the social harms associated with illegal drug use, policy makers and the public stand to gain significantly with improved data systems and research that will allow them to assess the value of those expenditures. Better data and research offer the potential to uncover new opportunities to halt or prevent illegal drug use or to render such drug use less harmful to the nation.

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1

Introduction

America's problem with illegal drugs seems to be declining, and it is certainly less in the news than it was 20 years ago. Surveys have shown a decline in the number of users dependent on expensive drugs (Office of National Drug Control Policy, 2001), an aging of the population in treatment (Trunzo and Henderson, 2007), and a decline in the violence related to drug markets (Pollack et al., 2010). Still, research indicates that illegal drugs remain a concern for the majority of Americans (Caulkins and Mennefee, 2009; Gallup Poll, 2009).

There is virtually no disagreement that the trafficking in and use of cocaine, heroin, and methamphetamine continue to cause great harm to the nation, particularly to vulnerable minority communities in the major cities. In contrast, there is disagreement about marijuana use, which remains a part of adolescent development for about half of the nation's youth. The disagreement concerns the amount, source, and nature of the harms from marijuana. Some note, for example, that most of those who use marijuana use it only occasionally and neither incur nor cause harms and that marijuana dependence is a much less serious problem than dependence on alcohol or cocaine. Others emphasize the evidence of a potential for triggering psychosis (Arseneault et al., 2004) and the strengthening evidence for a gateway effect (i.e., an opening to the use of other drugs) (Fergusson et al., 2006). The uncertainty of the causal mechanism is reflected in the fact that the gateway studies cannot disentangle the effect of the drug itself from its status as an illegal good (Babor et al., 2010).

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BACKGROUND

The federal government probably spends $20 billion per year on a wide array of interventions to try to reduce drug consumption in the United States, from crop eradication in Colombia to mass media prevention programs aimed at preteens and their parents.[1] State and local governments spend comparable amounts, mostly for law enforcement aimed at suppressing drug markets.[2] Yet the available evidence, reviewed in detail in this report, shows that drugs are just as cheap and available as they have ever been.

Though fewer young people are starting to use drugs than in some previous years, for each successive birth cohort that turns 21, approximately half have experimented with illegal drugs. The number of people who are dependent on cocaine, heroin, and methamphetamine is probably declining modestly,[3] and drug-related violence has appears to have declined sharply.[4] At the same time, injecting drug use is still a major vector for HIV transmission, and drug markets blight parts of many U.S. cities.

The declines in drug use that have occurred in recent years are probably mostly the natural working out of old epidemics. Policy measures—whether they involve prevention, treatment, or enforcement—have met with little success at the population level (see Chapter 4). Moreover, research on prevention has produced little evidence of any targeted interventions that make a substantial difference in initiation to drugs when implemented on a large scale. For treatment programs, there is a large body of evidence of effectiveness and cost-effectiveness (reviewed in Babor et al., 2010), but the supply of treatment facilities is inadequate and,

[1]The official estimate from the Office of National Drug Control Policy of $14.8 billion in fiscal 2009 excludes a number of major items, such as the cost of prosecuting and incarcerating those arrested by federal agencies for violations of drug laws. See Carnevale (2009) for a detailed analysis of the limits of the official estimate of the federal drug budget.

[2]The only estimates of drug-related expenditures by state and local governments are for 1990 and 1991 (Office of National Drug Control Policy, 1993). Given the number of people prosecuted and incarcerated each year for drug offenses, that estimate remains a plausible but unsubstantiated claim.

[3]The most recent published estimates only extend through 2000 (Office of National Drug Control Policy, 2001).

[4]There are no specific indices that measure drug-related violence. The assumption of reduced violence reflects an inference from (1) the aging of the populations that are dependent on cocaine, heroin, and methamphetamine as reflected in the Treatment Episode Data Set, maintained by the Substance Abuse and Mental Health Administration of the U.S. Department of Health and Human Services; (2) the declining share of arrests of drug users that are for violent crimes, as reflected in the Surveys of Prison and Jail Inmates (Pollack et al., 2010); (3) the 70 percent decline in homicides since 1991; and (4) the increasing share of drug transactions that are conducted in nonpublic settings.

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perversely, not enough of those who need treatment are persuaded to seek it (see Chapter 4). Efforts to raise the price of drugs through interdiction and other enforcement programs have not had the intended effects: the prices of cocaine and heroin have declined for more than 25 years, with only occasional upward blips that rarely last more than 9 months (Walsh, 2009).

STUDY PROJECT AND GOALS

Given the persistence of drug demand in the face of lengthy and expensive efforts to control the markets, the National Institute of Justice asked the National Research Council (NRC) to undertake a study of current research on the demand for drugs in order to help better focus national efforts to reduce that demand. In response to that request, the NRC formed the Committee on Understanding and Controlling the Demand for Illegal Drugs. The committee convened a workshop of leading researchers in October 2007 and held two follow-up meetings to prepare this report. The statement of task for this project is as follows:

> An ad hoc committee will conduct a workshop-based study that will identify and describe what is known about the nature and scope of markets for illegal drugs and the characteristics of drug users. The study will include exploration of research issues associated with drug demand and what is needed to learn more about what drives demand in the United States. The committee will specifically address the following issues:
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> 1. What is known about the nature and scope of illegal drug markets and differences in various markets for popular drugs?
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> 3. What issues can be identified for future research? Possibilities include the respective roles of dependence, heavy use, and recreational use in fueling the market; responses that could be developed to address different types of users; the dynamics associated with the apparent failure of policy interventions to delay or inhibit the onset of illegal drug use for a large proportion of the population; and the effects of enforcement on demand reduction.
>
> Drawing on commissioned papers and presentations and discussions at a public workshop that it will plan and hold, the committee will prepare a report on the nature and operations of the illegal drug market in the United States and the research issues identified as having potential for informing policies to reduce the demand for illegal drugs.

The committee drew on economic models and their supporting data, as well as other research, as one part of the evidentiary base for this

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report. However, the context for and content of this report were informed as well by the general discussion and the presentations in the workshop. The committee was not able to fully address task 2 because research in that area is not strong enough to give an accurate description of consumers across different markets nor to address the questions about why markets remain robust despite the risks associated with buying and selling. The discussion at the workshop underscored the point that neither the available ethnographic research nor the limited longitudinal research on drug-seeking behavior is strong enough to inform these questions related to task 2. With regard to task 3, the committee benefitted considerably from the paper by Jody Sindelar that was presented at the workshop and its discussion by workshop participants.

This study was intended to complement *Informing America's Policy on Illegal Drugs: What We Don't Know Keeps Hurting Us* (National Research Council, 2001) by giving more attention to the sources of demand and assessing the potential of demand-side interventions to make a substantial difference to the nation's drug problems. This report therefore refers to supply-side considerations only to the extent necessary to understand demand.

The charge to the committee was extremely broad. It could have included reviewing the literature on such topics as characteristics of substance users, etiology of initiation of use, etiology of dependence, drug use prevention programs, and drug treatments. Two considerations led to narrowing the focus of our work. The first was substantive. Each of the topics just noted involves a very large field of well-developed research, and each has been reviewed elsewhere. Moreover, each of these areas of inquiry is currently expanding as a result of new research initiatives[5] and new technologies (e.g., neuroimaging, genetics). The second consideration was practical: given the available resources, we could not undertake a complete review of the entire field.

Thus, we decided to focus our work and this report tightly on demand models in the field of economics and to evaluate the data needs for advancing this relatively undeveloped area of investigation. That is, this area has a relatively shorter history of accumulated findings than the more clinical, biological, and epidemiological areas of drug research. Yet it is arguably better situated to inform government policy at the national level. A report on economic models and supporting data seemed to us more timely than a report on drug consumers and drug interventions.

The rest of this chapter briefly lays out some concepts that provide a basis for understanding the committee's work and the rest of the report.

[5]These include the National Epidemiologic Survey on Alcohol and Related Conditions and the Community Epidemiology Work Group of the National Institute on Drug Abuse.

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Chapter 2 presents the economic framework that seems most useful for studying the phenomenon of drug demand. It emphasizes the importance of understanding the responsiveness of demand and supply to price, which is the intermediate variable targeted by the principal government programs in the United States, namely, drug law enforcement. Chapter 3 then examines changes in the consumption of drugs and assesses the various indicators that are available to measure that consumption. Chapter 4 turns to the program type that most focuses specifically on reducing drug demand, the treatment of dependent users. It considers how well these programs work and how the treatment system might be expanded to further reduce consumption. Finally, Chapter 5 presents our recommendations for how the data and research base might be built to improve understanding of the demand for drugs and policies to reduce it.

PROGRAM CONCEPTS

A standard approach to considering drug policy is to divide programs into supply side and demand side. This approach accepts that drugs, as commodities, albeit illegal ones, are sold in markets. Supply-side programs aim to reduce drug consumption by making it more expensive to purchase drugs through increasing costs to producers and distributors. Demand-side programs try to lower consumption by reducing the number of people who, at a given price, seek to buy drugs; the amount that the average user wishes to consume; or the nonmonetary costs of obtaining the drugs. This approach has value, but it also raises questions.

The value of this framework is that it allows systematic evaluation of programs. A successful supply-side program will raise the price of drugs, as well as reduce the quantity available, while a demand-side program will lower both the number of users and the quantity consumed, as well as eventually reducing the price. As noted above, this report is primarily focused on improving understanding of the sources of demand.

There are two basic objections to this approach. First, some programs have both demand- and supply-side effects. Since many dealers are themselves heavy users, drug treatment will reduce supply, just as incarceration of drug dealers lowers demand. Second, there is a collection of programs that do not attempt to reduce demand or supply; rather, their goal is to reduce the damage that drug use and drug markets cause society, which are generally referred to as "harm-reduction" programs (Iversen, 2005; National Institute on Drug Abuse, 2010).[6] Nonetheless, the classifi-

[6]An expanded classification to include harm-reduction programs is common in the drug control strategies of other countries, including Australia, Switzerland, and the United Kingdom.

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cation of interventions into demand reduction and supply reduction is a very helpful heuristic for policy purposes, as well as being written into the legislation under which the Office of National Drug Control Policy operates.

What determines the demand for drugs? Clearly, many different factors play a role: cultural, economic, and social influences are all important. At the individual level, a rich set of correlates have been explored, either in large-scale cross-sectional surveys (such as the National Survey on Drug Use and Health and the National Household Survey on Drug Abuse) or in small-scale longitudinal studies (see, e.g., Wills et al., 2005). Below we briefly summarize the complex findings of those studies.

Less has been done at the population level. It is known that rich western countries differ substantially in the extent of drug use, in ways that do not seem to reflect policy differences. For example, despite the relatively easy access to marijuana in the Netherlands, that nation has a prevalence rate that is in the middle of the pack for Europe, while Britain, despite what may be characterized as a pragmatic and relatively evidence-oriented drug policy, has Europe's highest rates of cocaine and heroin addiction (European Monitoring Center for Drugs and Drug Addiction, 2007). There is only minimal empirical research that has attempted to explain those differences. Similarly, there is very little known about why epidemics of drug use occur at specific times. In the United States, for example, there is no known reason for the sudden spread of methamphetamine from its long-term West Coast concentration to the Midwest that began in the early 1990s. There are only the most speculative conjectures as to the proximate causes.

A DYNAMIC AND HETEROGENEOUS PROCESS

The committee's starting point is that drug use is a dynamic phenomenon, both at the individual and community levels. In the United States there is a well-established progression of use of substances for individuals, starting with alcohol or cigarettes (or both) and proceeding through marijuana (at least until recently) possibly to more dangerous and expensive drugs (see, e.g., Golub and Johnson, 2001). Such a progression seems to be a common feature of drug use, although the exact sequence might not apply in other countries and may change over time. For example, cigarettes may lose their status as a gateway drug because of new restrictions on their use.[7] Recently, abuse of prescription drugs has emerged as a possible gateway, with high prevalence rates reported for youth aged 18-25;

[7]In Amsterdam, people can smoke marijuana at indoor cafes but not marijuana mixed with tobacco.

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however, because of limited economic research on this phenomenon, this report's focus is on completely illegal drugs.

At the population level, there are epidemics, in which, like a fashion good, a new drug becomes popular rapidly in part because of its novelty and then, often just as rapidly, loses its appeal to those who have not tried it. For addictive substances (including marijuana but not hallucinogens, such as LSD), that leaves behind a cohort of users who experimented with the drug and then became habituated to it.

An important and underappreciated element of the demand for illegal drugs is its variation in many dimensions. For example, the demand for marijuana may be much more responsive to price changes than the demand for heroin because fewer of those who use marijuana are drug dependent (Iversen, 2005; National Institute on Drug Abuse, 2010). Users who are employed, married, and not poor may be more likely to desist than users of the same drug who are unemployed, not part of an intact household, and poor. There may be differences in the characteristics of demand associated with when the specific drug first became available in a particular community, that is, whether it is early or late in a national drug "epidemic."

There are also unexplained long-term differences in the drug patterns in cities that are close to each other. In Washington, DC, in 1987 half of all those arrested for a criminal offense (not just for drugs) tested positive for phencyclidine, while in Baltimore, 35 miles away, the drug was almost unknown. Although the Washington rate had fallen to approximately 10 percent in 2009 (District of Columbia Pretrial Services Agency, 2009), it remains far higher than in other cities. More recently, the spread of methamphetamine has shown the same unevenness: in San Antonio only 2.3 percent of arrestees tested positive for methamphetamine in 2002; in Phoenix, the figure was 31.2 percent (National Institute of Justice, 2003). These differences had existed for more than 10 years.

The implication of this heterogeneity is that programs that work for a particular drug, user type, place, or period may be much less effective under other circumstances, which substantially complicates any research task. It is hard to know how general are findings on, say, the effectiveness of a prevention program aimed at methamphetamine use by adolescents in a city where the drug has no history. Will this program also be effective for trying to prevent cocaine use among young adults in cities that have long histories of that drug?

This report does not claim to provide the answers to such ambitious questions. It does intend, however, to equip policy officials and the public to understand what is known and what needs to be done to provide a more sound base for answering them.

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2

Markets for Drugs

This chapter uses the idea of a drug market as an analytical concept with which to consider how market-level demand and supply forces affect prices and drug use. Other social science research, such as ethnographic studies, provides much richer descriptions and other insights about how actual illegal drug markets function on a day-to-day basis, and our discussion of the distinctive features of drug markets incorporates insights from this type of research. Further developing the economic approach to capture more of the features of real-world drug markets across the world is an important on-going research topic.

This chapter provides a summary of what is known about major illegal drug markets. It first lays out the basic demand-and-supply analysis framework and explores the strengths and limitations of the basic models, and then considers three distinctive features of illegal drug markets:

1. the role of imperfect information: the fact that sellers and buyers are uncertain about the quality and quantity of drugs in a transaction;
2. epidemics and contagion: the sudden speed with which drug use can increase and the fact that it spreads through social contact; and
3. the role of enforcement in affecting the price of drugs and the manner in which they are distributed.

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FRAMEWORK: SUPPLY-AND-DEMAND MODEL

The supply-and-demand model provides the basic economic framework for drug policy. Efforts to provide economic models of illegal markets go back at least four decades (e.g., Becker, 1968), but the standard economic model has key limitations in understanding illegal drug markets. The implicit features of many legal markets in modern economies—for example, quality certification and available legal mechanisms to guard against fraud—are typically absent from illegal drug markets. Moreover, many key variables are difficult to observe. Illegal drug markets are also characterized by complex features, such as addiction (which means responses to increases and decreases in prices may differ) and high search costs (so that consumers must invest time in finding information about the product) that are sometimes found in legal markets but that are difficult to incorporate in simple models.

Despite these limitations, the basic supply-and-demand model provides a specific language to explore causal pathways of proposed public policies. It provides a framework to interpret available data on observed prices and quantities of illegal substances in particular markets. It focuses attention on basic parameters—the sensitivity of supply and demand to prevailing prices, production technologies, and costs—that are influenced by public policy. Finally, these simple models provide points of departure for richer theoretical and empirical investigations of particular markets. Figure 2-1 presents a very basic model to illustrate the impact of a supply-side law enforcement intervention.

The market demand curve D1 slopes downward: at higher prices, users in the aggregate purchase a lower quantity of the drug in question. The market demand curve reflects two types of responses to higher prices: some drug users cut back on their consumption, while others may drop out of the market and become nonusers (at least of the drug in question). As is discussed below, addiction raises the possibility of asymmetry in that lower prices may increase participation; higher prices may not reduce participation in the short run.

The market supply curve S1 slopes upward: at higher prices, the supply network is willing to provide more drugs to the market. The market supply curve again reflects two types of responses to higher prices: some current suppliers expand the size of their drug-dealing business, and there may also be new entrants who provide new sources of supply.

A supply-side intervention—such as increased border interdiction or more intensive police actions against street dealers—causes the market supply curve to shift up, or alternatively to the left, to curve S2. The vertical distance between S1 and S2 may be interpreted as the increase in unit production and distribution costs induced by supply-side interventions.

This shift captures the idea that to compensate for the extra risks and

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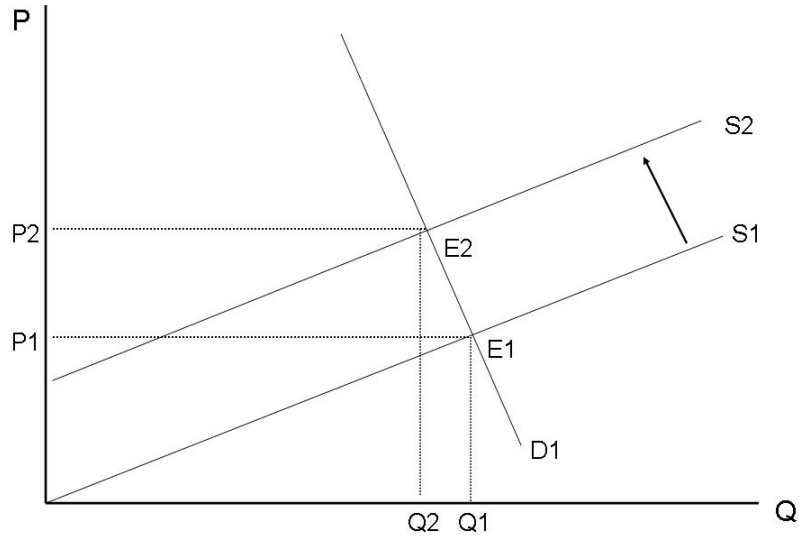


FIGURE 2-1 Impact of a supply-side enforcement with a steep demand curve.

costs created by the policy intervention, suppliers require a higher price to bring any given quantity of drugs to the market. *How much* the supply curve shifts depends on the effectiveness of the enforcement efforts and suppliers' ability to respond to those efforts. Suppose, for example, that police increase arrests of street-level dealers. How much this raises unit production costs reflects how much drug-selling organizations have to raise wages to compensate dealers for the additional risk, on the assumption that the dealers can estimate that rise. It also reflects how effectively these organizations can shift their production and distribution systems in response to these enforcement shifts. If sellers can shift sales activities indoors or otherwise avoid the increased enforcement, the shift from S1 to S2 will be small.

The standard model assumes that the market price adjusts until an equilibrium is reached at which the quantity demanded equals the quantity supplied. The original equilibrium in Figure 2-1 is E1: Q1, P1. After the supply-side intervention, a new equilibrium is reached, E2: Q2, P2. This new equilibrium reflects an interaction of both supply and demand factors. The relative slopes of these curves determine the extent that increased production costs are borne by consumers in the form of higher prices. The supply-and-demand model yields the fundamental insight that a supply-side intervention on the model of the "war on drugs"

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should produce higher drug prices. At the new drug market equilibrium E2, the market price of the drug is higher (P2 > P1), and the quantity of drugs purchased and consumed is lower (Q2 < Q1).

Even when this model is not explicitly used, this fundamental insight of the supply-and-demand model is commonly recognized. For example, when drug prices have remained constant or have fallen during a period of increased antidrug efforts, many observers conclude that the war on drugs has failed (e.g., Walsh, 2008). In essence, these observers view the market price of a drug as a sufficient statistic for, or at least a useful indicator of, conditions in the drug market. Although it cannot be interpreted as a performance measure without other indicators, it does have substantial information.

However, the information contained in the market price must be interpreted carefully. The first insight is illustrated by the difference between Figures 2-1 and 2-2. That comparison shows that the magnitudes of the effects of the same supply-side intervention depend on the steepness of the demand curve for drugs.

In Figure 2-2 with a relatively flat demand curve (i.e., one that is very responsive to price changes), the supply-side intervention causes a relatively small increase in the market price to P2′. Under this hypothetical situation, the war on drugs has worked quite well by sharply reducing the quantity of drugs consumed to Q2′. However, precisely because drug demand is so responsive to the higher prices caused by the intervention, the price does not have to increase much to restore equilibrium. In contrast, the sharp increase in price seen in Figure 2-1 is accompanied by a smaller reduction in the quantity of drugs consumed—the war on drugs did not work that well. The comparison of Figures 2-1 and 2-2 shows that it is important not to confuse the indicator—the market price—with the policy objective (reducing drug use).

Which figure is a more realistic description of the drug market depends on the price elasticity of demand (discussed in more detail below). In this situation elasticity denotes the percentage change in the quantity of drug demanded given a 1 percent increase in the price. In similar fashion, the price elasticity of supply denotes the percentage change in the quantity of drug supplied given a 1 percent increase in the price.[1]

One might assume, based on the commonsense notion of addiction, that drug demand is relatively inelastic or unresponsive to prices, which is the assumption behind Figure 2-1. However, as we discuss in more detail below, the price elasticity of demand varies across drugs (heroin, cocaine, marijuana), types of users (heavy, occasional), and time (with

[1]Given these definitions, the price elasticity of demand is generally negative, and the price elasticity of supply is generally positive.

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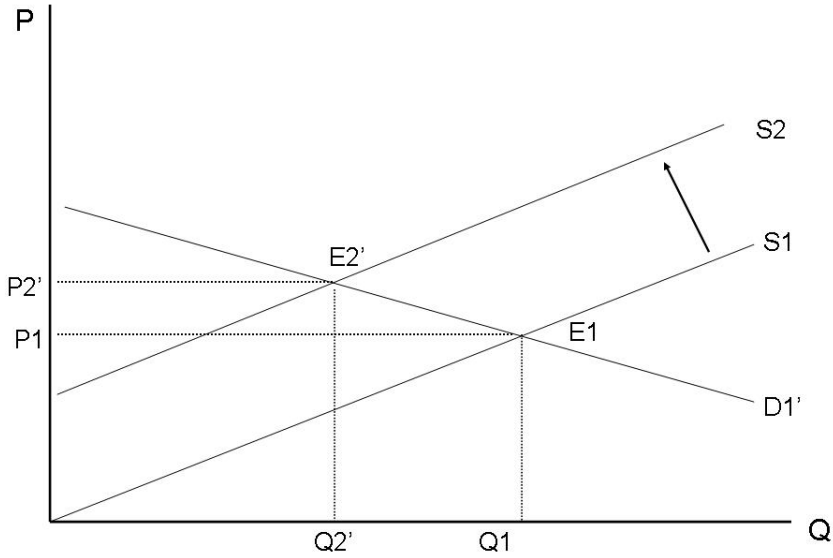


FIGURE 2-2 Impact of a supply-side enforcement with a flat demand curve.

consumers being more sensitive to price over the long term). In fact, demand for heavily addictive substances is consistent with a wide range of price elasticities. Suppose, for example, that an individual spends every cent of her monthly income on crack cocaine. If crack cocaine prices rise by 1 percent with no accompanying change in her economic circumstances, she will spend the same amount and thus purchase 1 percent less crack than she did before. This implies a price elasticity of demand of –1. Luksetich and White (1983) suggest, based on early ethnographic work, that heroin addicts may have a fixed budget for all items other than heroin, representing the minimum that is needed for shelter, food, and clothes; if so, there would be unitary price elasticity. In contrast, more affluent users of marijuana, for whom the drug accounts for a small share of their total incomes, may change their total consumption very little in response to price increases.

A second insight is that many market factors other than price can cause drug demand to shift. The analytical emphasis of the supply-and-demand model is on prices and quantities, but this analytical emphasis does not mean that price is the most important empirical demand influence. The demand curve shows the relationship between quantity demanded and price if all other influences are constant. When one or more of these other influences change, the entire demand curve shifts: at each given price, the quantity of the drug demanded has shifted.

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Potential demand shifters include demand-side public policies, such as antidrug media campaigns or treatment programs; law enforcement measures that target users; demographic factors; changing attitudes toward intoxication and self-control; and economic factors, such as income and employment opportunities. Under the conventional view that drug demand is relatively price inelastic, changes in these other influences are likely to be important explanations for observed variation in drug markets over time and across geographic units, particularly since some of them, especially tastes, can change rapidly.

Demand-side policies seek to shift the demand curve down (left). All else being equal, such policies shift the equilibrium down the supply curve, resulting in a lower equilibrium price and a lower quantity of drugs consumed. If social harms associated with illegal drug use are positively related to the dollars spent on these substances (since these are criminal incomes), demand-side interventions are especially attractive because they induce favorable price and quantity effects, while supply-side interventions generate only favorable quantity effects.

Demand shifts can also obscure the impact of supply-side interventions. Figure 2-3 shows a hypothetical situation in which a supply-side

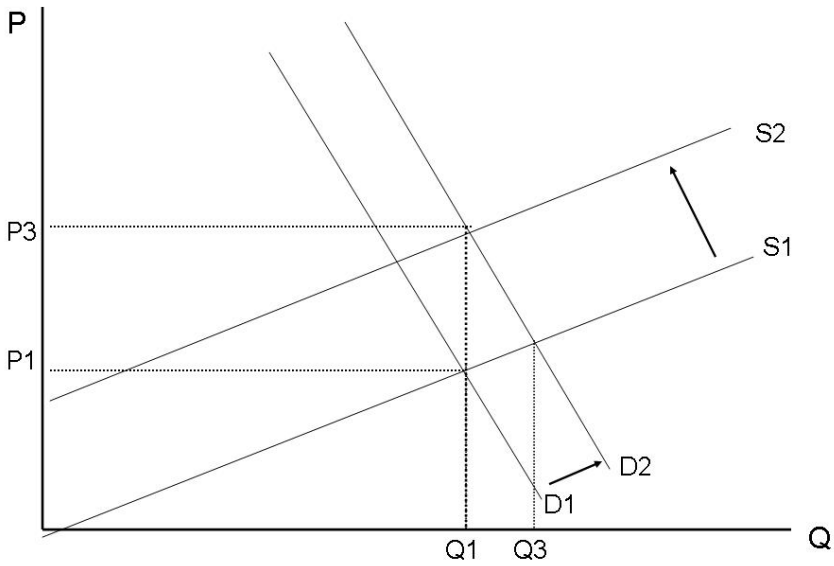


FIGURE 2-3 Drug supply and demand with simultaneous shifts in demand and supply curves.

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intervention was launched about the same time as a nonprice influence shifted the demand curve out (up and to the right). An example of such a demand influence is an increase in the population cohort size of adolescents and young adults. Jacobson (2004) found that marijuana prevalence was strongly and positively correlated with the number of 15- to 19-year-olds in the U.S. population, perhaps reflecting what is referred to as the "Easterlin hypothesis"—that behavior is affected by competition within a cohort (see, e.g., Easterlin, 1978). At the new equilibrium, the quantity of drug use has not changed much because of the offsetting effects of the supply-side intervention and the demand shift. However, the supply-side intervention succeeded in preventing drug use from increasing to Q3, which would have been the result if the demand had shifted in the absence of the intervention. In this case, the price increase from P1 to P3 is a valid indicator of the success of the supply-side intervention, even though success is not apparent in changes in the quantity used.

BEYOND THE BASIC MODEL: DISTINCTIVE FEATURES OF DRUG MARKETS

The discussion so far has used the basic model of supply and demand as described in any introductory economics textbook (e.g., Frank and Bernanke, 2004). The textbook model is about an ideal market with many rational and well-informed consumers and producers who buy and sell units of a homogenous commodity. The markets for an agricultural product like wheat might approach this ideal. Yet in many respects, conditions in the markets for illegal drugs seem to dramatically depart from the textbook model.

These departures do not invalidate insights from the basic model of supply and demand, but they once again call for careful interpretation. Many legitimate markets also diverge, in their particulars, from the basic supply-and-demand model. The phenomenon of unemployment suggests excess supply of workers (at a given wage) within the labor market. Such economic models as efficiency wage theory seek to explain why wages persist above the market-clearing level (Akerlof and Yellen, 1986).

Product Quality

Illegal drug consumers cannot directly verify product quality prior to purchase. Yet the same might be said of the cross-country traveler who stops at a roadside diner or the life insurance company that is forbidden by law from performing certain informative medical tests. Prior to the founding of eBay and related websites, search costs and quality differences were dominant factors in the markets for collectibles and antiques.

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Yet even when compared with those market factors, unknown quality variation is likely greater for illegal drugs. One reason is that, even after consumption, the quality of cocaine or heroin can be rated only imperfectly; given substantial variation over time for a given individual in the experience provided by a given quantity of cocaine, heroin, or other substances. For example, the intensity of a drug experience is influenced by the time since last use, the expectations of the user, and circumstances of use, summarized in the phrase, "drug, set, and setting" (Zinberg, 1984).

Intermingling of Supply and Demand

Another distinctive element of illegal drug markets is the intermingling of the supply and demand sides. Many heavy users of illegal drugs engage in some drug selling, with the proportion of seller-users differing by substance (see National Institute of Justice, 2003). Frequent users may account for a large share of the drug-selling workforce and sellers may account for a large share of total consumption; selling is a highly opportunistic activity, so that most dealers do it only on an occasional basis (e.g., Reuter et al., 1990).

Users are also important in the supply side of heroin and cocaine markets for another reason. Facing limited opportunities in legal labor markets and already in contact with drug-selling networks, users provide a ready low-wage labor pool for illegal markets. Thus, demand-side measures, such as expanded treatment, may raise distribution costs for drugs because it takes users out of the drug-selling labor force. Users play an important, if casual, role in the marijuana market; in an analysis of data from the 2001 National Household Survey on Drug Abuse (NHSDA), Caulkins and Pacula (2006) found that 89 percent of marijuana users most recently acquired the substance from a friend or relative, typically in small amounts.

Addiction is also an important and distinctive feature of the illegal drug market, though it is also important for the markets for tobacco, alcohol, and caffeine. A sophisticated literature exists to explore the supply and demand sides of these markets for addictive legal products. In many analyses, researchers examined variations across the states in tobacco and beer excise taxes to explore supply-demand models (see, e.g., Cook and Moore, 1993; Grossman, 2004). Given evidence that producers pass almost the entire excise tax burden to consumers, these analyses provide reasonable estimates of consumers' demand response to increased prices.

Role of Rationality and Efficiency

Important lines of theoretical and empirical research in economics show that the notion of rational drug consumers is not as far-fetched as it

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initially seems. In a seminal work, Becker and Murphy (1988) developed a model with rational consumers that demonstrates how many of the phenomena of addiction can be analyzed in an economic model. Orphanides and Zervos (1995) extended the rational addiction model to incorporate learning and regret.

Significant criticisms are made of rational addiction and related models. (e.g., Auld and Grootendorst, 2004). Such models may presume a high level of foresight and market knowledge among consumers—a combination that rests uneasily with the high discount rates observed in empirical research (Becker et al., 1994; Chaloupka, 1991).

More recent work in behavioral economics addresses these difficulties. These analyses incorporate insights from psychological studies, including certain departures from rationality, into economic models. Gruber and Koszegi (2001) reformulated the rational model to incorporate time-inconsistent preferences.

Most recently, Bernheim and Rangel (2004) developed an economic model of cue-triggered addiction. In this framework, a consumer is assumed to operate in two modes. In the "cold" mode, the consumer's decision processes are properly functioning and lead to selection of most preferred alternatives. In the "hot" mode, decision processes are dysfunctional, possibly resulting in drug use even when that is not (rationally) preferred. Because addicts know they make bad decisions while in the hot mode, they can make life-style changes to reduce the probability of that mode.

Notably, the different theoretical economic models of addiction yield the same prediction: drug users will respond to higher prices, so the market demand curve slopes downward. Many of these models also suggest that users (and potential users) are more responsive to long-standing or permanent price changes than they are to recent or transient changes in price.

Empirical studies of the price responsiveness of drug demand are discussed in more detail below. Although it has been hard to pin down the magnitude of the price responsiveness (as summarized by the price elasticity of demand), there is general empirical support for the proposition that drug demand curves slope downward.

Analyses of legal addictive substances provide two broad insights that likely apply to illegal substances. First, the demand curves of new and low-income consumers are more price elastic than other consumers. Second, as noted above, consumers respond more aggressively to permanent price changes than they do to transient fluctuations. Elasticity shows up in a related analytic literature that examines the efficiency consequences of drug control policies. For example, Becker and colleagues (2006) show that the social costs of enforcement policies decline with

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supply and demand elasticities. The more there is inelasticity in either supply or demand, the higher are the social costs, construed narrowly, from constraining the quantity consumed.

As noted above, it is impossible to assess policies aimed at the demand side of a market without some basic understanding of the supply side. A comparatively small economic literature examines points of similarity and departure between the supply side of the illegal drug market and standard economic accounts (for a useful review, see Rhodes et al., 2007). Superficially, the decentralized network of dealers, producers, and the various intermediaries between them seems to bear little resemblance to an organized supply chain. Nevertheless, basic economic concepts provide an organizing framework to understand the actors on the supply side and how they react to supply-side interventions.

Scope of Individual Operations

Levitt and Venkatesh (2000) provide a uniquely detailed organizational analysis of one drug-selling operation. Drawing on internal financial data, the authors describe the franchise nature of Chicago drug selling, in which gangs and their subunits control specific areas where illegal transactions can occur. They suggest that this is in effect a tournament compensation system, in which low-level dealers earn relatively low wages in return for the prospect of advancement. The authors also document the high rates of injury and death among street-level dealers, far higher than those of most civilian occupations (even policing).

There are some troubling aspects to the Levitt and Venkatesh data. We mention just three ways in which their data are inconsistent with other data on drug markets. The best estimate of total sales volume in the cocaine market is $30 billion for 1995 (Office of National Drug Control Policy, 2001). We assume, conservatively, that one-quarter of that was accounted for by crack, giving total crack revenues of $7.5 billion. Levitt and Venkatesh estimate annual sales per participant of $6,000, implying that there are over 1 million sellers of crack, which is a far larger number than estimated in other studies (e.g., Caulkins and Reuter, 1998). They also estimated a 4 percent annualized risk of a homicide death for the gang. However, the FBI has never estimated more than 2,000 drug-related homicides annually, almost certainly too low a figure given the results of individual city studies (e.g., Goldstein et al., 1992) and the limits of police knowledge of the motives for specific homicides. But for crack alone, it is unlikely to be as high as 2,500 (of a total of 20,000 homicides from all causes), which, with a mortality rate of 4 percent, suggests only 62,500 sellers.

The enterprise seems too small in some dimension. If purchases were

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made in units of 100 milligrams of pure cocaine, then this gang made only 1,000 transactions per month. With 30 street dealers, this would total about two sales per dealer per day, assuming that individuals sell only about half the days of the year. This is a very low volume. In the most closely comparable study, involving street-level dealers on cocaine and heroin in Washington, DC, in 1988 based on interviews with dealers as they entered probation, Reuter and colleagues (1990) reported about 12 sales transactions for a 4-hour selling session, as well as substantially higher annual revenues per dealer. The Chicago gang records are consistent with very occasional selling on the part of participants, but that can not be reconciled with the authors' estimate that the street dealers average 20 hours a week selling (Levitt and Venkatesh, 2000, p. 10). Although this study provides important insights about the dynamics of drug-selling careers, the actual numbers should be treated with caution.

Some Cost and Price Factors

Caulkins and Reuter (1998) provide a useful breakdown of the magnitude of the components of costs of cocaine. They estimate that the wholesale price of cocaine in Colombia accounts for about 1 percent of the retail price of the drug on the street in the United States.[2] Piecing together several data sources, the authors estimate that the extra profits required to compensate drug dealers for the risks of incarceration and the risks of being killed or injured while dealing account for a little more than 50 percent of the retail price. This study relied heavily on the Washington, DC, study noted above (Reuter et al., 1990), which found that compensation for the risks of deaths, injury, and incarceration accounted for approximately $21,000 per dealer annually.

Supply-side intervention can thus increase retail drug prices by increasing the risk of incarceration and by increasing several other components of costs, such as seizures of drugs and assets. Kuziemko and Levitt (2004) estimate that increases in the certainty and severity of incarceration between 1985 and 2000 raised cocaine prices by 5-15 percent. The implied elasticity of price with respect to incarceration rates was low. During that 10-year period, incarceration for drug law violations increased from 82,000 to 376,000, about two-thirds of which were cocaine offenders (roughly 200,000). Thus, to achieve the modest increase in cocaine prices, it cost an extra $6 billion a year just for incarceration (assuming a cost of $30,000 per year to house an inmate), not including the costs of apprehension and prosecution. This analysis, though just for one period and with

[2]Kilmer and Reuter (2009) provide a more fully documented price chain for both cocaine and heroin for 2006.

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limited data—for example, on actual time served by drug dealers—raises questions about the cost-effectiveness of tough enforcement.

Another important complexity arises because the transactions between drug users and drug sellers differ sharply from the textbook model. In that model, consumers pay an agreed-upon price for a certain quantity of a good of known quality, such as a gallon of gasoline of a specified octane. In contrast, retail drug markets are characterized by conventional pricing, where consumers pay $5 or $10 for "nickel" and "dime" bags (Caulkins, 2007) and avoid any haggling about price or making change. This conventional pricing has obvious advantages for illegal transactions, but it can result in poorly informed consumers since the weight and purity of the contents of the nickel and dime bags are not standardized.

To interpret data on drug prices, researchers commonly adjust the price for weight and purity. The resulting price per pure gram of drug corresponds to the notion of price in the textbook model, but it does not correspond to actual transaction prices. Drug users, and even drug dealers, do not know the exact number of grams of pure drug in the dime bags they exchange. As a result, there is great dispersion in the drug prices paid. For example, the System to Retrieve Information from Drug Evidence (STRIDE) data show that in 2002 the interquartile range of price for heroin (for less than one gram raw weight) was $280 to $428 at the retail level. In other words, a buyer had a one-quarter probability of paying less than $280 and an equal probability of paying more than $428 (Office of National Drug Control Policy, 2004).

This uncertainty by both consumers and sellers about the real price and purity of drugs may have important implications for the behavior of the market. Reuter and Caulkins (2004), using a model of the market for "lemons" (products whose quality is difficult for the buyer to determine [Akerlof, 1970]), present a set of conjectures as to the sources and consequences of this uncertainty. For example, it encourages customers to purchase regularly from more than one seller in order to obtain information about the relative quality-adjusted price of their principal source. For sellers, it allows limited strategic manipulation of these prices. For a formal model that attempts to incorporate these aspects of the market, see Galenianos and colleagues (2009).

The process of consumer search plays a key role and can have complex implications. For example, enhanced law enforcement efforts may hinder consumer efforts to switch suppliers or compare prices. If consumers are targeted (e.g., through sell-and-bust operations), it enhances the bargaining power of sellers and hence may lead to higher prices or the equivalent in terms of reduced quality.

Although several theoretically plausible accounts exist of consumer demand for addictive substances, existing research rarely provides suffi-

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cient information to distinguish among them. Drug markets include many interconnected or unobservable components that complicate economic analysis.

For analytical purposes, one key question is whether conventional pricing (the use of a standardized price, with variable and unknown quantity) changes the predictions of the supply-and-demand model, such as the prediction that a supply-side intervention will reduce quantity and increase price. Instead of raising the price of a dime bag, dealers are assumed to react to a supply-side intervention by cutting the weight or purity of the bag. If users consume the same number of dime bags per day, the reduction in weight or purity means that they are consuming a reduced quantity of pure drug and paying a higher price, adjusted for weight and purity. Users may react to the cut in weight or purity by purchasing more dime bags. However there may be a "quality illusion," in which the variability that users come to expect leads them to at least be slow to adjust, if they adjust at all, to any decline in purity.

DRUG SUPPLY AND ELASTICITIES

Surveys provide greater information about drug demand than they do about drug supply. As noted above, changes in observed prices reflect the relative slopes (the relative elasticities) of both supply-and-demand curves. In legal markets with good data on prices and quantities, estimating demand-and-supply curves is a straight-forward, although often challenging, econometric exercise. The covert nature of illegal drug markets means that prices and quantities are not easily observed, if at all, but some guidance can be found in studies of legal markets. In competitive markets that display constant returns to scale, supply curves tend to be more elastic than demand curves. These assumptions have been explicitly addressed in tobacco and alcohol markets, which find highly elastic supply (Chaloupka et al., 2002). There are no comparably sound studies about illegal drug markets.

Most studies of illegal drug markets implicitly or explicitly assume very high elasticities. For example, Rhodes and colleagues (2002) assume very elastic cocaine supply on the grounds that the agricultural production technology is simple and inexpensive. To the extent that scarce resources are required—for example, access to constrained smuggling routes or specific marketing channel to street users—some upward slope may be found.

One recent paper scrutinizes cross-state variation in the sanctions imposed on marijuana users to examine the elasticity of marijuana supply (Pacula et al., 2010). With lower user sanctions, the market demand curve for marijuana increases (shifts up). The authors found that in response

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to this demand shift, there is a short-term increase in marijuana prices. This effect implies that the marijuana supply curve slopes upward (is not perfectly elastic) in this market over the short run; in order to meet the new demand spurred by lower user sanctions, suppliers require more compensation in the form of higher prices.

A second analysis scrutinizes demographic changes to examine marijuana markets (Jacobson, 2004). This paper demonstrates that youth cohort size is positively related to marijuana use prevalence and negatively related to street marijuana prices. The author concludes: "Larger youth cohorts yield thicker drug markets that, through lower sales arrest risk and informational economies, generate cost-savings in drug distribution" (p. 1481). This is an instance in which illegality leads to a tighter connection between changes in the demand side and supply elements.

There is a substantial noneconomic literature about the supply side of drug markets, particularly at the retail level. For New York City in particular, there is a long tradition of ethnographic studies of the subject (e.g., Johnson et al., 1985; Preble and Casey, 1969) that has produced rich descriptions of individual markets. For example, Bourgois spent 3 years in a Hispanic section of Harlem observing the activities and lives of a small group of dealers (Bourgois, 1996). A report of the National Research Council (2001) made extensive reference to work by Curtis and Wendel (2000). As summarized by Johnson and colleagues (2000), the New York drug market had been through several transformations between 1960 and 2000 with varying degrees of organization. For other cities, there are just occasional studies such as those about in Milwaukee (Hagedorn, 1998), Chicago (National Drug Intelligence Center, 2007a), and Los Angeles (National Drug Intelligence Center, 2007b).

Except for temporary and quite local situations, there is rarely mention of market power by any group of drug retailers or of very large retailing organizations. At the importing and wholesale level there may indeed be large organizations, with hundreds of employees and sales volumes in the tens of millions. An excellent and undercited study is that by Fuentes (1998) describing Colombian-run importing organizations in the early 1990s.

There does not appear to be any systematic synthesis of these studies that would allow general statements about the factors that influence, for example, the extent to which a market is dominated by youth gangs involved in other criminal activities or the share of revenues that go to retail sellers or to higher-level participants. Both this line of research and the economics literature would be enhanced by more collaborative work.

Three overlapping reviews explore price elasticies of demand for illegal substances. Before briefly summarizing their findings, it is useful

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to distinguish between different forms of demand elasticities in common use.

Participation elasticity denotes the percentage change in the number of individuals who report *any* substance use that corresponds to a unit percentage change in price. If Γ(P) is the proportion of individuals who report any substance use at some price P, the participation elasticity is then

$$\varepsilon_{participation} = \frac{P}{\Gamma}\left[\frac{\partial \Gamma}{\partial P}\right].$$

Participation elasticities are especially important when the goal is to minimize the number of individuals who report any substance use.

Conditional elasticity is the percentage change in consumption that corresponds to a unit percent change in price among individuals who consume a positive quantity of the drug. If Q is the means quantity consumed between active users,

$$\varepsilon_{conditional} = \frac{P}{Q}\left[\frac{\partial Q}{\partial P}\right].$$

Total price elasticity of demand represents the percentage change in total consumption corresponding to a unit percentage change in price. Since the total amount consumed is (ΓQ),

$$\begin{aligned}\varepsilon_{total} &= \frac{P}{\Gamma Q}\left[\frac{\partial(\Gamma Q)}{\partial P}\right] = \frac{P}{\Gamma Q}\left[\Gamma\frac{\partial Q}{\partial P} + Q\frac{\partial \Gamma}{\partial P}\right] \\ &= \frac{P}{Q}\left[\frac{\partial Q}{\partial P}\right] + \frac{P}{\Gamma}\left[\frac{\partial \Gamma}{\partial P}\right] = \varepsilon_{conditional} + \varepsilon_{participation}.\end{aligned}$$

As defined above, the total price elasticity of demand is the sum of the conditional elasticity and the participation elasticity. Currently, the drug research offers more analyses on participation elasticities than on the other two quantities.

A second important distinction concerns *long-run* and *short-run* demand elasticities. Economic theory predicts that consumers should be more sensitive to long-term price changes than transient ones. This pattern holds true for most goods, but particularly for addictive ones. Under a rational addiction framework, long-run price increases raise the cost of initiating use. Under a variety of other frameworks, such as those which require adjustment costs, consumers may have some lag in responding to price changes.

Grossman (2004) provides a useful policy discussion of the role of

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price mechanisms to regulate substance use. Using Monitoring the Future (MTF) Survey data collected from high school seniors, he finds a participation elasticity of –0.46 for marijuana use. This point estimate is very similar to that reported by Pacula and colleagues (2001), who reported that the elasticity is between –0.69 and –0.30.

Rhodes and colleagues (2002) estimated a series of demand equations, linking NHSDA data on drug use behaviors to STRIDE data (from undercover purchases) on the price of street drugs. The authors examined demand behaviors among more chronic users by examining drug use forecasting data from the National Institute of Justice, which provide information from arrestees. Using 1988-1996 data, the authors find a conditional price elasticity of approximately –0.33 for marijuana, with greater price sensitivity for weekly users (a conditional price elasticity of –0.50) and a lesser price sensitivity for more occasional users (a conditional price elasticity of –0.25).

In the case of cocaine, several studies indicate a participation price elasticity of demand for cocaine participation in the past year between –0.41 and –1.00 (see, e.g., Grossman et al., 2002). These studies indicate the highest participation elasticities for youth and young adults. Surveys such as MTF, NHSDA, and the National Survey on Drug Use and Health appear more limited in their ability to scrutinize heavy use.

One strand of studies links price series to the receipt of drug-related emergency medical services. This approach provides an independent measure of the extent of use, since it will rise with the amount consumed (other things being unchanged). There is accumulating evidence that heavy cocaine and heroin use are especially price sensitive, perhaps because heavy users face more binding budget constraints on their ability to finance a high level of drug consumption (Caulkins, 2001). A second strand of literature explores self-reported or chemically detected substance use among arrestees (see Rhodes et al., 2002)

Unfortunately, the strong correlation over time and space in drug prices hinders efforts to obtain definitive elasticity estimates. The results reported by Grossman (2004) illustrate the underlying problem. In this analysis, Grossman examines the relationship between drug prices and drug-related emergency department visits. He estimates two reasonable specifications, one that controls for a linear time trend and one that controls for linear, quadratic, and cubic time trends. As shown below in Table 2-1, elasticity estimates are markedly different and the pattern is inconsistent across drugs and methods. The inconsistent estimates in Table 2-1 demonstrate that in many cases, econometric analysis of aggregate data will not yield useful information about the price elasticity of the demand for illegal drugs.

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TABLE 2-1 Participation Elasticities, According to Statistical Assumptions

Marijuana		Cocaine		Heroin	
Linear Trend	Cubic Trend	Linear Trend	Cubic Trend	Linear Trend	Cubic Trend
–1.188	–0.265	–0.133	–1.73	–0.095	–0.614

NOTE: Participation elasticities in alternative statistical specifications.
SOURCE: Grossman (2004). Reprinted with permission.

In the most recent analyses in this literature, Dave (2006) examined cocaine and heroin-related emergency department admissions in 21 large metropolitan areas. The author found an elasticity of the probability of a cocaine mention with respect to cocaine prices was –0.27; the corresponding elasticity in the case of heroin was –0.15. The author also found evidence that heroin and cocaine act as complements in consumption. In addition, he found negative lagged price effects, a pattern consistent with either an addiction model or a cumulative insult model of individual vulnerability to drug-related health concerns.

In another study, Dave (2004) reported on illegal drug use (as detected by urinalysis) among arrestees. The author found short-term participation elasticities of approximately –0.17 for cocaine and –0.09 for heroin, with long-term elasticities approximately twice as large. The most striking aspects of these papers are the low-point estimates of participation elasticity compared with prior work.

CONCLUSION

The basic supply-and-demand approach from economics provides a useful analytical framework to understand markets for illegal drugs. On the conceptual side, we draw two main lessons. First, the economic approach is flexible enough to capture many of the special features of illegal drug markets and provides important insights. The second lesson, however, is that much remains to be done to more fully incorporate insights from richly detailed descriptions of illegal drug markets into the economic approach. On the empirical side, the main lesson to be drawn is the difficulty of estimating basic relationships between illegal drug prices and the behavior of users and suppliers. This difficulty does not mean the enterprise should be abandoned, but the current empirical understanding should be viewed as very much a work in progress.

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3

Measuring the Demand for Drugs

Illegal drug use is a covert behavior. Whether such use is ignored, tolerated, or aggressively deterred through law enforcement, it occurs outside the explicit framework of legal markets. Determining the prevalence of such use—defined as either the number of users or the quantity of drugs consumed—poses inherent challenges to both social scientists and epidemiologists. Interpreting the patterns is further complicated by the heterogeneity within the population of drug users. A substance such as marijuana is consumed in small quantities by many casual users, who may use it irregularly and rarely satisfy standard criteria for abuse or dependence.[1] In contrast, most people who use heroin consume it regularly and frequently, and they are much more likely to satisfy the Diagnostic and Statistical Manual of Mental Disorders 4th Edition (DSM-IV) criteria for substance use disorders. This chapter describes the datasets that are available on drug use and its consequences in the United States. It assesses the strengths and weaknesses of each dataset and how it contributes to understanding of the demand for illegal drugs.

[1]The standard criteria are those in the Diagnostic and Statistical Manual of Mental Disorders 4th Edition.

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POPULATION SURVEYS

The National Household Survey of Drug Abuse and the National Survey of Drug Use and Health

The 1990-2001 National Household Survey of Drug Abuse (NHSDA) and its successor, the National Survey of Drug Use and Health (NSDUH), provide key data regarding the prevalence of substance use, abuse, and dependence and substance abuse treatment participation in a nationally representative sample of the noninstitutionalized U.S. population. These datasets include information regarding substance use, psychiatric disorders (including substance abuse and dependence), welfare receipt, and substance abuse treatment receipt during the 12 months prior to the survey interview.

Figure 3-1 shows changes in the percentage of respondents (aged 12 years and older) who reported that they had used cocaine or marijuana in the previous 30 days from 1979 to 2007. For marijuana, the prevalence of use fell sharply in the 1980s from a very high rate (13 percent) in the late 1970s, rebounded modestly in the 1990s, and has been relatively stable since 2002 at about 6 percent. For cocaine, the story is somewhat similar,

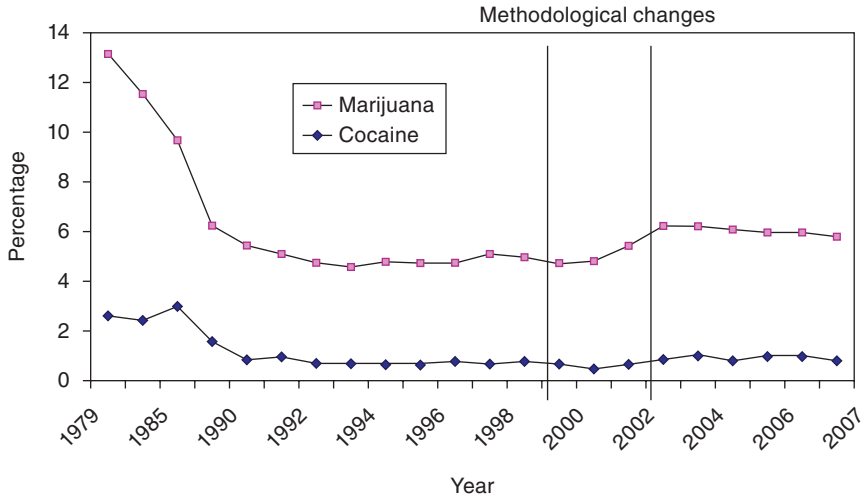


FIGURE 3-1 Drug use in the past month, 1979-2007, for persons aged 12 and older.
SOURCE: Substance Abuse and Mental Health Services Administration (2008).

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though the figures are much lower: in 2007, only 0.8 percent of respondents reported cocaine use in the past 30 days.[2]

For no other illegal drug are prevalence rates so high. Methamphetamine has become a major health and criminal justice problem in many parts of the country, as indicated by the numbers of treatment admissions and the percentage of arrestees testing positive for use of that drug; however, the prevalence of past month use among 18-25-year-olds, the highest use group, has never risen above 0.7 percent.

In recent years a new pattern of drug use has emerged that has generated considerable concern: the reported consumption of diverted pharmaceuticals, that is, prescription drugs (see, e.g., Compton and Volkow, 2006). In 2004, 6.2 percent of the population aged 12 and over reported nonprescribed use of a prescription drug in the previous 12 months. Among those aged 18-25, the rate was more than twice as high, 14.8 percent. Approximately 12 percent of those reporting use within the past 12 months reported that they had used more than twice per week over that period.

The NHSDA and NSDUH have many limitations that complicate trend analysis. Such analyses are particularly difficult when one seeks to compare current substance use patterns to those of the mid-1990s or earlier because of changes in survey methodology. The two surveys do not provide data for incarcerated individuals or those in residential treatment settings. They also do not provide chemical verification of survey responses. Other aspects of NHSDA and NSDUH design also suggest that these surveys provide poor coverage for the most criminally active segment of the drug-using population (see Fendrich et al., 2004; Gfroerer et al., 1997; Midanik, 1982; Midanik and Greenfield, 2003; Pollack and Reuter, 2006). NHSDA and NSDUH also face more general challenges that result in declining response rates and increased rates of refusal, which is true for many epidemiological studies over the past three decades (Galea and Tracy, 2007).

Perhaps most important, the surveys are of self-reported data and are therefore vulnerable to underreporting of substance use and other stigmatized characteristics and behaviors. There are known biases in reported substance use and in substance abuse treatment (see Midanik and Greenfield, 2003; Minkoff et al., 1997). NHSDA and NSDUH are known to underrepresent frequent users of cocaine and heroin and to underrepresent the overall volume consumed of both substances (National Institute on Drug Abuse, 1997; Office of National Drug Control Policy, 2001).

[2]The increase in rates in 2002 is almost certainly the consequence of methodological changes, discussed below. Population rates have probably been stable over the 10-year period, 1997-2007, for both drugs.

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Analysis of the 2000 NHSDA illustrates these difficulties. Only 29 of 58,647 respondents reported at least weekly heroin use over the past 12 months. Accounting for the weighted and stratified nature of NHSDA, this number corresponds to an estimated 150,528 weekly heroin users[3] in the United States. But this number represents approximately 16 percent of the estimated number of weekly heroin users as determined by a study done for the Office of National Drug Control Policy (ONDCP) (2001) in the same year.

NHSDA and NSDUH have captured a somewhat greater number of cocaine users. The 2000 NHSDA included 225 respondents who reported at least weekly powder or crack cocaine use (Office of National Drug Control Policy, 2001, Table 3). This number corresponds to an estimated 606,364 weekly cocaine users.[4] However, this estimate is still less than ONDCP's estimated number of chronic cocaine users.

Research by Fendrich and colleagues (2004) attempted to validate household survey responses of Chicago respondents through the use of biomarkers. The authors found that the majority of women who tested positive for heroin and cocaine in hair, urine, or saliva tests did not reveal their use of these substances. Responses regarding marijuana use appeared more complete in these data. Harrison (1995) and Harrison and Hughes (1997) documents these patterns in greater detail, showing that self-report bias increases with the social stigma associated with a specific substance and that self-administered questionnaires reduce, but do not eliminate, such underreporting. A more recent study by Harrison and colleagues (2007) of a large subsample of the NSDUH wave found that only 21 percent of those who tested positive for recent use of cocaine reported that in their questionnaires. When the NSDUH replaced the NHSDA in 2002, it included several survey design improvements. The survey now appears to capture a somewhat greater percentage of chronic substance users. An analysis of 2008 NSDUH data showed an estimated 173,839 weekly heroin users[5] and an estimated 1,096,630 weekly cocaine users (powder or crack).[6] The documentation for the survey specifically warns against performing trend analysis that compares NHSDA and NSDUH data because of the major changes in survey methodology. Among other things, increased payments to respondents reduced survey nonresponse, and so it appears that there was an increase in estimated drug use prevalence in the NSDUH (Substance Abuse and Mental Health Services Administration, 2003). Likely as a result of improved survey

[3]This estimate has a 95 percent confidence interval [58,617, 242,439].
[4]This estimate has a 95 percent confidence interval [472,063, 740,664].
[5]This estimate has a 95 percent confidence interval [90,645, 257,034].
[6]This estimate has a 95 percent confidence interval [885,646, 1,307,614].

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methodology, the estimated prevalence of last-year cocaine use rose from 1.9 percent in 2001 to 2.5 percent in 2002 (almost a one-third increase), which is implausible in the light of the much more modest changes in the years before and after.

Survey methodology poses other obstacles to trend analysis in many variables. Over the 1990s, NHSDA used varying operational definitions of important demographic variables, including family income, welfare participation, and the age and number of dependent children in the household. We believe that we have constructed consistent subsamples for the committee's trend analysis. However, NHSDA and NSDUH pose difficulties for trend analysis not found in more consistently implemented surveys, such as the Monitoring the Future (MTF) datasets used to track adolescent substance use.

Until the year 2000, NHSDA did not operationalize DSM-III-Revised criteria for abuse. NHSDA provides an inconsistent and incomplete measure of drug and alcohol dependence across survey years—a problem addressed in one-time surveys such as the 2002 National Epidemiologic Survey of Alcohol and Related Conditions and now the NSDUH, but not addressed in a consistently implemented annual survey.

Despite these limitations, NHSDA and NSDUH provide nationally representative individual data widely used for policy analysis, though the lack of state identifiers in public-use files has been a major hindrance to such analysis. We take this up in Chapter 5.

Monitoring the Future Survey

The MTF survey, which began in 1975 and continues, examines substance use and other behaviors for a nationally representative sample of approximately 50,000 8th, 10th, and 12th grade students in 420 schools across the United States. MTF provides a high-quality data source to scrutinize the prevalence of self-reported substance use among students enrolled in school. In particular, the survey has asked exactly the same core questions on drug use over its almost 35 years of operation (although initially covering only 12th graders), allowing for consistent data on the major measures. However, a key study limitation is that MTF surveys of high school seniors capture only those who remain in school: dropouts are thus not effectively captured in the survey. For 12th grade, dropouts constitute about 9 percent, although there are wide disparities by race and ethnicity (Child Trends Data Bank, 2010). The MTF survey methodology also undersamples students who are pursuing General Educational Development certification.

MTF technical materials suggest that the survey excludes between 15 and 20 percent of the pertinent cohort in the 12th-grade year (Bachman et

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al., 2001). Given the strong correlation between substance use and limited educational attainment, this is an important concern, though one that has been acknowledged and subjected to analysis by MTF investigators (Bachman et al., 2001).

MTF, NHSDA, and NSDUH differ in methodology, and there are consistent differences in reported rate of drug use. Perhaps most importantly, MTF is administered in the classroom and provides respondents with greater anonymity than does the household survey. Thus it is not surprising that analyses comparing the reported rates for youth find higher rates in MTF than for a closely matched age group from NHSDA and NSDUH (Gfroerer, 1992). However, the time trends of the two surveys for the common age groups are so similar that we report only the MTF results for youth to show the greater variation in changes over time for this group in comparison with the broader population aged 12 and over.

Figure 3-2 shows the changes over time in prevalence of drug use among high school seniors. In this figure, for marijuana we use the prevalence of more intense use, namely daily use ("on at least 20 of the last 30 days"). The data again show the deep decline during the 1980s, following the upturn in the late 1970s, the recovery of rates during the 1990s, and the more recent stabilization and decline. Less restrictive measures of use, such as "any use during the past 12 months," yield higher prevalence

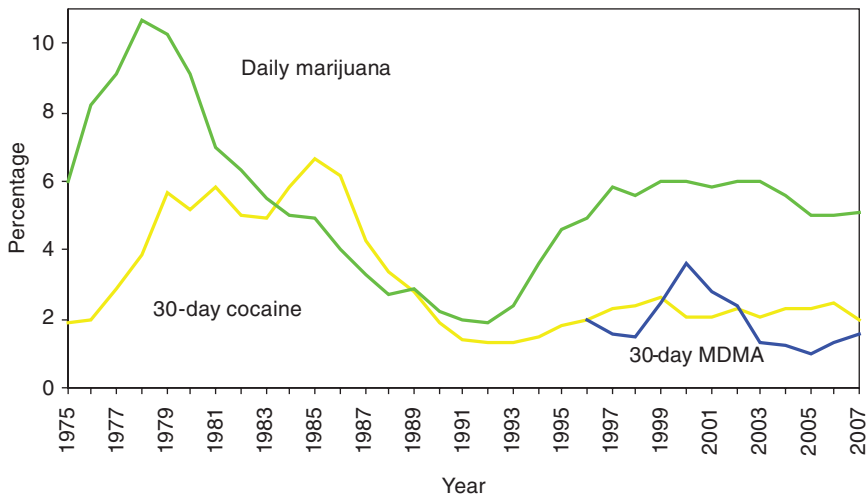


FIGURE 3-2 Drug use by high school seniors, 1975-2007.
NOTE: MDMA = ecstacy.
SOURCE: Johnston et al. (2009).

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estimates but display similar trends over time (Johnston et al., 2009). At its height, the prevalence of daily use exceeded 10 percent; at its nadir it was barely 2 percent. For cocaine the timing is different, but the pattern is similar. Figure 3-2 also shows that use of ecstasy, a matter of great concern at the end of the 1990s has now declined to very low rates, illustrative of a drug that is briefly popular and then fades from sight.

MTF also creates a panel of high school seniors each year, and the respondents are surveyed on their drug use for many years afterward. Some drug use data from these panels are reported in an annual report. However, the data are little used by scholars outside the Survey Research Center research group at Ann Arbor, which has itself made minimal use of the data. A National Research Council (2001) report commented on the loss of important information attributable to the restriction on access to the data. We take up this matter in Chapter 5.

Other Surveys

The 1990-1992 National Comorbidity Study (NCS) was the first nationally representative survey to use a fully structured diagnostic interview to assess the prevalence and correlates of (then-DSM-III) psychiatric disorders, including substance use disorders.

The 2001-2003 Collaborative Psychiatric Epidemiology Surveys (CPES) replicated NCS methodologies. These surveys provide high-quality, nationally representative data to explore a wide range of DSM-IV defined psychiatric disorders, including lifetime and current substance use disorders. They also capture diverse physical and mental health measures, as well as respondents' sociodemographic characteristics that are likely associated with both welfare receipt and substance use. CPES includes three distinct surveys, each of which is a weighted and stratified national probability sample of a specific population pertinent to policy debate (see Heeringa et al., 2004); see below.

One of them is the 2001-2003 National Comorbidity Study-Replication (NCS-R), an enhanced replication of the NCS. It provides a high-quality, nationally representative survey to explore a wide range of DSM-IV defined psychiatric disorders, including lifetime and current substance use disorders (see Degenhardt et al., 2007). NCS-R also provides data on diverse issues related to individual well-being (Alegria et al., no date). The survey explores such outcomes as homelessness and food insecurity that are of particular importance to very low-income populations. NCS-R also explores problem behaviors, such as fighting, vandalism, and theft. NCS-R examines a more diverse range of psychiatric disorders, with higher fidelity to DSM-IV criteria than is available from other national data sources (such as NHSDA and NSDUH). NCS-R also captures the

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receipt of mental health and substance abuse services, along with important information regarding both the financing of services and respondents' perceived barriers to service receipt.

The second of the CPES is the National Survey of American Life (NSAL). NSAL is a national household probability sample of 3,570 African Americans, 1,006 non-Hispanic whites, and 1,623 Afro-Caribbean adults (Heeringa et al., 2004). NSAL provides the most detailed information currently available on psychiatric disorders, well-being, and social performance of African and Afro-Caribbean Americans (see Ford et al., 2007; Jackson et al., 2004a, 2007a; Neighbors et al., 2007). The survey replicates the methodology and questions used in the NCS-R and it further explores questions of specific concern to populations of color (Jackson et al., 2004b; Pennell et al., 2004).

The third of the CPES is the National Latino and Asian-American Study of Mental Health (NLAAS). NLAAS also replicates the NCS-R methodology to provide the most detailed information currently available on psychiatric disorders, well-being, and social performance of Latino and Asian American adults in U.S. households (see Abe-Kim et al., 2007; Alegria et al., 2007; Chae et al., 2006; Chatterji et al., 2007; Nicdao et al., 2007; Pennell et al., 2004).

Like NSDUH, CPES likely undersamples individuals with severe mental illness or substance use disorders, precisely because each of the surveys is also a household sample. Because these surveys replicate the NCS methodology, it is possible to examine trend changes in a national sample.

Proxy Measures

Given the limits of household surveys, particularly in obtaining data on frequent cocaine, heroin, and methamphetamine users, there has been great interest in proxy indicators that might provide insight regarding the levels of use and changing size of this population. Proxy indicators include drug-related emergency department admissions and overdoses, alcohol-related traffic fatalities, admissions into substance abuse treatment, and toxicology screening of arrestees in major metropolitan areas. Each of these proxies captures some dimension of the social harms associated with substance use and fails to capture others. Showing how they jointly provide a picture of drug use remains an important task.

DATASETS FOR RESEARCH

In this section we describe the features and main strengths and weaknesses of the most pertinent datasets for the committee's work on under-

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standing demand. We do not summarize all datasets. For example, we have not discussed cohort studies of treatment participants such as Drug Abuse Treatment Outcome Study and the National Treatment Improvement Evaluation Study (NTIES), or studies of treatment participants affiliated with the Clinical Trials Network.

We also do not summarize other data collection and dissemination activities that are useful for drug policy formulation but that play a smaller role in academic research. For example, the Community Epidemiology Work Group (CEWG) provides a venue for policy makers and researchers to assemble diverse data to conduct and communicate ongoing community-level surveillance of drug use and related trends (National Institute on Drug Abuse, 2010). CEWG seeks to help policy makers and researchers identify emerging trends, characteristics of vulnerable populations, and the social and health consequences of substance use (Community Epidemiology Work Group, 2009). It is not itself an important source of data for research.

Several datasets provide specific information regarding the population of people who receive substance abuse treatment services. These datasets provide detailed clinical information, as well as administrative data concerning payment sources, entry characteristics of treatment clients, and characteristics of the treatment experience itself. These datasets also provide pre-post data regarding substance use, criminal offending, and other factors.

These datasets also have several limitations. They are not representative of the full population with substance use disorders, since the majority of those people do not receive treatment services. The most detailed datasets are also not generalizable to the full treatment population, since the underlying sample frames are not representative of the full population of treatment units.

National Treatment Improvement Evaluation Study

NTIES, conducted from 1992 to 1997, features a large sample size of substance abuse treatment clients across short- and long-term residential settings, methadone maintenance, and ambulatory outpatient interventions. NTIES has a higher follow-up response rate (82 percent) than any comparable client-level follow-up treatment survey (Flynn et al., 2001; Gerstein and Johnson, 2000, 2001). Funded by the Center for Substance Abuse Treatment (CSAT), NTIES is available for public use through the Inter-university Consortium for Political and Social Research (ICPSR) at the University of Michigan (see Gerstein et al., 1997)

NTIES was not designed to be nationally representative of treatment clients. It does not cover people who are out of contact with the substance

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abuse treatment system. The sample universe is drawn from units supported by CSAT. Compared with nationally representative client surveys, NTIES included a high percentage of nonwhites and criminal justice clients (Zarkin et al., 2002).

Treatment Episodes Data Set

The Treatment Episodes Data Set-Admissions (TEDS-A) provides annual, individual-level data on the demographic characteristics and substance use disorders for 1.9 million annual client admissions to treatment facilities for substance use disorders. The data items collected include primary and secondary substances of abuse, treatment referral source, prior treatment episodes, age at first use, metropolitan area, and age. The 2005 TEDS-A included more than 640,000 treatment referrals from the criminal justice system, providing ample coverage of this key population of public health and law enforcement concern. Facilities that receive state funding (including federal funding through the substance abuse prevention and treatment block grant) for alcohol or drug disorders form the TEDS-A sample frame. In 1997, TEDS-A was estimated to cover about 67 percent of all substance abuse treatment clients. The system has been characterized by uneven participation by treatment units, particularly in the correctional system. Analyses at the state level can be seriously affected by these inconsistencies.

The Treatment Episode Data Set-Discharges (TEDS-D) is an administrative data system that provides annual client-level data on discharges from alcohol or drug treatment in the same public or private substance abuse treatment facilities that comprise the TEDS sample frame. TEDS-D began data collection in 2000, though data were only released for public use through ICPSR in September 2008 for 2006.

TEDS-D captures several variables that are critically important to policy makers and researchers. It provides basic admissions data, including primary, secondary, and tertiary drug of abuse; number of prior treatments; primary source of referral; employment status; whether methadone was prescribed in treatment; diagnosis codes; presence of psychiatric problems; living arrangements; source of income; health insurance; expected source of payment; substance(s) abused; route of administration; frequency of use; age at first use; pregnancy and veteran status; health insurance; and days waiting to enter treatment. It also provides useful discharge data, such as client length of stay, whether the client successfully completed treatment, and service modality at time of discharge.

TEDS-D features many of the strengths and weaknesses of the TEDS admission data. Investigators request data from all substance abuse treatment facilities that receive public funds. Although data are requested on

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all clients, some facilities provide data only on clients whose treatment is financed by public funds. Data are collected on distinct admissions rather than distinct individuals. So some people may appear more than once in TEDS-D data. Moreover, a person who experiences a single treatment episode that involves multiple providers or care modalities may appear as multiple admissions and discharges in these data. Technical features of the data complicate comparisons of TEDS-D data across different states. Facility identifiers are stripped from TEDS-D.

TEDS-D appears to provide a rich set of client and program characteristics for future research, yet we are unaware of any research papers using these data. TEDS-D provides, and will provide, a valuable data source for researchers and policy makers who seek to examine trends in length of stay, treatment completion, and other key measures. Moreover, the data provides a resource for multivariate analysis of basic associations, such as differences in length of stay as a function of insurance type, referral source, and the sociodemographic characteristics of clients.

Although TEDS-D is not fully representative, it provides a large discharge-level national dataset with no close substitute in other available datasets. TEDS-D would be especially valuable if provisions were made to allow controlled research access to additional confidential data, such as identifiers of specific facilities that are linked with the National Survey of Substance Abuse Treatment Services dataset of the Substance Abuse and Mental Health Services Administration (SAMHSA). Such linkage would facilitate comparisons across space and time and also would facilitate improved multivariate analysis controlling for unit effects.

Arrestee Drug Abuse Monitoring Program and Drug Use Forecasting Series

The Arrestee Drug Abuse Monitoring (ADAM) Program and Drug Use Forecasting (DUF) series provides data on the prevalence of drug use among arrested and booked persons. Between 1987 and 1997, DUF collected data in 24 sites across the United States and expanded to 35 sites in 1998. Beginning in 2000, ADAM implemented a probability-based sampling strategy (although a number of studies had shown that the earlier data do not generate biased results). The sampling frame comprised all people arrested and booked on local and state charges in identified ADAM counties in the United States.

ADAM includes detailed, representative data regarding the severity of charges leading to arrest and booking; individuals' contact with health care and substance abuse treatment systems; lifetime, 12-month, 30-day, and 72-hour experiences of substance use; and circumstances of drug purchases and sales. ADAM also includes voluntary urine test results.

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Toxicology results are reported for a wide range of illegal substances. Data are available through SAMHSA.

ADAM was terminated in 2003, but ONDCP (Office of National Drug Control Policy, 2009) restarted it in 10 sites in 2007 and plans to continue it as an annual survey. The only information currently available for the public is some initial prevalence estimates released as a data appendix.

Drug Abuse Warning Network

The Drug Abuse Warning Network (DAWN) is a SAMHSA-funded public health surveillance system that monitors drug-related emergency department use, along with drug-related deaths and other health-related harms investigated by medical examiners and coroners. It began operation in 1972. Until 2002 it provided estimates for emergency department visits both nationally and for about 30 metropolitan areas, and it also provided estimates of deaths due to drug use for about 38 counties in metropolitan areas. Medical chart review data are available since 1994 in selected emergency departments.

In 2002 DAWN switched to a new data collection system, which differs in the kind of record abstracted and the sample of cities and facilities. Many hospitals that had previously reported refused to do so after the switch, partly because of privacy concerns raised by the 1996 Health Insurance Portability and Accountability Act of 1996 and partly because of increasing cost concerns. Only 220 of 550 eligible hospitals participate in the national panel.

By February 2010, almost 8 years after the switch in data collection, there were very few published reports available from the new DAWN. In early 2010 the most recent report of national emergency department data was for 2006; for more recent years the agency website contained only Excel files that could be downloaded and used to prepare tables a researcher might want. No subnational data were available. For drug-related mortality, the 2007 report was available, but it presented no national data, only figures for 10 states and 40 metropolitan areas.

DAWN had been little used in the past: since the new system was created, it has been difficult to use at all since no public-use data (apart from recent national emergency department data) have been made available. The loss of many hospitals from the sample that occurred during the redesign reduced the potential accuracy of the system.

These datasets, along with the others discussed above, provide information on the characteristics of drug users and their experience that adds to understanding of demand. However, the analytic task remains of showing how they should be put together for that purpose.

Public health investigators have also assembled useful datasets

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regarding specific critical populations at risk. For example, one valuable recent dataset is the National HIV Behavioral Surveillance System (NHBS). Beginning in 2003, NHBS has collected data regarding sexual and drug use risk behaviors from men who have sex with men, injection drug users, and heterosexual adults in areas in which HIV is prevalent (Sanchez et al., 2006).

ESTIMATES OF PREVALENCE AND QUANTITIES USED

The population surveys described above, and the accompanying indicator series, have mainly been used to examine the prevalence and incidence of drug use in the general population. There have been minimal efforts to estimate the quantities of drug consumed or how much is spent by consumers (see, e.g., Bretteville-Jensen, 2006). One exception is the government estimates that have been published on three occasions (Office of National Drug Control Policy, 1995, 1997, 2001), covering the period since 1988 up to, in the most recent publication, 2000. These studies are, to our knowledge, the only efforts to estimate the number of persons using illegal drugs on a frequent and intense basis, the total quantity consumed by all users, and the amount spent in purchasing the drugs. These are three important measures of consumption and indicators of demand. The studies have been conducted by a research team at Abt Associates on behalf of ONDCP. They rely on integrating data from various data series—including NHSDA and NSDUH (for occasional use), DUF and ADAM (for chronic or heavy use), and DAWN and System to Retrieve Information from Drug Evidence (STRIDE)—and cover four drugs: (1) cocaine, (2) heroin, (3) marijuana, and (4) methamphetamines.

These estimates have been used by policy makers, yet they are based on complex analysis of datasets with important weaknesses that have not been subject to detailed research scrutiny. They show a decline in quantity consumed for cocaine, sharp during the period 1988 to 1991 and gradual thereafter; by 2000 the estimate was more than one-fourth lower than that in 1991: see Table 3-1. For heroin, the figures showed no clear trend but fluctuated over the period.

Changes in the estimates of total cocaine consumption over the period show the limited insight provided by NSDUH data. While the population survey shows fairly stable prevalence during the 1990s, the Abt estimates of chronic users (individuals who had used the drug on at least eight occasions in the previous 30 days) show a substantial decline. This estimate may be the consequence of a decline in the number of dependent users, though it is somewhat surprising since the decline in cocaine prices (discussed later in the chapter) would suggest that each user would consume more.

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TABLE 3-1 Total Amount of Cocaine and Heroin Consumed, 1988-2000 (metric tons)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000*
Cocaine	660	576	447	355	346	331	323	321	301	275	267	271	259
Heroin	14.6	16.6	13.6	12.5	11.7	11.2	10.8	12.0	12.8	11.8	14.5	14.3	13.3

*Estimates for 2000 are projections.
SOURCE: Office of National Drug Control Policy (2001).

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There is a minimal base of studies of quantities consumed by individual users (for a review of what is available for heroin, mostly from European studies of treatment samples, see Paoli et al., 2009, Appendix B). Kilmer and Pacula (2009) review studies for other drugs in trying to estimate the total size of the world markets for cocaine, heroin, amphetamines, and marijuana. Treatment samples are a troubling source for estimates of consumption levels, since treatment entry is frequently motivated by problems resulting from higher than usual consumption, so that reports of prior 30-day or 3-month consumption (as is typically collected) provide upwardly biased estimates; that same problem holds for arrestee samples. Questions about earlier periods before entry to treatment suffer from the problems of long-term recall, particularly serious for a population of frequent users of psychoactive drugs.

There is a still more fundamental problem for quantity estimates based on self-reports, namely that, as noted in Chapter 2, users do not know how much was in the package purchased. What the user knows is the cost of the purchase. Thus Abt's estimates of total quantity are calculated by first estimating total expenditures from self-reports and then dividing that figure by an estimate of average price. Since both the expenditure and price data series are noisy, the result is considerable uncertainty about quantity estimates.

The NHSDA and NSDUH surveys include self-report data on quantity each year. These data generate implausibly low estimates of the total quantity, as would be expected from a survey that missed a large proportion of the users who are frequent users. The data are hardly used in research. It is unclear how one improves the estimation of quantity estimates at the individual level. We discuss this further in Chapter 5.

PRICES

All the prices discussed in this section are adjusted for the consumer price index and for purity. We discuss data at the city level because there are such large differences in absolute prices, though there is considerable consistency in trends.

One of the most surprising observations about major drug markets over the last 30 years has been failure of increasingly stringent supply-side enforcement (as measured by the number of people imprisoned for offenses related to drug sales) to raise the prices of cocaine and heroin. Indeed, in spite of those stringent efforts, there have been marked price declines over the period.

Price data are generally drawn from STRIDE of the Drug Enforcement Administration (DEA). STRIDE records price and purity information from drug purchases undertaken by the DEA and a few local police

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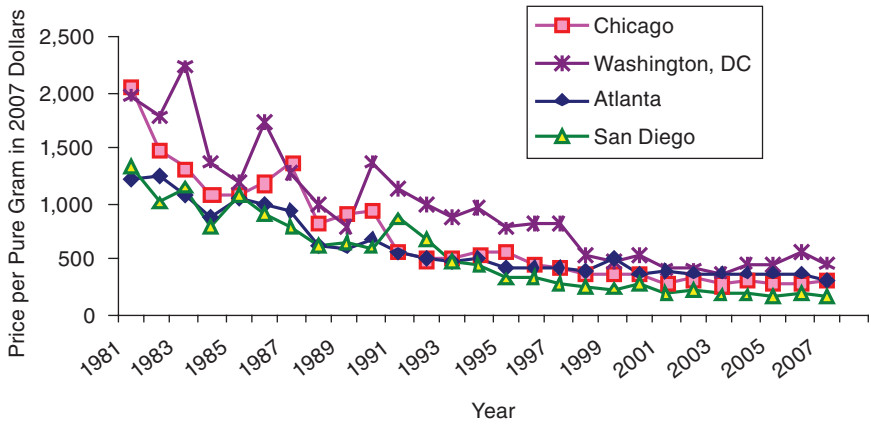


FIGURE 3-3 City trends in retail price of one pure gram of heroin at average purity offered, 1981-2007.
SOURCE: Office of National Drug Control Policy (2008).

departments (most notably, in the District of Columbia) who use the DEA laboratory for testing drug seizures. STRIDE's merits and drawbacks have been addressed by a number of authors, including a previous report of the National Research Council (2001; see also Horowitz, 2001; Rhodes and Kling, 2001). Caulkins (2007) provides further information on the proper use of STRIDE and its limitations (Arkes et al., 2008; Caulkins 2007). The most recent data, extending a price and purity series through 2007, were recently published by ONDCP (Office of National Drug Control Policy, 2008).

Figures 3-3 and 3-4 show inflation-adjusted price trends for heroin and powder cocaine, in Chicago; Washington, DC; Atlanta; and San Diego. Both figures show the average price per gram at the average purity offered. Heroin and cocaine displayed sharp price declines between 1983 and 1993, with much slower declines after that. There are occasionally short-lived spikes in prices, but none that has lasted for longer than a year. Price trends are also similar across cities, suggesting the difficulty of any cross-sectional time-series analysis that controls for city and year effects.

The real price of marijuana (for which only national estimates were available) was rather stable over the sample period: see Figure 3-5. However potency (the percentage of tetra hydrocannabinol [THC]) as measured by seizure samples rose over most of the period (National Drug Intelligence Center, 2008), so that one cannot determine what happened to potency-adjusted prices.

Figure 3-5 provides data for three levels of the market. One level is retail transactions, involving purchase of about one-tenth of an ounce at

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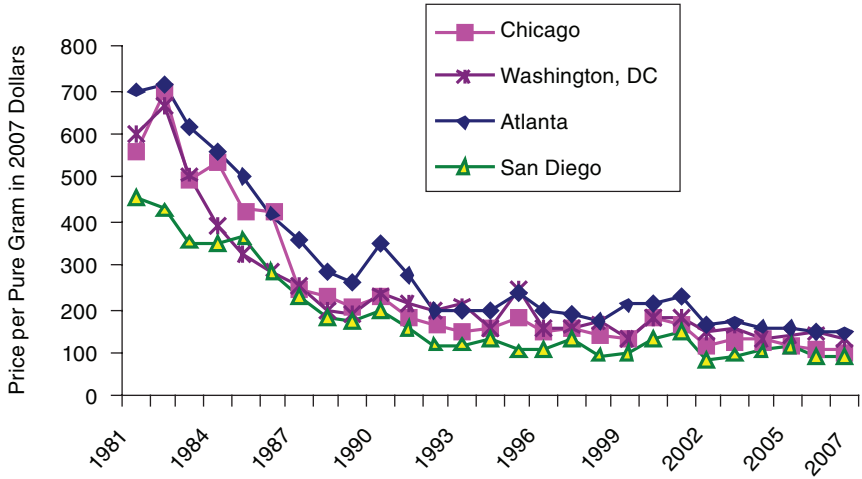


FIGURE 3-4 City trends in retail price of one pure gram of powder cocaine at average purity offered, 1981-2007.
SOURCE: Office of National Drug Control Policy (2008).

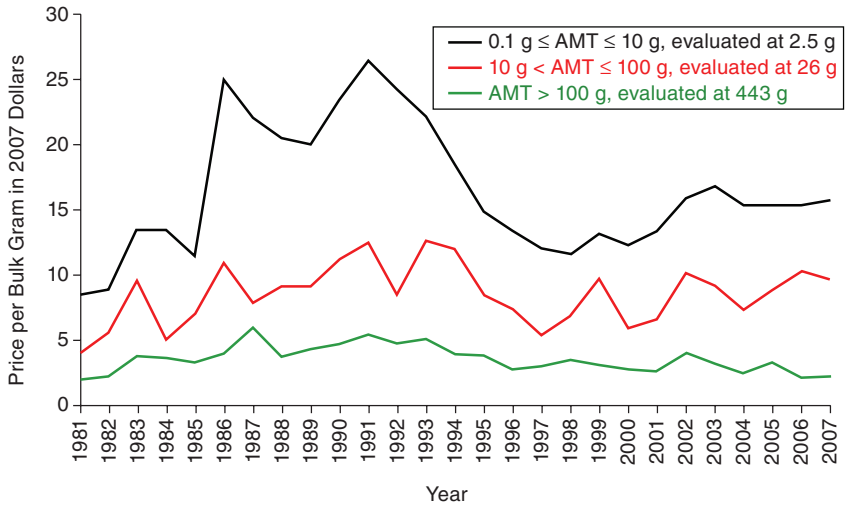


FIGURE 3-5 Price of one bulk gram of marijuana at three different market levels, 1981-2007.
NOTES: AMT = amount; g = gram.
SOURCE: Office of National Drug Control Policy (2008).

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$20 per gram (in recent years) and individual expenditures of approximately $50. Another level is low-level wholesale transactions, with purchases of about an ounce; the price has been about $10 per gram and expenditures would be around $250. The third level is transactions at the high wholesale level, involving about a pound and, in recent years, a price of $6 per gram and expenditure of $2,500. These data indicate how high a proportion of the final price of marijuana is accounted for the activities of lower level dealers.

In order to assess the effects of these price changes over time on consumption, it is important to pay attention to substances that are potential substitutes or complements to these drugs. The real price of beer and spirits also declined markedly over the same period. Real tobacco prices sharply increased, reflecting state and local excise tax increases, as well as price increases brought about by the tobacco master settlement agreement.

CHANGES IN DRUG MARKETS SINCE 1990

Drug markets have changed in many ways since 1990. In particular, the markets for cocaine and heroin now both involve much older buyers and sellers, and this change has profound consequences for how the markets operate and for their effects on society.

During the 1990s, the number of "chronic users" of cocaine and heroin showed steady decline according to the most recent estimate published by the ONDCP (Office of National Drug Control Policy, 2001).[7] Yet the number of emergency department admissions and the number of deaths related to these drugs markedly rose. In the case of heroin, it was estimated that the total number of chronic users fell from 1,000,000 in 1990 to 800,000 in 1999 while the estimated number of emergency department admissions related to heroin rose from 33,000 to 84,000. Over this time period, the rate of emergency department admissions per heroin addict rose from about 3 per hundred to 10 per hundred. This is consistent with a population which, through aging, is increasingly subject to acute health problems (Scott et al., 2007).

Another manifestation of the aging phenomena may be the decline in crime despite continued high rates of detected crack use. Levitt (2004) argued that the receding of the crack epidemic was a major factor in explaining the decline in black youth homicides in the 1990s, just as the epidemic itself was a principal driver of the homicide rise in the

[7]Successive estimates showed considerable variation both in absolute numbers for the same estimate year and in the pattern of changes year to year (Office of National Drug Control Policy, 1995, 1997).

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1980s. In a subsequent article (Fryer et al., 2005), Levitt and colleagues develop a crack index that summarizes diverse indicators of crack use. The index was flat through most of the 1990s, and the authors conjecture that the decline in homicide, in particular, arose from the creation of property rights—that is, established ownership of specific locations for selling drugs—in a stabilized market. The property rights hypothesis is an interesting one; we know of no evidence to directly test it. However, large urban policy initiatives, such as the Chicago Housing Authority's Transformation project, may provide policy experiments to scrutinize this hypothesis (Jacob and Ludwig, 2006). A recent study of the Denver heroin market (Hoffer, 2006) points to the complexity of arrangements in these markets and the extent to which they are shaped by specific physical and social environments. In Denver, the open air heroin market settled in an area that had been occupied by a number of homeless men, some of whom were themselves heroin addicts. When Hoffer observed the market in the 1990s, these men had become important go-betweens for the more professional sellers, mostly illegal Mexican immigrants working for a Mexican drug gang, and the broader population of users in the city. The city cleaned up the area in the mid-1990s, partly to prepare for the new baseball stadium. This change made the area much less attractive both to customers and to the immigrant sellers; the locals moved from being go-betweens to active sellers themselves and forced the market to be reconfigured in a number of different ways.

Given that male violence declines with age, a simpler, compelling hypothesis for the changed linkage between aggregate measures of crack use and homicide may be found in the aging of the crack-using population, conjectured in MacCoun and Reuter (2001). This pattern is also consistent with prison inmate survey data, which show marked aging in the population of prison inmates who reported recent cocaine use at the time of their incarceration (Pollack, Reuter, and Sevigny, 2010). Prison inmate survey data also indicate sharply declining age profiles in violent offending among cocaine users (Pollack et al., 2010).

The contrasting trends in numbers and adverse consequences suggest that the overall number of drug users is just one of several variables that influence the health, employment, and crime consequences of substance use. The age of drug users, the duration and intensity of their drug use, and other factors play important roles. Similar insights apply to the supply side of illegal drug markets. The aging of drug sellers and the maturing of drug markets may be more important than the overall number of drug sellers in determining the social effects of these markets on local communities.

An influential study by Levitt and Venkatesh (2000), based on data collected in the early 1990s, examined the young and eager sellers will-

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ing to work for low wages in the hope of succeeding to the position of a high-level dealer. These sellers, 15 years later, may form an aging cohort of cocaine-dependent sellers, who are advantaged by the fact that they take some of their return in the form of reduced-price drugs. More recently, youths may no longer be so readily tempted to enter into drug selling rather than completing school.

In this respect, data collected on juvenile arrestees in the District of Columbia since 1987 are of some interest. In the late 1980s more than 20 percent of juvenile arrestees tested positive for recent cocaine use; the comparable figure since about 2003 has been less than 4 percent (District of Columbia Pretrial Services Agency, 2009).

Given the chronic, relapsing nature of substance use disorders, these age patterns become especially important (Pollack et al., 2010). For example, Hser and colleagues (2001) found that the risk of incarceration for a cohort of heroin addicts they recruited in 1964 varied over the 33 years that they followed them. When the addicts were surveyed at the first follow-up in 1973-1974 at average age 37, 23 percent were incarcerated; in 1996-1997, at average age 57, only 14 percent of the survivors were incarcerated.

Most recently, Basu, Paltiel, and Pollack (2008) used data from NTIES to examine criminal offending among substance abuse treatment clients. These authors report that clients under the age of 25 were four times as likely to report that they had recently robbed someone with a weapon as were clients over the age of 30. Although by some measures older clients achieved better treatment outcomes, substance abuse treatment was most cost-beneficial when provided to the most criminally active population of male clients under 25, precisely because these younger drug addicts inflict such high costs on society through their criminal offending.

Recently, there has been some attention to the aging of the population being treated for drug dependence. Trunzo and Henderson (2007) show that, of those in treatment for drugs or drugs and alcohol, the number over age 50 quintupled in 13 years (1992-2005), while the total population in treatment rose only by 14 percent over about the same period (1993-2003). According to 2005 TEDS data, substance abuse treatment clients over the age of 50 have been using for a very long time (Trunzo and Henderson, 2007): the average duration of cocaine use was 20 years; the average duration of heroin use was 34 years.

These data indicate strong period effects in the reported initiation of some substances, though not others. Figure 3-6 shows the reported year of first use among patients recently admitted for heroin use disorders aged 50 or older in 2005: more than one-third of them initiated use between 1966 and 1971; more than three-fourths initiated use before 1980.

Figure 3-7 shows the most dramatic descriptive evidence of cohort

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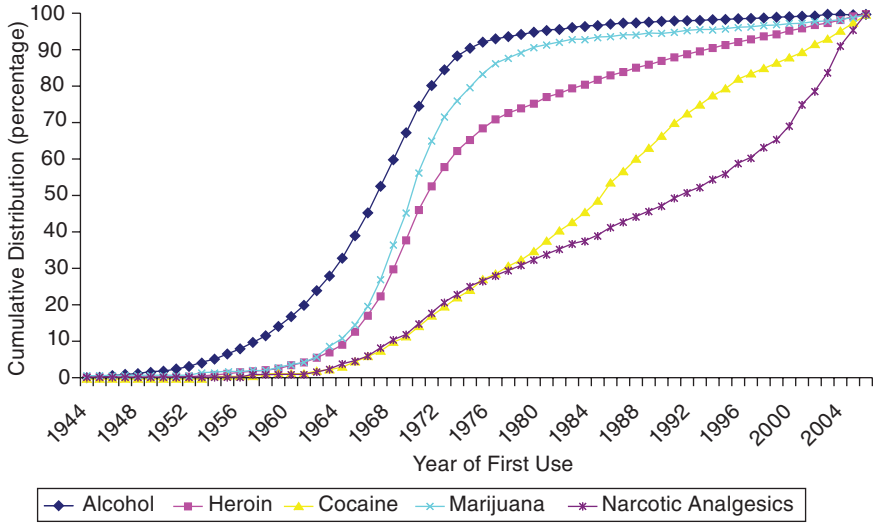


FIGURE 3-6 Year of first use for clients over age 50 at treatment entry in 2005, by substance.
SOURCE: Modified from Trunzo and Henderson (Substance Abuse and Mental Health Services Administration, 2007).

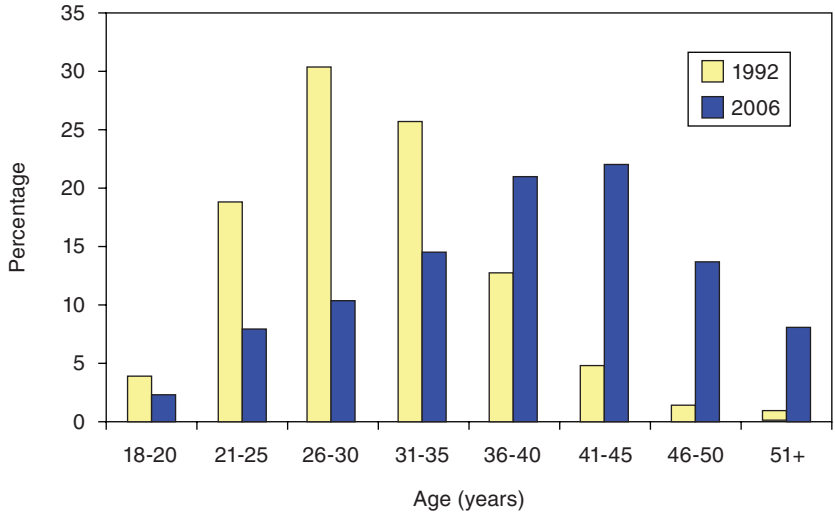


FIGURE 3-7 Changes in the age distribution of clients admitted for smoked cocaine disorders, 1992 and 2006.
SOURCE: Treatment Episode Data Set (Substance Abuse and Mental Health Services Administration, 2007).

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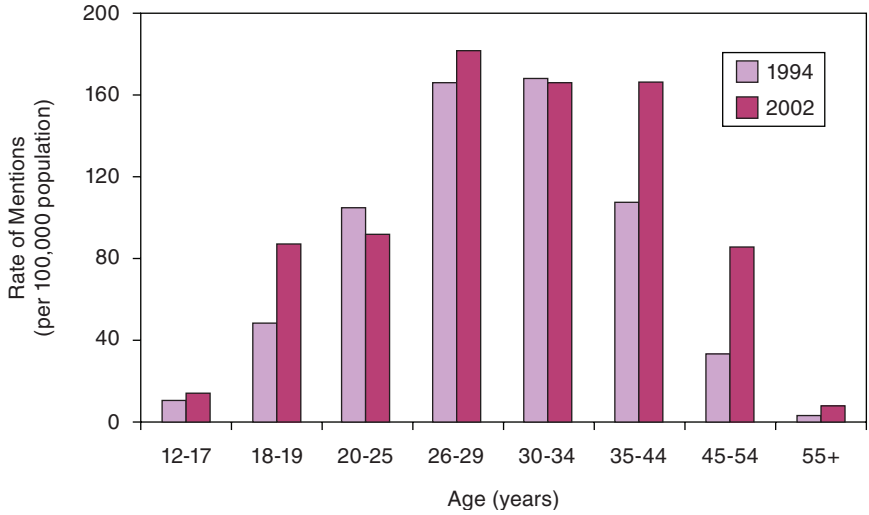


FIGURE 3-8 Mentions of cocaine in emergency departments, by age, 1994 and 2002.
SOURCE: Data from Substance Abuse and Mental Health Services Administration (2002, 2003).

aging among in-treatment substance users. The figure, drawn from 1992 and 2006 TEDS data, displays changes in the age distribution of clients admitted for cocaine (smoked) disorders. In 1992 more than 50 percent of those entering treatment were 30 years old or younger; in 2006 that figure had dropped to 21 percent. At the same time, the percent over age 40 rose from 7 percent to more than 40 percent. These changes do not reflect the consequence of an epidemic of new use among the older population; rather, they represent the aging of those who were caught in the earlier epidemics.

Similar, although somewhat weaker evidence of aging can be found in DAWN emergency department data: see Figure 3-8. The population-adjusted rate of cocaine-related admissions hardly changed between 1994 and 2002 for age groups under 35. The rate increased by 75 percent for patients aged 35-44, and it more than doubled for those aged 45-54.

In the case of heroin, there is other evidence of a sudden elevation of initiation rates during the late 1960s and early 1970s, followed by a rapid decline to a much lower rate, a phenomenon first reported by Kozel and Adams (1986). Similarly, in an early 1990s sample of street heroin users, Rocheleau and Boyum (1994) also found evidence of much higher initiation rates in the early 1970s than in the following 15 years. For cocaine powder, the decline is less pronounced than that for heroin

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(Rydell and Everingham, 1994). More recently, Caulkins and colleagues (2004) reported estimates of annual cocaine initiation using NHSDA and a variety of methods; all show a peak in 1980 followed by a decline of two-thirds in the next 5 years. For crack cocaine, the epidemic was still later, starting between about 1982 and 1986, depending on the city (Cork, 1999).

This phenomenon of sudden change in initiation has been the subject of a new class of epidemiologic models developed by Jonathan Caulkins and collaborators (e.g., Caulkins et al., 2004; Tragler et al., 2001). These authors use diverse data to document the long trajectory of drug epidemics. After the peak, the initiation rate does not return to its original zero level, but it does fall to a rate well below the peak. Under reasonable assumptions, the result is a flow of new users who do not fully replace those lost through desistance, death, or incarceration. Thus, the number of dependent users declines over time. Moreover, the drug-using population ages, with corresponding changes in the health, employment, and crime consequences of substance use.

This aging phenomenon is not restricted to the United States. Similar analyses of the aging heroin-dependent population can be found in Switzerland. For example, Nordt and Stohler (2006) show the same kind of sharp increase and decline in heroin initiation. They reference a similar pattern in Italy. However, data from England (De Angelis et al., 2004) and Australia (Law et al., 2001) show a much slower and less peaked epidemic of initiation. These findings are a reminder that epidemics represent social rather than biological contagion and so vary in shape over time and place, and they focus attention on what can be done to prevent new ones from taking hold. In addition to the formal modeling of epidemics of drug use, there is a substantial observational literature, often based on ethnographic research that describes the process of change; see, for example, Agar and Risinger (2002) on heroin, Hamid (1991) on crack, and Murphy and colleagues (2005) on ecstasy. Understanding what generates these sudden upsurges in particular places and particular times is a research issue of the greatest importance.

CONCLUSION

Economic models help to illuminate drug markets, but they leave many unsettled questions. Nationally representative survey data provide a useful resource to examine the determinants of occasional drug use, particularly among youth and young adults. The most socially costly forms of chronic substance abuse and dependence are not well captured in available survey data. Other epidemiological sources—including emergency department data and analysis of data from arrestees—provide a better, albeit indirect, window into these patterns.

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4

Treatment

Treatment can be considered one in the panoply of strategies that could reduce demand for drugs. The logic is simple: if drug users can be systematically removed from the drug marketplace through participation in treatment, demand will be reduced. The extent of the impact on demand would depend on the numbers removed, the amount they consume, and the duration of their removal (Meara and Frank, 2005; Reuter and Pollack, 2006). This logic is compelling and supported by the observation that treatment episodes are frequently associated with reduction (in relation to pretreatment levels) or cessation of drug use (see Carroll and Onken, 2005; Higgins et al., 2000; Hubbard et al., 1997). The empirical question is whether the reductions in drug use are sustained enough, given the high relapse and dropout rates that characterize treatment, to make a large difference in total demand.

We emphasize treatment rather than prevention primarily because the evidence on the effectiveness of prevention programs at the population level is discouraging. Caulkins and colleagues (1999) demonstrated that even an optimistic reading of the research literature at that time showed a limited capacity of prevention to reduce total drug consumption; for a more recent review of research on efficacy of prevention see Faggiano et al. (2005). Developing better drug prevention programs is an important issue, but it is one that goes beyond what this committee was able to consider.

This chapter takes a broad perspective to examine the question of whether and how treatment can affect drug demand. We start by explor-

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ing what is currently known about the natural history of drug use and the role of treatment in the lives of drug users: what proportion of users enter treatment, when, how, and why they do so. We next briefly explore current treatment data. We then turn to the potential for reducing demand through expansion of treatment, with particular attention to integration of drug treatment with the criminal justice system. Finally, we consider how the impact of policy changes designed to expand, improve, or better integrate drug abuse treatment services can be modeled and researched.[1]

NATURAL HISTORY OF DRUG USE

Entry into substance abuse treatment is clearly not the only or even the most prevalent pathway to stopping harmful levels of psychoactive substance use. Natural history cohort studies of alcoholics, for example, have revealed that most people modulate or stop heavy use on their own, without formal treatment. One large survey of randomly selected adults in the general population (Sobell et al., 1996) found that 78 percent of individuals who had recovered from an alcohol problem for 1 year or more did so without help or treatment. Dawson and colleagues (2005) reported findings from another large population-based study, the National Epidemiologic Survey of Alcohol and Related Conditions. Overall, independent of current recovery status, only 26 percent of adults with prior alcohol dependence reported having received treatment. However, this percentage was considerably higher (49 percent) among those who were currently abstaining and much lower (12-19 percent) among those who were still drinking at some level. One factor clearly associated with independent change versus treatment entry is severity of alcohol use and associated problems: those who elect treatment have a more serious substance use history than those who change on their own (Carballo et al., 2008).

Long-term studies that contribute to understanding of the natural history of opiate and stimulant use have also been conducted with drug users. In contrast to the research with alcoholics, however, for which large samples of the general population have formed the basis for research, samples of drug users have generally been drawn from people in treatment programs. This difference may reflect, in part, the difficulties of conducting population-based research with the relatively small (in relation to the general population) and "hidden" population represented by drug users.

George Vaillant (1973) pioneered the research with opiate users by

[1]We are indebted to Sindelar and Kilmer (2007) for their presentation at the committee's workshop on many of the issues in this chapter.

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following for 25 years a cohort of 100 heroin abusers who had been incarcerated at the federal facility at Lexington, Kentucky, a program designed specifically to benefit a population of urban heroin users. The theory was that these individuals would desist from drug use after return to their home environment following a lengthy period of enforced abstinence accompanied by "healthful" activities at the Lexington facility. At 20 years after the index incarceration, 35 percent of the original sample were indeed stably abstinent in the community. However, 48 percent were still addicted or had died, with 17 percent having an unknown outcome.

Another group of epidemiological researchers at the University of California, Los Angeles, have expanded on these early natural history studies by conducting a 33-year follow-up of 581 male opiate addicts who were admitted to the California Civil Addict program (a treatment alternative to incarceration) in 1962-1964. Over the course of the follow-up, many individuals stopped opiate use for extended periods, with nearly half (47 percent) reporting abstinence for 5 years or longer at some time. Yet the overall findings at the time of the 33-year follow-up, when the average age of the cohort was 47.6 years, were less favorable: 41 percent did test negative for opiates, indicating at least recent abstinence, but 31 percent tested positive for opiates, and 28 percent had died (Hser et al., 2001).

Hser and colleagues (2007b) identified three groups of opiate abusers with distinctive profiles: (1) stable high-level users (59 percent) who maintained consistent use over time despite intermittent periods of abstinence, (2) decelerating users (32 percent), who decreased use only after extended periods (10 years or more) of regular use; and (3) early quitters (9 percent), who ceased use within 10 years of initiation. Although many opiate users in follow-up studies have reported trying both self-help and formal treatment at various times, a relatively low percentage (< 10 percent) reported being enrolled in methadone treatment at any given time (Hser et al., 2001). This finding suggests that treatment does not play a major role in the lives of the majority of these drug users. We note, however, that these longitudinal studies yield little information about the role of treatment exposure, if any, in the long-term trajectory of drug users who do eventually stop in comparison with those who do not (Hser et al., 2007a). These studies do suggest, however, a potentially useful way of looking at long-term outcome data to determine whether the proportion of drug users in the decelerating trajectories could be increased by treatment intervention.

Since lifetime patterns of use may be influenced by the type of drug being abused, it is useful to conduct separate longitudinal analyses with primary users of nonopiate drug classes. Hser and colleagues (2007a) examined long-term patterns of cocaine, methamphetamine, marijuana,

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and heroin use of 566 drug users selected from a sample recruited at jails, hospital emergency rooms, and clinics for sexually transmitted diseases in Los Angeles County in 1992-1994. For marijuana, weekly use was reported by slightly more than 40 percent of the sample at age 20 but by only 15 percent at age 43: this difference suggests a natural decline as these users take on adult responsibilities. Reports of methamphetamine use were low to begin with but declined further: from about 8 percent to 2 percent of the sample between ages 20 and 43. For cocaine, weekly use increased from 17 percent at age 20 to 37 percent in the mid-30s and declined somewhat thereafter. Heroin use increased with age: from about 7 percent who reported weekly (or more) use or more at age 20 to nearly 20 percent at age 43. These data suggest that lifetime trajectories of use differ across specific substances. However, as with the opiate sample studies, they provide little information about the role of treatment in altering these trajectories.

Another study by Hser and colleagues (2006) examined outcomes for a sample of 266 male veterans admitted for treatment of cocaine dependence in 1988-1989. The study found that 52 percent achieved stable recovery by maintaining abstinence from cocaine for 5 years or longer. Although quantitative data on treatment exposure was not reported in this sample, there was a positive relationship between treatment participation and changes in drug use over time. Both treatment and early response to treatment predicted a higher rate of decline in cocaine use over time.

Researchers at Chestnut Health Systems followed a cohort of drug users (N = 1,162) recruited at 22 treatment programs in Chicago between 1996 and 1998 and interviewed annually for 8 years (Dennis et al., 2007; Scott et al., 2003, 2005a). Over half, 54 percent, were opioid users; 82 percent had used stimulants; and 73 percent were marijuana users. At the 8-year follow-up interview, 57 percent were actively using drugs. Long-term abstinence (1 year or more) was documented for 23 percent of the sample, while 20 percent had been abstinent for at least 1 month but less than 1 year (i.e., unstable or short-term abstinence) at the time of the 8-year follow-up. Although the time frame is much shorter in this than in other studies, these data are consistent with those of Hser and colleagues (2001, 2007b) in that about 60 percent of drug users followed after an index treatment episode had poor long-term outcomes as evidenced by continued drug use.

The data reported in longitudinal studies suggests that there may be discernible patterns of drug use over the course of a lifetime and that these patterns may vary across substances. While the role of treatment over the life span is not at all well documented, the hope is that the lifetime pattern of decline in and cessation of drug use observed in subsets of

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drug users would occur earlier, at a faster pace, or increased in prevalence if more drug users were involved in effective treatment intervention.[2]

Currently, drug dependence is usually well established and lengthy before first entry into treatment; the average time between initiation of use of the problem drug and entry into treatment is 10-15 years (Dennis et al., 2007; Hser et al., 2006, 2007b). This gap suggests that treatment is not an especially attractive option for drug users early in their drug use careers. Drug users may fail to enter treatment for a variety of reasons, including limited availability in the health care system and the stigma, cost, and reporting burden of participation, as well as the competing attraction of continued drug use so long as associated problems are not overwhelming. These dynamics and others may explain why drug users tend not to seek treatment for many years after drug use is initiated. However, more research on the determinants of first entry timing would be valuable.

Also valuable would be research on the interplay between natural fluctuations in drug use and participation in episodes of treatment, as well as the impact of treatment entry on the long-term course of drug use. Drug dependence has increasingly been defined as a chronic relapsing brain disorder for which permanent abstinence may not be a realistic goal of any single round of treatment for heavy long-term users (National Research Council, 2001). Dennis and colleagues (2005), for example, document that multiple treatment episodes are the norm for drug users and suggest that prior treatment exposure may be associated with poor outcomes. But other data suggest that long-term prognosis appears to be better for those who re-enter treatment promptly after relapsing (Moos and Moos, 2007; Scott et al., 2003). These findings highlight the current lack of clear understanding about the interplay between treatment entry and drug use trajectories.

Importantly, however, it has been observed that the long-term effects of treatment can be predicted by a person's short-term response during treatment (e.g. Higgins et al., 2000) and participation in aftercare and self-help programs (Scott et al., 2003; Weisner et al., 2003a). For example, Higgins and colleagues (2000), with data from 190 clients who had participated in a variety of specific treatment research conditions, found a linear relationship between the percent abstinent at the 12-month follow-up and the duration of documented abstinence achieved during treatment, irrespective of the conditions under which this abstinence was attained. Weisner et al. (2003a) showed that 5-year outcomes were strongly predicted by 6-month outcomes in a large sample of patients (N = 784) from a managed care chemical dependency program, and Dennis and colleagues

[2]The National Research Council (2001) noted that between 3.5 and 6.7 million people in the United States are in need of effective drug treatment but less than half currently receive it.

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(2007) have documented the positive life-style changes that are associated with prolonged periods of abstinence. These observations suggest the potential importance of treatments that can effectively promote abstinence and potentially lengthen the perspective on intervention with drug users to include longer-term monitoring and re-treatment (Dennis et al., 2003; Scott and Dennis, 2009; Scott et al., 2005b).

TREATMENT AVAILABILITY, EFFECTIVENESS, AND USE

This section considers the capacity and effectiveness of the current drug abuse treatment system and its adequacy to affect levels and patterns of drug use. In the United States, there are about 14,000 facilities that offer drug abuse treatment, and they serve more than 1.1 million drug and alcohol users, according to the National Survey of Substance Abuse Treatment Services (Substance Abuse and Mental Health Services Administration, 2008). The majority of these (more than 70 percent) are "drug-free" treatment programs that offer outpatient psychosocial counseling, generally of 3-6 months' duration; the others offer short-term (1 month or less) or long-term residential programming, outpatient methadone maintenance, or brief detoxification services. The large national studies that have been conducted to examine the effectiveness of the treatment in the United States have generally supported the effectiveness of all treatment modalities as intervention for drug users, with the exception of brief detoxification. This research includes several long-term follow-up studies of large samples of treated drug users: the Drug Abuse Report Program, conducted in 1969-1973 (Sells and Simpson, 1980; Simpson et al., 1979); the Treatment Outcome Prospective Study conducted in 1979-1981 (Hubbard et al., 1989); and the Drug Abuse Treatment Outcome Studies (DATOS), conducted in 1991-1993 (Hubbard et al., 1997). Findings are consistent with treatment benefits reported in national survey studies from both Australia (Teesson et al., 2004) and Great Britain (Gossop et al., 2003).

Using a pre-post comparison design, these studies show that the amount of drug use in the years following treatment entry is lower than the amount reported prior to treatment entry. Because these are not controlled studies, however, it is difficult to know how much this reduction is due to the treatment itself and how much to a natural recovery from heavy periods of drug use. Nonetheless, cost–benefit analyses have supported the benefit to society of treatment intervention for drug users. One study conducted in California, for example (Ettner et al., 2006), calculated that $7 is saved for every $1 spent on drug abuse treatment; the main benefits are from reductions in drug-use-associated criminal activity and increases in employment earnings. Given that studies show the effectiveness of treatment, it is underutilized. National treatment databases, compared

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with national estimates of drug use prevalence, support the evidence from epidemiological studies that a relatively small proportion of drug users are in treatment at any given time. For example, the Treatment Episode Data Set (TEDS) shows that for 2000 (the year of the most recent estimate of the number of chronic users of cocaine and heroin) there were an estimated 898,000 chronic heroin users in the United States (Office of National Drug Control Policy, 2001) but only about 270,000 treatment admissions for people whose primary drug problem was with heroin. This comparison across databases suggests that as many as 30 percent of users were in treatment. However, this may be an overestimate since TEDS does not differentiate between multiple admissions of the same individual and those entering long- or short-term (including detoxification) treatment. In 2006, the number of admissions for opioid use problems in the United States climbed to about 310,000, due mostly to an increase in admissions of prescription opioid users to the same system that serves heroin users. Although the exact percentage of drug users who are in treatment is debatable, it is clear that the majority of users are not in treatment at any given time. The relatively low treatment participation rate may reflect insufficient availability, low treatment acceptability among users, or low treatment efficacy such that capacity is used to recycle previously treated clients rather than new, previously untreated, users (McCarty et al., 2000). In contrast to the pattern in the United States, a number of Western European nations (including the Netherlands, Switzerland, and the United Kingdom) have treatment participation rates of more than 50 percent for those who are opioid dependent.

TREATMENT EXPANSION

Voluntary Participation

If treatment is going to have a larger impact on the demand for drugs, it would be important to increase its reach by attracting the participation of more drug users. Improving voluntary participation may require some new strategies that remove barriers to treatment entry while making treatment itself a more attractive option. For example, there has been some success in promoting treatment entry by using vouchers that are distributed to drug users at the locations such as needle exchange sites (Booth et al., 1998; Strathdee et al., 2006). This strategy could be expanded to contact drug users in other sites, such as medical and mental health facilities, pediatric clinics, drop-in centers, and welfare and child protective services agencies. Research and evaluation would be needed to support the effectiveness of such efforts. The acceptability of treatment could be enhanced by removing some of the barriers to entry (e.g., expanding treatment

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hours and locations) and by including more tangible and desired services for clients, such as employment and housing services (Laudet and White, 2010), as well as evidence-based incentive interventions (DeFulio et al., 2009; Silverman et al., 2002, 2007; Stitzer and Petry, 2006). The issue of treatment acceptability and attractiveness to clients is critical in the case of voluntary participation, and more research is needed on the attributes of treatment that drug users would find desirable.

Integrating Treatment with the Criminal Justice System

Although the methods that may be needed to increase voluntary participation are currently speculative, one logical and more certain pathway for enhancing the reach of drug abuse treatment to a large relevant population of drug users would be through coordination with the criminal justice system (Chandler et al., 2009). The interplay between drug use and criminal behavior has been well documented in longitudinal research with opiate users (Nurco et al., 1985). It is also well known that a high percentage of people in prison have been involved with drugs. For example, a 1997 national survey showed that more than half of state and federal inmates reported drug involvement in the month before their offense and 70-80 percent reported some past drug use (Mumola, 1999). Similarly, a 2004 survey indicated that 53 percent of state and 45 percent of federal prisoners met the psychiatric criteria[3] for drug dependence or abuse (Mumola and Karberg, 2006).

Behavior Therapy Approaches

In response to the clear overlap between drug use and criminal involvement, both state and federal prisons have begun to provide drug abuse treatment services to inmates. Overall, it is estimated that substance abuse treatment services are offered in about half of correctional system agencies, including jails, prisons, and probation and parole departments (Taxman et al., 2007). As reviewed by Grella and colleagues (2007) and Taxman and colleagues (2007), however, the majority of these services consist of low intensity education and counseling, although some more intensive in-prison therapeutic communities and counseling services have been established and evaluated. Mitchell and colleagues (2007) reviewed the research on efficacy of these intensive incarceration-based treatment models and conducted a meta-analysis of published studies. They found that in-prison therapeutic community

[3]The standard criteria are those in the Diagnostic and Statistical Manual of Mental Disorders 4th edition.

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treatment was consistently associated with reductions in both criminal recidivism and drug use of inmates when released in comparison with those who did not receive this type of treatment. Thus, the effectiveness of therapeutic community treatment appears to be supported. In-prison counseling programs were also associated with lower rates of recidivism but not with lower rates of postrelease drug use. The latter finding needs further study because it is inconsistent with the assumption of a functional association between drug use and criminal behavior.

The effectiveness of in-prison treatment may be further enhanced by continuing postrelease interventions. Pelissier and colleagues (2007) provide a thoughtful review of aftercare research that highlights the difficulties of interpreting and drawing conclusions from the existing literature. These difficulties include cross-study inconsistencies in the definition of aftercare (e.g., residential or outpatient services), as well as differences in definition and analysis of outcomes. There are also interactions between aftercare, in-prison treatment, and judicial supervision practices that make clear conclusions about the role of aftercare very difficult to draw. Furthermore, it is important to keep in mind a basic weakness of all the criminal justice treatment literature, which is that participation in special programs has been voluntary so that samples are self-selected rather than randomly assigned to treatment conditions. Thus, while research generally supports the efficacy of in-prison treatment followed by community aftercare (see, e.g., Aos et al., 2006), there is much more information needed to fully elucidate the nature, amount, and timing of effective treatment and the characteristics of drug-involved offenders who can benefit from various treatment configurations.

Although existing data on the benefits of treatment for drug-involved offenders may be less rigorous than is desirable, there are studies that show treatment of drug-involved offenders has a positive cost-benefit ratio when analyses are conducted with a variety of comparison groups and drug-using populations (Daley et al., 2004; Ettner et al., 2006; Godfrey et al., 2004; McCollister et al., 2004). For a more complete discussion on the effects of drug treatment for drug-involved offenders, see National Research Council (2001, Chapter 8).

Drug Courts

Drug courts represent a relatively new and innovative variation on pretrial diversion strategies whose goal is to integrate treatment with criminal justice supervision. Drug courts, which have been operating in the United States since 1994 (Belenko, 1998, 2000; U.S. Department of Justice, 1995, 1998, 2006), generally mandate that drug-involved offenders receive treatment in the community in lieu of serving time in jail or

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prison. Within the system, judges have the discretion to impose a mixture of sanctions (including incarceration) and rewards based on evidence of active treatment participation and abstinence from drug use. These types of programs are likely a cost-saving alternative to prosecution and incarceration for drug-involved criminals, considering the high cost of prosecution and incarceration. In addition, the sanctions available in the criminal justice system can provide a strong motivation for positive outcomes in drug court participants.

There is a growing body of evidence of the effectiveness of drug courts, particularly with regard to reduced recidivism (Belenko, 2001; U.S. Government Accountability Office, 2005). However, a recent Urban Institute study (Bhati et al., 2008), notes that eligibility for drug court participation is currently highly restrictive and only a trivial proportion of criminally involved drug users participate in such programs. In that study (Bhati et al., 2008), a synthetic dataset was constructed from several sources—the National Survey on Drug Use and Health, the Arrestee Drug Abuse Monitoring Program, and DATOS—to examine the theoretical crime reduction benefits that could be expected if treatment were provided to all offenders in the United States with a history of drug abuse or dependence (estimated at 1.5 million offenders). The study found that the current system saves $2.2 in costs to society for every $1 spent on the diversion program but that only about half of those eligible under current criteria are actually treated. In this model, expansion of treatment to all at-risk arrestees would remain cost-beneficial, with an estimated $3.36 saved for every $1 spent. This is a provocative study that supports in theory the benefits of expanding diversion programs.

Medication-Assisted Treatments

A recent addition to the literature on treatment of drug-involved offenders highlights the utility of medication-based interventions for individuals with histories of opioid dependence (Gordon et al., 2008; Kinlock et al., 2008). In this study, prisoners with a history of opioid dependence (N = 211) were randomly assigned to receive methadone maintenance treatment initiated either before or shortly after release from incarceration; the control group who was released received drug abuse counseling without medication. The study demonstrated significantly better outcomes on measures of treatment entry, drug use, and criminal activity both 3 months after (Kinlock et al., 2008) and 6 months after release (Gordon et al., 2008) for those who could access methadone maintenance in comparison with those who were not offered this option. Among those who received counseling only, 65 percent tested positive on a urine test for opiate use at 6 months follow-up in comparison with 48 percent and 28

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percent, respectively, for those who initiated methadone treatment shortly after or before release from prison. Those in the methadone maintenance groups reported about half the number of crime days as those in the counseling-only group. Finally, there was a substantial difference in the amount of treatment participation reported by the groups, with means of 65, 32, and 11 days, respectively, reported at 6 months for the prerelease methadone, postrelease methadone and counseling-only groups. This is an important finding from a relatively small but well-designed study that suggests more widespread implementation of methadone treatment for incarcerated opioid abusers would be useful. Whether such an initiative would be acceptable to the criminal justice system—and the conditions under which it could be implemented—remain to be determined.

A second option for medication treatment of opioid-involved offenders is the long-acting formulation of the opioid antagonist, naltrexone. A recent randomized clinical trial (Hulse et al., 2009) demonstrated the efficacy of sustained-release formulations in comparison with short-acting oral medication. Naltrexone, when implanted, sustained higher blood levels across time and significantly reduced rates of opioid relapse at 6 months in comparison with an oral formulation (relapse rates of 8 and 30 percent). The potential utility of sustained-release naltrexone as a treatment alternative for use with opioid-involved criminal justice clients seems apparent, and the strategy was acknowledged (though not funded) in the Second Chance Act signed by President George Bush in 2008. The utility of this intervention has been demonstrated in a study conducted with federal parole and probation clients (Cornish et al., 1997), but research on this model remains sparse (but see Patapis and Nordstrom, 2006), and the Second Chance Act has been largely ignored. Additional research on the feasibility and effectiveness of sustained-release naltrexone for use in criminal justice populations is warranted.

Overall, better coordination of treatment and criminal justice programs could be a very effective component of a demand reduction strategy. Expansion of treatment to accommodate more users involved in crime would almost certainly affect a large number of drug users, including those who would not otherwise go voluntarily to treatment. It is estimated that there are about 2.3 million adults incarcerated in the United States (Bureau of Justice Statistics, 2009), and, as noted above, about half of them used drugs in the month prior to their incarceration (Mumola and Karberg, 2006). An additional 4.8 million adults are on probation or parole in community settings (Glaze and Bonczar, 2006), with a similar percentage of drug-involved individuals. To the extent that prison inmates and releasees under community supervision are an accessible and receptive population, the reach of treatment programs could be substantial. However, treatment of more than 3 million new drug users would require

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approximately a doubling of the current 1.8 million annual nationwide drug abuse treatment admissions reported in the TEDS for 1996-2006. Clearly, this strategy would come at some cost, though it appears that diversion of more drug users into treatment or direct delivery of treatment services in the criminal justice system could be cost-beneficial, with the costs of treatment offset by reduction in future criminal justice costs, including arrests, prosecutions, and incarceration of recidivist offenders (Bhati et al., 2008; Daley et al., 2004; Ettner et al., 2006; Godfrey et al., 2004; McCollister et al., 2004).

One caveat to any cost–benefit analysis is that expanded treatment might bring more severe cases into treatment, a factor that could reduce the cost–benefit tradeoff that is based on current treatment clients. But additional support for the potential effectiveness of this approach comes from research on outcomes for coerced participants, which shows that the outcomes are similar to or better than those for voluntary participants (Perron and Bright, 2008). More research would be beneficial to provide actual rather than theoretical data on the cost-benefit tradeoff of therapeutic jurisprudence programs and to broaden the circumstances under which coerced versus voluntary treatment is examined.

Barriers and Issues in Treatment Expansion

Expansion of the current treatment system would require allocation of additional funding that could come from a variety of sources. In addition to the identification of funding sources, several other challenges are also historically associated with the ability to expand treatment services. For example, it may be difficult to identify physical locations for new treatment programs due to the reluctance of neighborhood residents to host drug treatment clinics in their area. This means that innovation may be required for treatment expansion that requires new physical sites. One example is use of mobile treatment vans that can park either in a single location or move to service several different locations during a day. There have been successful mobile methadone maintenance programs in Baltimore (Butler and Swanton, 2006; Greenfield et al., 1996) and other cities (Boston, San Francisco, Seattle), as well as entire states and territories (New Jersey, Vermont, and Puerto Rico). Availability of buprenorphine by prescription at physician offices is yet another innovation that could expand treatment availability, at least for opioid users (Sullivan and Fiellin, 2008). New psychosocial counseling programs may be more easily established than programs that dispense medication since they could be established at novel sites, including primary care and mental health facilities, as well as community service agencies or drop-in centers. However,

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research would be needed to determine how such integration could be most effectively accomplished.

The mobile approach in Baltimore was one part of a major expansion of the treatment system that the city undertook in 1996. The expansion involved a tripling of funding and an increase in the number of treatment slots, from about 5,000 to nearly 9,000 in 2003, a 62 percent increase (Baltimore City Health Department, 2006). One interesting observation from this natural experiment is that the treatment slots were taken at high rates, suggesting that accessibility is a limiting factor in treatment use, at lease under some circumstances. Unfortunately, such public health initiatives are rarely conducted with adequate evaluation support to be able to document an impact on broader measures of community drug use and crime. It should also be noted, however, that an increase from 5,000 to 9,000 treatment slots for opioid abusers may not be expected to produce noticeable changes in citywide rates of drug use or crime given a city with an estimated population of opiate drug users that is perhaps five times larger (McAuliffe et al., 2008; Substance Abuse and Mental Health Services Administration, 2007).

Limitations in the quality and quantity of the counseling workforce are other potential barrier to expansion of the treatment system. Counselors may be poorly compensated, especially in not-for-profit clinics (Olmstead et al., 2005), and there is a chronic shortage as well as a high turnover in most counseling staffs (McLellan and Meyers, 2004). Clinic leadership also has a remarkably high turnover rate, a factor that affects both the quality and stability of services delivered: McLellan and colleagues (2003) reported a 53 percent annual turnover rate of clinic directors within 175 nationally representative drug and alcohol treatment programs interviewed in 2001. These issues can be addressed by expansion of training for substance abuse counselors and may also be aided by management training for clinic leaders, many of whom may have risen through the ranks of clinical staff and assumed leadership roles with little expertise or experience in management.

Another innovative solution to treatment expansion is the use of modern technology. Several small studies (Bickel et al., 2008; Carroll et al., 2008; Marsch et al., 2007) have recently been conducted that show efficacy for psychosocial counseling treatment by computer. In the study by Carroll and colleagues (2008), for example, drug use outcomes were improved when a computerized cognitive-behavioral therapy was added to the usual treatment, while in the study by Bickel and colleagues (2008) the outcomes were the same whether the therapy was delivered by computer or human counselors. Adoption of computerized intervention technology could facilitate treatment expansion by reducing the need for human service workers while retaining the benefits of evidence-based

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treatment interventions. More research is needed on efficacy and effectiveness of this innovative technology.

Improved Treatment

Once a drug user enters treatment, there is a window of opportunity to promote behavior and attitude change. As discussed above, drug treatment programs are associated with positive outcomes in terms of drug use reduction and improved social functioning (Hser et al., 2006; Hubbard et al., 1997; Weisner et al., 2003b). In addition, long-term outcomes have been directly related to the duration of abstinence during treatment (Higgins et al., 2000; Weisner et al., 2003a). Thus, if the goal is to reduce demand for drugs through treatment, it would be beneficial to have improved treatments that could more reliably engender sustained periods of abstinence. However, this goal has to be tempered with the findings that relapse to drug use is a consistent and pervasive occurrence following treatment episodes for the majority of those who enter programs, a dynamic similar to that observed for other chronic illnesses, such as diabetes and hypertension (McLellan et al., 2005a).

There are several strategies that could be used for improving the outcomes of existing or expanded treatment programs (see also Sindelar and Fiellin, 2001):

1. addition of evidence-based medications for treatment of drug and alcohol dependencies (e.g., Strain and Stitzer, 2006),
2. adoption of evidence-based behavioral and psychosocial counseling strategies (see Carroll and Onken, 2005),
3. better methods for treatment of co-occurring medical and psychiatric disorders either through on-site provision of services (see Parthasarathy et al., 2003; Umbricht-Schneiter et al., 1994) or through better client-problem matching and case management (see McLellan et al., 1997, 1999, 2005b),
4. adoption of a long-term rather than an acute-care model of treatment for drug dependence (see Dennis et al., 2003; McKay, 2005; McLellan et al., 2005a; Scott et al., 2005b), and
5. outcomes-based accountability for treatment funding (see McLellan et al., 2008).

Research would be needed to determine how much additional improvement in outcomes could be expected with implementation of any of these innovations or combinations thereof and the extent to which the innovations are cost-beneficial.

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Modeling Potential Policy Changes

Policy changes that would be expected to affect treatment include increased funding to expand treatment and improve availability, expansion of pretrial (e.g., drug courts), in-prison, and postincarceration aftercare treatment programs in compulsory treatment, and more funding per client to improve quality of care. The case for treatment expansion is often based on the broad social benefit that might result (see, e.g., Meara and Frank, 2005), as well as cost-benefit calculations that include the offset of criminal justice costs, lost productivity, and reductions in health care costs.

It may also be possible to characterize the direct impact of treatment expansion on drug demand by using data on drug purchases, which is information that drug users in treatment are routinely asked to report. For example, if a user spends on average $30 per day ($10,950 per year) on drug purchases, the direct effect on demand reduction can be seen for each day on which that person does not purchase and use drugs. Following this logic, the positive impact of treatment can be estimated directly by the number of abstinent days observed during and after treatment for each drug user enrolled in treatment compared with that user's days of abstinence in a comparable time frame without treatment.[4] As noted, information about money spent on drugs is often collected, while data on days of drug use (versus abstinence) in the past 30 days (Cacciola et al., 2007; McLellan et al., 1992) is one of the most common self-report measures collected at treatment entry and follow-up in studies that examine treatment outcome.

This direct approach to understanding treatment effects on demand reduction would predict that the demand reduction benefits of residential or pharmacological treatment for opioid dependence may be more readily apparent than the benefits of psychosocial counseling interventions. Opiate (e.g., heroin) abusers usually seek treatment when they are physically dependent and using the drug on a daily basis, thus directly fueling a high demand for illicit drugs. Residential treatment, which temporarily removes drug users from the marketplace, can be a relatively cost-effective strategy for demand reduction relative to incarceration. However, efficacious outpatient pharmacotherapy treatments, notably methadone and buprenorphine, which can suppress or eliminate on-going use of opiate drugs (National Consensus Development Panel on Effective Medical Treatment of Opiate Addition, 1998; Strain and Stitzer, 2006), would have an even lower per patient cost. Furthermore, to the extent that these phar-

[4]This approach is somewhat crude since fluctuations in the cost of a drug on a drug use day are not taken into account. However, considering drug use as an all-or-nothing event in a given day may be useful as a place to start for economic modeling.

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macological treatments are delivered in a chronic care model of opioid substitution (i.e., methadone maintenance), they address the life-long risk of relapse that is characteristic of drug use disorders. This reasoning suggests that expansion of pharmacotherapy treatment for opiate users would be an especially effective demand reduction strategy, at least with regard to this drug class. The caveat, as demonstrated from the Baltimore experience, is that the extent of expansion may need to be substantial in order to affect the local prevalence of opiate use and consequent reduction in drug demand.

The demand reduction calculation is a bit muddier for alcohol, stimulant, and marijuana users who enter the large network of psychosocial counseling programs. Not only is this a more heterogeneous group in terms of drugs used, but much of the use may have been sporadic rather than daily, and the users may have stopped use for some time prior to treatment entry. An episodic pretreatment drug use pattern would complicate estimates of treatment-associated improvement in abstinence rates.

It may nevertheless be possible to model the impact of treatment expansion on demand for non-opioid drugs if appropriate datasets are available. The Services Research Outcome Study (Substance Abuse and Mental Health Services Administration, 1998), for example, has reported days of use for each drug in a large cohort (N = 2,222) of drug users enrolled in outpatient psychosocial counseling programs who entered treatment in 1989-1990. This is a useful dataset because it reports days of use per month for a variety of drugs, including alcohol, marijuana, and stimulants, during the 5 years before and after treatment. Although still imperfect (due to recall bias and the long time frame of recall), such data could be used to model treatment-associated demand reductions.

Another useful approach to understanding the impact of treatment expansion or improvement policies on demand would be to conduct experiments in the natural environment. For example, block grant funds could be manipulated (e.g., doubled or tripled) in specified locations. The effects on treatment utilization and outcomes could then be followed closely in a comparative research design (i.e., including locations where funding is not altered). Ideally, changes in drug demand could be simultaneously monitored using ethnographic techniques to study street-level drug sales. Such an experiment would be complex, but it is possible and would provide invaluable data on the question of optimal levels of funding for drug treatment.

CONCLUSION

As noted by Reuter and Pollack (2006), drug abuse treatment is imperfect and does not "work" comprehensively in the way that patients,

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clinicians, or society would like. Nevertheless, there is a compelling argument to be made that treatment-facilitated abstinence from drugs, even if abstinence is not permanent, will have a direct impact on demand, reducing that demand. Whether or not the behavior changes associated with treatment are sufficient to detect demand reduction will depend on a myriad of factors, including the population being treated and the quality and amount of treatment being delivered.

This argument is compelling only if the extent of expansion is sufficient to make significant inroads on the problem. Furthermore, as discussed above, it may be more likely to see an impact on demand for illicit opiates (heroin) with expansion of opioid substitution programs than for reduction in other types of illicit drug demand (stimulants and marijuana) from expansion of psychosocial counseling programs. Despite the caveats, treatment expansion, both within and outside of the criminal justice system, as well as treatment improvement, need to be seriously considered in any policy discussions about demand reduction.

As always, the debate would be better informed by advances in a variety of research areas. Questions that need to be addressed include (but are not restricted to) the following:

1. How do multiple treatment episodes influence patterns and amounts of drug use over the lifetime of drug users?
2. Are there ways to shift treatment entry to an earlier time in a drug use career?
3. Under what conditions can treatment increase the number of drug users who begin a long-term abstinence trajectory?
4. What are the costs and benefits of expanding existing treatments for voluntary clients?
5. What are the feasibility and effectiveness of various strategies to improve the attractiveness of treatment to users?
6. What are the costs and benefits of expanding behavioral treatment delivered through the criminal justice system, including pretrial diversion programs (such as drug courts), in-prison treatment (such as therapeutic communities), and various kinds of residential and outpatient aftercare treatment?
7. What are the costs and benefits of expanding medication treatments for offenders with opioid dependence histories?
8. What are the costs and benefits of specific treatment improvement strategies and strategy combinations, including adoption of evidence-based practices and inclusion of such services such as employment and housing and longer-term models of care?
9. How can the demand reduction impact of treatment best be examined and modeled?

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10. How many users would need to be taken out of the marketplace through treatment to make a perceptible impact in the demand for drugs?
11. How would different strategies and amounts of funding for drug treatment affect demand reduction?

We take up the design of a research agenda in Chapter 5.

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Findings and Research Recommendations

Over the past 25 years, governments at all levels have made great efforts to reduce drug use in the United States. Government expenditures on drug control total about $40 billion annually. The number of people incarcerated for drug offenses on any given day has risen from less than 50,000 in the early 1980s to about 500,000 in 2005, including many held in local jails (Caulkins and Chandler, 2006). Treatment has expanded substantially, and much has been learned about what constitutes effective treatment. And although the prevalence of illegal use is below the highest levels achieved in the late 1970s (for marijuana) and in the mid-1980s (for cocaine), it has remained stubbornly high. For many young people today, occasional marijuana use is a part of adolescent development, as it has been since the birth cohort of about 1960. At the same time use of diverted prescription drugs has been rising.

The data available for understanding why the nation still has a large demand for illegal drugs is woefully inadequate. For example, even the most basic numbers for policy purposes—estimates of the number of chronic users of cocaine, heroin, and methamphetamine; the quantity used; and the amount spent purchasing them—have not been published for almost a decade (Office of National Drug Control Policy, 2001). In this chapter we offer recommendations for data collection and research activities, both epidemiology and treatment research, that might enable the government to respond effectively to the continued demand for illegal drugs.

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PREVIOUS RECOMMENDATIONS AND CURRENT DATA USE

We start by noting that the report of a prior committee of the National Research Council (2001) made numerous recommendations for strengthening the federal data collection effort. That committee concluded, for example, that there was a dearth of data on consumption (as opposed to prevalence) and that this topic deserved high priority. The committee expressed concern that access to critical prevalence datasets was unreasonably restricted. It recommended, for example, that the Substance Abuse and Mental Health Services Administration (SAMHSA) work out arrangements along the lines developed by the National Center for Educational Statistics to allow researchers to work with restricted datasets in a way that preserves confidentiality but still allows full utilization of the data. It also recommended that the National Institute on Drug Abuse (NIDA) ensure that the longitudinal panels of Monitoring the Future (MTF) Survey become available for outside researchers.

Although there have been some improvements in data systems in recent years, such as the National Survey on Drug Use and Health (NSDUH) and the Treatment Episode Data Set (TEDS), few of the recommendations of the 2001 committee report have been implemented. In this report we repeat and emphasize some of those previous recommendations, and we supplement them by providing specific comments on individual datasets that are critical to assessing the determinants of the demand for illegal drugs. We note that we did not have the resources to develop a full research agenda for assessing the effectiveness of existing programs and policies aimed at reducing demand. Before providing recommendations on data and research, we note that existing data are often misused. Advocates, legislators, and policy makers frequently cite level and trend data from the NSDUH or other survey data sources that are misleading. In some cases, such data are used to produce point estimates of some quantities, such as annual U.S. cocaine consumption, that are known to severely understate the true figures. In other cases, comparisons are made about drug use behaviors among sociodemographic groups with very different response rates and that do not have internal validity.

It is important that policy makers and the public be aware of systematic limitations and potential biases when these data are used. In addition, it would be helpful to policy makers and analysts if the Office of National Drug Control Policy (ONDCP), the Centers for Disease Control and Prevention, and other agencies would provide more extensive, explicit, and accessible guidance regarding the known limitations of existing data that might otherwise be miscommunicated or misused.

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RECOMMENDATIONS FOR DATA SYSTEMS

Population Surveys

National Survey on Drug Use and Health

NSDUH is now one of the largest annual surveys of the household population conducted by the federal government, with approximately 67,000 respondents in 2007, and it represents several methodological improvements over its predecessor, the National Household Survey of Drug Abuse (NHSDA). These improvements have increased response rates and likely also improved data quality. NSDUH remains a critical data source in understanding trends and correlates associated with illegal drug use.

Given the importance of these data, it is a high priority to improve NSDUH's utility for both policy making and research. Some of these improvements reflect the need to implement recommendations offered in the previous National Research Council (2001) report, *Informing America's Policy on Illegal Drugs: What We Don't Know Keeps Hurting Us.* We endorse those recommendations, many of which still remain pressing.

In particular, we echo the previous committee's recommendations on data collection and systematic research:

The committee recommends that the National Survey on Drug Use and Health (NSDUH) and other national surveys expand their data collection efforts to more effectively survey subpopulations with high prevalence of substance use. In the specific case of NSDUH, we recommend that methods be developed to survey the institutionalized populations that are currently excluded from the data.

The committee recommends that the National Institute on Drug Abuse, the Office of National Drug Control Policy, and other funding organizations support a systematic research program (a) to understand the effects of nonresponse and reporting errors in surveys and (b) to design and implement surveys in ways that minimize the resulting biases.

It is especially critical that this research include systematic work on the strengths, weaknesses, and best practices of increasingly widespread methodologies used to reach and survey hidden populations. Research to improve and scrutinize such methods as respondent-driven sampling deserve priority, given that nontraditional survey methodologies are required to reach such hidden populations as street-injection drug users.

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Methodological research on the impact of respondent incentive payments on research participation, for example, would be quite valuable.

Although we reaffirm the earlier recommendations regarding NSDUH, the committee finds that this important survey and others used to monitor substance abuse have some important weaknesses from a policy-making perspective.

NSDUH was designed and is mainly used to provide descriptive information on basic trends and correlates of illegal drug use. Both policy analysis and social science research require the ability to systematically link such data with a rich set of variables regarding personal circumstances, public policies, and individual encounters with social service systems. NSDUH (and its predecessor, NHSDA) have operationalized key variables in ways that undermine comparability with other available data and that are not always consistent over time.

The committee recommends that the National Survey of Drug Use and Health follow current best practices methodologies and be more systematically and explicitly coordinated with other high-quality datasets in areas important to substance abuse.

One example of such a dataset is the National Comorbidity Study and its successors, which provide valuable instruments in screening for psychiatric disorders and in understanding barriers to the treatment of such conditions. Two other examples are the Panel Study of Income Dynamics and the Women's Employment Study, which provide valuable information on the receipt of food stamps, support from Temporary Assistance to Needy Families, and other forms of public aid. Yet another valuable dataset is the National Health Interview Survey, which is widely used in substance abuse policy research.

Many of the most important policy research questions concern public policies and other factors that operate at the state level. Analyses at that level are typically hindered by the common practice of masking geographic identifiers, even in datasets for which such geographic identifiers pose little risk of respondent disclosure. Procedures to secure access to these identifiers are often arbitrary or clumsy, parallel to those required to gain access to much more confidential data. The policies for these datasets are often more restrictive than those that are generally applied to census and birth record data, which include confidential data about a much larger fraction of the American public.

The committee recommends that individual-level survey data released for public or research use should routinely include state

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identifiers barring specific justification that such identifiers pose a significant risk of respondent disclosure.

We are encouraged that SAMHSA is developing procedures to facilitate researcher access to data with substate identifiers, and we hope that SAMHSA's Office of Applied Studies will move this effort forward.

Large, nationally representative datasets such as NSDUH are designed to provide reasonably precise estimates of key parameters, such as the prevalence of recent illicit drug use. Although these data are valuable to policy makers, the large sample size and national coverage comes at some price. These datasets do not provide extensive coverage of key populations, such as people in rural areas and homeless people. Moreover, these national datasets do not provide the descriptive detail required to scrutinize the interactions among diverse drug users and sellers in drug markets. For this reason and others, nationally representative datasets must be complemented with more extensive localized studies, including qualitative and ethnographic studies and studies that use administrative data, to provide a more granulated view than can be obtained from national surveys.

Other Datasets

Other available datasets, collected for different purposes, could provide improved guidance for policy makers and researchers on the changing epidemiology and market conditions pertinent to illegal drug use. National surveys of treatment facilities, including TEDS, the National Drug Abuse Treatment System Survey (NDATSS), and the National Survey of Substance Abuse Treatment Services, were mainly developed and designed to explore service delivery issues in substance abuse treatment. These data can be augmented to include richer data on clients' drug use behaviors and treatment outcomes. For example, NDATSS and TEDS include rich data regarding the primary drug of abuse and sociodemographic characteristics of clients entering treatment facilities. We caution, however, that these data have to be interpreted with care because they are not representative of the full population of drug users. By definition, these data exclude people who do not enter treatment, but they remain useful for many purposes.

These datasets typically also include a larger number of drug-dependent people with particular circumstances and disorders than is available through NSDUH. For example, the 2006 TEDS included admissions data for more than 22,000 pregnant women entering substance abuse treatment. In contrast, the 2006 NSDUH included less than 200 pregnant women who reported using any illegal substance in the previous year.

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Unit-level datasets might also provide sample frames for individual-level surveys. National cohort studies, such as the National Treatment Improvement Study, have provided valuable information for policy makers on drug use careers and other matters. Although individual-level data are available from many sources, there has been no comparable national cohort study in more than a decade.

Monitoring the Future Survey

The MTF survey of approximately 50,000 respondents has been collecting data for more than 35 years with great consistency of questions and with results reported in a timely fashion. It is conducted by the Survey Research Center at the University of Michigan, with funding from NIDA at the National Institutes of Health. For the past 8 years, it has been the principal indicator for the federal government in assessing the success of the federal drug strategy in reducing illegal drug use, particularly for adolescent substance use. However, its value has been limited by not adding noncore items that would allow a better understanding of changes in drug use among youth. The usefulness of the MTF data would also be enhanced if outside researchers had better access, with appropriate safeguards, to information necessary to explore methodological issues about survey design. For example, each year 30-50 percent of the schools selected to participate in the MTF survey decline to participate (for details, see National Research Council, 2001). Research is needed to explore the reasons for nonparticipation and the implications of the method used to find replacement schools.

MTF and other datasets, such as the National Longitudinal Survey of Youth and the National Longitudinal Study of Adolescent Health, provide especially strong survey data on adolescents and young adults. Continuing these cohorts over time offers a valuable opportunity to explore drug use careers in the age ranges that are less often studied as respondents reach adulthood.

However, the longitudinal panels of MTF still are not used extensively by researchers. There are now 35 distinct panels, some with observations extending over decades, and they could provide immensely valuable information for understanding the dynamics of drug use careers in the general population. We are concerned that the research community may not be fully aware of the possibility of gaining access.

The National Research Council (2001, pp. 82-84), almost 10 years ago, critiqued a lack of transparency in the MTF data-sharing plan. At present, selected portions of the MTF cross-sectional data are being made available through the Substance Abuse and Mental Health Data Archive (SAMHDA), which has been operated since 1995 by the Inter-university

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Consortium for Political and Social Research (ICPSR).[1] There also is an ICPSR/SAMHDA web page that introduces the idea of a process through which sharing of longitudinal data might be achieved by outside (non-MTF) principal investigators.[2] These positive developments are consistent with a recently stated MTF research objective: "Objective 11: To continue to facilitate the use of the MTF databases by others—including investigators in a variety of substantive and disciplinary fields—while adequately protecting the confidentiality of the study's many respondents" (quoted in Johnson et al., 2006).

However, the possibility of obtaining access to the MTF panel data is only mentioned on the ICPSR/SAMHDA web page cited above in an answer to a Frequently Asked Question (Is the longitudinal data available for Monitoring the Future?). This answer, reached by clicking through from the ICPSR home page to the SAMHDA home page to "Tutorials and FAQs" to "Series-Specific Questions," is the following:

> All data for a particular individual are linked (or, in the case of form-specific items, capable of being linked) in the panel dataset. The sheer amount of information greatly increases the risk of breaching confidentiality. Thus, based on policies approved by our funding source and IRB, the panel data set cannot be made available to the public in totality and without modification.
>
> Special data requests can be made through the Web site email address. Once we get a request, information about policies and procedures is sent out. Requests are considered on a case-by-case basis, and may be fulfilled—at requestor's cost—typically by providing data analytic access. . . . To make a request for this data and for further information, please contact MTF staff at: MTFinfo@isr.umich.edu.

No other website provides information about the possibility of accessing the MTF panel data.

The committee contacted the staff of the Survey Research Center (SRC) and requested information on the number of researchers who have been provided access to the MTF panel data. They reported that, between August 1997 and July 2010, they received 35 requests for access to panel data that would be used for in-depth analysis. All of these requests were granted. The SRC staff acknowledged that it is difficult to find information about their data sharing policies and procedures on the MTF website, but they explained their concern that the success of MTF's scientific

[1]See http://www.icpsr.umich.edu/icpsrweb/SAMHDA/studies?q=Monitoring+the+Future [accessed July 2010].

[2]See http://www.icpsr.umich.edu/icpsrweb/SAMHDA/support/faqs/0039 [accessed July 2010].

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mission of gathering data on sensitive topics depends on their promise of strict confidentiality. The staff said that they are developing a separate website regarding data sharing that will be announced soon.

Given the unique value of these MTF panel data, the committee endorses the recommendation of the previous National Research Council (2001) committee that NIDA create an advisory panel to work with the grantee on issues of data access, in particular to foster additional awareness about methods of providing access that will meet the needs of the research field.

INDICATOR SYSTEMS

Public Health Surveillance

The emergence of HIV/AIDS among injection drug users three decades ago, the crack epidemic of the 1980s and early 1990s, and the 2007-2008 epidemic of fentanyl-related opiate overdoses underscore the serious public health challenges associated with illegal drug use. These events also underscore the value of early warnings about emerging drug use "epidemics" and other emerging threats to the health and well-being of substance users. Our recommendation on this issue is consistent with that of the previous National Research Council (2001) committee.

The committee recommends that the Office of National Drug Control Policy, in consultation with pertinent agencies of the National Institutes of Health and the Centers for Disease Control and Prevention, develop procedures for effective epidemiological surveillance concerning emerging forms of substance use and their related harms to human health and well-being.

There have been major losses of indicator systems in recent years. In 2003, the Arrestee Drug Abuse Monitoring (ADAM) system, supported by the National Institute of Justice (NIJ) was ended, thus eliminating the most useful platform for the study of criminally active drug offenders. As noted in Chapter 2, ONDCP has restarted a much smaller version of ADAM, but little is known about it. At about the same time, the redesign of the Drug Abuse Warning Network (DAWN), which is sponsored by SAMHSA, substantially reduced its utility for research purposes.

Arrestee Drug Abuse Monitoring

Funding for the ADAM program was provided exclusively by the NIJ, the research arm of the Department of Justice, and it accounted for a large share of the NIJ budget in 2003. After lengthy consideration, the

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agency decided that without support from other agencies, it was not central enough to the NIJ mission to continue. Moreover, NIJ was not responsible for funding any other statistical series, a function more regularly associated in the department's Bureau of Justice Statistics.

ADAM is not an ideal system to study frequent drug users. Although many drug users do come in contact with the criminal justice system, treatment data show clearly that a substantial fraction of the people admitted with cocaine or heroin involvement have had no contact with that system. Nonetheless, given the centrality of ADAM for understanding the behavior of drug markets, the loss of ADAM has been a serious loss to understanding drug demand. We are not in a position to make recommendations as to the size, structure, and scope of an ADAM-like program, but we conclude that it is important to have some regular method for surveying this population.

The committee recommends that the U.S. Department of Justice reinstitute an Arrestee Drug Abuse Monitoring-like survey to collect data on the behavior of criminally involved drug users.

An ADAM-like survey is less important for the data it provides on the levels of drug use among arrestees than it is as a platform for studying the behavior of the population that accounts for most of the cocaine, heroin, and methamphetamine used in the United States. At present it appears impossible to develop estimates of the quantities used and the expenditures on illegal drugs without data from these populations.

Drug Abuse Warning Network

The redesign of DAWN in 2002, though intended to strengthen the system for collecting data on emergency department visits and on deaths related to drug use, has instead resulted in a substantial weakening of the system. Fewer hospitals are willing to participate than previously in part because of greater concerns about privacy protections and potential liability from misuse of data that have developed in recent years, particularly since the passage of the Health Insurance Portability and Accountability Act. It may be impossible to overcome this reluctance by hospitals to participate and therefore to obtain the data.

DAWN, even before 2002, played only a modest role in research on the demand for drugs (see Caulkins, 2001; Dave, 2006). It has been used occasionally, for example, as a method for calculating the relative sizes of drug-using populations in particular cities (e.g. Office of National Drug Control Policy, 2001). As noted in Chapter 3, the redesigned DAWN has yet to produce some of the basic series. Moreover, DAWN was budgeted

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at approximately $17 million in 2009, which is relatively expensive for drug data indicators.

The committee recommends that the U.S. Department of Health and Human Services consider, first, whether the Drug Abuse Warning Network series should be continued given that these data have not had much value for either policy or research, and, second, if it is continued, whether it should be conducted by agencies that are already collecting information from emergency departments and medical examiners.

On the second point, for example, the Food and Drug Administration and other agencies collect data from emergency departments for other purposes, and the Centers for Disease Control and Prevention regularly receives data from medical examiners on vital statistics. It may be more useful to merge DAWN into those other systems, reducing the reporting burden and taking advantage of the expertise these other agencies have in dealing with emergency departments and medical examiners. We believe that continuing DAWN in this way would lower its cost.

Treatment Episode Data System

Although TEDS was originally developed as an administrative dataset, as noted above it has become an increasingly valuable research tool in understanding changing patterns of illegal drug use. The quality of the data appears to have improved in recent years, and it provides a large-sample dataset about the circumstances of people who enter substance abuse treatment. The publication of the TEDS-D discharge dataset, starting in 2008, is potentially a major addition to the capacity for both monitoring and studying drug abuse treatment.

TEDS also might be made more valuable through the inclusion of additional data, such as individual identifiers, including specific sociodemographic identifiers, and through additional surveys conducted on a subsample of treatment clients. Because TEDS imposes data collection burdens on providers and clients, we are not in a position to specify these changes in detail.

The Committee recommends that the Substance Abuse and Mental Health Services Administration give high priority to expanding and improving the Treatment Episode Data Set.

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RECOMMENDATIONS FOR RESEARCH

There are many components to a research agenda on the demand for illegal drugs. We focus here on a particularly important, promising, and neglected area, namely, longitudinal research, which can help answer many of the most significant questions about demand.

Cohort and Longitudinal Studies

TEDS and other data sources may provide a promising sample frame for additional cohort studies. Although cohort studies conducted on the population in treatment have inherent limitations, these datasets also provide unique information on other factors, including desistence rates among chronic users and mortality and incarceration rates. For example, TEDS includes detailed information on the age of onset of drug use of admitted patients. Such data can be used to assemble panels of individuals to explore drug use careers more extensively than is currently possible.

The need for such data is increasingly pressing, given the absence of recent cohort studies comparable to prior efforts, such as the National Treatment Improvement and Evaluation Study. The earlier prominent cohort studies are more than a decade old and thus do not address some important contemporary questions, including trajectories of drug use and offending among methamphetamine users and changing patterns of marijuana and prescription drug abuse.

Other research efforts provide equally promising opportunities for informative cohort studies. For example, most academic research conducted in the Clinical Trials Network examines short-term clinical outcomes subsequent to treatment interventions. Long-term follow-up of patients in that network may provide unique opportunities to gauge long-term outcomes, as well as to collect longitudinal data on an accessible cohort of current and former drug users.

The committee recommends that the National Institute on Drug Abuse and other responsible funding agencies pursue available opportunities for cohort studies facilitated by recent research efforts.

Longitudinal epidemiological studies of drug use can be exploited more fully to inform scientific questions about the demand for illegal drugs. They can uniquely provide data for two purposes: (1) to generate estimates of the number of drug users, the quantity of a drug used, and the price paid for a drug; and (2) to track the process of initiation and desistence of drug involvement. Longitudinal studies can shed light on

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the correlates, the suspected causal determinants, and the consequences of drug abuse.

There are many longitudinal studies of large representative cohorts that have been followed from childhood to adulthood in specific areas of the United States, with good retention rates: they include the Denver, Pittsburgh, and Rochester Youth Studies, the Great Smoky Mountains Study, the Iowa Youth and Families Project, the Oregon Social Learning Study, the Children-in-the-Community Study of upstate New York, and the Baltimore Prevention Research Center cohorts. There are also a few nationwide studies with repeated measures, including the National Longitudinal Study of Adolescent Health and the selected subsamples of college-aged students followed after high school in the MTF survey.

The National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) has excellent potential for contributions in this area, if its interview protocol is amended for the purposes of modeling drug demand nationwide. An additional NESARC wave of assessment is slated to occur sometime within the next 5 years, which presents an opportunity for such changes. However, that possibility needs to be considered in relation to some concerns that have been expressed about the accuracy and completeness of NESARC estimates on drug use (see, e.g., Grucza et al., 2007) and its constrained information value with respect to prescription painkillers that recently have become more prominent in drug demand research (see, e.g., Boyd and McCabe, 2008).

Estimating the Demand for Drugs

As detailed in Chapter 1, the information needed to model the demand for drugs is missing, with a heavy reliance, to date, on cross-sectional survey designs used to answer questions—for example, How many active drug users are there? What quantity of a drug are these users buying and consuming? What price are these users paying?—that could be added to ongoing longitudinal cohort studies. Virtually all existing longitudinal studies already ask participants about illegal, nonmedical, and extra-medical drug use in some depth. However, to date, the questions have been designed for purposes other than understanding the demand for drugs. These purposes include estimating age of drug use initiation for developmental research, diagnosing drug use disorders for psychiatric research, and assessing self-reports of illegal drug possession and selling for criminological research.

The committee recommends that researchers working with ongoing longitudinal surveys be encouraged to add standardized

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items to collect data more useful for economic and drug demand modelling.

Such topics include prices and quantities consumed by active users. But, as discussed in Chapter 2, collecting useful measures of drug prices is difficult in markets characterized by a standardized price, such as a "dime bag" of unknown weight and purity. Additional questions, such as how far users travel to obtain drugs, could be asked to help anticipate whether displacement should be expected if price changes in one location but not all locations.

Longitudinal cohort studies offer certain advantages for collecting such data. Studies that began to interview their participants during childhoods in the 1970s, 1980s, and 1990s and have now followed them into adulthood offer enhanced validity of self-reports, because individuals interviewed repeatedly about drug use learn that they can trust the confidentiality guarantee and become unusually willing to provide frank reports. For example, the Dunedin Longitudinal Study compared experienced longitudinal cohort members with matched adult respondents: 30 percent more of the experienced subjects revealed daily cannabis use (Moffitt et al., 2010). Moreover, the recall failure that compromises validity of self-reports in retrospective surveys can be avoided if longitudinal studies reinterview participants frequently enough so that responses cover a recent and relatively brief period of time. One comparison found that the prevalence of cannabis dependence from age 18 to 32 years was doubled in prospective longitudinal study data in comparison with retrospective survey reports (Moffitt et al., 2010).

Challenges can be anticipated. New methods of questioning have to be developed to obtain reliable and valid self-reports of quantity and price. Longitudinal twin studies (such as the Virginia Twin Study of Adolescent Development or the Minnesota Twin Study) are particularly useful for evaluating the reliability of self-reports, as they provide two same-age knowledgeable informants about the illegal drug use of each participant (twin and co-twin). There is another challenge if nationwide data are needed. Existing longitudinal cohort studies whose participants have reached adulthood with good retention rates tend to represent specific cities or states. Good longitudinal sample retention is essential for modelling drug demand, because substance use is associated with nonresponse, and high rates of nonresponse characterize many contemporary surveys and make them problematic for ascertaining drug demand (see e.g., Galea and Tracy, 2007). Few longitudinal studies with good retention rates have nationwide samples.

The previous National Research Council (2001) report contained a critical discussion of the System to Retrieve Information from Drug Evi-

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dence (STRIDE) data on illegal drug prices. Although we were unable to address this issue in depth, we support on-going research efforts to further assess the reliability of the STRIDE data and consider alternatives.

Tracking the Process and Correlates of Desistence

Longitudinal cohort studies have yielded many insights about the process of the initiation of drug use (and the reasons for that initiation). Over time, these studies have become well positioned to examine the process of naturalistic desistence from drug use (and reasons for desistance). Such research, if undertaken, would parallel the scientific benefits accrued from criminology research that characterized crime careers by following individual offenders over time (see, e.g., Laub and Sampson, 2003). Results from research into the predictors and correlates of naturalistic drug desistence might be harnessed to develop novel prevention and treatment approaches. Representative birth or school cohorts whose subjects have now reached their 30s are well suited to studying desistence from drug use in the general population. Longitudinal follow-up studies of adult samples can also be highly informative on other issues. For example, research should track desistence in longitudinal studies of adults sampled for their dependence on particular drugs to determine whether desistence processes vary by drug type. Long-term longitudinal follow-up of randomized clinical trials of drug treatment programs could be used to identify factors that discriminate between recovery and relapse.

Longitudinal cohort studies offer certain advantages for studying desistence. As in research on criminal careers, self-report data from longitudinal cohorts are particularly valuable for studying desistence. The alternative is official record data, which are not well suited to this purpose because drug abuse treatment records tap only a small percentage of drug users (just as official crime conviction records cover only a small percentage of offenders). Similarly, a drug-dependent person who no longer appears in treatment records after some time cannot be presumed to have ceased drug use (just as a criminal offender who no longer appears in conviction records cannot be presumed to have ceased law breaking). Another advantage is that longitudinal designs allow not only the study of drug desistence, but also the study of factors that accompany desistence and may cause it. Studies of within-individual change can take one step toward building an evidence base on causal factors by using individual drug users as their own controls, linking decreasing drug use to antecedent events while all other characteristics of the drug users remain constant. Longitudinal studies of adult twins (such as the Vietnam-Era Twin Study) can go even further toward documenting causality by exam-

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ining factors that account for differences in drug use cessation between twins in monozygotic pairs.

Virtually all longitudinal cohort studies in the United States have collected data on their participants' drug use, and many of the participants in these studies will soon reach the ages when desistence from drug use occurs. However, the capacity of these studies to follow their cohorts further for several years to cover the period of drug desistence is uncertain because they have largely been funded by federal agencies who are now under pressure to support translational research and randomized clinical trials in the context of stagnant budgets. In this funding climate, agencies may view continuing longstanding longitudinal epidemiological studies as lower priority than other research.

The committee recommends that funding agencies provide continued support for key prospective longitudinal studies that are best suited for tracking the causes and correlates of drug use desistence, including treatment and criminal justice involvement.

Finally, such panel studies as the MTF survey have repeatedly interviewed the same respondents across years, yet most of the reports from these studies concern the cross-sectional prevalence of drug use in a particular year or changes in this aggregate-level prevalence across a series of years. We have not found any MTF longitudinal analyses that inform economic or drug demand models, although the data are a national resource that could be exploited to track within-individual change in drug use over long-term study periods and to identify the correlates and suspected causal determinants of such change. Even if the MTF panels are not accessible to outside researchers, we urge grantee research groups to explore these data more deeply.

Treatment

The short-term efficacy and effectiveness of various modalities of drug abuse treatment has been repeatedly and convincingly demonstrated. However, the committee notes that additional data collection and analytic approaches are needed in order to better understand how participation in treatment affects the long-term trajectory of drug use and desistence among various types of drug users. The answer to this question is needed in order to put treatment effectiveness into proper perspective in light of emerging information about the role of "spontaneous," or untreated, recovery from drug and alcohol use. Longitudinal data would help to answer questions about the role of treatment in drug use trajectories

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while taking into account other important environmental factors, such as contact with the criminal justice system.

If treatments can be effective in moving the trajectory of drug use toward earlier or more frequent desistence, then the key question for policy makers is what steps should be taken to expand and improve treatment options and programs and to increase the utilization of treatments known to be effective.

Treatment capacity is one important part of the equation, with evidence that current capacity is seriously inadequate if all drug users in need were to seek help. However, efforts to increase the acceptability and utilization of treatment may also be needed. The criminal justice system appears especially well positioned to exert a positive impact on treatment utilization and outcome through drug courts and other diversion initiatives (see Chapter 4). Again, research on the effectiveness of such innovations will be critical in order to gauge their effects on drug use trajectories and demand reduction.

There are a number of innovations and improvement that could be made to further enhance the reach and effectiveness of the treatment as currently provided. The committee is reasonably confident that treatment innovations and improvements of existing treatments will continue to emerge, in part through successful dissemination and adoption of new treatment practices. The goal of such improvements in the quality of treatment is to make drug desistence a more certain and reliable outcome of a given treatment episode or of cumulative treatment episodes which will, in turn, stimulate further demand reduction.

The committee recommends that drug abuse treatment providers adopt new practices with research conducted to examine effectiveness.

The available evidence suggests that investment in treatment capacity and other strategies of increasing participation, especially by users of opiate and stimulant drugs, would reduce the demand for drugs while generating other significant social benefits (e.g., reduced crime, increased work productivity), although the magnitude of those benefits are difficult to calculate. It also appears that policy makers are increasingly interested in considering investments in drug abuse treatment. Much can be learned from careful evaluation of initiatives to expand treatment capacity and other interventions designed to increase participation. Unfortunately, however, this opportunity is too often overlooked.

The committee recommends increased research on the costs and benefits of policies designed to increase treatment utilization by

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taking advantage of the natural experiments that are likely to occur in the years ahead. A key goal of these studies should be to assess the impact of increased treatment utilization on reducing the demand for drugs.

Also enormously informative would be purposefully planned and executed experiments or demonstration projects conducted at a community level in which treatment capacity or utilization was varied in a systematic manner. Again, the key goal would be to assess the effects of treatment expansion on reducing the demand for drugs.

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Appendix

Workshop Agenda and Participants*

THE NATIONAL ACADEMIES
Committee on Law and Justice

National Academies of Sciences and Engineering
Arnold and Mabel Beckman Center
100 Academy Way
Irvine, CA

AGENDA

Friday, October 12, 2007

8:30-8:45 am **Introductions and Welcome**
James Q. Wilson
James Collins Professor of Management and Public Policy, Emeritus
University of California, Los Angeles
Chair, Committee on Law and Justice

David W. Hagy
Acting Principal Deputy Director
National Institute of Justice

8:45-9:00 am **Overview of Workshop**
Peter Reuter
Professor, School of Public Policy and Department of Criminology
University of Maryland

*Note that some of the participants currently do not have the same affiliation as listed at the time of this 2007 workshop.

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9:00-9:45 am **Presentations**

What Can Treatment Do to Reduce Aggregate Demand?

Jody Sindelar
Professor and Head, Division of Health Policy and Administration, School of Public Health
Yale University

Beau Kilmer
Drug Policy Research Center
Associate Policy Researcher
RAND

9:45-10:15 am **Discussants**

Robert L. Johnson
Sharon and Joseph L. Muscarelle Endowed Dean, Interim Professor of Pediatrics, and Psychiatry
Director of Adolescent and Young Adult Medicine
New Jersey Medical School

Harold Pollack
Associate Professor, School of Social Service Administration, and Faculty Chair, Center for Health Administration Studies
University of Chicago

10:15-10:30 am **Break**

10:30-11:15 am **Understanding the Behavior of Heavy Users**

Anne-Line Bretteville-Jensen
Researcher, Norwegian Institute for Alcohol and Drug Research
Oslo, Norway

11:15-11:45 am **Discussants**

Maxine Stitzer
Professor, Department of Psychiatry and Behavioral Sciences
Johns Hopkins University School of Medicine

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Mark Harrison Moore
Faculty Chair and Faculty Director, Hauser Center for Non-Profit Organizations
Harvard University

11:45 am-12:05 pm **The Dynamics of Drug Using Careers**
James C. Anthony
Professor and Chair of Epidemiology, Department of Epidemiology, College of Human Medicine
Michigan State University

12:05-12:30 pm **Discussant**
John H. Laub
Professor, Department of Criminology and Criminal Justice
University of Maryland

12:30-1:30 pm **Lunch**

1:30-2:15 pm **How Local Level Drug Users and Dealers React to Law Enforcement Actions**
Richard Wright
Curators' Professor and Chair, Department of Criminology and Criminal Justice
University of Missouri, St. Louis

Scott Jacques
Doctoral Student, Department of Criminology and Criminal Justice
University of Missouri, St. Louis

2:15-2:45 pm **Discussants**
Robert Crutchfield
Professor, Department of Sociology
University of Washington, Seattle

Mark Kleiman
Professor of Public Policy and Director, Drug Policy Analysis Program, School of Public Affairs
University of California, Los Angeles

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2:45-3:05 pm **How Well Are Prices Measured?**
Rosalie Liccardo Pacula
Senior Economist and Codirector, Drug Policy Research Center
RAND

3:05-3:30 pm **Discussant**
Donald Kenkel
Professor of Economics, Department of Policy Analysis and Management
College of Human Ecology, Cornell University

3:30-3:45 pm **Break**

3:45-4:05 pm **The Effects of Early Drug Exposure on Adult Dependency**
Candice Odgers
Assistant Professor, Department of Psychology and Social Behavior, School of Social Ecology
University of California, Irvine

Terrie E. Moffitt
Professor, Department of Psychology and Neuroscience
Duke University

4:05-4:30 pm **Discussant**
Christy A. Visher
Principal Research Associate, Justice Policy Center
Urban Institute, Washington, DC

4:30-5:00 pm **International Perspectives**
Peter Reuter

5:00-5:30 pm **Wrap-Up and Discussion**
Peter Reuter

5:30-6:30 pm **Break**

6:30-9:00 pm **Working Dinner—Wrap-Up Discussion**

9:00 pm **Adjourn**

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Understanding the Demand for Illegal Drugs

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