EXECUTIVE SUMMARY

WHAT AMERICA'S USERS SPEND ON ILLEGAL DRUGS: 1988-1995

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF NATIONAL DRUG CONTROL POLICY
BARRY R. McCAFFREY, DIRECTOR

NOVEMBER, 1997

Executive Summary

As part of an ongoing project to determine how much Americans spend on illegal drugs, this report focuses on the amount and retail sales value of cocaine, heroin, marijuana, and other illegal drugs Americans consumed from 1988 through 1995. The methodology used to make these estimates has evolved and improved since the first report in 1991. This year's estimates of illicit drug expenditures are appreciably higher than previous years for two reasons. The first is that improved methodology for estimating the number of drug users suggests there were more hardcore users during 1988 through 1995 than were estimated in previous retail sales reports. The second major difference results from using the consumer price index to inflate past year expenditures on cocaine, heroin, marijuana and other illicit drugs.

We used two approaches to make these estimates. First, from a consumption-based approach, we investigated the dollar expenditures by Americans on illicit drugs. We estimated that:

- In 1995, Americans spent $57 billion on these drugs: $38 billion on cocaine, $10 billion on heroin, $7 billion on marijuana, and $3 billion on other illegal drugs and legal drugs used illicitly (Table A).[1]

- Between 1988 and 1995, the expenditures on cocaine and heroin appear to have fallen. This trend results partly from a decrease in the number of users, but mostly from a decrease in the street prices of these two drugs.

- Between 1988 and 1995, expenditure on marijuana increased slightly (as marijuana prices increased) then decreased slightly (as marijuana prices fell).

- Between 1988 and 1995, expenditures on other illicit drugs, and on legal drugs used illicitly, remained fairly constant.

A second approach to estimating the retail sales value of illicit drugs consumed in the United States is to estimate the amounts supplied to the domestic market. From this supply-based perspective, we estimate that:

- About 287 to 376 metric tons of cocaine were available for domestic consumption in 1995 (Table B). For reasons discussed in the report, it is not practical to develop estimates for heroin, marijuana, and other drugs.[2] The estimated amount of cocaine available for consumption in the United States between 1988 and 1995 declined markedly, but imprecision in the estimates for each year make it difficult to draw inferences about trends.

- The street value of the 287 to 376 metric tons of cocaine is $40 to $52 billion (Table B).[3]

Consumption-based and supply-based estimates do not always agree about the amount of cocaine shipped into the United States over the last eight years. According to consumption-based estimates, an average of 319 metric tons entered the States each year since 1988; according to the supply-based estimates, an average of 390 metric tons entered the States each year since 1988. Because the supply-based estimates do not account for unknown quantities of cocaine consumed by people outside the States, unknown quantities seized by the State and local authorities, and unknown amounts otherwise lost through the production and transshipment process, the supply-based estimates have an upper bias, so the two estimates are in broad agreement. The two methods produce similar estimates for 1989, 1994 and 1995, but the supply-based estimates are 57 to 90 percent higher than their consumption-based counterparts for 1990 through 1993. Moreover, the supply-based estimates show considerable year-to-year variation, which seems inconsistent with most indicators that show a modest decline in cocaine users and cocaine prices between 1988 and 1995. One conclusion is that the supply-based estimates provide a rough, yet useful, view of the flow of cocaine into the United States, but that it would be imprudent to rely on the supply-based estimates to judge cocaine's year-to-year availability.

Although these estimates are imprecise, they are sufficiently reliable to conclude that the trade in illicit substances was roughly $57 billion to $91 billion per year between 1988 and 1995, according to consumption-based estimates (Table A).[4] The costs to society from drug consumption, however, exceed the amounts represented by this range. Drug use fosters crime; facilitates the spread of catastrophic health problems, such as hepatitis, endocarditis, and AIDS; and disrupts personal, familial, and legitimate economic relationships. The public bears much of the burden of these indirect costs because it finances the criminal justice response to drug-related crime, a public drug-treatment system, and anti-drug prevention programs.

Although lacking precision, the supply-based estimates presented in this report imply that the amount of cocaine available for consumption has decreased over time. Of course, this is consistent with the observations that the number of users has fallen.

This decrease in the number of users may have put downward pressure on cocaine prices which have fallen from roughly $177 per pure gram in 1988 to $139 per pure gram in 1995. This decrease might be attributed to the small decrease in the number of hardcore users (as those who are incarcerated have little or no access to cocaine) and/or to a large decrease in the number of occasional users (because the number of occasional users fell from about 7.3 million in 1988 to about 4.0 million in 1993), but mostly it arises from inflation in the consumer price index.

Putting these data together provides a mosaic of drug use trends in America. It allows us to see that data from the State Department (crop data), the Drug Enforcement Administration (price data), the Substance Abuse and Mental Health Administration (household survey data), and the Department of Justice (arrestee drug testing data) provide a consistent picture of major drug use trends.

Table A

Total U.S. Expenditures on Illicit Drugs, 1988-1995 ($ in billions, 1996 dollar equivalents)

	1988	1989	1990	1991	1992	1993	1994	1995
Cocaine	$61.2	$56.7	$51.5	$45.9	$41.7	$40.3	$37.4	$38.0
Heroin	$17.7	$16.8	$14.3	$11.9	$10.2	$9.8	$9.3	$9.6
Marijuana	$9.1	$10.9	$11.0	$10.7	$11.5	$8.8	$8.2	$7.0
Other Drugs	$3.3	$2.8	$2.2	$2.3	$2.0	$1.5	$2.6	$2.7
Total	$91.4	$87.2	$79.0	$70.7	$65.4	$60.4	$57.5	$57.3

Columns may not add due to rounding
Sources: See Tables 1 through 8

Table B

Trends in the Cocaine Supply, 1989-1995
(in metric tons unless otherwise noted)

	1989	1990	1991	1992	1993	1994	1995
Cocaine HCl available for export from producing countries[1]	709-842	714-851	777-931	834-972	561-692	556-670	616-736
Cocaine destined for the United States	603-716	595-709	635-760	667-778	455-542	428-513	462-553
Foreign seizures of cocaine destined for the United States[2]	56	86	98	84	80	58	41
Cocaine shipped to the United States	547-660	509-624	539-684	583-694	375-462	371-456	421-513
Federal Seizures[3]	115	96	128	120	110	120	98
Cocaine available for consumption in the United States	432-545	413-528	412-532	437-555	364-463	258-345	287-376
Retail value of cocaine in the United States (1996 dollars, billions)[4]	$70-89	$82-104	$68-88	$70-89	$56-72	$36-48	$40-52

1 Estimates of cocaine HCl come from computer model of cocaine production. The range is based on the error band reported by the Department of State for the area under cultivation.
2 UNCSR, 1996 (and previous years); Royal Canadian Mounted Police, National Drug Intelligence Estimate, 1994 (and previous years) and International Narcotics Control Board, Narcotic Drugs Statistic for 1991 (and previous years). The category excludes seizures of cocaine not destined for the United States.
3 Drug Enforcement Administration, Federal-wide Drug Seizures System, 1989-1996.
4 Estimates are a two-year moving average of years T and T-1. The estimate for 1989 is for year 1989 alone.

U.S. Drug Policy in the Andes

An Office of National Drug Control Policy White Paper
March 1998

Prepared by:
Gary M. Bruce
Executive Office of the President
Office of National Drug Control Policy
Office of Programs, Budget, Research and Evaluation

This paper has benefitted from the criticism of a number of researchers and drug policy officials. In particular, the author is thankful for the insights provided by John Carnevale, Terry Zobeck, Michael Ahola, V.L. Elliott, Raphael Perl, and Mark Smith.

Contents

Introduction

The purpose of U.S. drug control policy is to reduce illegal drug use and its consequences. Since 1973, national drug control strategies have provided policy guidance for reducing the demand for illegal drugs in the United States by organizing programs to reduce illegal drug use and availability and by matching Federal resources against these programs. After marijuana, cocaine is the most widely consumed illegal drug in the United States. Since the end of the last heroin epidemic in the late 1970s, cocaine use has been the prime focus of U.S. drug control policy.

With cocaine as the principal concern, U.S. international drug control programs have centered on the cocaine source countries of the Andean region: Bolivia, Colombia, and Peru. In 1996, Bolivia, Colombia, and Peru were estimated to have over 200,000 hectares of coca under cultivation.[1] This hectarage could potentially produce an estimated 300,000 metric tons of coca leaf which, in turn, could potentially yield 760 metric tons of cocaine hydrochloride.[2] By comparison, in 1995 cocaine users in the United States consumed 304 metric tons of pure cocaine.[3]

The Andean strategy is an important part of a broader effort by the United States to cripple the international cocaine industry and consequently disrupt and diminish the domestic black markets for cocaine. The Andean strategy was first conceived in the 1989 *National Drug Control Strategy*, which established a policy framework for coordinating U.S. cocaine control efforts in the Andean region. This initial framework, which came to be called the Andean Initiative, proposed a $2 billion plan for Bolivia, Colombia, and Peru over 5 years consisting of military, law enforcement, and economic assistance.[4] The Initiative had the following four goals:

1. Strengthen the political commitment and institutional capability of the Bolivian, Colombian, and Peruvian Governments to confront the cocaine trade;
2. Increase the effectiveness of law enforcement and security activities of the three countries against the cocaine industry by assisting efforts to (a) isolate major coca growing areas, (b) block shipments of precursor chemicals, and (c) destroy processing facilities;
3. Inflict significant damage on the cocaine trafficking organizations through cooperative efforts to disrupt trafficking operations; and

---

[1]One hectare is equivalent to 2.477 acres, so 200,000 hectares is equivalent to 495,400 acres or about 774 square miles (1 square mile = 640 acres), which is a little more than half the area of Rhode Island (1,545 square miles).

[2]U.S. Department of State, Bureau of International Narcotics and Law Enforcement Affairs (INL), *International Narcotics Control Strategy Report* (March 1997), 22-23. This includes 435 metric tons potentially available from Peru, 215 metric tons potentially available from Bolivia, and approximately 110 metric tons potentially available from Colombia.

[3]W. Rhodes, et al., *What America's Users Spend on Illegal Drugs, 1988–1995*.

[4]U.S. House of Representatives, *United States Anti-Narcotics Activities in the Andean Region: Thirty-Eighth Report by the Committee on Government Operations Together with Separate Views*, 17.

4. Strengthen and diversify the legitimate economies of the Andean nations to enable them to overcome the destabilizing effects of eliminating cocaine.[5]

The plan expanded significantly the level of U.S. Department of Defense (DoD) support for drug control activities in the source countries and provided adjunct economic assistance through the Andean Trade Initiative.[6] Agreements reached among the United States and the Andean nations at drug summits in Cartagena (1990) and San Antonio (1992) validated the policy objectives. From Fiscal Year (FY) 1990 through FY 1993, approximately $1.2 billion was spent on the Andean Initiative.[7]

In 1993, the Clinton administration directed an interagency review of the international cocaine situation. The Presidential decision directive that resulted from the review (PDD-14) reaffirmed that the cocaine industry represented a threat to the national security of the United States.[8] It called for a *controlled shift* in the focus of interdiction operations from the transit zone to cocaine source countries.[9]

Within the context of PDD-14, the 1997 *National Drug Control Strategy* called for a regional coca control initiative with the goal of "complete elimination within the next decade of cultivation of coca destined for illicit cocaine production" and focused on "alternative economic development in Peru."[10]

Since 1989, when the Andean strategy first was conceived, there have been significant changes to the political and economic landscape in Latin America. For example, amidst regional democratization and economic reform, the situation of the Peruvian state under the rule of President Alberto Fujimori has improved markedly, recovering from a rapidly hemorrhaging institutional and fiscal environment in which drug control activities were severely constrained. There also have been some shifts in the configuration of the international drug markets. For instance, Colombia, which produced almost no heroin in the 1980s, now supplies an increasing share of the U.S. domestic market for the drug. In Mexico, the cocaine trade has transformed profitable smuggling groups into powerful trafficking conglomerates that have made deep inroads into the Mexican economy and political system and are credited with the increased violence and corruption along the Southwest border of the United States.

[5]Office of National Drug Control Policy (ONDCP), *National Drug Control Strategy* (1990), 50–51; (1991), 78–79; (1992), 81–83. The fourth goal was added to the 1991 *Strategy*.

[6]ONDCP, *National Drug Control Strategy* (1991), 81–82. The Andean Trade Initiative was to provide unilateral, duty-free access to the U.S. market for imports from the Andean region for 10 years.

[7]This figure comprises approximately $348 million in military assistance, $529 million in development assistance, and $251 million in law enforcement assistance.

[8]The directive reaffirmed a position of the U.S. Government since 1986, when President Reagan declared cocaine a security threat to the Americas.

[9]ONDCP, *National Drug Control Strategy: Strengthening Communities' Response to Drugs and Crime* (February 1995), 98.

[10]ONDCP, *National Drug Control Strategy* (1997), 54.

> pinning was worse than useless: Not only did it not produce results, but it allowed the traffickers to flout the justice system and call into question the government's ability to govern.[46]

The fifth crackdown, following the assassination of presidential candidate Luis Carlos Galan, however, was successful because of (1) President Virgilio Barco's decision to extradite drug suspects to the United States and (2) the constant pressure against the Medellin bosses, which prevented them from running their business and made them more susceptible to capture.[47] The reduced demand for coca caused by the crackdown temporarily depressed coca leaf prices. (The average leaf price in Bolivia decreased by 60 percent; the decrease was smaller in Peru.) These effects were associated with a temporary increase in the cocaine price and a decrease in cocaine purity in the United States (see Figures 2 and 3).

The dismantling of the Medellin cartel and disruption of the Cali cartel have not affected drug availability in the United States, but have removed important threats to the security and integrity of the Colombian Government and Andean region. As Clawson and Lee noted:

> Between 1990 and 1993, for example, the Colombian government managed to eliminate virtually all of the top tier and much of the middle-echelon leadership of the Medellin cartel. Some 200 to 250 criminals were exterminated and approximately 40 surrendered under a government leniency program. Unfortunately, this success had little impact on drug control, because the epicenter of the cocaine trade simply shifted to Cali; however, the crackdown wiped out an important narcoterrorist threat to the Colombian state.[48]

Counterorganizational actions have not reduced the corruptive capacities of the major trafficking organizations in Colombia. The estimated $4 billion in drug profits that returns to the Andean economies enables the traffickers to corrupt and suborn key sectors of Andean society and erode political will.[49] The infusion of illegal money into the Andean nations' economic systems through legal purchases of necessities and consumer items in effect makes a sizable portion of the legitimate business community accessories to the illegal drug trade.

As evidenced by the roles of the Cali cartel in Colombia and the trafficking conglomerates in Mexico, vast amounts of wealth generated by the illegal drug industry transforms small criminal groups into powerful

---

[46]Gugliotta, "The Colombian Cartels," 123–124.

[47]U.S. Department of State, INL, *International Narcotics Control Strategy Report*, 7. Gugliotta, "The Colombian Cartels," 124. In August 1989, presidential candidate Luis Carlos Galan was assassinated by Medellin hit-men, prompting a crackdown by the Colombian Government. The crackdown was supported by a $65 million emergency equipment package from the United States and supplementary support from several European countries. The Colombian Government extradited 14 major traffickers to the United States and froze millions of dollars in trafficker assets.

[48]Clawson and Lee, *The Andean Cocaine Industry*, 243.

[49]Ibid., 33–34.

In light of the political and economic developments in Latin America, shifts in the international drug markets, and U.S. plans for a major coca control initiative in the Andean source countries, a review of U.S. drug control policy in the Andean region is germane.

The purpose of this paper is to provide a summary review of U.S. drug control policy in the Andean region and the key factors that have affected its implementation. The analysis is organized into six sections. The first section outlines the objectives of the Andean strategy. Subsequent sections discuss the functions and outcomes of the major Andean drug control programs; key political and socioeconomic factors that affect the outcome of the strategy; cocaine market structure and demand trends; and international program resources. The final section offers conclusions.

Objectives of the Andean Strategy

International drug control programs are part of a broader effort to reduce illegal drug use and its consequences in the United States. The purpose of international drug programs is summarized in the 1997 *International Narcotics Control Strategy Report*:

> For the drugs that threaten us most—cocaine and heroin—a five-stage, grower-to-user chain connects the drug producer abroad with the consumer in the United States. At one end is the farmer growing coca or opium poppies in the Andes or Burma; at the other is the cocaine or heroin addict in a US town or city. In between lie processing (drug refining), transit (shipping), and wholesale distribution stages. We cannot reduce the flow of drugs to the United States unless we strike as close as possible to the source. Thus, the USG's international drug control programs target the first three links in the chain: cultivation, processing, and transit.[11]

In addition, control at the source is the most effective use of supply control resources, as the 1997 *International Narcotics Control Strategy Report* noted: "We stand our best chance if we can eliminate the first stage, cultivation, altogether. By eliminating drug crops on the ground, no drugs can enter the system. And it is by far the most cost-effective means available, as the costs rise exponentially at each subsequent intervention point."[12] An analogy used for this argument is that it is easier and more cost-effective to remove a beehive than to track down the bees.

These concepts provide the basic policy context for U.S. drug control activities in the Andean region, specifically: (1) that Andean drug control programs complement other domestic and international drug control efforts, and (2) that the domestic availability of cocaine is most effectively and efficiently reduced by reducing coca cultivation and cocaine production.

The Andean strategy has two principal objectives. The domestic policy objective is to limit cocaine availability in the United States, and thereby reduce domestic consumption. The foreign policy objective is to protect source-country institutions from the corruptive (and sometimes destructive) power of wealthy, sophisticated, and violent criminal syndicates.

Domestic Policy Objective

The domestic policy objective is grounded in social policy and motivated by domestic political constituencies. It is premised on the idea that an unabated supply of illegal drugs undermines demand-side efforts. The principal benefit of reducing cocaine availability in the short run is the effect on cocaine demand over the long run. Specifically, short-run

---

[11] U.S. Department of State, INL, *International Narcotics Control Strategy Report* (1997), 4.

[12] Ibid.

disruptions in cocaine supply may contribute to lower rates of initiation, consequently reducing aggregate demand over the long run, as Kevin Jack Riley explained:

> Restricting supply reduces initiation into cocaine use because casual and first-time users will be less willing to buy relatively expensive cocaine. Their reluctance may be related to the higher cost of the product, since new users might be more responsive than regular users, or to availability issues, since heavy users will be better able to maintain access to supplies in times of scarcity. A lower initiation rate leads to fewer casual and heavy users, and ultimately, less addiction. Thus, to the extent that future consumption is linked to levels of present consumption through addiction, a decline in present consumption will shift the future, long-term demand for cocaine inward.[13]

Domestic substitution is possible but, as Peter Reuter found, "declines in imports caused by major disturbances overseas or by the risks faced by smugglers are by no means fully compensated for by domestic production or diversion."[14]

The domestic policy objective has historically been the de facto standard against which the Andean strategy has been evaluated. As stated in the 1997 *International Narcotics Control Strategy Report*, "Stopping the flow of cocaine to the United States remains our main international drug control priority."[15] This is consistent with the purpose of a drug policy: reducing illegal drug use and its consequences. Criteria for the domestic policy objective, however, have historically not been well-defined (i.e., it has never been clear what amount of reduced domestic availability is required or how this target relates to production control targets at the source-country level). A key goal of the 1989 *National Drug Control Strategy* was to reduce the estimated amount of cocaine entering the United States by 10 percent over 2 years and 50 percent over 10 years.[16] The 1989 targets were modified in 1991 to a 20-percent reduction by 1993 and a 65-percent reduction by 2001.[17] The 1992 *Strategy* discarded specific targets altogether, stating objectives for 1994 and 2002 as "reduction below a (to be established) baseline level" in estimated amounts of cocaine entering the United States.[18] The Performance Measures of Effectiveness (PME) system established in 1998 reflects the Goals and Objectives of the 1997 and 1998 national strategies. Key supply reduction targets under this PME system include (1) reducing drug availability in the United States by 25 percent by

[13]Kevin Jack Riley, *Snow Job? The Efficacy of Source Country Cocaine Policies*, 138.

[14]Peter Reuter, *After the Borders Are Sealed: Can Domestic Sources Substitute for Imported Drugs?*, 173.

[15]U.S. Department of State, INL, *International Narcotics Control Strategy Report* (1997), 9.

[16]ONDCP, *National Drug Control Strategy* (1989), 96.

[17]ONDCP, *National Drug Control Strategy* (1991), 15.

[18]ONDCP, *National Drug Control Strategy* (1992), 26.

2002 and by 50 percent by 2007 compared with the 1996 base year, and (2) reducing the rate of outflow of illicit drugs from source zones by 15 percent by 2002 and by 30 percernt by 2007 as measured against the 1996 base year.[18]

Foreign Policy Objective

The foreign policy objective, protecting source-country institutions, is rooted in U.S. national security interests. Support for democratic or democratizing governments has long been a core foreign policy interest of the United States. The intersection of this foreign policy cornerstone with the threat posed by transnational trafficking groups to often fragile democratic governments has extended the drug policy issue beyond the domestic objective of reducing drug abuse. Given the cocaine industry's demonstrated capacity to supply illegal drug markets in the United States regardless of which organizations are dismantled or which kingpins are arrested, the de facto purpose of institution-building and counterorganizational actions is to maintain the stability and integrity of source-country governments.

In Colombia, for example, the major cocaine trafficking groups (most notably the Medellin and Cali cartels) have institutionalized the ethic of *plata o plomo* (silver or lead). Disrupting and dismantling these groups has been viewed as essential for maintaining a viable Colombian democracy. In Peru and Bolivia, where the influence of the trafficking groups is not considered as pervasive or potentially destabilizing, cocaine production control objectives drive the policy discussion. The national security dimension of drug policy also applies to the situation in Mexico, where U.S. policy is being driven as much by the specter of *Colombianization* as it is by cocaine smuggling across the Southwest border. At one level, the U.S. Government is concerned about the corruption and violence that accompanies the activities of powerful Mexican trafficking organizations because these factors facilitate the continued flow of illegal drugs into the United States. At another level, U.S. Government concern centers on the effects these syndicates have on Mexican institutions and political stability in Mexico.

Defining measures for the foreign policy objective is inherently difficult, because such measures tend to be "soft" and subject to interpretation. Evaluations of Andean drug policy inevitably turn on questions about its sustainability (i.e., whether the security and integrity of Andean states presupposes continued U.S. assistance over the long term, or whether it realistically anticipates building, over 5 to 10 years, an Andean state capacity to effectively investigate and dismantle major drug syndicates operating within their own borders without U.S. funding).

The global scope of the illegal drug trade suggests that decreased domestic cocaine use will not necessarily diminish the national security threat posed by the international drug syndicates. A decline in domestic

[18]Office of National Drug Control Policy, *Performance Measures of Effectiveness: A System for Assessing the Performance of the National Drug Control Strategy*, 13–14.

cocaine consumption may deprive the trafficking groups of revenues from the U.S. market, but it does not necessarily affect cocaine revenues from other regions or global proceeds from drugs other than cocaine.

Andean Drug Control Programs

To achieve the domestic and foreign policy objectives, U.S. drug control programs in the Andean region have focused on (1) limiting cocaine flows to the United States by reducing cultivation and processing through eradication, source-country interdiction, and alternative development (production control programs) and (2) strengthening source-country political will and institutional integrity by disrupting and dismantling major drug trafficking organizations (counterorganizational programs) and by implementing institution-building programs.

Production Control Programs

The United States spent more than $500 million on source-country drug control programs from 1989 to 1996.[20] Despite these outlays, total estimated coca cultivation has remained relatively stable at approximately 200,000 hectares (see Table 1). Nevertheless, production control programs have been favored in the Andean region for many years because coca is grown in well-defined (albeit large) geographic areas where the United States has traditionally enjoyed political access and influence. In contrast, opium poppies are cultivated worldwide and largely in areas where the United States has little access or influence.

Eradication

The purpose of eradication is to reduce coca production through the physical destruction of the coca plant, either manually (on the ground) or through aerial application of herbicides. Eradication programs may be forced (such as the current program in Colombia) or voluntary (as with the compensated eradication program in Bolivia). In theory, eradication raises the risks and costs to farmers and, therefore, should raise costs for refiners.[21] In practice, however, the risk to farmers from eradication has been negligible. Eradication risk can be defined as the amount of coca eradicated in any given year as a percentage of coca under cultivation. In 1996, for example, the risk from eradication for all coca growers in the Andean source countries was approximately 7 percent (14,400 hectares eradicated out of an estimated 218,000 hectares under cultivation) (see Figure 1).[22]

As indicated by the 1997 *International Narcotics Control Strategy Report*, eradication remains an important component of the Andean strategy:

---

[20]The actual expenditure on production control programs in the Andean region probably is closer to $1 billion, because in addition to the International Narcotics Control program funding for coca control and interdiction in Peru and Bolivia, there are interdiction and eradication resources for the Colombian national police, development assistance funds, and portions of the U.S. Department of Defense drug control budget earmarked for source-nation support and dismantling cartels.

[21]Peter Reuter, *The Limits and Consequences of U.S. Foreign Drug Control Efforts*, 153–154.

[22]U.S. Department of State, INL, *International Narcotics Control Strategy Report* (1997), 24.

Table 1. Worldwide illicit coca cultivation totals

	1991	1992	1993	1994	1995	1996
Cultivation (in hectares)						
Bolivia	53,388	50,649	49,500	48,200	54,093	55,612
Colombia	36,472	36,059	40,493	49,610	59,650	67,200
Peru	120,800	129,100	108,800	108,600	115,300	95,659
Total Cultivation	212,658	217,808	198,893	207,410	229,043	218,471
Eradication (in hectares)						
Bolivia	5,486	5,149	2,400	1,100	5,493	7,512
Colombia	972	959	793	4,910	8,750	5,600*
Peru	—	—	—	—	—	1,259
Total Eradication	6,458	6,108	3,193	6,010	14,243	14,371
Net Cultivation (in hectares)						
Bolivia	47,900	45,500	47,200	48,100	48,600	48,100
Colombia	37,500	37,100	39,700	44,700	50,900	61,600*
Peru	120,800	129,100	108,800	108,600	115,300	94,400
Total Net Cultivation	206,200	211,700	195,700	201,400	214,800	204,100
Potential Leaf Production (in metric tons)						
Bolivia	78,000	80,300	84,400	69,800	85,000	75,100
Colombia	30,000	29,800	31,700	35,800	40,800	49,280*
Peru	222,700	223,900	155,500	165,300	183,600	174,700
Total Potential Leaf Production	330,700	333,800	271,600	290,900	309,400	299,080
Potential Cocaine Production (in metric tons)						
Bolivia	220	225	240	225	240	215
Colombia	60	80	65	70	80	110
Peru	525	550	410	435	460	435
Total Potential Cocaine Production	805	835	715	760	780	760

*1996 data for Colombia reflect estimated kill figure and consequent harvestable leaf at a ratio of 800 Kg. per hectare.

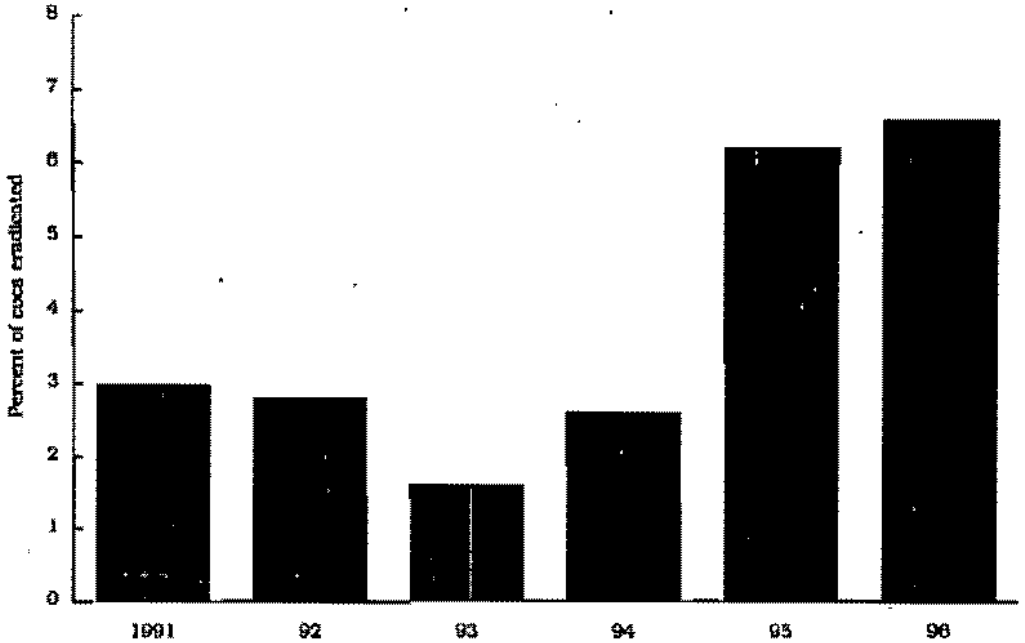
Sources: U.S. Department of State, Bureau of International Narcotics and Law Enforcement Affairs, *International Narcotics Control Strategy Report* (1997), 24, 25, 71, 91, 107. U.S. Department of State, unpublished message. U.S. Department of Justice, Drug Enforcement Administration, *The NNICC Report 1996: The Supply of Illicit Drugs to the United States* (1997), 16.

> A coca field is a large, stationary target; a load of finished cocaine distributed among trucks, boats, and aircraft is not. Even manual eradication, therefore, can play an important role. But we have better means available. Modern agricultural spray aircraft could, in a matter of months, take out a large percentage of the coca crop using environmentally safe herbicides. Since it takes two years for a coca bush to become productive, intensive aerial spraying campaigns could unquestionably cripple the cocaine trade for at least two years.[23]

During the last decade, the "large, stationary" Andean coca fields have been very elusive and difficult to "take out." In fact, in some cases, eradication programs appear to have had the unintended consequence of

[23]Ibid., 4.

Figure 1. Eradication risk (percentage of total estimated coca cultivation eradicated), 1991–96



promoting drug production. For instance, from 1983 to 1989, approximately 18,000 hectares of coca were eradicated in the Upper Huallaga Valley (UHV). As the plants on the valley floor were destroyed, farmers planted more coca on the less accessible valley slopes. By the end of the decade, an estimated 2 to 3 hectares had been planted for every hectare eradicated. In effect, farmers overcompensated for hectarage lost to eradication, and net coca cultivation expanded sharply.[24]

In Bolivia, the compensated, voluntary eradication program has been the centerpiece of the U.S. coca reduction effort since 1989. The program compensates farmers approximately $2,000 per hectare of coca eradicated for coca planted before 1988. From 1987 to 1994, 25,232 hectares were voluntarily eradicated, and nearly $50 million was provided for compensation.[25] During the same period, coca cultivation in Bolivia *increased* by 7,800 hectares (from 40,300 hectares in 1987 to 48,100 in 1994) and coca leaf production increased by 13 percent (from 79,200 metric tons in 1987 to 89,800 metric tons in 1994).[26] These data suggest that the compensated, voluntary eradication program has not had the desired effect of a net reduction in coca cultivation. In fact, the program may have unintentionally served as a price subsidy for coca, providing farmers an incentive to

[24]ONDCP, *Crop Substitution in the Andes*, 58.

[25]Patrick L. Clawson and Rensselaer W. Lee III, *The Andean Cocaine Industry*, 221.

[26]U.S. Department of State, INL, *International Narcotics Control Strategy Report* (1996), 24–25.

eradicate older unproductive plants while maintaining younger, productive bushes as a hedge against depressed licit crop prices.

However, the combination of compensated eradication and alternative development programs has substantially increased the value and extent of legal crops in the Chapare Valley.[27] The greater role of legal crops in the Chapare has not reduced coca production, but it has reduced the potential impact that forced eradication programs and the resultant loss in coca revenue would have on the economy in the Chapare. Consequently, the improved social and economic conditions in the Chapare have lowered the potential for large-scale social unrest in response to forced eradication. In sum, although the combination of compensated eradication and alternative development programs in Bolivia has not brought about a net reduction in coca cultivation, it has brought about conditions that are more favorable for reducing coca over the long term.

To be effective, *eradication programs must substantially increase the risk of growing coca throughout the Andean region.* With an average of less than 4 percent of coca cultivation eradicated in the source countries from 1991 to 1996, the risk to coca growers has been inconsequential. Massive, aperiodic eradication must occur regionally to produce the short-term market disruptions necessary to support demand reduction programs in the United States.[28]

Source-Country Interdiction

In contrast to eradication, which depletes directly the raw material in cocaine production, source-country interdiction indirectly creates disincentives to produce coca. Source-country interdiction programs focus on seizing drugs and precursor chemicals, disrupting processing facilities, and arresting drug traffickers. Such programs are designed to increase production risks and costs by denying links between primary base producers in Peru and Bolivia and final cocaine refiners in Colombia, or by seizing and destroying processing capital (e.g., precursor chemicals and processing facilities) to reduce processing demand, in turn depressing local prices. Source-country interdiction is substantively different from interdiction operations against cocaine smugglers in the transit zone or at the U.S. border, which seek to reduce availability by directly disrupting cocaine already destined for the United States. The ultimate purpose of source-country interdiction operations is not to seize illegal drugs per se, but to cause local oversupply in base or leaf, consequently causing price depression sufficient to compel the coca farmer to seek alternative sources of income.

Operation BLAST FURNACE (1986) provided the conceptual underpinning for source-country interdiction in the Andes. Operation BLAST

[27]Clawson and Lee, *The Andean Cocaine Industry*, 235.

[28]In Colombia during 1997, better herbicides, improved eradication techniques, and an expanded program resulted in the destruction of more than 16,000 hectares of coca, more than double the amount of coca destroyed the previous year. However, almost all spray activity occurred in the Guaviare department. Growing areas in the Putamayo and Caqueta departments were not adequately addressed due to resource constraints.

FURNACE employed six U.S. Army Blackhawk helicopters and 160 U.S. support personnel to provide air mobility for combined Bolivian National Police–Drug Enforcement Administration (DEA) attacks on coca production. It was followed by Operation SNOWCAP (1987–95) a regional effort that combined destruction of processing facilities with crop eradication and drug and precursor interdiction on land and waterways.[29] Operation SNOWCAP was the conceptual and operational center of the Andean Initiative. The most recent and most successful demonstration of source-country interdiction has been the airbridge denial effort, Operation LASER STRIKE (1995–present).

As with eradication, the ability of source-country interdiction to cause sustained reductions in coca production has been limited by the adaptability of the cocaine industry to disruptions. For instance, Operation BLAST FURNACE caused coca leaf prices in Bolivia to drop from an average of $2.30 per kilogram in June 1986 to 30 cents per kilogram in July, but leaf prices rebounded at the end of that year.[30] Operation LASER STRIKE contributed to depressed cocaine base prices in the UHV which, in turn, led to an 18-percent reduction of coca cultivation in Peru in 1996.[31] However, evidence of new smuggling routes and methods within Peru (e.g., overland routes to Ecuador, riverine routes, and clandestine airfields near the Colombian and Brazilian borders), information showing Peruvian traffickers have transported processed cocaine directly to Mexico, and a 32-percent increase in coca cultivation in Colombia, all suggest the cocaine industry adapts to interdiction by redistributing production and transportation networks.[32]

This redistribution continued in 1997, but the industry has not yet fully adapted to the effects of source-country programs. Cultivation in Peru declined by another 27 percent in 1997, while cultivation in Colombia increased by 18 percent. Colombia now has more hectares under coca cultivation than any other country, having increased cultivation by 56 percent in 2 years. However, the increase in Colombian cultivation has not completely offset the declines in Peru and Bolivia. Total Andean coca cultivation declined by 7 percent in 1997, and total estimated production potential decreased by 15 percent (from 760 to 650 metric tons).

It also is important to recall that price declines in the coca economy and redistribution of coca cultivation have occurred before. After peaking in 1989, coca leaf and cocaine paste prices in Peru declined sharply, with the average price for a kilogram of cocaine paste dropping by more than 85 percent from 1989 to 1993 (from $1,500 to $200 per kilogram).[33] The sharp price decline was a result of overproduction, which had been brought

[29]U.S. House of Representatives, Committee on Government Operations, *Anti-Narcotics Activities in the Andean Region*, 13–14.

[30]Clawson and Lee, *The Andean Cocaine Industry*, 224, 225.

[31]U.S. Department of State, INL, *International Narcotics Control Strategy Report* (1997), 102.

[32]Ibid., 91, 102, 104.

[33]Bruce Howard Kay, "Violent Democratization and the Feeble State: Political Violence, Breakdown and Recomposition in Peru, 1980–1995," 196.

about by intensified source-country interdiction operations as well as lower production costs made possible by Sendero Luminoso protection of growers (which encouraged growers to shift to monocrop coca cultivation).[34]

The extent of this overproduction is brought into perspective by noting that the extensive crop destruction caused by a root fungus (*Fusarium oxisporum*) destroyed an estimated 25,000 to 65,000 hectares of coca in the UHV from 1990–92, but was insufficient to offset the price decline. The net result was a massive displacement of the coca economy throughout Peru that, consequently, undermined Sendero Luminoso's lucrative hold over the coca economy in the UHV.[35]

Increased coca cultivation in Colombia reflects the weakness of the Colombian interdiction program. As with eradication, *the success of source-country interdiction is predicated on its effective application throughout the Andean region.* In turn, an effective regional interdiction program requires adequate, long-term funding and multilateral cooperation.

Alternative Development

In contrast to both eradication and source-country interdiction, alternative development seeks to draw coca farmers away from the cocaine industry by providing incentives primarily in the form of income alternatives. Although the term *alternative development* denotes programs specifically designed to reduce coca cultivation, the scope of programs commonly designated as alternative development has ranged from crop substitution to macroeconomic development assistance.[36] Alternative development in the Andean region largely has consisted of a series of crop substitution and area development programs in Bolivia and Peru. In Bolivia, major programs have included the Agricultural Development in the Coca Zones Project (1975–80); the Chapare Regional Development and Associated High Valleys Project (CRDP) (1983–91); and the Cochabamba Regional Development Project, an integrated regional development effort that replaced the CRDP in 1991. In Peru, the major alternative development effort was the Upper Huallaga Special Project (PEAH) (1981–93), an integrated regional development effort.[37]

None of these efforts succeeded in reducing regional coca cultivation. The failure of alternative development programs has been attributed to insufficient funding, isolation from major markets for alternative crops, bureaucratic corruption, and lack of security and state presence in rural

[34]Ibid., 196–197.

[35]Ibid., 197–198.

[36]Crop substitution projects initially were centered in the coca growing areas and focused on developing licit, alternative crops. These projects were later expanded into integrated regional development programs that attempted to draw labor out of the coca growing areas into other rural zones. Most recently, projects have focused on assisting institutions in the central government to implement economic policies conducive to macroeconomic development to improve other sectors of the economy, consequently slowing out-migration into the coca zones.

[37]U.S. Congress, Office of Technology Assessment, *Alternative Coca Reduction Strategies in the Andean Region*, 7, 84–89, 90–91.

areas.[38] It also has been argued that the alternative development projects in Bolivia and Peru have been similar in concept and implementation to the failed integrated rural development (IRD) projects undertaken in Latin America by the multilateral lending community in the 1970s.[39] In many cases, provided with credit and technical assistance, farmers diversify their crops while continuing to cultivate coca. In Peru, PEAH was partially responsible for the increase in legal crop cultivation since the early 1980s, but the program did not affect coca cultivation. Among other obstacles, PEAH was hindered by lack of security in the growing areas as well as antagonistic perceptions among farmers who associated PEAH with the U.S.-financed Peruvian eradication agency, CORAH (Special Project for Control and Eradication of Coca in the Alto Huallaga).[40]

It is difficult to establish legal crops in remote areas lacking agroindustry processing centers and market access. The social and infrastructural investments necessary to establish market access may be extremely costly. These costs could be shared among international lending institutions, but experience has shown that international funding for drug control programs has been too limited to make an impact.[41] There also are concerns about the *sunk costs* that attend any infrastructural effort linked to coca reduction. Roads, wells, schools, and rural electrification are fixed investments that cannot easily be retracted if coca cultivation returns. There also are the *steady state* and recurring maintenance costs that continue for a community, costs that become particularly difficult for poorer governments to sustain when foreign development capital and coca control funds are reduced.

The poor track record for alternative development has prompted recommendations for different approaches. Some researchers advocate combining source-country interdiction and national economic development. Others, noting the similarities between the Andean alternative development programs and the failed IRD projects of the 1970s, have called for peasant-based development strategies that stress basic changes to agrarian policies and popular participation in program implementation and resource allocation to achieve broad-based agricultural development.

Lessons From Production Control in Thailand

The case of Thailand is instructive for understanding some of the conditions required for production control success. Between 1982 and 1993, net poppy cultivation in Thailand declined by 50 percent. Thai success in reducing opium poppy cultivation has been attributed to the following: (1) strong macroeconomic performance as demonstrated by

[38]ONDCP, *Crop Substitution*, 10, 44, 55. Kevin Healy, "The Role of Economic Development: Policy Options for Increased Peasant Participation in Peru and Bolivia," 143. The Fujimori government's effective campaign against the guerrilla group Sendero Luminoso has significantly expanded state presence in Peru. In Colombia, however, the 30-year insurgency continues, accompanied by violence from paramilitary groups and vigilantes.

[39]Healy, "The Role of Economic Development," 140–150.

[40]ONDCP, *Crop Substitution*, 44.

[41]U.S. General Accounting Office, *Drug Control: Long-Standing Problems Hinder U.S. International Efforts*, 17.

strong per capita gross domestic product (GDP) growth both nationally (7 percent annual average since World War II and 11 percent since 1988) and in the opium zones in northern Thailand; (2) Thai Government commitment to integrating the poppy-growing northern hilltribes into the national polity; (3) Thai Government penetration and control of national territory; (4) long-term Thai and foreign funding for highland development and crop substitution projects; (5) creation of nonlocal administrative structures to guide highland development efforts; (6) annual eradication campaigns; (7) Thai responsiveness to U.S. and international concerns over poppy cultivation; and (8) competitive production of opium in neighboring Burma.[42]

The situation of Thailand in the early 1980s and the current situation in the Andean source countries are, however, vastly different as indicated by the following:

1. Unlike Bolivia and Peru, which produce 70 percent of all coca, Thailand was never a major producer of opium (Thailand accounted for 6 to 7 percent of Golden Triangle output in the early 1980s).

2. Colombia (and until recently, Peru) continues to be fragmented by rural violence, and the Bolivian Government has been forced to contend with powerful coca growers' unions. In contrast, Thailand had largely resolved its nation-building issues and territorial control questions before beginning its crop control efforts and sought to complete its process of national integration by establishing effective state authority over the poppy-growing northern hilltribes. The motivation and rationale for poppy control was not drug control per se, but a means to consolidating long-term political stability.

3. The poppy reduction in Thailand was accompanied by significant expansions of poppy cultivation in Burma and Afghanistan. The significant 1996 increases in the Colombian coca crop, amidst reductions in Peruvian cultivation, suggest the *balloon* or *Burma* effect is at work in the Andean region as well.

4. Thai development projects and eradication programs eventually began to yield diminishing returns in reducing opium cultivation (i.e., the marginal costs for opium control increased as Thai poppy cultivation decreased).[43]

This last point suggests that if all current socioeconomic conditions remain static, including strong global consumption of cocaine, the incentives for growing coca in the Andean region should increase as overall cultivation decreases.

[42]Rensselaer Lee, *Narcotics Production in Thailand*, 1–8, 26–32.

[43]Lee, *Narcotics Production*, 29.

Counterorganizational Programs

The cocaine industry has been compared to an hourglass: Between the hundreds of thousands of coca growers and primary processors at the production end and the millions of cocaine users at the domestic market end, there are an estimated 500 top cocaine traffickers distributed among 10 major exporting groups.[44] These 500 traffickers and the transnational trafficking groups they control dominate the Andean cocaine industry. While production control has sought to disrupt supply by reducing the crop and product prior to export from the source countries, counterorganizational actions under the Andean strategy have sought to disrupt and dismantle organizations that supply cocaine and other illegal drugs to the United States and that directly threaten Andean political and economic institutions. Key counterorganizational activities have included (1) "kingpin" investigations that seek to disrupt and dismantle the major trafficking groups by apprehending, convicting, and incarcerating their highest leadership; (2) crackdowns, surge operations (used thus far only in Colombia) that broadly target key traffickers, processing, and trafficking operations; and (3) anti-money-laundering and related programs that target trafficker wealth and illicit assets.

Counterorganizational actions in the Andean region have been highlighted by five major crackdowns by the Colombian Government against the Medellin cartel between 1984 and 1990, the Gaviria administration's manhunt for Medellin cartel leader Pablo Escobar, and the disruption (by 1996) of the key Cali cartel leadership due to persistent Colombian national police investigations and operations.[45]

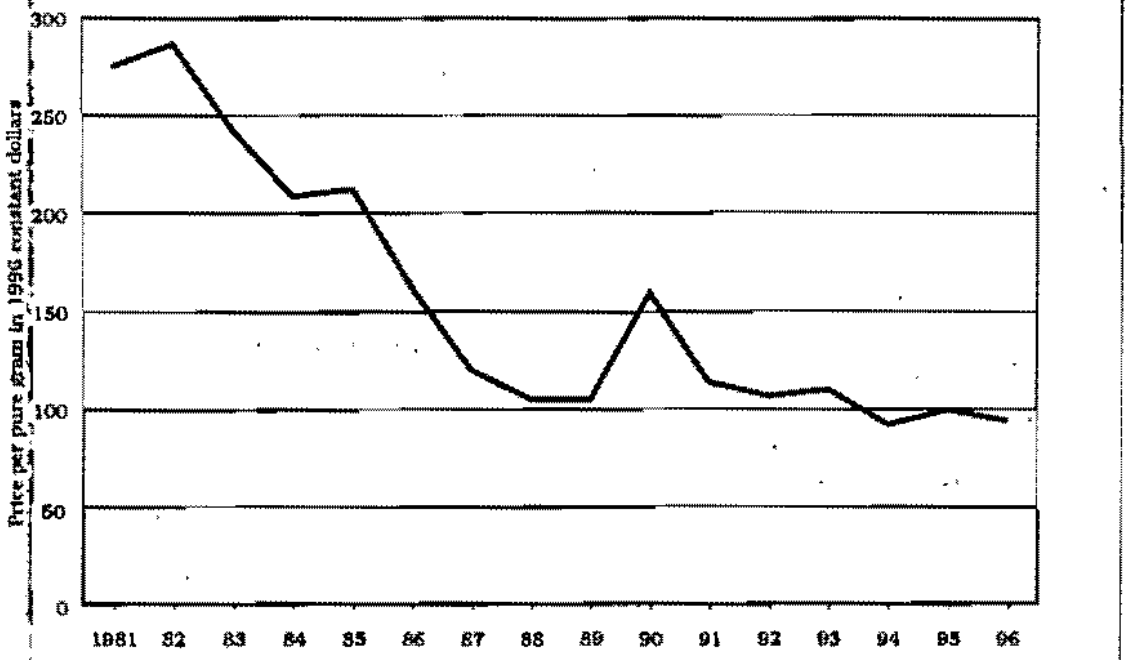
According to Guy Gugliotta, the first four crackdowns by the Colombian Government against the Medellin cartel were not effective:

> At no time during the first four crackdowns did the Colombian government have any comprehensive strategy for dealing with the cartels. . . . No systematic attempt was made to reform Colombian law enforcement, reinforce the courts, or enact new laws more congenial to the arrest and prosecution of drug cases. The entire justice system was crippled or hopelessly compromised. In short, the crackdowns were a waste of time. Law enforcement without institutional under-

[44]Guy Gugliotta, "The Colombian Cartels and How to Stop Them," 117. Sidney Zabludoff, "Colombian Narcotics Organizations as Business Enterprises." Zabludoff estimates that 500 traffickers dominate the cocaine industry in Colombia. These 500 are supported by 6,000 specialists (pilots, chemists, shippers, and overseas distributors) and 10,000 semiprofessional and unskilled workers (laborers, guards, couriers, and money launderers).

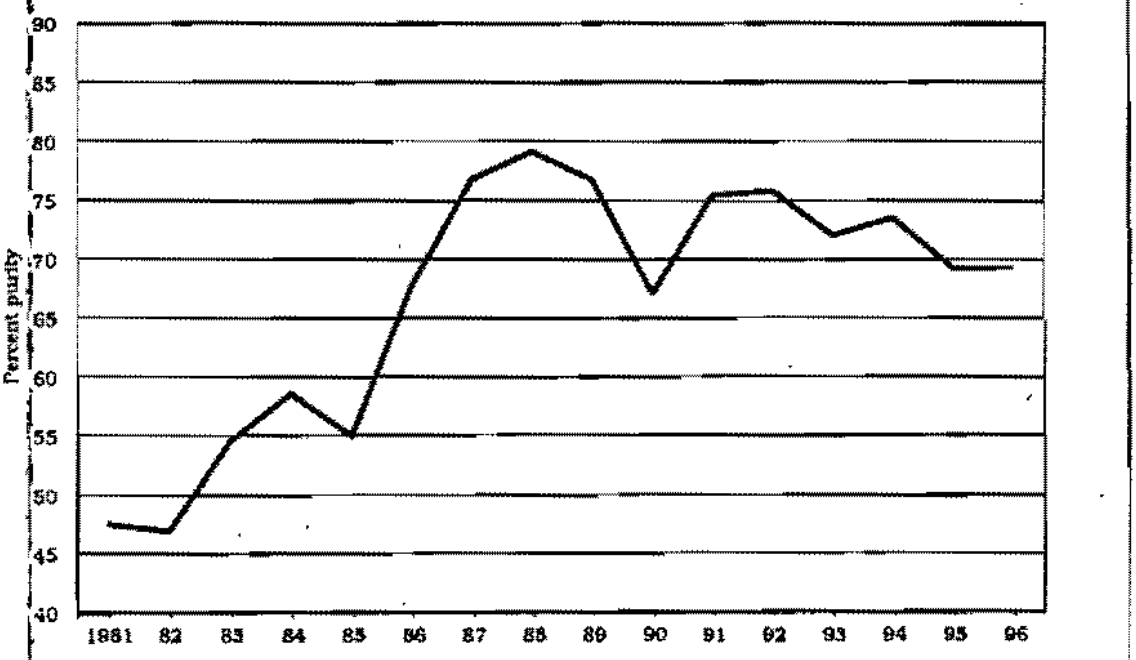
[45]Gugliotta, "The Colombian Cartels," 113, 115, 122–125. U.S. Department of State, INL, *International Narcotics Control Strategy Report* (1994), 1. The first crackdown was conducted by the Betancur administration (1982–86); the other four by the Barco administration (1986–90). In each case, a specific event precipitated the government crackdown: (1) the assassination of Justice Minister Rodrigo Lara Bonilla in April 1984, (2) the release on bail of Jorge Ochoa from jail in August 1986, (3) the murder of *El Espectador* newspaper editor Guillermo Cano in December 1986, (4) the kidnap-murder of Attorney General Carlos Mauro Hoyos in January 1988, and (5) the August 1989 assassination of Liberal Party presidential candidate Luis Carlos Galan. After a 17-month search, Colombian authorities killed the Medellin drug lord in a shoot-out on December 2, 1993. Pablo Escobar's death effectively eliminated the organization that had dominated the cocaine trade for more than a decade.

Figure 2. Average price of cocaine in the United States*



Source: Abt Associates, Inc., *Prices of Illicit Drugs, 1981-1997*. Unpublished report, 1997.
*Purchases of 5 ounces or less.

Figure 3. Average purity of cocaine in the United States*



Source: Abt Associates, Inc., *Prices of Illicit Drugs, 1981-1997*. Unpublished report, 1997.
*Purchases of 5 ounces or less.

institutions with political interests. Samuel Huntington observed that "the functions, as well as the causes, of corruption are similar to those of violence. . . . both are symptomatic of the weakness of political institutions" and that "the society which has a high capacity for corruption also has a high capacity for violence."[50]

This corruptive wealth in the context of fragile institutions and inadequate systems of criminal justice has ensured relative impunity for many international drug criminals. Drug-related corruption erodes institutional capacity and undermines the rule of law. In Bolivia, corruption is a problem within the armed forces, civilian antidrug agencies, and the courts. And in Colombia, the drug syndicates continue to influence the political, judicial, and legislative processes.[51] According to the U.S. Ambassador to Colombia, corruption is the most significant impediment to a successful drug control effort.[52] In Peru, official corruption also impedes drug law enforcement, but the U.S. Government has characterized it as "a pervasive individual phenomenon, not an institutional one."[53]

Institution-building and multilateral cooperation are critical to countering drug trafficking corruption over the long term. Important counterorganizational tools include effective anti-money-laundering legislation, extradition, and the use of vetted units. Anti-money-laundering initiatives and International Economic Emergency Powers Act sanctions constrain the traffickers' corruptive wealth. Extradition ensures that transnational criminals cannot take refuge from justice and the rule of law. Vetted units insulate counterorganizational efforts from compromise, enabling honest officials in heavily corrupted governments to conduct effective investigations and internal security missions.

The long-term requirement, however, is to *institutionalize* counterorganizational programs and anticorruption efforts within the governing and financial structures of the Andean states. As the history of the Mafia and the Asian triads suggests, with U.S. drug control assistance, achieving a sustainable Andean institutional capability against the drug syndicates will take well beyond 20 years.

In sum, counterorganizational programs address the national security dimension of international drug control. The national security objective of the Andean strategy is not about reducing the domestic availability of cocaine; rather, it is about limiting the influence of international organized crime. A long-term commitment to pursuing counterorganizational actions is an important policy independent of any effects it may have on the illegal drug supply in the United States.

[50]Samuel P. Huntington, *Political Order in Changing Societies*, 61, 63–64.

[51]U.S. Department of State, INL, *International Narcotics Control Strategy Report* (1996), 68, 84.

[52]U.S. General Accounting Office, *Drug Control*, 12.

[53]U.S. Department of State, INL, *International Narcotics Control Strategy Report* (1996), 102.

Political and Economic Conditions Affecting the Andean Strategy

Cocaine control efforts in the Andean source countries have not succeeded in reducing domestic availability of cocaine. However, this failure to achieve a domestic outcome does not mean that cocaine control is conceptually invalid. Reuter examined three cases in which reduced domestic availability of illegal drugs led to reduced consumption: (1) heroin in the 1970s, (2) methaqualone (Quaalude) in the 1980s, and (3) Colombian marijuana in the 1980s. Reuter concluded that:

> If it were possible to achieve a lasting reduction in the availability of foreign-source cocaine to the United States—not only from the Andes but from all other potential growing areas around the world—then the result might be a substantial reduction in both the consumption of cocaine and the recruitment of new users into stimulant abuse. The existence of substitutes such as methamphetamines is not enough to justify nihilistic skepticism about the worth of international control programs. The fundamental question is whether in fact these programs have any prospect of achieving their proclaimed goals.[54]

The utility of cocaine control is not the issue; rather, it is the uncertain *expected* utility of implementing a cocaine control policy under unfavorable political and economic conditions in the Andean region. Unfavorable underlying conditions substantially lower the expected utility of the source-country strategy for achieving a favorable domestic outcome.[55] The Andean strategy must, therefore, be set in the context of the conditions under which it has been implemented.

This section examines the key political and socioeconomic conditions in the Andean region that affect the implementation of U.S. drug control policy.

Political Conditions

The significant political variables in the Andean drug policy equation involve the capacity of the state to formulate and implement viable drug control policies and programs. In this sense, state capacity is principally determined by three interrelated factors: (1) the political will to confront the drug trade, (2) institutional capability, and (3) the extent of state authority over its national territory. U.S. Government assessments of the state capacity of major source and transit countries tend to focus on political will and institutional capabilities but fail to adequately consider the role of state authority and the legitimacy of the government. The absence of order and

[54] Reuter, *After the Borders Are Sealed*, 175.

[55] For a general discussion of expected utility see Jonathan Baron, *Thinking and Deciding*, 290–294.

state authority in the Andean source countries has been a limiting condition on the ability of the Andean strategy to achieve its production control objectives.

Political Will

The political will of a major drug source or transit country is considered the principal measure of its commitment to confront the drug trade. The 1997 *International Narcotics Control Strategy Report* stated that "the key to dealing with drug supply, however, is an intangible: political will. The best-trained, best-equipped anti-drug units cannot succeed for long without the determined commitment of their country's political authorities to take the often painful measures that can mortally wound the drug trade."[56]

Judgments about the strength or weakness of political will generally refer to the priority a source or transit country gives to drug control activities relative to other competing state priorities. These judgments are based largely on demonstrated drug control actions and the consonance of these actions with U.S. drug policy. However, the presence or absence of particular actions may not indicate the strength or weakness of the government's political will to confront the drug trade. Rather, action (or lack of action) tends to reflect rational responses by decisionmakers to a set of incentives, as Thomas Sowell explained:

> While decisions are *constrained* by the kinds of organizations and the kinds of knowledge involved, the *impetus* for decisions comes from the internal preferences and external incentives facing those who actually make the decisions. . . . Typically, these incentives are structured in some way, so that there are gradations of rewards (or penalties) corresponding to different kinds of results. It is not just a question of being rewarded or not, but of how *much* reward or penalty is likely to follow from various decisions. . . . An organization may make decisions which fail to achieve its assigned purpose or fail to serve society's interest, without any "failure" of understanding or ability, simply because it is responding to the actual structure of incentives confronting it rather than to the rhetoric or hopes of others.[57]

Understanding the structure of incentives facing decisionmakers within a source-country government can explain judgments about political will as well as the role of drug-related corruption in conditioning political will.

For example, the 1993 *International Narcotics Control Strategy Report* cited as an impediment to political will the Peruvian Government's "unwillingness to attack coca fields in the insurgent-infested Upper Huallaga Valley."[58] President Fujimori had deferred undertaking effective

[56]U.S. Department of State, INL, *International Narcotics Control Strategy Report* (1997), 5.

[57]Thomas Sowell, *Knowledge and Decisions*, 14–15.

[58]U.S. Department of State, INL, *International Narcotics Control Strategy Report* (1993), 2.

coca control actions to focus on the acute political and economic crises that threatened to destabilize the Peruvian state, specifically (1) the insurgent group Sendero Luminoso and (2) critical economic problems inherited from the Garcia administration. At that time, the Peruvian Government viewed coca control as inimical to a successful counterinsurgency and nation-building program. As the key decisionmaker, President Fujimori was responding to a structure of incentives that rewarded the prevention of a Sendero Luminoso takeover and financial disintegration more than it rewarded controlling coca. The irony is that these decisions ultimately resulted in political and economic conditions that made coca control more feasible than before. By 1995, the government had expanded its authority through a successful counterinsurgency effort against Sendero Luminoso and had stabilized the economy through a sweeping program of economic liberalization and privatization of parastatals.[59] Had the Peruvian state undertaken effective coca control actions in the late 1980s and early 1990s, the results might have run counter to long-term U.S. interests.

Huntington described corruption as "one measure of the absence of political institutionalization."[60] Corruption has been used effectively by the drug syndicates to obtain the active or passive complicity of law enforcement officials, judges, bankers, and political leaders. Key to understanding the role of corruption in conditioning political will is understanding what Sowell termed the "structure of incentives" facing decisionmakers, specifically the *net* structure of incentives: institution-building less corruption.

While the United States funds institution-building programs and other measures to strengthen political will, the drug syndicates bankroll decisionmakers at all levels to erode political will. In Colombia particularly, the wealth of the cocaine industry resulted in informal policies of co-optation, effectively proscribing the political will to confront the drug trade. As early as 1975, when the government was first confronted with large foreign exchange inflows from the drug trade, President Lopez Michelsen opened the side window at the Central Bank, where dollars could be exchanged for pesos with no questions asked.[61] A decade later, the Medellin cartel had amassed enough wealth and influence to directly challenge the authority of the Colombian state. In Peru, the debt- and inflation-plagued Garcia government "implemented a series of measures designed to encourage reinvestment of drug dollars in the economy, including grants of immunity from prosecution for tax violations and criminal investigations for drug traffickers who repatriated hard currency."[62] *Plata o plomo* is a dark but brutally effective structure of incentives facing decisionmakers in drug producing and transit countries.

[59]The sale of state-owned enterprises increased the central reserves of foreign exchange. These reserves, along with tax reform that improved government revenues, provided President Fujimori with greater discretionary spending for consolidating political gains at the expense of the guerrillas as well as strengthening his own political position vis-à-vis the electorate following the April 4, 1992, dissolution of the Peruvian Congress (the *autogolpe* or *self-coup*).

[60]Huntington, *Political Order*, 59.

[61]Patricia Bea McRae, "Impact of the Illegal Narcotics Trade on Economic and Legal Institutions in Colombia," 100.

[62]Kay, "Violent Democratization," 179.

Judgments based on the presence or absence of drug control actions also risk confusing political will for political expediency. For example, in Colombia, the Barco administration's decision to crack down on the Medellin cartel during 1989 and 1990 was a reaction to specific cartel-sponsored terrorism, not an expression of Colombian national political will against drug trafficking. Similarly, the Cali cartel's eschewal of Medellin's narcoterrorist methods and Cali's emphasis on shaping the law to its own advantage and that of corrupting officials encouraged government complacency after Pablo Escobar's death. Political will was subordinated to benign coexistence and inaction. The apparent contradiction between drug control policies of crackdown (Medellin) and coexistence (Cali) again reflects a rational response by decisionmakers (in this case, the Colombian political and economic elite) to an incentive structure, one that rewarded both eliminating Medellin (a direct challenge to the safety of the elites) and coexisting with Cali (the continued financial benefits from drug-related corruption and the avoidance of a violent showdown reminiscent of President Barco's *war without quarter* against the Medellin cartel).

Institutional Capability

In addition to strong political will, the state must have capable and sufficiently resourced institutions to effectively implement its drug control policy. Huntington defined institutions as "stable, valued, recurring patterns of behavior" and explained that "organizations and procedures vary in their degree of institutionalization," which is defined as "the process by which organizations and procedures acquire value and stability."[63]

U.S. international drug control assistance has been directed at strengthening the capabilities of Andean state institutions. The institutional capability of the Bolivian, Colombian, and Peruvian Governments to confront the cocaine trade has been strengthened during the last decade. Despite this progress, the resources for institution building and training generally have proven insufficient relative to the magnitude of the problem, and poorer nations (particularly Bolivia) lack the discretionary spending to sustain an adequate counterdrug capability. For instance, in Colombia, the lack of resources and adequate planning capabilities has precluded a coordinated, sustained government attack on the trafficking system.[64] In Bolivia, the poorest of the three source countries, the United States might expect that a decrease in its drug control assistance could result in at least a corresponding decrease in Bolivian drug control activities. U.S. officials in Peru have stated that developing an adequate riverine interdiction capability will take 3 to 10 years because Peru has no riverine strategy and lacks trained personnel, equipment, and infrastructure.[65] As Bruce Bagley wrote:

[63]Huntington, *Political Order*, 12.

[64]U.S. General Accounting Office, *The Drug War: Colombia Is Undertaking Antidrug Programs, but Impact Is Uncertain*, 25.

[65]Ibid., 13.

> While US financial and technical assistance might help improve state capacities to control some aspects of this transnational involvement in the drug trade, to believe that the institutionally underdeveloped, financially-strapped governments of Latin America will be in a position to gain or maintain effective control over these actors within the next decade is out of touch with reality.[66]

Bagley also observed:

> If a comparatively strong state such as the United States has not managed to dismantle the *mafia* permanently, it is even less likely that Latin America's weak and uninstitutionalized democracies will be able to disrupt the enormously wealthy criminal organizations that have sprung from and are sustained by the drug trade.[67]

Institutional capability is relevant to the discussion about appropriate roles and missions for different government agencies. In the context of the Andean strategy, this discussion normally has centered on the involvement of U.S. and Andean source-country militaries in drug control activities. Early congressional assessments of the Andean Initiative criticized the Bush administration for militarizing the drug war at the risk of undermining programs designed to strengthen civilian government and reduce human rights abuses. General Accounting Office assessments concluded that in some cases U.S. policy has led to institutional rivalries between the police and the military.[68] However, with political trends suggesting stronger civilian governments throughout Latin America, it remains to be seen what the long-term effects are for encouraging Andean source-country military involvement in drug control activities.

State Authority and Political Order

National political will and institutional capability relate directly to the legal and political authority of the state throughout its national territory. The absence of state authority has been a critical limiting condition to the implementation of a successful production control strategy in the Andean source countries. During the late 1980s and early 1990s in Peru, eradication and alternative development programs largely were proscribed by guerrilla violence or the outright control of some parts of Peruvian territory by Sendero Luminoso. The strength of the insurgency was a function of the institutional weakness of the Peruvian state, which prevented the government from effectively penetrating and controlling its national territory.

[66]Bruce M. Bagley, "U.S. Foreign Policy and the War on Drugs: Analysis of a Policy Failure," *Journal of Interamerican Studies and World Affairs*, 197.

[67]Ibid., 198.

[68]In 1991, the U.S. General Accounting Office cited a lack of coordination and cooperation between the Peruvian police and military as an obstacle to the effective implementation of source-country policy in that country.

Establishing political order and increasing state capacity were prerequisites to controlling coca. In analyzing the democratization process in Peru, Kay wrote:

> Despite its massive size and its ownership over the economy's most productive assets, however, Peru's state proved to be one of the weakest in the region during the 1980s. Not only was it incapable of enforcing the rule of law, inept at macroeconomic management and ineffective at providing essential services, it was unable to sustain what many acknowledge to be the minimal condition for existence: control over national territory. That control . . . was contested in some areas of the country by Sendero Luminoso, which thrived from the weakness of the state and eroded its capacity to maintain order.[69]

Peru was able and willing to resume large-scale coca control programs only after first containing Sendero Luminoso and stabilizing the economy. Through a program of government downsizing and privatization of parastatals, by 1995 the Peruvian Government's role in the economy had been reduced substantially. Decreasing the size and role of the government resulted in increasing the state's capacity to establish and maintain order over its national territory. Kay explained the reasons for this paradox:

> Part of the formula for increased state capacity in the context of bureaucratic downsizing has been a substantial recovery in public sector real wages from their 1990 low point combined with stabilization of inflation, both of which have made public sector employment relatively more attractive and apparently reduced levels of official corruption from the Garcia period. In addition, police and military salaries have risen significantly as the size of the military budget in absolute terms increased. In sum, while the state bureaucracy has been reduced considerably, civil servants and law enforcement are better paid, thereby strengthening the state's technical and administrative capacities.[70]

The capacity of the Peruvian state to establish and maintain political order has improved markedly under President Fujimori. The reassertion of state authority has created opportunities for alternative development initiatives. In contrast to the late 1980s and early 1990s, alternative development programs in Peru today are not faced with the additional risks and costs of implementation in stateless areas, because more effective Peruvian state institutions have lowered the implementation costs through greater security. These more favorable conditions mean that alternative development programs in Peru have an a priori greater probability of success and, hence, a higher expected utility for the United States.

[69]Kay, "Violent Democratization," 297.

[70]Ibid., 297–298.

Peru is one example of how political order must precede production control. Other examples include the previously mentioned Thai poppy-reduction effort in the 1980s, which combined alternative development and eradication to reduce poppy cultivation by 50 percent over 10 years. The Thai Government did not attempt to conduct eradication campaigns or crop substitution schemes outside the context of its overall nation-building effort. Eradication and crop substitution were components of a much larger effort to bring the northern provinces and the insurgent forces under the influence and control of the national government. The importance of political and legal order is underscored further by Reuter, who noted that promising crop substitution programs in Afghanistan in the late 1970s came to an end when the government lost control of opium growing areas following the Soviet-backed coup.[71]

The conclusion Kay drew from analyzing Peru is generally applicable to Colombia, where the "territorial and functional maldistribution of state capacity" has resulted in "a structure of economic and political opportunities favorable to armed movements."[72] In Colombia, much of the national territory is under the de facto control of once Communist-backed guerrillas, whose devolution into terrorist criminality was foretold in a 1988 essay by philosopher Luis Alberto Restrepo:

> The undeniable military power, without any clear political orientation, of the guerrillas foreshadows a process of disintegration in the near future. The payment of wages to many guerrilla militants does not guarantee the development of their political consciousness; instead, it encourages a mercenary mentality that could lead to their criminalization.[73]

In addition to the guerrillas, the Colombian Government must contend for political space with paramilitary groups that grew out of peasant self-defense forces formed in the 1960s and 1970s. As drug traffickers purchased extensive tracts of land in the 1980s, the self-defense groups increasingly transformed into paramilitary units defending the drug lords' properties from guerrilla incursions. This transformation, in turn, created incentives for elements within the army to acquiesce to and cooperate with paramilitary leaders in prosecuting a *dirty war* against the guerrillas and left-wing political groups.

As the 1997 *National Drug Control Strategy* indicated, an effective coca control effort must be regional in scope. Peru's success in strengthening its weak state and nearly eliminating Sendero Luminoso is encouraging for U.S. coca control efforts. However, similar conditions do not exist in Colombia, which has a traditionally weak state. The inability of the Colombian Government to control its national territory is a critical constraint on production control activities and on the ability of the Andean

[71]Reuter, *After the Borders Are Sealed*, 158.

[72]Kay, "Violent Democratization," 103.

[73]Luis Alberto Restrepo, "The Crisis of the Current Political Regime and Its Possible Outcomes," 286.

strategy to achieve its domestic policy objective, reduced availability of cocaine in the United States.

Socioeconomic Conditions

Socioeconomic conditions have been central to the rise and resiliency of the Andean cocaine industry. The principal factor of growth was strong demand for cocaine in the United States beginning in the early 1980s. Concurrent factors included the fallout from flawed agricultural and development policies in Bolivia and Peru, exacerbated by conditions of poverty and regional economic instability.

In Bolivia, central-government policy has traditionally favored the agricultural elites in the lowland Santa Cruz region to the exclusion of the peasant producers in the highlands. This longstanding policy bias against highland producers in the context of a poor and deteriorating Bolivian economy in the 1980s exerted inexorable pressures on subsistence farmers in the highlands to leave ancestral farms and cultivate coca to survive.

In the case of Peru, flawed development projects as well as biased agricultural policies contributed to the growth of the coca economy. As Kay explained, the military government of General Juan Velasco Alvarado (1968–75) sponsored a colonization program of the UHV centered on agricultural cooperatives. The program ultimately failed because of poor management, lack of financing, and "faulty assumptions about the requirements of agricultural development in the high jungle." The result was "a new population center in search of economic opportunities in a vacuum of authority." By 1987, the UHV "was the center of a booming economy, employing hundreds of thousands of Peruvians, and generating hundreds of millions in foreign exchange."[74] As to the role of Peruvian agricultural policy, Healy noted that "the Peruvian state policy provided support to the modernization of coastal commercial farms in lieu of peasant agriculture. The small plot producer of the highlands was a victim rather than a beneficiary of the state's agricultural development plans."[75]

Colombia suffered much less economic turmoil during this period than did other Latin American countries, largely as a result of sound monetary policy and a robust export market for coffee. From 1981 through 1987, while the Bolivian economy was shrinking, real GDP in Colombia increased by nearly 22 percent. From 1980 through 1986, while Peru's export receipts declined, Colombian exports increased by 30 percent.[76] But in the late 1980s and early 1990s, Colombia was rocked by violence from leftist guerrillas, paramilitaries, and narcoterrorists. From 1989 to 1991, legal per capita gross national product (GNP) in Colombia declined from $2,000 to $1,280, adjusted for inflation.[77]

[74]Kay, "Violent Democratization," 170–171.

[75]Healy, "The Role of Economic Development," 136–137, 139.

[76]International Monetary Fund (IMF), *International Financial Statistics Yearbook*, 140–143, 194–199, 496–501.

[77]Clawson and Lee, *The Andean Cocaine Industry*, 26.

Since 1990, all three source countries have undertaken macroeconomic adjustments that have helped diminish the relative economic impact of the cocaine industry. In Bolivia, for example, the estimated share of exports for the cocaine industry dropped from 90 percent in 1988 to 23 percent in 1994.[78] In Peru, the Fujimori Government's proexport policy increased exports from $3.5 billion in 1993 to $5.6 billion in 1995.[79] From 1993 to 1995, Peru's legal economy grew by $10 billion, which was eight times greater than the $1.3 billion estimated income from cocaine in 1993.[80]

It is not clear how these economic trends will affect the size of coca and cocaine employment in the Andean source countries. Estimates suggest that the cocaine industry accounts for an important share of the labor force in the three countries. The most recent estimate for the Bolivian coca labor force is 74,000 workers, or just more than 2 percent of the national labor force. In Colombia, total cocaine industry employment has been estimated at not more than 160,000 workers, or just more than 1 percent of the national labor force. In Peru, estimates of coca-sector employment have ranged from 175,000 workers, or 2 percent of the national labor force, to nearly 300,000 workers, or 4 percent of the national labor force.[81]

In the context of national economic growth, well-designed alternative development programs supported by law enforcement should force traffickers to compete with the government or private industries for this labor.[82] However, the cost structure of the cocaine industry is such that even significantly higher costs for labor at the production stage will not necessarily affect U.S. consumption. Reuter noted that "crop-substitution programs involve, in effect, a bidding war between the government on one hand and cocaine refiners on the other; even if refiners have to raise the price they pay for leaf by 200 percent to persuade a sufficient number of farmers to raise coca, total U.S. demand will be negligibly affected."[83]

In the Andean region, as in other parts of the developing world, poverty is more intense than broad measures such as per capita GNP, exports, and size of the labor force would indicate. Conventional macroeconomic indicators understate the income distribution problems and related development characteristics that suggest the costs of poverty are endured almost entirely by the poor (whereas in wealthy, developed nations the costs of poverty are partially burdened by the entire society through transfers of wealth via welfare and other social programs). In the Andean source countries, development indicators reflect a serious maldistribution of

[78]Ibid., 14.

[79]IMF, *International Financial Statistics Yearbook*, 625.

[80]Clawson and Lee, *The Andean Cocaine Industry*, 30.

[81]Ibid., 14–15, 20.

[82]ONDCP, *Crop Substitution*, 66.

[83]Reuter, *Limits and Consequences*, 161.

income.[84] In Peru, for example, 55 percent of the population in 1991 was estimated to be living in abject poverty.[85]

These conditions in part explain the cocaine industry's resiliency to drug control programs. The continued profit from coca amidst poverty and unemployment dampens the incentives for farmers to shift completely to alternative crops or other sources of income. Vast drug wealth also facilitates government corruption, particularly among low-salaried public officials. Moreover, poor economic conditions impose fiscal constraints on source-country governments. Countries such as Bolivia do not have the resources to design and implement effective, long-term coca control programs. Funding is difficult even for a *relatively* wealthy nation like Colombia, where the modest national budget must accommodate trade-offs between drug control, counterinsurgency, and development programs. Key social and economic indicators of development for Bolivia, Colombia, and Peru are shown in Table 2.

Ultimately, as long as there is a global demand for cocaine, even the most spectacular economic growth in the Andean region is unlikely to overcome the socioeconomic incentives for participating in the illegal drug industry. In other words, national economic development alone is insufficient to reduce narcotics production. Economic development could raise Bolivia ($770 per capita GNP) to the level of Peru ($2,110 per capita GNP) or even to the level of Mexico ($4,180 per capita GNP).[86] However, Peru and Mexico also are major sources of illegal drugs; therefore, even if Bolivia were to develop rapidly enough to reach Mexico's level of economic development, it would still be able to produce coca at a cost that would not markedly raise U.S. retail cocaine prices.

[84]The International Bank for Reconstruction and Development/The World Bank, *From Plan to Market: World Development Report 1996*, 196–197. The most recent Gini coefficients for Bolivia, Colombia, and Peru, respectively, are 42.0 (1990), 51.3 (1991), and 44.9 (1994). The Gini index measures the extent to which the actual distribution of income differs from a hypothetical uniform distribution in which each individual or household receives an identical share. The Gini index has a maximum value of 100 percent, indicating that one person or household receives everything, and a minimum value of zero, indicating perfect equality. Among middle- and low-income countries, Brazil has the greatest maldistribution of income, with a Gini coefficient of 63.4; the Slovak Republic has the least, with a Gini coefficient of 19.5.

[85]Efrain Gonzales de Olarte, ed., *The Peruvian Economy and Structural Adjustment*, 7.

[86]The International Bank for Reconstruction and Development/The World Bank, *From Plan to Market*, 188–189. All per capita gross national product figures are in 1994 dollars.

Table 2. Basic source-country social and economic indicators

	Bolivia	Colombia	Peru
Land area (in thousand hectares)	108,438	103,870	128,000
Social Indicators			
Total population (millions), 1995 [2025]	7.414 [13.131]	35.101 [49.359]	23.780 [36.692]
Population density (per 1,000 hectares), 1995	68	338	186
Average annual population change (percent)			
1980–85	1.9	2.1	2.4
1990–95	2.4	1.7	1.9
2000–05	2.2	1.3	1.7
Average annual growth of the labor force (percent)			
1981–90	2.4	2.8	2.7
1991–00	2.4	2.3	2.6
Crude birth rate (births per 1,000 population)			
1970–75	45.2	32.8	40.5
1990–95	35.7	24.0	27.3
Life expectancy at birth (years)			
1970–75	67.2	61.7	55.5
1990–95	72.1	69.3	66.0
Crude death rate (per 1,000 population)			
1970–75	45.2	32.8	40.5
1990–95	35.7	24.0	27.3
Infant mortality rate (per 1,000 live births)			
1970–75	151.0	73.0	110.0
1990–95	75.0	37.0	64.0
Nutritional status			
Wasting (percentage of children under age 5), 1980–91	2.0	3.0	1.0
Stunting (percentage of children under age 5), 1980–91	38.0	17.0	37.0
Population with access to safe water (percent), 1994–95	60.0	96.0	60.0
Population with access to sanitation (percent), 1994–95	44.0	70.0	47.0
People living on less than $1 per day (percent), 1981–95	7.1	7.4	49.4
Gini Index	42.0 (1990)	51.3 (1991)	44.9 (1994)
Share of income or consumption (percent)			
Lowest 10 percent	2.3	1.3	1.9
Lowest 20 percent	5.6	3.6	4.9
Second quintile	9.7	7.8	9.2
Third quintile	14.5	12.8	14.1
Fourth quintile	22.0	20.4	21.4
Highest 20 percent	48.2	55.8	50.4
Highest 10 percent	31.7	39.5	34.3
Economic Indicators			
Gross Domestic Product (GDP) ($ million), 1960 [1995]	3,074 [8,131]	33,399 [76,112]	20,661 [57,424]
Average annual GDP growth (percent)			
1980–90	0.0	3.7	-0.2
1990–95	3.8	4.8	5.3
Exports			
Total ($ millions), 1960 [1995]	942 [1,101]	3,920 [9,764]	3,900 [5,575]
Average annual growth rate of export volume (percent)			
1980–90	1.7	9.7	-1.9
1990–95	-5.4	4.8	11.0
Imports			
Total ($ millions), 1980 [1995]	665 [1,424]	4,740 [13,853]	2,500 [9,224]
Average annual growth rate of import volume (percent)			
1980–90	-2.8	-1.9	-1.0
1990–95	18.9	22.3	12.1
Official Development Assistance (ODA)			
Average annual ODA ($ millions), 1984–86 [1991–93]	232 [584]	71 [159]	306 [528]
ODA as a percentage of GNP, 1991–93	11.5	0.3	1.7
ODA per capita ($), 1993	80	3	24

Sources: The World Resources Institute, et al. *World Resources 1996–97*. New York and Oxford: Oxford University Press, 1996. The International Bank for Reconstruction and Development/The World Bank. *World Development Report 1997: The State in a Changing World*. New York and Oxford: Oxford University Press, 1997.

The Cocaine Market and the Andean Strategy

The source-country strategy is designed to affect the international black market for cocaine and other drugs. This section examines the patterns of domestic and international cocaine consumption (demand) and the structure and dynamics of the cocaine market. Cocaine demand trends and market structure are the broader context within which U.S. drug policy is formulated and implemented.

Cocaine Demand

From 1985 to 1995, casual cocaine use in the United States decreased substantially. The National Household Survey on Drug Abuse (NHSDA) estimated that the number of past-year, occasional cocaine users decreased from 7.1 million users in 1985 (3.7 percent of the population) to 2.5 million users in 1995 (1.2 percent of the population). The NHSDA estimated that past-month (current) cocaine use decreased from a peak of 5.7 million users in 1985 to 1.5 million users in 1995.[87]

Rates of initiation into cocaine (incidence) for 12- to 17-year-olds declined by 65 percent from 1984 to 1991. Most of this decline occurred before the Andean Initiative was launched. Conversely, from 1991 to 1994, when Andean strategy expenditures were at their highest, incidence for 12- to 17-year-olds increased by 124 percent[88] (see Figure 4).

Cocaine prices also have declined. The retail price of cocaine fell by 52 percent from 1987 to 1995.[89] In large part, the price decline reflects inflation in the Consumer Price Index, but lower cocaine prevalence may also have been a contributing factor.[90]

Decreasing incidence prior to 1989 and the long-term price decline suggest that the availability of cocaine was not a factor in reducing cocaine use from 1985 to 1995. The *Monitoring the Future* Study reported in 1995:

> Through 1989, there was no decline in perceived availability of cocaine among twelfth graders; in fact, it rose steadily from 1983 to 1989, suggesting that availability played no role in bringing about the substantial downturn in use. After 1989, however, perceived availability has fallen some among seniors; the decline may be explained by the greatly reduced proportions of seniors who say they have any friends who

---

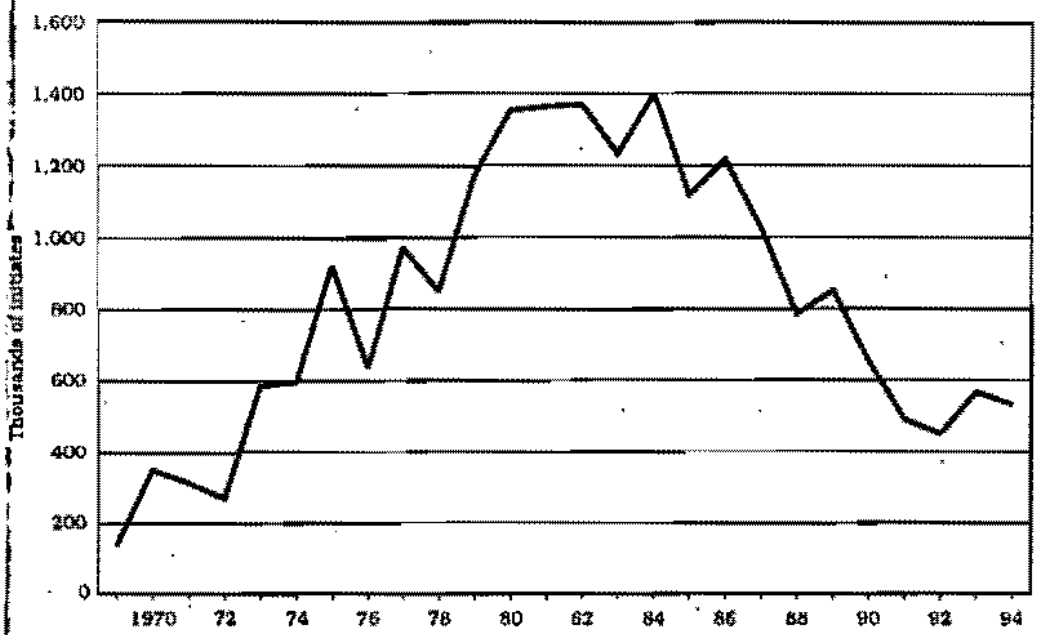
[87]Substance Abuse and Mental Health Services Administration (SAMHSA), Office of Applied Studies, *Preliminary Estimates From the 1995 National Household Survey on Drug Abuse*, 58-61. The National Household Survey on Drug Abuse (NHSDA) measures the prevalence of drug use among the U.S. household population ages 12 and older. Estimates are tabulated in the following three categories: lifetime, past-year, and past-month. Casual use is (1) within the last 30 days (past-month use) and (2) within the past year but less often than monthly. The latter category also is termed *occasional use* and defined by NHSDA as use "in the past-year but on fewer than 12 days." Occasional use has decreased sharply from the 1985 estimate of 7.1 million users to the 1995 estimate of 2.5 million users.

[88]SAMHSA, *Preliminary Estimates*, 93.

[89]Abt Associates, Inc., *Prices of Illegal Drugs, 1981-1997*.

[90]Rhodes et al., *What America's Users Spend*.

Figure 4. Estimated initiation into cocaine



Source: Substance Abuse and Mental Health Services Administration, Office of Applied Studies, 1994 and 1995.

use, because friendship circles are an important part of the supply system. Since 1992 there has been rather little change in eighth and tenth grade reports of availability of powder cocaine. Among seniors, reported availability declined from 1992, before leveling.[91]

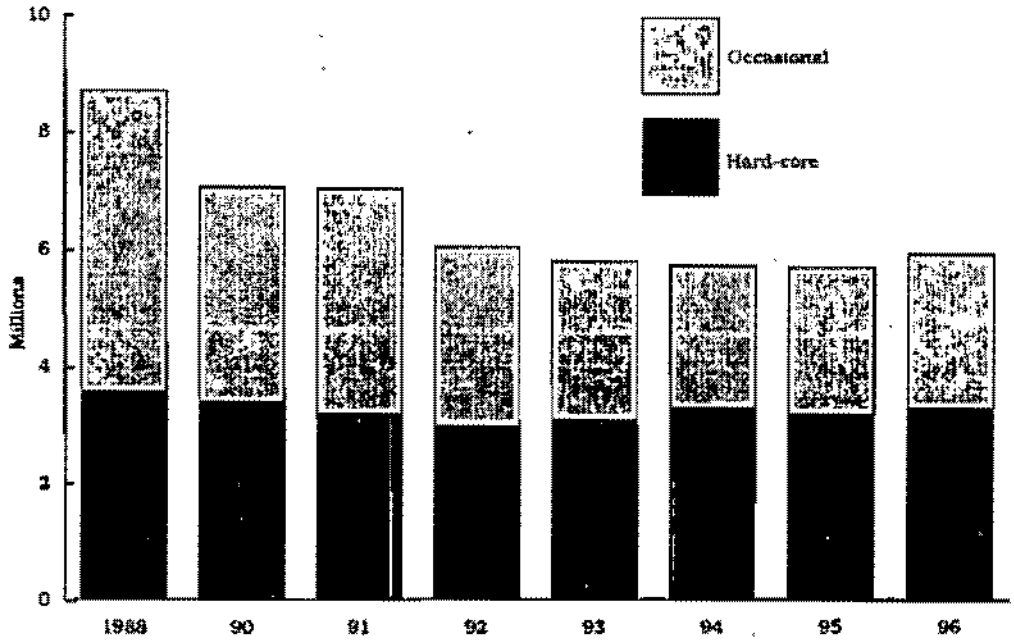
While occasional use has decreased substantially, *hard-core* use has remained relatively stable. Hard-core cocaine users consume cocaine at least weekly and exhibit behavioral problems stemming from that use. Between 1988 and 1995, there were approximately 3.0 to 3.6 million hard-core cocaine users in the United States[92] (see Figure 5). Hard-core cocaine users are estimated to consume more than two-thirds of all cocaine consumed domestically, or about eight times the amount of cocaine consumed by occasional users.[93] This means that the decline in the

[91]National Institute on Drug Abuse, *National Survey Results On Drug Use from The Monitoring the Future Study, 1975–1995: Volume 1, Secondary School Students*, 16–17.

[92]Rhodes et al., *What America's Users Spend*. Hard-core use is analogous to what the NHSDA defines as *frequent* use (i.e., "use on 51 or more days during the past year"). Since the measure of frequent use was first estimated in 1985, no significant increases or decreases have been detected. The 1995 estimate for frequent use was 582,000 users. Although this trend among frequent users is consistent with other estimates showing a stable hard-core population, SAMHSA notes that the estimates of frequent use are subject to large sampling error and potentially large nonsampling error. The NHSDA provides a broad measure of illegal drug use, but because it fails to survey (1) those who are too unstable to be considered part of a household and (2) those who are unlikely to answer surveys, it probably understates the number of chronic, hard-core users.

[93]Susan S. Everingham and C. Peter Rydell, *Modeling the Demand for Cocaine*, 17.

Figure 5. Estimated number of occasional vs. hard-core cocaine users



Sources: Substance Abuse and Mental Health Services Administration, Office Of Applied Studies, National Household Survey on Drug Abuse. Rhodes, W., et al., *What America's Users Spend on Illegal Drugs, 1988-1995* (in press).

number of cocaine users has not substantially affected the demand for cocaine.

As hard-core users comprise a larger portion of the overall user population, aggregate demand has become more inelastic. A lower elasticity of demand, in turn, limits the effect that price increases can have on cocaine use. In other words, Andean drug control programs must reduce domestic availability more substantially than in 1985 (when aggregate demand was more elastic) for supply reduction to be a factor in further reducing current use.

Finally, cocaine use outside the United States, particularly in Europe, is another source of demand. Non-U.S. demand provides the cocaine industry with additional incentives to avoid or adapt to source-country policy interventions designed to decrease availability in the United States.

Price Structure and Dynamics

The structure of the cocaine industry reveals that most of the value added occurs during domestic distribution, not source-country production. This information is illustrated by examining cocaine prices through the distribution chain as follows:[94]

[94]Peter Reuter, "The Organization and Measurement of the International Drug Trade."

Distribution Point	Price per Pure Kg. Equivalent (1992)
Farmgate (Peru)	$ 650
Export (Colombia)	1,050
Import (Miami)	23,000
Wholesale kilogram (Chicago)	40,000
Wholesale ounce (Chicago)	52,000
Retail (Chicago)	188,000

The farmgate price is 0.3 percent of the retail price, and the export price is only 0.6 percent of the retail price.[95] Even at the import level, the price of cocaine is only 12 percent of its retail price. This price structure suggests that even substantial increases in coca and cocaine production costs within the source zone would have a negligible impact on domestic retail prices. In other words, the price structure of the cocaine market severely limits the ability of even successful production control programs (eradication, source-country interdiction, and alternative development) to affect cocaine consumption in the United States. However, the utility of source-country programs must be evaluated in the context of other drug control efforts, as Riley explained:

> The weak impact that international drug control programs have on street retail prices may not obviate the utility of such programs. The policies would remain useful insofar as they cause permanent disruptions in output, or insofar as short-run interruptions of supply can be integrated with other aspects of drug control strategy. The weak impact also implies that the policies need to be of large scale. Massive movements in source country prices will be required to affect demand even modestly at the street level.[96]

There also are unresolved issues regarding the relationship between prices at different market levels. Specifically, it is not understood how price changes within the wholesale cocaine market (e.g., as a result of a source-country intervention) affect prices within the domestic retail cocaine market. Two models have been used to describe the dynamic between wholesale and retail prices: the additive model and the multiplicative model. The additive model states that a dollar-per-unit increase in price at one market level results in a dollar-per-unit increase at lower market levels. The multiplicative model holds that a percentage increase in prices results in

[95] Farmgate refers to the quantity of coca leaves necessary to produce a kilogram of cocaine.

[96] Riley, *Snow Job?*, 79.

the same percentage increase in prices at lower market levels.[97] Both theories posit a linear relationship between wholesale prices and retail prices, but the magnitude of effect is potentially much greater for the multiplicative model.

Which theory is more accurate is at the center of the debate about the effectiveness of supply control programs. Some researchers have used the additive model to conclude that supply control programs are not viable.[98] Conversely, other researchers have used the multiplicative model to demonstrate the efficacy of supply control.[99] Empirical analysis using historical data suggests the multiplicative model more accurately describes price changes for cocaine.[100] Nevertheless, the issue remains unresolved.[101] The possibility that some stages in the cocaine industry may exhibit an additive effect and others a multiplicative effect supports earlier work, which suggested that the actual pricing characteristic for the overall market lies between the two extremes.[102]

[97]Jonathan P. Caulkins, *Developing Price Series for Cocaine*, 39. Distribution costs for most products are proportional to quantity, so the additive model is reasonable. For other products, distribution costs are a function of the value of the product, so the multiplicative model is more accurate.

[98]Clawson and Lee, *The Andean Cocaine Industry*, 214, 263.

[99]Barry D. Crane, A. Rex Rivolo, and Gary C. Comfort, *An Empirical Examination of Counterdrug Interdiction Program Effectiveness*, II: 10–18.

[100]Caulkins, *Developing Price Series*, 39–44.

[101]Clawson and Lee, *The Andean Cocaine Industry*, 215.

[102]Ibid. Riley, *Snow Job?*, 124–125.

Resources for the Andean Strategy

From 1989 through 1996, the United States spent more than $90 billion on drug control programs. About $3.5 billion (4 percent) was spent on international programs. The national drug control budget represents the sum total of drug-related resource expenditures by approximately 50 Federal drug control program agencies. For most agencies, drug budgets represent estimates of drug-related spending. For the purpose of policy and budget formulation, the national drug control budget has traditionally been presented at three levels of detail:

1. The *two-way split* divides the budget between demand programs and supply programs.
2. The *four-way split* divides the budget among demand programs, domestic law enforcement, interdiction, and international programs.
3. The *functional split* divides the budget into 13 functions: drug abuse treatment, drug abuse prevention, treatment research, prevention research, investigations, prosecution, corrections, State and local assistance, intelligence, regulatory and compliance, law enforcement research, interdiction, and international programs.

With the 1997 *National Drug Control Strategy*, agency budgets also are aligned along five major *goals*:

- Goal 1: Educate and enable America's youth to reject illegal drugs as well as alcohol and tobacco.
- Goal 2: Increase the safety of America's citizens by substantially reducing drug-related crime and violence.
- Goal 3: Reduce health and social costs to the public of illegal drug use.
- Goal 4: Shield America's air, land, and sea frontiers from the drug threat.
- Goal 5: Break foreign and domestic drug sources of supply.

Goal 5 corresponds primarily to international programs. This section reviews funding for international drug control programs and the apportionment of drug control and related funds in the Andean region.

International Drug Control Funding

The debate over funding drug control programs has traditionally focused on the apportionment between supply programs and demand programs (the two-way split). The apportionment has remained relatively stable during the last decade. From 1989 to 1996, approximately two-thirds of drug control funds were allocated for supply programs. However, at this level of budget aggregation it is not apparent that domestic law enforcement programs have accounted for most of the supply allocation.

The four-way split reveals that the overall trend in drug budgets has been (1) an increased emphasis on domestic law enforcement, (2) a relatively unchanged emphasis on demand reduction programs, and (3) substantially decreased funding for interdiction and international programs. The functional breakdown provides a more detailed analysis, revealing the component parts of the demand and domestic law enforcement budgets.

The agencies with major international programs have been the Department of State, Bureau for International Narcotics and Law Enforcement affairs (State/INL), which manages the International Narcotics Control program; DEA; and DoD. DEA and State/INL accounted for more than two-thirds of the $3.5 billion spent on international programs from 1989 to 1996. The drug control activities of the U.S. Agency for International Development and State Department, Bureau of Politico-Military Affairs also contributed substantially to international programs until FY 1996, when both were incorporated with the State/INL budget (see Table 3).

Andean source-country programs accounted for $375 million (37 percent) of State/INL spending from 1989 to 1996 but only $162 million (14 percent) of DEA spending during this period. DoD also has been heavily involved in supporting Andean drug control programs. From 1991 through 1996, DoD spent nearly $6 billion in counterdrug funds, of which $404 million (7 percent) was spent on dismantling cartels and $793 million (13 percent) was spent on source-nation support (see Table 4).

In addition, drug control program resources in the Andean region have been complemented by various forms of security assistance (see Table A-12 in the Appendix).

Policy and Budget Dissonance

Although the U.S. Government officially regards the Andean cocaine industry as a national security threat, Government rhetoric does not match funding for international drug control programs. The size of the international drug control budget enacted for FY 1997 was $450 million, less than three one-hundredths of 1 percent of the total Federal budget. During the same time period, the United States spent more money on Federal

Table 3. Funding for international drug control programs ($ millions), FY 1989–96

	1989	1990	1991	1992	1993	1994	1995	1996	Total
DEA	97.6	141.3	172.4	161.4	172.6	153.1	127.5	128.1	1,154.0
State/INL (INM until 1995)	101.0	129.5	150.0	144.8	147.8	100.0	105.0	135.0	1,013.0
USAID	13.3	54.5	189.6	250.2	134.8	35.0	19.8	0.0	697.2
State/P	21.6	114.5	107.6	75.3	52.3	14.9	13.2	0.0	399.5
Other international drug control programs	70.5	60.3	13.8	28.8	15.8	26.3	30.3	26.8	272.5
Total	304.0	500.1	633.4	660.4	523.4	329.4	295.8	289.8	3,536.3

Source: Office of National Drug Control Policy.

Table 4. Funding for Andean source-country and related programs ($ millions), FY 1989–96

Country	1989	1990	1991	1992	1993	1994	1995	1996	Total
INL									
Bolivia	10.0	15.7	15.7	15.7	17.0	16.1	11.0	15.0	116.2
Colombia	10.0	20.0	20.0	23.4	25.0	20.0	16.0	16.0	150.4
Peru	10.5	10.0	19.0	12.5	17.5	8.4	15.0	15.5	108.4
Subtotal INL	30.5	45.0	54.7	51.6	59.5	44.5	42.0	46.5	375.0
DEA									
Bolivia	4.3	6.2	7.7	10.6	10.5	10.0	9.3	9.9	73.4
Colombia	4.0	4.7	5.9	6.4	7.8	9.1	8.3	8.0	58.4
Peru	2.5	2.5	3.6	4.0	4.9	4.2	3.7	3.1	30.5
Subtotal DEA	10.9	13.5	17.2	21.0	23.2	23.3	21.3	21.0	162.3
DoD									
Dismantling cartels	—	—	90.7	67.9	76.2	48.1	57.4	63.3	403.6
Source-nation support	—	—	76.1	120.7	155.0	144.5	148.7	147.6	792.6
Subtotal DoD	—	—	166.8	188.6	231.2	192.6	206.1	210.9	1,196.2
Total	41.4	58.5	238.7	261.2	313.9	260.4	269.4	278.4	1,733.5

Sources: U.S. Department of State; U.S. Department of Defense; U.S. Department of Justice.

transfers to the District of Columbia ($719 million), refugee programs ($700 million), and education reform ($691 million).

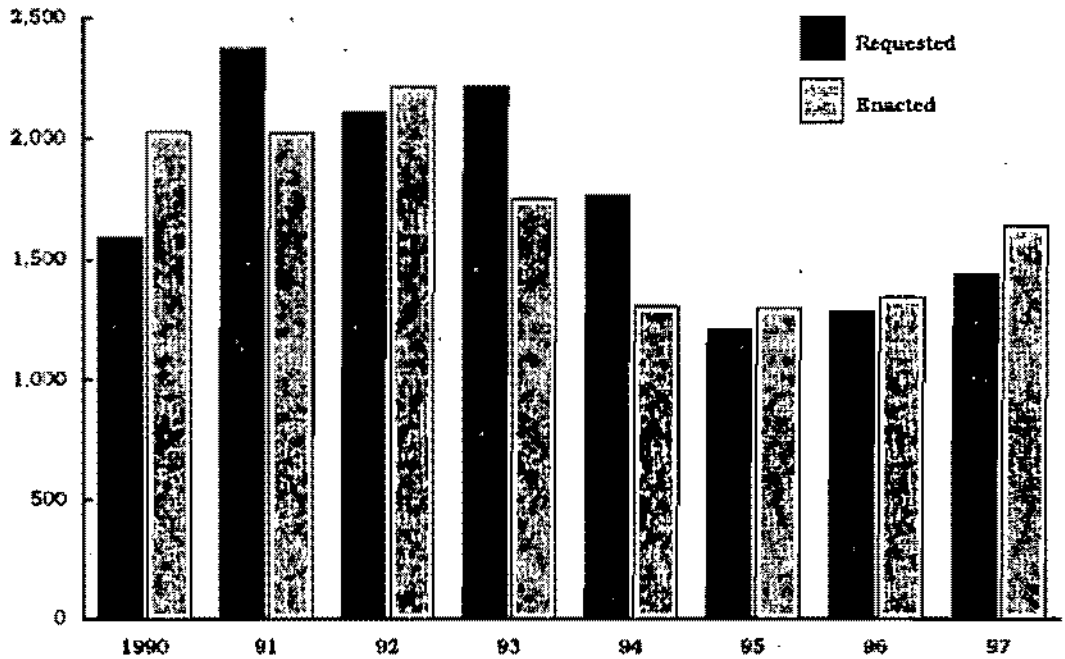
Arguably, this spending level may reflect a sensible understanding of the lack of opportunities for controlling cocaine at the source. From this perspective, it would be difficult to spend $1 billion in the Andean region in a way that could be defended as likely to reduce U.S. cocaine consumption. From another perspective, however, this spending level suggests a mismatch between policy and resources and argues for substantially increasing the level of funding for international drug control programs.

The mismatch between policy and funding also has manifested itself within the drug budget itself. The international programs' share of the national budget has not been consistent with U.S. policy as directed by PDD-14. Under the *controlled shift* from the transit zone to the source zone, funding for drug interdiction decreased 12 percent ($1.5 billion in FY 1993 to $1.3 billion in FY 1996). However, the shift in funding to the source countries was never realized. During the same period, funding for international programs *declined* by more than 44 percent ($523 million in FY 1993 to $290 million in FY 1996). The sharply reduced levels of funding requested for *both* interdiction and international programs after FY 1993 reveal that the controlled shift never occurred (see Figures 6 and 7).

The policy–funding mismatch was addressed in the 1995 *National Drug Control Strategy*, which highlighted the fact that "the shift in focus so far has not included any direct shift in resources from the transit zones to the source nations."[103] *In short, PDD-14 has not been fully operationalized.* Funding for international programs was increased to $449.1 million in FY 1997, or 68 percent of its peak in FY 1992 ($660.4 million).

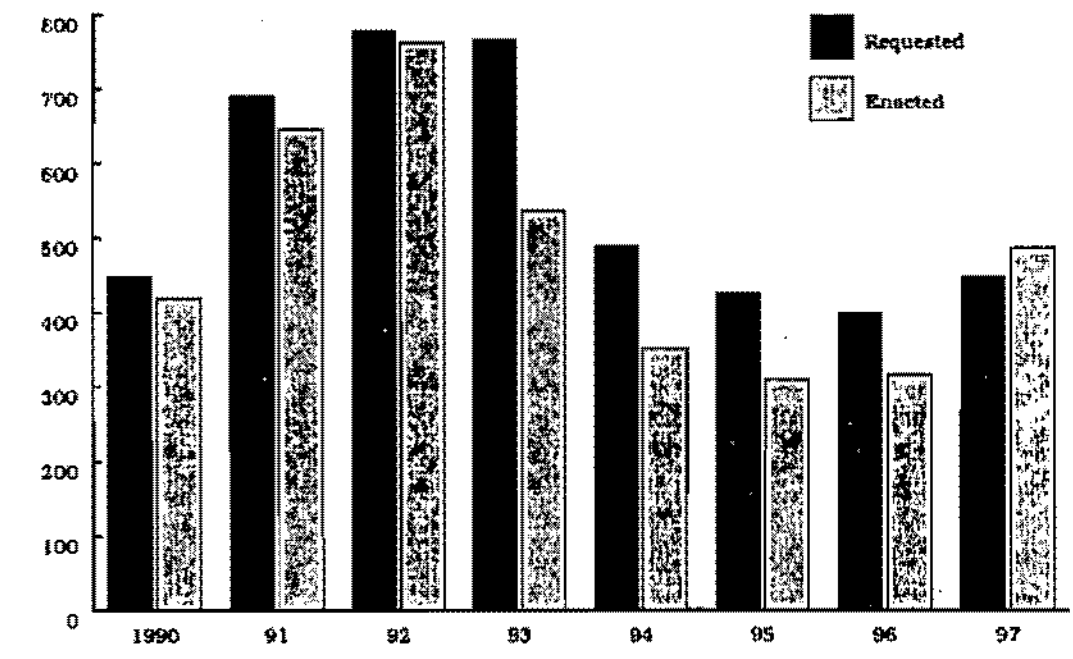
[103]ONDCP, *National Drug Control Strategy: Strengthening Communities' Response to Drugs and Crime* (February 1995), 98.

Figure 6. Interdiction programs, requested vs enacted ($ millions) FY 1990-97



Source: Office of National Drug Control Policy.

Figure 7. International programs, requested vs. enacted ($ millions) FY 1990-97



Source: Office of National Drug Control Policy.

Conclusions

The purpose of U.S. drug policy is to reduce illegal drug use and its consequences. The Andean strategy has been an important part of a broader effort by the United States to cripple the international cocaine industry and, consequently, disrupt and diminish the domestic black markets for cocaine. This paper has examined the underpinning rationale for the U.S. drug control policy in the Andean region and has summarized the issues and factors affecting policy implementation. There are nine key findings.

1. *Substantial progress has been made against the Andean cocaine industry.* Key regional developments and programmatic achievements mark the significant progress that has been made toward realizing the four goals of the Andean Initiative. The political commitment and institutional capability of the Bolivian, Colombian, and Peruvian Governments to confront the cocaine trade have been strengthened. Cooperative efforts to disrupt trafficking operations have inflicted significant damage on cocaine trafficking organizations. In Colombia specifically, law enforcement and security forces dismantled the Medellín cartel and disrupted the Cali cartel. Source-country interdiction and alternative development programs in Peru have contributed to reduced coca cultivation. Economic reforms have strengthened and diversified the economies of the three source countries, better enabling them to overcome the destabilizing effects of eliminating the cocaine industry.

2. *State authority and political order is essential for coca control.* Regional coca reduction is predicated on state penetration of the national territory in all coca producing countries. As with the Thai poppy reduction effort, coca reduction programs in each of the Andean states must be part of a larger program of national integration. In Peru, the reassertion of state authority and elimination of Sendero Luminoso as a viable political force provided the foundation for effective coca control. For Colombia, this means that coca control can succeed only after that government is able to assert control over Colombian territory uncontested by insurgents or paramilitary groups. Colombia's failure to assert control over its coca-growing areas has undermined success achieved elsewhere in the region.

3. *Coca reduction must be regional in scope.* The Thai poppy reduction effort illustrates the tendency for crop displacement (e.g., the *balloon* or *Burma* effect). A coca control strategy that lacks specific plans for concurrently containing and reducing coca cultivation throughout the source zone is likely to result in crop displacement. Increased cultivation into areas with less favorable political conditions for crop control would have the net effect of making an already difficult crop control problem even more formidable.

4. *The effects of eradication on coca cultivation have been negligible.* With an average of less than 4 percent of coca cultivation eradicated

annually, the risk for coca farmers has been inconsequential. At some point, to produce the short-term market disruptions necessary to support demand reduction efforts, *massive* aperiodic eradication must occur *regionally*. Multilateral cooperation, international support, and *uncontested* source-country government control over the growing regions are prerequisite.

5. *Alternative development is the essential, long-range component of the Andean coca reduction program.* The continued global demand for cocaine and the current political and economic conditions in the Andean region make full or partial participation in the cocaine economy a rational option. Without a comprehensive, adequately funded alternative development program, efforts to establish state authority over the coca zones and to reduce coca cultivation will not succeed. Conversely, the lack of compelling alternatives underscores the requirement to substantially increase the costs of growing and processing coca. Consequently, alternative development must be implemented in concert with other coca control efforts as part of a larger program of national integration and economic development.

6. *A long-term commitment to the stability and integrity of Andean institutions is an important policy independent of any effects it may have on illegal drug supplies in the United States.* The Andean drug policy is not simply about reducing the domestic availability of cocaine; it is about limiting the influence of international organized crime. Institution-building programs and counterorganizational programs are essential for protecting and strengthening fragile Latin American and Caribbean governing institutions against powerful transnational criminal groups. The task is to continue moving the drug syndicates away from being a regional security threat to being a manageable law enforcement problem for the Andean states.

7. *PDD-14 has not been fully operationalized.* The stated policy of the U.S. Government has not been matched by adequate resources for reducing coca cultivation and cocaine production and trafficking. Funding for Andean source-country programs remains lower than before the controlled shift. From a budget perspective, the net result of PDD-14 was a substantial shift in resources away from *both* interdiction and international programs.

8. *Debilitating political, economic and institutional conditions in the Andean region continue to hinder effective implementation of the source-country strategy.* Even a fully operationalized source-country strategy is of questionable value if its programs must be implemented amidst conditions of political disorder and abject poverty without viable alternatives. The Fujimori Government's focus on stabilizing the Peruvian economy and eliminating Sendero Luminoso created conditions under which coca control programs have had an opportunity to succeed. In contrast, coca control programs in Bolivia and Colombia are hindered by institutional debilities coupled with and exacerbated by adverse social and political conditions. The

lack of enabling conditions in Bolivia and Colombia attenuate the overall effectiveness of the source-country strategy.

9. *Andean drug policy should be informed by and complement other U.S. policy interests.* An effective Andean strategy requires U.S. Government engagement with all key institutions in the source countries: the civilian bureaucracy, the military, national police and investigative agencies, and nongovernmental organizations. With a broad-based and consistent institutional underpinning, U.S. drug policy complements and helps advance other U.S. foreign policy interests in the region, namely respect for human rights and the rule of law; the development of strong democratic institutions; and the growth of prosperous, free-market economies.

The continued domestic demand for cocaine and the potential expansion of the South American heroin trade underscore the importance of formulating and implementing an effective source-country strategy. The findings of this paper indicate that to achieve a successful policy outcome in the Andean region, the United States must fully operationalize PDD-14, consolidate and expand successful drug control programs in Peru, and provide assistance to bring about conditions that enable effective coca reduction in Bolivia and Colombia.

Fulfilling these requirements will necessitate a long-term political commitment and a substantial financial investment by the United States. In light of the estimated $67 billion in annual, domestic social costs of drug abuse,[104] a substantial commitment of resources for a coherent, regional coca reduction initiative is rational and appropriate. Absent such a commitment, source-country programs will continue to consume scarce resources without affecting illegal drug consumption in the United States.

[104]Dorothy P. Rice, unpublished data.

References

Abt Associates, Inc. *Prices of Illicit Drugs, 1981–1997.* Unpublished report, 1997.

Alvarez, Elena H., and Francisco Joel Cervantes. "The Economic Consequences of the Peruvian Disease." In *The Peruvian Economy and Structural Adjustment,* edited by Efrain Gonzales de Olarte. Miami: University of Miami, North-South Center Press, 1996.

Bagley, Bruce M. "U.S. Foreign Policy and the War on Drugs: Analysis of a Policy Failure," *Journal of Interamerican Studies and World Affairs,* 30, nos. 2 and 3 (Summer/Fall 1988): 189–212.

Baron, Jonathan. *Thinking and Deciding.* Cambridge, England: Cambridge University Press, 1988.

Caulkins, Jonathan P. *Developing Price Series for Cocaine.* Santa Monica, CA: RAND, 1994.

Clawson, Patrick L., and Rensselaer W. Lee III. *The Andean Cocaine Industry.* New York: St. Martin's Press, 1996.

Crane, Barry D., A. Rex Rivolo, and Gary C. Comfort. *An Empirical Examination of Counterdrug Interdiction Program Effectiveness.* Alexandria, VA: Institute for Defense Analyses, 1997.

Everingham, Susan S., and C. Peter Rydell. *Modeling the Demand for Cocaine.* Santa Monica, CA: RAND, 1994.

Gonzales de Olarte, Efrain, ed. *The Peruvian Economy and Structural Adjustment: Past, Present, and Future.* Miami: University of Miami, North-South Center Press, 1996.

Gugliotta, Guy. "The Colombian Cartels and How to Stop Them." In *Drug Policy in the Americas,* edited by Peter H. Smith. Boulder, CO: Westview Press, 1992.

Healy, Kevin. "The Role of Economic Development: Policy Options for Increased Peasant Participation in Peru and Bolivia." In *Drugs and Foreign Policy: A Critical Review,* edited by Raphael F. Perl. Boulder, CO: Westview Press, 1994.

Huntington, Samuel P. *Political Order in Changing Societies.* New Haven and London: Yale University Press, 1968.

The International Bank for Reconstruction and Development/The World Bank. *From Plan to Market: World Development Report 1996.* New York: Oxford University Press, 1996.

International Monetary Fund. *International Financial Statistics Yearbook, Vol. L, No. 1, January 1997.* Washington, DC: International Monetary Fund, 1997.

International Monetary Fund. *International Financial Statistics Yearbook, Vol. XLIX 1996.* Washington, DC: International Monetary Fund, 1996.

Kay, Bruce Howard. "Violent Democratization and the Feeble State: Political Violence, Breakdown and Recomposition in Peru, 1980–1995." Ph.D. dis., University of North Carolina at Chapel Hill, 1996.

Lee, Renssalaer W. III. *Narcotics Production in Thailand.* Washington, DC: Office of National Drug Control Policy, 1994. Unpublished draft.

McRae, Patricia Bea. "Impact of the Illegal Narcotics Trade on Economic and Legal Institutions in Colombia." Ph.D. dis., University of South Carolina, 1995.

National Institute on Drug Abuse. *National Survey Results on Drug Use from the Monitoring the Future Study, 1975–1995: Volume 1, Secondary School Students*. Rockville, MD: U.S. Department of Health and Human Services, 1996.

Office of National Drug Control Policy. *Crop Substitution in the Andes*. Washington, DC: Office of National Drug Control Policy, 1993.

Office of National Drug Control Policy. *National Drug Control Strategy*. Washington, DC: The White House, 1997 and previous years.

Office of National Drug Control Policy. *Performance Measures of Effectiveness: A System for Assessing the Performance of the National Drug Control Strategy*. Washington, DC: Office of National Drug Control Policy, 1998.

Restrepo, Luis Alberto. "The Crisis of the Current Political Regime and Its Possible Outcomes." In *Violence in Colombia: The Contemporary Crisis in Historical Perspective*, edited by Charles Berquist, Ricardo Penaranda, and Gonzalo Sanchez. Wilmington, DE: Scholarly Resources Inc., 1992.

Reuter, Peter. *After the Borders Are Sealed: Can Domestic Sources Substitute for Imported Drugs?* Santa Monica, CA: RAND, 1992.

———. *The Limits and Consequences of U.S. Foreign Drug Control Efforts*. Santa Monica, CA: RAND, 1992.

———. "The Organization and Measurement of the International Drug Trade." In *Conference Report: Economics of the Narcotics Industry*. (November 21–22, 1994). Sponsored by the Bureau of Intelligence and Research, U.S. Department of State and the Central Intelligence Agency.

Rhodes, W., et al. *What America's Users Spend on Illegal Drugs, 1988–1995*. Washington, DC: Office of National Drug Control Policy, In press.

Rice, Dorothy P. Unpublished data. San Francisco, CA: Institute for Health and Aging, University of California.

Riley, Kevin Jack. *Snow Job? The Efficacy of Source Country Cocaine Policies*. Santa Monica, CA: RAND, 1993.

Sowell, Thomas. *Knowledge and Decisions*. New York: Basic Books, 1996.

Substance Abuse and Mental Health Services Administration, Office of Applied Studies. *Preliminary Estimates From the 1995 National Household Survey on Drug Abuse*. Rockville, MD: U.S. Department of Health and Human Services, August 1996.

U.S. Congress, Office of Technology Assessment. *Alternative Coca Reduction Strategies in the Andean Region*. No. OTA-F-556. Washington, DC: U.S. Government Printing Office, July 1993.

U.S. Department of State, Bureau of International Narcotics and Law Enforcement Affairs. *International Narcotics Control Strategy Report*. Washington, DC: Government Printing Office, 1997 and previous years.

U.S. General Accounting Office. *Drug Control: Long-Standing Problems Hinder U.S. International Efforts* (GAO/NSIAD-97-75). Washington, DC: General Accounting Office, February 1997.

U.S. General Accounting Office. *The Drug War: Colombia Is Undertaking Antidrug Programs, but Impact Is Uncertain* (GAO/NSIAD-93-158). Washington, DC. General Accounting Office, August 1993.

U.S. House of Representatives, Committee on Government Operations. *United States Anti-Narcotics Activities in the Andean Region: Thirty-Eighth Report by the Committee on Government Operations Together With Separate Views*. Washington, DC: U.S. Government Printing Office, 1990.

Zabludoff, Sidney. "Colombian Narcotics Organizations as Business Enterprises." In *Conference Report: Economics of the Narcotics Industry*. (November 21–22, 1994). Sponsored by the Bureau of Intelligence and Research, U.S. Department of State and the Central Intelligence Agency.

Appendix: Additional Tables

Table A-1. Estimated numbers (in thousands) and percentages in the U.S. population age 12 and older reporting cocaine use, 1979–96

	1979	1982	1985	1988	1990	1991	1992	1993	1994	1995	1996
Past Year											
Fewer than 12 days	—	—	7,141[a]	5,121[a]	3,656	3,837[b]	3,042	2,688	2,408	2,486	2,614
Percentage	—	—	3.7[a]	2.6[a]	1.8[b]	1.9[b]	1.5	1.3	1.2	1.2	1.2
12 or more days	—	—	2,722[a]	2,045[b]	1,789	1,460	1,297	1,262	1,255	1,178	1,418
Percentage	—	—	1.4[a]	1.0[b]	0.9	0.7	0.6	0.6	0.6	0.6	0.7
51 or more days	—	—	781	1,112	855	806	829	615	734	582	608
Percentage	—	—	0.4	0.6	0.4	0.4	0.4	0.3	0.4	0.3	0.3
Past Year Total	8,608[a]	10,458[a]	9,839[a]	7,151[a]	5,442[b]	5,284[b]	4,332	3,947	3,664	3,664	4,640
Percentage			5.5	4.2	3.1	3.0	2.5	2.2	2.2	2.1	2.2
Past Month	4,743[a]	4,491[a]	5,686[a]	3,140[a]	1,720	2,032	1,402	1,404	1,382	1,453	1,749
Percentage	2.6[a]	2.4[a]	3.0[a]	1.6[a]	0.9	1.0	0.7	0.7	0.7	0.7	0.8

[a] Difference between estimate and 1995 estimate is statistically significant at the .01 level.
[b] Difference between estimate and 1995 estimate is statistically significant at the .05 level.

Source: U.S. Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Office of Applied Studies. *Preliminary Estimates from the 1995 National Household Survey on Drug Abuse*. Advance Report No. 18. August 1996.

Table A-2. Estimated number of hard-core users of cocaine and heroin (in thousands), FY 1988–95

	1988	1989	1990	1991	1992	1993	1994	1995
Cocaine	3,600	3,400	3,200	3,000	3,100	3,300	3,200	3,300
Heroin	675	890	780	730	690	790	600	810

Source: W. Rhodes et al., *What America's Users Spend on Illegal Drugs, 1988–1995* (in press).

Table A-3. Estimated number (in thousands) of persons who first used cocaine during each year 1962–94, their mean age at first use, and annual age-specific rates of first use (per 1,000 person-years of exposure)

Year	Initiates (1,000s)	Mean Age	Age-Specific Rate of First Use[a]		
			12–17	18–25	26–34
1962	**	*	**	**	**
1963	*	*	0.5	**	**
1964	*	*	0.7	0.5	**
1965	*	*	**	0.2	**
1966	*	*	0.7	1.6	1.1
1967	*	*	0.6	0.6	**
1968	59	18.7	0.7	1.5	**
1969	146	17.9	1.9	3.4	0.4
1970	328	18.7	2.7	6.9	**
1971	314	20.2	3.7	5.9	1.2
1972	294	19.0	2.9	7.0	0.1
1973	536	20.5	3.9	12.8	2.0
1974	814	22.3	3.8	15.9	0.5
1975	810	21.2	4.5	18.2	5.4
1976	671	21.0	5.1	13.7	3.6
1977	1,079	21.6	4.7	26.1	5.3
1978	1,048	21.4	8.2	20.4	4.9
1979	1,089	21.8	7.3	21.2	6.3
1980	1,292	21.0	8.0	28.6	6.9
1981	1,243	21.5	8.9	25.4	7.2
1982	1,317	21.6	8.6	27.8	8.4
1983	1,154	21.8	8.9	22.5	7.7
1984	1,357	22.1	10.8	25.2	11.9
1985	1,157	22.5	7.0	22.9	11.5
1986	1,268	22.8	10.4	25.9	7.5
1987	1,030	22.3	8.6	22.0	6.0
1988	762	21.3	5.5	16.1	4.4
1989	821	22.1	6.2	16.9	5.3
1990	666	22.6	8.1	14.0	4.5
1991	485	21.3	4.6	11.3	2.6
1992	450	20.2	5.8	10.2	2.0
1993	552	20.2	8.4	12.5	2.8
1994[b]	531	20.1	7.9	10.8	1.7
1995[c]	652	19.1	10.6	13.8	1.8

*Low precision; no estimate reported.

**Estimate rounds to zero.

[a] The numerator of each rate equals the number of persons who first used the drug in the year (times 1,000). The denominator of each rate equals the number of persons who were exposed to risk of first use during the year, weighted by their estimated exposure time measured in years. For example, for the age group 12–17 in 1990, the denominator is the sum of three components:

(1) Those persons 12–17 years old in 1990 who first used the drug in 1989 or earlier, times a weight of zero. The weight is zero since they had zero exposure to the risk of first use in 1990.

(2) Those who first used the drug in 1990 times a weight of .5. The weight of .5 assumes that these people, on average, first used the drug at midyear and consequently have a half year of exposure (i.e., the first half of the year).

(3) Those who never used, or those who first used the drug in 1991 or later, times a weight of one. The weight of one assumes their exposure to the risk of first use during 1990 was for the whole year.

Each person is also weighted by his/her sample weight.

[b] Estimated using 1995 and 1996 data only.

[c] Estimated using 1996 data only.

Source: Substance Abuse and Mental Health Services Administration, Office of Applied Studies, *Preliminary Results from the 1996 National Household Survey on Drug Abuse*.

Table A-4. Average price and purity of cocaine and heroin in the United States, 1981–96

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Cocaine																
Purchases of 5 oz. or less																
Price per pure gram	275.12	286.54	242.57	208.76	212.50	162.17	120.03	105.13	105.09	159.41	114.05	106.77	110.45	92.70	101.49	94.52
Purity	47.53	46.87	54.53	56.62	55.00	67.76	76.77	79.16	78.75	67.05	75.43	75.72	72.01	73.52	68.89	68.61
Number of cases	985	1,353	1,833	2,391	3,389	3,537	3,641	3,994	4,311	3,764	5,018	4,026	2,771	3,596	3,391	3,799
Purchases of 2.5 oz. or less																
Price per pure gram	276.99	288.29	247.38	212.30	216.23	166.54	124.95	110.02	110.98	167.83	120.59	111.95	115.05	97.04	105.34	99.39
Purity	47.36	46.87	53.83	58.03	54.46	67.12	76.22	78.69	78.94	67.54	75.59	75.88	72.18	73.64	69.24	68.90
Number of cases	972	1,336	1,771	2,306	3,279	3,392	3,406	3,718	3,928	3,420	4,533	3,695	2,585	3,308	3,135	3,440
Purchases of 1 oz. or less																
Price per pure gram	283.15	295.40	257.36	223.03	225.53	175.87	135.50	118.86	119.82	177.79	131.13	122.08	123.07	104.74	113.42	108.43
Purity	47.23	46.52	52.97	57.04	53.94	66.44	75.65	76.78	77.38	68.64	76.21	76.44	72.86	74.15	70.00	70.20
Number of cases	900	1,253	1,621	2,078	2,918	2,984	2,861	3,232	3,415	2,977	3,840	3,120	2,258	2,815	2,627	2,769
Purchases of .125 oz. or less																
Price per pure gram	373.02	379.30	348.53	318.17	320.82	261.57	208.34	168.29	155.38	221.90	175.10	173.50	168.00	153.24	164.03	156.60
Purity	47.20	46.35	48.22	51.43	46.69	59.62	72.93	79.10	80.32	73.37	80.21	78.51	75.68	76.65	71.46	73.84
Number of cases	268	463	568	758	1,095	1,169	1,060	1,495	1,801	1,660	1,918	1,397	1,025	1,078	1,092	1,059
Heroin																
Purchases of 5 grams or less																
Price per pure gram	3,374.00	3,320.90	3,322.63	3,066.56	2,652.71	2,673.96	2,281.05	1,835.09	1,457.89	1,935.32	2,023.48	1,715.83	1,404.20	1,252.51	1,311.25	1,126.57
Purity	6.73	9.07	11.34	13.77	14.16	16.34	21.80	30.16	30.31	24.24	26.37	34.22	37.20	48.54	46.35	41.48
Number of cases	852	985	802	729	769	676	577	619	504	686	868	499	264	298	310	294
Purchases of 1 gram or less																
Price per pure gram	3,474.70	3,367.18	3,422.96	2,927.12	2,565.75	2,667.68	1,984.10	1,806.46	1,471.09	1,855.12	1,940.63	1,640.05	1,466.18	1,265.24	1,272.82	1,022.36
Purity	8.06	11.18	12.95	15.45	15.70	16.98	24.41	33.34	34.32	26.65	28.93	37.26	41.58	53.42	49.71	45.09
Number of cases	560	652	586	575	612	566	458	511	406	579	722	427	219	255	273	247
Purchases of .5 gram or less																
Price per pure gram	3,852.36	3,485.00	3,612.22	2,808.25	2,579.26	2810.17	1,898.66	1,800.00	1,434.99	1,774.44	1,886.11	1,616.36	1,594.88	1,320.73	1,245.78	1,017.36
Purity	7.35	10.31	11.44	14.68	13.70	14.43	25.35	35.75	36.74	28.92	33.01	40.79	45.43	58.80	55.82	48.92
Number of cases	319	446	432	457	485	451	333	370	302	435	515	294	161	173	168	167

Source: Abt Associates, Inc. *Prices of Illicit Drugs, 1981–1997*. Unpublished report. 1997.

Table A-5. Long-term trends in lifetime prevalence of use of various types of drugs for 12th graders

Percent ever used

	Class of 1975	Class of 1976	Class of 1977	Class of 1978	Class of 1979	Class of 1980	Class of 1981	Class of 1982	Class of 1983	Class of 1984	Class of 1985	Class of 1986	Class of 1987	Class of 1988	Class of 1989	Class of 1990	Class of 1991	Class of 1992	Class of 1993	Class of 1994	Class of 1995	Class of 1996	'95–'96 change
Approx. *N* =	9400	15400	17100	17800	15500	15900	17500	17700	16300	15900	16000	15200	16300	16300	16700	15200	15000	15800	16300	15400	15400	14300	
Marijuana/hashish	47.3	52.8	56.4	59.2	60.4	60.3	59.5	58.7	57.0	54.9	54.2	50.9	50.2	47.2	43.7	40.7	36.7	32.6	35.3	38.2	41.7	44.9	+3.2s
Cocaine	9.0	9.7	10.8	12.9	15.4	15.7	16.5	16.0	16.2	16.1	17.3	16.9	15.2	12.1	10.3	9.4	7.8	6.1	6.1	5.9	6.0	7.1	+1.1
Crack	—	—	—	—	—	—	—	—	—	—	—	—	5.4	4.8	4.7	3.5	3.1	2.6	2.6	3.0	3.0	3.3	+0.3
Other cocaine	—	—	—	—	—	—	—	—	—	—	—	—	14.0	12.1	8.5	8.6	7.0	5.3	5.4	5.2	5.1	6.4	+1.3
Heroin	2.2	1.8	1.8	1.6	1.1	1.1	1.1	1.2	1.2	1.3	1.2	1.1	1.2	1.1	1.3	1.3	0.9	1.2	1.1	1.2	1.6	1.8	+0.2
Stimulants	22.3	22.6	23.0	22.9	24.2	26.4	32.2	27.9	26.9	27.9	26.2	23.4	21.6	19.8	19.1	17.5	15.4	13.9	15.1	15.7	15.3	15.3	0.0
Crystal meth. (ice)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2.7	3.3	2.9	3.1	3.4	3.9	4.4	+0.5

Note: Level of significance of difference between the two most recent classes: s = 0.5, ss = .01, sss = .001.
Source: The Monitoring the Future Study, University of Michigan.

Table A-6. Long-term trends in annual prevalence of use of various types of drugs for 12th graders

Percent who used in last 12 months

	Class of 1975	Class of 1976	Class of 1977	Class of 1978	Class of 1979	Class of 1980	Class of 1981	Class of 1982	Class of 1983	Class of 1984	Class of 1985	Class of 1986	Class of 1987	Class of 1988	Class of 1989	Class of 1990	Class of 1991	Class of 1992	Class of 1993	Class of 1994	Class of 1995	Class of 1996	'95–'96 change
Approx. *N* =	9400	15400	17100	17800	15500	15900	17500	17700	16300	15900	16000	15200	16300	16300	16700	15200	15000	15800	16300	15400	15400	14300	
Marijuana/hashish	40.0	44.5	47.6	50.2	50.8	48.8	46.1	44.3	42.3	40.0	40.6	38.8	36.3	33.1	29.6	27.0	23.9	21.9	26.0	30.7	34.7	35.8	+1.1
Cocaine	5.6	6.0	7.2	9.0	12.0	12.3	12.4	11.5	11.4	11.6	13.1	12.7	10.3	7.9	6.5	5.3	3.5	3.1	3.3	3.6	4.0	4.9	+0.9s
Crack	—	—	—	—	—	—	—	—	—	—	—	4.1	3.9	3.1	3.1	1.9	1.5	1.5	1.5	1.9	2.1	2.1	0.0
Other cocaine	—	—	—	—	—	—	—	—	—	—	—	—	9.8	7.4	5.2	4.6	3.2	2.6	2.9	3.0	3.4	4.2	+0.8
Heroin	1.0	0.8	0.8	0.8	0.5	0.5	0.5	0.6	0.6	0.5	0.6	0.5	0.5	0.5	0.6	0.5	0.4	0.6	0.5	0.6	1.1	1.0	-0.1
Stimulants	16.2	15.8	16.3	17.1	18.3	20.8	26.0	20.3	17.9	17.7	15.8	13.4	12.2	10.9	10.8	9.1	8.2	7.1	8.4	9.4	9.3	9.5	+0.2
Crystal meth. (ice)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.3	1.4	1.3	1.7	1.8	2.4	2.8	+0.4

Note: Level of significance of difference between the two most recent classes: s = 0.5, ss = .01, sss = .001.
Source: The Monitoring the Future Study, University of Michigan.

Table A-7. Long-term trends in perceived availability of drugs for 12th graders

How difficult do you think it would be for you to get each of the following types of drugs, if you wanted some?	Percent saying "fairly easy" or "very easy" to get																					
	Class of 1975	Class of 1976	Class of 1977	Class of 1978	Class of 1979	Class of 1980	Class of 1981	Class of 1982	Class of 1983	Class of 1984	Class of 1985	Class of 1986	Class of 1987	Class of 1988	Class of 1989	Class of 1990	Class of 1991	Class of 1992	Class of 1993	Class of 1994	Class of 1995	Class of 1996	'95-'96 change
Approx. *N* =	2627	2865	3065	3598	3172	3240	3578	3602	3385	3269	3274	3077	3271	3231	2806	2549	2476	2586	2670	2526	2552	2340	
Marijuana	87.8	87.4	87.9	87.8	90.1	89.0	89.2	88.5	86.2	84.8	85.5	85.2	84.8	85.0	84.3	84.4	83.3	82.7	83.0	85.5	88.5	88.7	+0.2
Cocaine	37.0	34.0	33.0	37.8	45.5	47.9	47.5	47.4	43.1	45.0	48.9	51.5	54.2	55.0	58.7	54.5	51.0	52.7	48.5	46.6	47.7	48.1	+0.4
Crack	—	—	—	—	—	—	—	—	—	—	—	—	41.1	42.1	47.0	42.4	39.9	43.5	43.6	40.5	41.9	40.7	-1.2
Cocaine powder	—	—	—	—	—	—	—	—	—	—	—	—	52.9	50.3	53.7	49.0	46.0	48.0	45.4	43.7	43.8	44.4	+0.6
Heroin	24.2	18.4	17.9	16.4	18.9	21.2	19.2	20.8	19.3	19.9	21.0	22.0	23.7	28.0	31.4	31.9	30.6	34.9	33.7	34.1	35.1	32.2	-2.9
Amphetamines	67.8	61.8	58.1	58.5	59.9	61.3	69.5	70.8	68.5	66.2	66.4	64.3	64.5	63.9	64.3	59.7	57.3	58.6	61.5	62.0	62.8	59.4	-3.4s
Crystal meth. (ice)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	24.1	24.3	26.0	26.6	25.6	27.0	26.9	-0.1

Note: Level of significance of difference between the two most recent classes: s = 0.5, ss = .01, sss = .001.
*Answer alternatives were: (1) Probably impossible, (2) Very difficult, (3) Fairly difficult, (4) Fairly easy, and (5) Very easy.
Source: The Monitoring the Future Study, University of Michigan.

Table A-8. Long-term trends in harmfulness of drugs as perceived by twelfth graders

How much do you think people risk harming themselves (physically or in other ways), if they ...	Percentage saying "great risk"*																					
	Class of 1975	Class of 1976	Class of 1977	Class of 1978	Class of 1979	Class of 1980	Class of 1981	Class of 1982	Class of 1983	Class of 1984	Class of 1985	Class of 1986	Class of 1987	Class of 1988	Class of 1989	Class of 1990	Class of 1991	Class of 1992	Class of 1993	Class of 1994	Class of 1995	Class of 1996	'95-'96 change
Approx. N =	2804	2918	3052	3770	3250	3234	3604	3557	3305	3262	3350	3020	3315	3276	2796	2553	2549	2684	2759	2591	2600	2449	
Try marijuana once or twice	15.1	11.4	9.5	8.1	9.4	10.0	13.0	11.5	12.7	14.7	14.8	15.1	18.4	19.0	23.6	23.1	27.1	24.5	21.9	19.5	16.3	15.6	-0.7
Smoke marijuana occasionally	18.1	15.0	13.4	12.4	13.5	14.7	19.1	18.3	20.6	22.6	24.5	25.0	30.4	31.7	38.5	38.9	40.6	39.6	35.6	30.1	25.6	25.9	+0.3
Smoke marijuana regularly	43.3	38.6	36.4	34.9	42.0	50.4	57.6	60.4	62.8	66.9	70.4	71.3	73.5	77.0	77.5	77.8	78.6	76.5	72.5	65.0	60.8	59.9	-0.9
Try cocaine once or twice	42.6	39.1	35.6	33.2	31.5	31.3	32.1	32.8	33.0	35.7	34.0	33.5	47.9	51.2	54.9	59.4	59.4	56.8	57.6	57.2	53.7	54.2	+0.5
Take cocaine occasionally	—	—	—	—	—	—	—	—	—	—	—	54.2	66.8	69.2	71.8	73.9	75.5	75.1	73.3	73.7	70.8	72.1	+1.3
Take cocaine regularly	73.1	72.3	68.2	68.2	69.5	89.2	71.2	73.0	74.3	78.8	79.0	82.2	88.5	89.2	90.2	91.1	90.4	90.2	90.1	89.3	87.9	88.3	+0.4
Try crack once or twice	—	—	—	—	—	—	—	—	—	—	—	—	57.0	62.1	62.9	64.3	60.6	62.4	57.6	58.4	54.6	56.0	+1.4
Take crack occasionally	—	—	—	—	—	—	—	—	—	—	—	—	70.4	73.2	75.3	80.4	76.5	76.3	73.9	73.8	72.8	71.4	-1.4
Take crack regularly	—	—	—	—	—	—	—	—	—	—	—	—	84.6	84.8	85.6	91.6	90.1	89.3	87.5	89.6	88.6	88.0	-0.6
Try cocaine powder once or twice	—	—	—	—	—	—	—	—	—	—	—	—	45.3	51.7	53.8	53.9	53.6	57.1	53.2	55.4	52.0	53.2	+1.2
Take cocaine powder occasionally	—	—	—	—	—	—	—	—	—	—	—	—	58.8	61.9	65.8	71.1	69.8	70.8	68.6	70.6	69.1	68.8	-0.3
Take cocaine powder regularly	—	—	—	—	—	—	—	—	—	—	—	—	81.4	82.9	83.9	90.2	88.9	88.4	87.0	88.6	87.6	86.8	-1.0
Try heroin once or twice	60.1	58.9	55.8	52.9	50.4	52.1	52.9	51.1	50.8	49.8	47.3	45.8	53.6	54.0	53.8	55.4	55.2	50.9	50.7	52.8	50.9	52.5	+1.6
Take heroin occasionally	75.6	75.6	71.9	71.4	70.9	70.9	72.2	69.8	71.6	70.7	69.8	68.2	74.6	73.8	75.5	76.6	74.9	74.2	72.0	72.1	71.0	74.8	+3.8s
Take heroin regularly	87.2	86.6	86.1	86.6	87.5	86.2	87.5	86.0	86.1	87.2	86.0	87.1	88.7	88.8	89.5	90.2	89.6	89.2	88.3	88.0	87.2	89.5	+2.3s
Try crystal meth. (ice) once or twice	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	61.6	61.9	57.5	58.3	54.4	55.3	+0.9

Note: Level of significance of difference between the two most recent classes: s = .05, ss = .01, sss = .001.
*Answer alternatives were: (1) No risk, (2) Slight risk, (3) Moderate risk, (4) Great risk, and (5) Can't say, drug unfamiliar.
Source: The Monitoring the Future Study, University of Michigan.

Table A-9. National drug control budget, by function ($ millions), FY 1981–97

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Demand Reduction																	
Drug abuse treatment	513.8	505.8	549.1	582.2	625.3	635.7	827.1	868.5	1,148.2	1,638.9	1,877.3	2,204.7	2,251.6	2,398.7	2,692.0	2,553.8	2,808.7
Drug abuse prevention	86.4	101.9	124.9	128.1	146.0	145.0	444.3	464.7	725.4	1,238.0	1,479.2	1,538.7	1,556.4	1,597.4	1,559.1	1,400.7	1,648.0
Prevention research	30.1	24.1	26.4	32.0	35.8	40.8	65.9	73.4	81.0	127.7	150.6	157.5	164.3	174.8	174.8	212.2	226.5
Treatment research	41.5	35.2	37.8	41.8	48.1	46.9	75.1	76.5	124.9	160.2	187.9	194.4	242.0	253.6	253.6	282.8	302.2
Total demand reduction	671.8	666.8	738.2	784.1	855.2	868.4	1,413.4	1,483.1	2,079.5	3,164.8	3,695.0	4,095.3	4,214.3	4,424.5	4,679.5	4,449.5	4,985.4
Percentage of drug budget	44	39	37	33	31	30	30	32	31	32	34	34	35	36	35	33	33
Supply Reduction																	
Domestic Law Enforcement																	
Investigations	211.3	235.9	369.1	410.1	489.0	537.8	712.2	804.8	1,075.2	1,275.9	1,490.2	1,681.5	2,044.8	2,152.8	2,344.8	2,326.1	2,576.1
Prosecution	70.6	78.9	95.3	122.2	152.1	175.3	236.3	305.6	388.9	455.9	583.4	716.9	792.0	801.2	820.4	924.9	931.7
Corrections	87.6	114.1	140.0	148.8	215.6	258.8	397.8	588.8	933.4	1,780.7	1,265.1	1,520.5	1,736.5	1,765.6	2,057.1	2,098.1	2,487.9
State and local assistance	27.6	25.0	32.5	33.4	51.2	91.7	307.5	186.5	334.1	696.5	1,015.4	992.7	1,055.6	1,128.3	1,492.4	1,773.7	1,763.9
Intelligence	23.1	25.6	29.2	30.9	35.4	35.6	47.2	52.8	53.4	64.9	104.1	98.6	138.1	123.9	125.0	114.5	146.4
Regulatory and compliance	18.5	21.4	26.0	23.0	25.9	14.5	17.9	21.9	29.8	28.5	31.4	31.4	63.5	55.3	42.2	42.1	75.9
Other research	4.9	5.4	9.4	7.9	9.9	11.3	15.8	21.9	24.8	39.8	111.6	152.6	91.9	91.9	101.4	114.3	103.2
Total domestic law enforcement	443.6	506.3	701.5	776.3	979.1	1,095.0	1,734.5	1,982.3	2,839.8	4,342.2	4,601.2	5,194.2	5,922.4	6,119.0	6,983.3	7,393.7	8,085.1
Percentage of drug budget	29	29	35	33	36	38	37	43	43	44	42	44	49	50	53	55	53
International	66.8	87.8	83.9	95.8	109.2	147.7	220.9	209.3	304.0	500.1	633.4	660.4	523.4	329.4	295.8	289.8	449.7
Percentage of drug budget	4	5	4	4	4	5	5	5	5	5	6	6	4	3	2	2	3
Interdiction	349.7	458.0	473.5	706.9	807.3	744.0	1,350.5	948.1	1,440.7	1,751.9	2,027.9	1,960.2	1,511.1	1,311.8	1,280.1	1,321.0	1,638.6
Percentage of drug budget	23	27	24	30	29	26	29	21	22	18	19	16	12	11	10	10	11
Total supply reduction	860.1	1,052.1	1,258.9	1,579.0	1,895.6	1,986.7	3,305.9	3,139.7	4,584.3	6,594.2	7,262.5	7,814.8	7,956.9	7,760.0	8,559.2	9,004.5	10,173.4
Percentage of drug budget	56	61	63	67	69	70	70	68	69	68	66	66	65	64	65	67	67
Total National Drug Control Budget	1,531.9	1,718.9	1,997.1	2,363.1	2,750.8	2,855.1	4,719.3	4,622.8	6,663.8	9,759.0	10,957.5	11,910.1	12,171.2	12,184.5	13,238.7	13,454.0	15,158.8

Note: FY 1997 is enacted level.
Source: Office of National Drug Control Policy.

Table A-10. Funding for drug interdiction ($ millions), FY 1981–97

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
DoD	—	4.9	9.7	14.6	54.8	105.7	405.3	94.7	329.1	543.4	751.0	854.4	631.5	395.5	396.8	413.8	527.0
National Park Service	—	—	—	—	—	—	—	—	—	—	—	—	—	6.1	6.1	1.8	1.7
Bureau of Land Management	—	—	—	—	—	—	—	—	—	0.2	0.2	2.3	2.7	—	—	0.2	0.2
Bureau of Indian Affairs	—	—	—	—	—	—	—	—	—	—	—	—	—	0.1	0.1	—	—
OTIA	—	—	—	—	—	—	—	—	0.5	1.0	1.3	0.8	0.8	0.5	0.5	—	—
Immigration and Naturalization Service	0.2	0.2	0.3	0.4	0.4	0.7	17.2	17.5	52.0	48.6	62.6	67.7	71.0	74.8	86.9	106.8	138.8
U.S. Coast Guard	227.5	328.9	359.9	508.2	506.6	397.8	553.0	509.8	628.9	661.2	714.6	431.2	308.1	313.6	300.3	322.6	335.2
Federal Aviation Administration	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.8	3.2	9.3	16.5	15.1	12.2	16.6	7.7	8.6	9.2
U.S. Customs Service	122.0	124.0	103.6	183.7	245.3	239.7	367.1	317.5	427.0	488.6	481.8	586.8	484.9	504.4	481.8	466.1	527.6
Special forfeiture fund	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.3	0.3
Payments to Puerto Rico	—	—	—	—	—	—	7.8	7.8	—	—	—	—	—	—	—	—	—
ONDCP salaries	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.1	1.9
ONDCP special forfeiture	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	67.8
ONDCP HIDTA	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6.8
ICMA	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	22.5
Treasury forfeiture fund	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.3
Total	349.8	458.1	473.6	707.0	807.2	744.0	1,350.5	948.1	1,440.7	1,752.0	2,028.0	1,960.3	1,511.2	1,311.6	1,280.2	1,321.3	1,638.9

Source: Office of National Drug Control Policy.

Table A-11. Funding for international drug control programs ($ millions), FY 1981–97

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
U.S. Agency for International Development	—	15.7	9.2	10.6	6.7	23.5	7.1	9.9	13.3	54.5	189.6	250.2	134.6	35.0	19.8	—	—
DoD [506(A)(2) and EDA]	—	—	—	—	—	—	—	—	65.0	53.3	—	—	—	—	—	—	—
Assets forfeiture fund	—	—	—	—	—	—	—	—	—	—	—	12.4	—	8.7	10.0	3.5	4.0
Drug Enforcement Administration	31.0	34.3	36.9	42.8	51.0	67.7	91.1	97.4	97.6	141.3	172.4	161.4	172.6	153.1	127.5	128.1	232.1
Federal Bureau of Investigation	—	—	—	—	—	—	1.3	1.1	1.1	1.5	1.8	2.2	3.0	4.1	4.6	8.5	7.2
Special forfeiture fund	—	—	—	—	—	—	—	—	—	—	—	—	—	1.0	—	—	—
Office of National Drug Control Policy	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.6	0.9
State/INL (INM until 1995)	34.7	36.7	36.7	41.2	50.2	55.1	118.4	98.8	101.0	129.5	150.0	144.8	147.8	100.0	105.0	135.0	193.0
Interpol	0.1	0.1	0.1	0.1	0.1	0.2	0.6	0.8	0.7	1.1	1.3	1.9	1.9	1.9	1.8	1.6	0.8
U.S. Marshals	—	—	—	0.1	0.2	0.2	0.3	0.5	0.6	0.9	3.5	2.6	1.5	2.7	3.5	3.0	2.6
Treasury forfeiture fund	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.4	1.0	0.4
Bureau of Politico/Military Affairs	—	—	—	—	—	—	—	—	21.6	114.5	107.6	75.3	52.3	14.9	13.2	—	—
Emergencies in the diplomatic and consular service	—	—	—	—	—	—	—	—	0.3	—	—	—	0.1	—	0.2	0.3	1.0
U.S. Information Agency	1.0	1.0	1.0	1.0	1.0	1.0	2.0	1.0	2.8	3.4	7.3	9.7	9.3	7.9	9.8	8.3	7.6
Total	66.8	87.8	83.9	95.8	109.2	147.7	220.8	209.5	304.0	500.0	633.5	660.5	523.3	329.3	295.8	289.9	449.6

Source: Office of National Drug Control Policy.

Table A-12. Security assistance to the Andean source countries ($ millions), FY 1989–97

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
Bolivia										
FMFP	—	39.0	35.0	25.0	18.6	4.7	2.8	—	—	125.1
MAP	5.0	—	—	—	—	—	—	—	—	5.0
506 Drawdown	—	—	7.8	—	—	—	—	—	—	7.8
Economic Support Fund	25.0	30.0	12.0	25.0	25.0	25.0	11.8	—	—	153.8
Excess Defense Articles	—	—	—	1.5	—	0.9	47.4	—	—	49.8
IMET	0.4	0.6	0.9	0.9	0.9	0.4	0.4	0.5	0.5	5.5
INL	10.0	15.7	15.7	15.7	17.0	16.1	11.0	15.0	45.5	161.7
Total Bolivia	40.4	85.3	71.4	68.1	61.5	47.1	73.4	15.5	46.0	508.7
Colombia										
FMFP	—	71.7	47.0*	47.0	27.0	7.7	10.0	—	—	210.4
MAP	7.1	—	—	—	—	—	—	—	—	7.1
506 Drawdown	65.0	20.0	—	7.0	—	—	—	39.7	14.2	145.9
Economic Support Fund	—	—	49.8	55.0	11.2	1.0	—	—	—	117.0
Excess Defense Articles	—	63.0	4.0	3.2	90.0	—	27.0	—	—	187.2
IMET	1.0	1.5	2.6	2.3	2.2	0.9	0.6	0.1	—	11.2
INL	10.0	20.0	20.0	23.4	25.0	20.0	16.0	16.0	32.5	182.9
Total Colombia	83.1	176.2	123.4	137.9	155.4	29.6	53.6	55.8	46.7	861.7
Peru										
FMFP	—	1.0	12.4	—	—	—	—	—	—	13.4
MAP	2.5	—	—	—	—	—	—	—	—	2.5
506 Drawdown	—	—	—	—	—	—	—	13.8	2.3	16.1
Economic Support Fund	2.0	5.0	60.0	—	—	—	5.5	—	—	72.5
Excess Defense Articles	—	47.7	—	121.4	—	—	27.0	14.2	77.3	287.6
IMET	0.5	0.5	0.5	0.1	0.7	—	0.3	0.4	0.5	3.5
INL	10.5	10.0	19.0	12.5	17.5	8.4	15.0	15.5	25.8	134.2
Total Peru	15.5	64.2	91.9	134.0	18.2	8.4	47.8	43.9	105.9	529.8
Total All Countries	139.0	325.7	286.7	340.0	235.1	85.1	174.8	115.2	198.6	1,900.2

MAP: Military Assistance Program
FMFP: Foreign Military Financing Program
* Includes $19.945 million repayable funds.

Source: Department of Defense, Defense Security Assistance Agency.

Table A-13. Interdiction and international programs, requested vs. enacted ($ millions), FY 1990–97

	1990	1991	1992	1993	1994	1995	1996	1997
Interdiction								
Requested	1,592.000	2,372.700	2,109.100	2,219.600	1,765.200	1,205.600	1,278.500	1,437.100
Enacted	2,029.200	2,023.000	2,216.900	1,746.200	1,299.900	1,293.400	1,339.165	1,638.615
International								
Requested	449.000	689.000	778.700	767.900	490.100	426.900	399.000	449.730
Enacted	419.400	646.700	763.200	538.000	351.400	310.000	315.916	487.630

Table A-14. International Narcotics Control Program, Bolivia funding ($ thousands), FY 1989–97

Project	1989	1990	1991	1992	1993	1994	1995	1996	1997
Interdiction									
Narcotics police	750	1,160	1,165	778	1,000	778	—	670	700
Ground operations	2,759	5,057	5,125	4,832	4,850	3,349	4,000	3,825	8,090
Air operations	1,500	1,800	2,180	2,214	2,600	2,500	2,500	2,200	2,209
Riverine operations	1,200	1,500	1,640	1,602	1,800	1,800	1,000	1,000	870
Government of Bolivia social defense[a]	300	450	450	450	450	320	—	70	70
Precursor chemicals[b]	—	250	250	300	250	300	—	250	257
Enforcement/prosecution	—	650	660	609	1,000	850	—	822	616
Canine[c]	—	—	—	—	—	208	—	208	326
Financial Investigative Unit (FIU)	—	—	—	—	—	45	—	45	64
Field support	—	—	—	1,365	1,750	1,500	1,400	1,500	2,238
Intelligence support	—	—	—	—	—	950	—	550	1,136
Judicial reform[d]	—	—	—	—	—	—	—	—	—[d]
Interdiction Subtotal	6,509	10,867	11,470	12,150	13,500	12,600	8,900	11,140	16,576
Coca Control									
DIRECO[e]	1,659	2,098	1,476	1,514	1,600	1,450	—	910	1,808
Coca Legal[f]	525	560	554	536	400	500	—	100	—
Ecological Police[g]	—	—	—	—	—	—	—	1,200	566
Coca Control Subtotal	2,184	2,658	2,030	2,050	2,000	1,950	—	2,210	2,374
Alternative Development	—	—	—	—	—	—	—	—	8,000
Macroeconomic initiatives[h]	—	—	—	—	—	—	—	—	18,000
Public Awareness	400	525	300	—	—	—	400	—	850
Program Development and Support	907	1,650	1,900	1,500	1,500	1,550	1,700	1,650	1,700
Total	10,000	15,700	15,700	15,700	17,000	16,100	11,000	15,000	45,500

[a] The Office of the National Secretary for Social Defense has as its mission the overall responsibility of planning and coordinating narcotics control policy, similar to the Office of National Drug Control Policy in the United States. Funds are used for administrative, travel, and office support.

[b] The National Directorate for the Registry, Control and Fiscalization of Controlled Chemical Substances and Precursors is a civilian regulatory agency charged with monitoring nongovernmental importation of controlled chemicals. This project also funds the Chemical Investigations Group, the police unit within the Special Force in Fight Against Narcotics (FELCN) charged with chemical investigations.

[c] The drug detection canine unit, part of the Bolivian National Police, uses specially trained dogs to detect cocaine and other products at various roadblocks, airports, and other locations throughout the country.

[d] The purpose of this program is to support structural judicial reform in Bolivia through the implementation of three draft laws that are pending congressional approval: the Code of Criminal Procedure, the Judicial Council, and the Constitutional Court. Once approved, these laws will be instrumental in making the Bolivian justice system more efficient, effective, transparent, and accountable. For FY 1997 $2 million in anticrime funds have been allocated for judicial reform in Bolivia.

[e] DIRECO is one of two Bolivian Government organizations (the Ecological Police is the other) exclusively involved in the eradication of illicit coca cultivation. DIRECO reports directly to the Secretariat of Social Defense, and has a staff of agronomists, surveyors, and field agents who negotiate coca eradication agreements, supervise the destruction of coca crops, and verify the measurements of destroyed fields. DIRECO also assists the Secretariat in its development and implementation strategies. In FY 1997 and FY 1998, $2 million in anticrime funds will be provided for administration of justice.

[f] Coca Legal was the program concerned with the control of legal coca. This involved providing carnets to coca sellers and monitoring the legal coca markets and prices. This has been folded into the DIRECO mission and will no longer be a separate line item.

[g] The Ecological Police were established in 1995 to eliminate illegal new coca and seedbeds through manual eradication. They are directly supervised by the National Secretary for Social Defense, rather than the FELCN, to ensure their work is fully complementary to the civilian eradication agency, DIRECO.

[h] Also known as sustainable development. The line item Macroeconomic Initiatives refers to the balance of payment (BOP) funds provided the Bolivian Government. The BOP/cash transfer support provides dollars to the Bolivian Government to finance the payment of official bilateral debt owed to the U.S. Government or multilateral debt owed by the Bolivian Government. This frees up scarce budgetary resources to allow the Bolivian Government to more vigorously pursue counternarcotics efforts. For FY 1996–97, a total of $21.5 million was obligated for disbursement under eradication conditions agreed upon in the FY 1996 BOP program and amendments thereto.

Table A-15. International Narcotics Control Program, Colombia funding ($ thousands), FY 1989–97

Project	1989	1990	1991	1992	1993	1994	1995	1996	1997
National Police[a]	9,113	17,002	17,700	20,983	21,800	16,800	13,000	13,000	25,500
Judicial Protection	—	1,498	350	200	—	—	200	—	—
Military Counternarcotics Support[a]	—	—	—	—	—	—	—	—	5,000
DAS[b]	100	300	300	300	600	500	300	—	—
Infrastructure	150	150	150	150	300	400	300	500	—
Public Awareness	—	200	300	200	400	300	200	500	—
Program Development and Support	637	850	1,200	1,550	1,900	2,000	2,000	2,000	2,000
Total	10,000	20,000	20,000	23,383	25,000	20,000	16,000	16,000	32,500

[a] The total for FY 97 included $5 million for military counternarcotics support (indicated by separate line item).
[b] The Department of Administrative Security (DAS) project provided computer and data collection equipment, which was used in drug and money laundering investigations. This minimal support has been assumed by the Colombian Government.

Source: U.S. Department of State, Bureau of International Narcotics and Law Enforcement Affairs.

Table A-16. International Narcotics Control Program, Peru funding ($ thousands), FY 1989–97

Project	1989	1990	1991	1992	1993	1994	1995	1996	1997
Law Enforcement[a]	—	—	—	11,400	12,200	5,425	9,400	9,550	11,390
National Police[a]	7,425	6,450	13,350	—	—	—	—	—	—
Coca Control	2,000	2,200	4,175	—	4,200	1,580	3,000	2,350	5,750
Technical Police	—	—	—	—	—	—	—	—	—
Customs Service	50	200	150	—	—	15	400	100	400
OFECOD[b]	100	100	—	—	—	—	—	—	—
Chemical Control	—	—	—	—	—	15	300	100	650
Prosecutions	—	—	—	—	—	15	200	250	200
Policy Development	—	—	—	—	—	—	—	50	250
Sustainable Development[c]	—	—	—	—	—	—	—	—	5,000
Drug Awareness	125	125	170	—	—	50	300	1,000	500
Intelligence	—	—	—	—	—	—	—	300	—
Guardia Civil[a]	—	125	125	—	—	—	—	—	—
Program Development and Support	800	800	1,030	1,100	1,100	1,300	1,400	1,800	1,610
Total	10,500	10,000	19,000	12,500	17,500	8,400	15,000	15,500	25,750

[a] Prior to 1992 the Peruvian police structure was divided into three components. In 1992 there was a restructuring of the police that put all components under the Peruvian National Police title, hence funding for narcotics control was put into the Law Enforcement Project, which covers the rural mobile police and the Peruvian National Police drug directorate on the enforcement side.
[b] OFECOD is the office charged with overall coordination and planning of the narcotics control strategy for the Peruvian Government. Funding provided by the U.S. Government was reduced and OFECOD is now wholly funded by the Peruvian Government.
[c] Sustainable Development is the International Narcotics Control program portion of U.S. Government support for alternative development programs.

Source: U.S. Department of State, Bureau of International Narcotics and Law Enforcement Affairs.

Table A-17. Drug Enforcement Administration, Andean program funding ($ thousands), FY 1988–97

Country Program Activity	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997 (enacted)
Bolivia										
Operation SNOWCAP	635	692	1,162	1,101	1,088	1,130	698	449	—	—
Other Projects	4,208	3,615	5,048	6,624	9,522	9,357	9,291	8,846	9,918	11,190
Subtotal	4,843	4,307	6,210	7,725	10,610	10,487	9,989	9,295	9,918	11,190
Colombia										
Operation SNOWCAP	19	13	—	—	—	—	157	146	—	—
Other Projects	4,161	4,019	4,723	5,920	6,438	7,761	8,922	8,139	8,021	9,766
Subtotal	4,180	4,032	4,723	5,920	6,438	7,761	9,079	8,285	8,021	9,766
Peru										
Operation SNOWCAP	188	469	431	394	382	1,488	1,311	562	—	—
Other Projects	1,676	2,051	2,092	3,197	3,660	3,443	2,927	3,185	3,057	5,514
Subtotal	1,864	2,520	2,523	3,591	4,042	4,929	4,238	3,747	3,057	5,514
Ecuador										
Operation SNOWCAP	197	116	97	20	—	—	—	—	—	—
Other Projects	1,151	1,132	1,273	1,445	1,357	1,373	1,524	1,472	1,388	1,711
Subtotal	1,348	1,248	1,370	1,465	1,357	1,373	1,524	1,472	1,388	1,711
Venezuela										
Operation SNOWCAP	—	—	—	—	—	—	—	—	—	—
Other Projects	918	822	882	988	1,543	1,769	2,183	1,843	1,715	1,825
Subtotal	918	822	882	988	1,543	1,769	2,183	1,843	1,715	1,825
Grand Total	13,153	12,929	15,709	19,670	23,990	26,319	27,013	24,642	24,099	30,006

Source: Department of Justice, Budget Area/Recurring Center Report (Fiscal Years 1988–1996).

Table A-18. DoD counterdrug budget by decision unit, FY 1991–96

	1991 $ million (%)	1992 $ million (%)	1993 $ million (%)	1994 $ million (%)	1995 $ million (%)	1996 $ million (%)
Dismantling cartels	90.7 (8.6)	67.9 (5.5)	76.2 (6.7)	48.1 (5.9)	57.4 (6.8)	63.3 (7.7)
Source-nation support	76.1 (7.2)	120.7 (9.8)	154.9 (13.6)	144.5 (17.7)	148.7 (17.7)	147.6 (17.9)
Detection and monitoring	407.1 (38.5)	504.5 (41.2)	426.0 (37.3)	220.4 (27.0)	214.7 (25.6)	228.9 (27.9)
DLEA support*	396.0 (37.5)	441.7 (36.0)	383.4 (33.6)	313.2 (38.4)	329.5 (39.2)	299.1 (36.4)
Demand reduction	86.6 (8.2)	91.0 (7.4)	100.1 (8.8)	88.8 (10.9)	89.9 (10.7)	83.1 (10.1)
Total	1,056.5	1,225.8	1,140.6	815.0	840.2	822.0

*Drug Law Enforcement Agency

Source: U.S. Department of Defense (Drug Enforcement Policy and Support).

Abt Associates Inc.

55 Wheeler Street
Cambridge, Massachusetts
02138-1168

617 492-7100 *telephone*
617 492-5219 *facsimile*

Hampden Square, Suite 500
4800 Montgomery Lane
Bethesda, Maryland
20814-5341

301 913-0500 *telephone*
301 652-3618 *facsimile*

640 North LaSalle Street
Suite 400
Chicago, Illinois
60610-3781

312 867-4000 *telephone*
312 867-4200 *facsimile*

The Domestic Monitor Program and the Heroin Signature Program: Recommendations for Changes

June 30, 1998

Final draft

Not for quotation, reproduction, or distribution

Prepared by
William M. Rhodes, Ph.D.
Linda Truitt, Ph.D.
Ryan Kling
Anna Nelson

Abt Associates Inc.
55 Wheeler Street
Cambridge, MA 02138
(617) 349-2731

Table of Contents

Table of Contents (continued)

List of Figures

List of Tables

Executive Summary

The Drug Enforcement Administration (DEA) uses the Domestic Monitor Program (DMP) to monitor trends in the domestic retail price and purity of heroin. DEA uses the Heroin Signature Program (HSP) and the DMP together to estimate the geographic origin of heroin entering into and distributed throughout the United States. DEA asked Abt Associates Inc. to examine these programs and to recommend how they could be improved.

Following meetings with members of the Intelligence Branch, including staff responsible for the DMP and HSP, we reviewed the data collection, analysis and reporting practices of both programs. We visited the Special Testing and Research Laboratory in McLean, Virginia, and the New York City and St. Louis field offices, and reviewed previous recommendations about the DMP and HSP programs.[1] We also acquired and analyzed data from several sources: the DMP, the HSP, the System to Retrieve Information from Drug Evidence (STRIDE), and the Federal-wide Drug Seizure System (FDSS). We discussed preliminary findings with members of the Intelligence Branch. This final report incorporates many of their comments, but the opinions expressed in this report are not necessarily the same as those expressed by DEA staff.

The DMP and the HSP are fundamentally sound programs; nevertheless, design changes could improve both. The report recommends modifications to data collection procedures, changes to the way data are analyzed and reported, and integration of the DMP and the HSP programs with other Federal studies.

Recommended Changes to Data Collection Procedures

Both the DMP and the HSP could be improved by changing DEA data collection procedures. DMP data currently are collected on a quarterly basis in 20 field division offices and two district

1 Westrate, David L. and Cooper, Glennon L. *Price/Purity Study Requested by the Administrator* (FFS: 370-215); Drug Enforcement Administration, *Heroin: It Never Went Away*, Reston VA, February 1997.

offices. Each quarter, agents make ten $100 purchases, typically in $10 bag units. It appears impractical to increase the number of purchases in any quarter, or to expand the number of district offices that make purchases, or to extend the DMP to purchases and seizures by State or local authorities. Abt Associates recommends the following changes:

- DEA should integrate heroin purchase data, collected through routine field operations, with the DMP data. This is virtually costless because those routine purchases already are recorded in the System to Retrieve Drug Evidence (STRIDE), from which they are easily retrieved.

- DEA should modify the DEA Form 7 in order to learn more about the circumstances surrounding the heroin purchase. A simple checklist of (perhaps) five questions would suffice. Compliance by field agents is key, so the reporting changes should be minor, and the importance of completing these forms should be emphasized by a high-level directive. These additional data would be instrumental toward providing better estimates of heroin's price, purity, and source area.

- A $100 purchase appears atypical of purchases made by heroin addicts. DEA should consider having its agents make smaller purchases that more closely mimic the behavior of heroin addicts. There are tradeoffs, however. Source area signatures are more difficult to establish for smaller amounts of heroin; nevertheless, instructions to make $50 purchases would not seriously jeopardize the objectives of the signature program.

HSP data comprise all seizures at ports of entry and a random sample of seizures and purchases within the United States. DEA analyzes the HSP data, as well as the DMP data, to determine source area: Mexico, South America, Southwest Asia, and Southeast Asia. DEA should segment the combined HSP/DMP data into three parts: seizures of imports, domestic seizures, and street-sales. It should then adopt a plan, based on statistical logic, to sample data within each segment. The sample size would depend on the desired measurement accuracy.

Recommended Changes to Data Analysis

Both the DMP and the HSP may appear to be simple data sets, amenable to tabular analysis, but the appearance is deceptive. Neither the DMP nor the HSP are probability samples, so simple

tabulations are inadequate to infer what the DMP and HSP imply about price, purity, or source area. The report recommends more rigorous analysis of these data.

- DEA should adopt a statistical model to better understand trends in the price and purity of heroin. Use of a model will greatly improve estimates of heroin's price and purity at any time, as well as estimates of trends in heroin's price and purity over time.

- Because the DMP requires ten samples from every field division and selected district offices, relatively small cities are over represented in the DMP data. A standard way to deal with such a problem is to weight the data; DEA should adopt a weighting procedure when analyzing the DMP data.

The report also recommends changes to the analysis of the combined DMP/HSP data. As mentioned previously, the signature data should be segmented. Each of these segments should be analyzed separately. Furthermore:

- For technical reasons, the Special Testing and Research Laboratory is sometimes unable to assign a signature to heroin samples, and in such cases, the source area is unknown. Basing analysis on just the identified samples can be misleading because the rate at which samples are unclassified seems to vary systematically across source areas. DEA should adopt imputational routines—that is, procedures to estimate the source area when the laboratory cannot establish a signature.

- As is true of the DMP data, the signature data should be weighted at the time of analysis.

Integration With Other Federal Data

The DEA requested that Abt Associates recommend how the DMP and HSP might be integrated with other Federal data collection efforts and studies. The potential is clear. Although a few State and local agencies report trends in drug prices and purity, most policy analysts and policymakers lack reliable estimates of this important barometer of the availability of illicit drugs. The DEA is uniquely situated to fill this void.

Other government agencies have ongoing studies of drug use. This report recommends that the DEA continue to work with the National Institute of Justice (NIJ) on the Arrestee Drug Abuse Monitoring program and to initiate a working relationship regarding NIJ's crime mapping center. It recommends that DEA work to integrate price and purity estimates into the National Household Survey on Drug Abuse and other surveys sponsored by the Department of Health and Human Services, and to continue to work with study groups, such as the Community Epidemiologic Working Group. The report recommends that DEA integrate price, purity, and source area estimates into the Office of National Drug Control Policy's performance measurement system, such as by informing the Counter Narcotics Committee's efforts to develop drug flow models.

Modeling and Statistical Analysis

Because HSP and STRIDE data come from the routine activity of DEA and other Federal agents, those data are unlikely to represent heroin sold in the United States, and even the DMP data lack a probability basis. Using simple tabulations to draw inferences from those data can result in misleading conclusions, so inferences must necessarily be based on mathematical modeling and statistical analysis. Extant DEA staff probably lack the requisite mathematical and statistical skills. This report recommends that DEA contract for the required services.

DEA Review

Members of the Intelligence Branch have expressed concerns about some of these recommendations. They are skeptical about DEA's ability to change the DMP Form 7, and they question using statistical routines to impute signatures when the laboratory is unable to establish a signature through chemical assay. They are reluctant to compromise data collection for the signature program, even if this would improve price and purity estimates because of the higher

priority attached to establishing signatures. These are ultimately matters of judgment that cannot be resolved by Abt Associates.

1. Overview

The Drug Enforcement Administration (DEA) asked Abt Associates Inc. to review both the Domestic Monitor Program (DMP) and the Heroin Signature Program (HSP) and to recommend how those programs might be improved. The DEA instructed Abt Associates to be sensitive to the practical limitations of operating those programs—chiefly, budgets and the DMP's reliance on field agents to collect heroin samples. However, DEA also told Abt Associates that budgets for the DMP and HSP might be expanded and that operational procedures could be modified, so recommendations need not be circumscribed by current practices.

Following meetings with members of the Intelligence Branch, including staff responsible for the DMP and HSP, we reviewed data collection, analysis, and reporting practices of both programs. We visited the Special Testing and Research Laboratory in McLean, Virginia, and the New York City and St. Louis field offices, and we reviewed previous recommendations about the DMP and HSP programs.[2] Finally, we acquired and analyzed data from several sources: the DMP, the HSP, the System to Retrieve Information from Drug Evidence (STRIDE), and the Federal-wide Drug Seizure System (FDSS).

The first section of this report briefly reviews the DMP and the HSP. These programs are already well known to readers of this report, so this section's focus is on methodological issues, especially those that limit the extent to which findings from the DMP and HSP generalize to the distribution of heroin in specific cities and across the United States. The second section and the bulk of this report recommend changes to the DMP and HSP programs and recommend ways that data obtained from these programs could be integrated with other Federal data sources.

This report concludes that both the DMP and the HSP are fundamentally sound programs that are capable of meeting DEA's objectives without major structural alterations. However, these programs could be improved by changing how data are collected and analyzed, and the utility of these programs could be improved by integrating them more closely with other Federal data

---

2 Westrate, David L. and Cooper, Glennon L. *Price/Purity Study Requested by the Administrator* (FFS: 370-215); Drug Enforcement Administration, *Heroin Is Never Went Away*, Reston VA, February 1997.

collection efforts. This report provides details about how these improvements could be accomplished.

2. Review of the Domestic Monitor and Heroin Signature Programs

2.1 The Domestic Monitor Program

The purpose of the DMP is to monitor retail-level heroin trends in terms of price, purity, and geographic origin to assess trafficking and adulterants/dilutents, to train field agents, and to develop cooperating sources and intelligence.[3] The present focus is limited to the issues of price, purity, and origin.

DMP purchases are currently made at 22 sites throughout the country (i.e., 20 field divisions plus two district offices), but these change over time. Because these sites were not selected randomly, they do not necessarily represent the Nation. Nevertheless, coverage is broad as these sites account for roughly two-thirds of heroin purchases, according to our analysis of STRIDE data. The DMP data, when combined with other heroin purchases reported to STRIDE, provide a sound basis for drawing national estimates.

Special Field Intelligence agents directly, or with the assistance of paid cooperating sources, make ten quarterly heroin purchases costing about $100 each. (New York City agents make 20 purchases; St. Louis agents spend $150 per purchase of 15 capsules.) According to DEA instructions, the ten (or more) purchases should be made throughout the quarter and dispersed geographically. Based on SAC evaluations and discussions with agents, compliance is mixed. Field offices do not always provide the minimum number of purchases; when they do, the purchases sometimes cluster within a narrow geographic area or period.[4]

---

3 Drug Enforcement Administration. *Heroin: It Never Went Away*. Reston, VA. February 1997.

4 Headquarters is sometimes late making payments to the field offices, so field agents sometimes are forced to make purchases over short periods. Another explanation is that field agents are not heavily invested in the DMP/HSP programs, finding that they detract from the main activity of working cases.

One of the DMP's purposes is to monitor the price and purity of heroin sold on U.S. streets. There are notable limitations to meeting that purpose. Because neither the sites nor the purchases within those sites are based on probability sampling, simple tabulations may provide a misleading impression of heroin sold on U.S. streets. Statistical analysis could help to reduce the effects of these limits, but DEA does not analyze these data beyond providing means and ranges, so the DMP is less useful than it might be at showing trends.

Another purpose is to learn the geographic source of heroin purchased through the DMP program. Obtaining a signature requires a threshold level of heroin (about 0.8 bulk grams) according to sources at the Special Testing and Research Laboratory. The size of this threshold is important because, in theory, a DMP sample would have to contain at least this much heroin to support a signature analysis. Unfortunately, street-level heroin purchases made by addicts typically are much less than this amount, so satisfying the requirement for a signature may render DMP samples unrepresentative of retail heroin transactions.[5]

2.2 The Heroin Signature Program

The objectives of the HSP are to study drug law enforcement, seizures, and trafficking patterns based on estimated proportions of heroin in the U.S. originating from each of the four major source areas: Mexico, South America, Southeast Asia, and Southwest Asia.[6]

The HSP uses lab analysis to determine the geographic source of seizures according to unique chemical profiles or *signatures* developed from authentic heroin samples from each region.[7]

---

5 Rocheleau and Boyum report that addicts bought an average of 1.7 bags of heroin per purchase in New York City, 1.9 bags per purchase in Chicago, and 2.0 bags per purchase in San Diego. Prices fluctuated between $10 to $20 per bag. A. Rocheleau and D. Boyum, *Measuring Heroin Availability in Three Cities*. Washington, D.C., 1994, Office of National Drug Control Policy. Our analyses of data collected through the National Institute of Justice's (NIJ's) Drug Use Forecasting (DUF) project suggest, at least among criminal populations, heroin purchases typically fall below $50 and that fewer than five bags are exchanged (see section 3 of this report). Finally, our analysis of DMP data shows that the bulk weight of a bag varies across the country, but it is not unusual to find 40 to 80 milligrams of bulk heroin in a bag. Typical street-level purchases apparently cannot provide the minimal amount of bulk heroin required by the Special Testing and Research Laboratory.

6 Drug Enforcement Administration, *Heroin: It Never Went Away*. Reston, VA, February 1997.

7 Most South American heroin appears to come from Colombia, the only nation with significant poppy crop cultivation.

Identification is by chemical assay, and the lab asserts that the resulting signature is 95 percent accurate. We do not question that assertion.

According to its design, the HSP includes heroin seizures made at all U.S. ports of entry (e.g., airports, borders, and through the mail) and a random sample of other seizures and purchases by DEA and FBI agents. The DEA also obtains signatures for all DMP purchases, so when discussing heroin signatures, it is convenient to treat the DMP as an adjunct to the HSP. Hereafter, when this paper refers to the HSP data, it means the combined DMP and HSP data.

Thus, the HSP is a mixture of seizures and purchases. A principal difficulty when using the HSP is to determine what this mixture represents and how inferences based on this mixture can be used to inform DEA intelligence and reporting activities. DEA carefully states that signatures based on the HSP apply strictly to the HSP sample and should not be construed to represent the configuration of source areas for all heroin used in the United States. For example, the National Narcotics Intelligence Consumers Committee (NNICC) agrees that an analysis of seizures cannot provide a reliable basis for inferring the origin of heroin in the U.S. In practice, however, the HSP is typically discussed in a context where that inference is exactly the issue. Indeed, it is difficult to understand why DEA would sponsor the HSP if learning about the source of heroin were not the objective. This raises the issue of how the HSP could be used to improve what DEA can learn about the source area of heroin sold on U.S. streets, and we treat this as an objective when making recommendations.

2.3 Objectives and Approach.

Given this background, Abt Associates' task is to recommend changes necessary to provide a statistical basis for drawing inferences about:

- the price and purity of heroin as sold in selected cities and across the Nation;
- the source area of heroin seized by Federal authorities; and,
- the source area of heroin sold on U.S. streets.

These objectives sometimes conflict with each other because the best design for learning about source area is not necessarily the best design for learning about drug prices and purity. Directions from the DEA advise that, when resolving conflicts, estimating the source area has top priority, estimating drug purity has second priority, and estimating drug price has the lowest priority.

Our approach is to recommend how changes in data collection and analysis could provide reliable estimates of source area, purity, and the price of street-level heroin purchases. Except where noted, we make no recommendations simply because they would lead to interesting studies, they would advance science, or they would complement other Federal government data. The focus is narrowly on meeting the three objectives.

We emphasize this point because many of the recommendations lack an intuitive basis for people who are not statisticians. Some of the recommendations may seem esoteric, but in fact, they are necessary because of the way that DEA collects its data, and they are recommended because they advance the three objectives. For example, we recommend that DEA collect additional data about DMP purchases, not because more data would provide a richer profile of heroin buys, but because that additional information would be instrumental to providing accurate estimates of source area, purity, and price. As another example, we recommend using advanced statistical modeling, not because we are enamored with complex data analysis, but because such modeling is the best way to make sense of data that otherwise are difficult to interpret. As a final example, we recommend imputing source areas for heroin samples when the National Laboratory cannot assign a signature, not because we wish to compromise the laboratory's standards, but because signatures based exclusively on laboratory assignments lead to demonstrably incorrect inferences about the source area of heroin sold in the United States. Above all, the recommendations are intended to be practical, but they necessarily advocate ways of collecting and analyzing data that depart in both form and degree from DEA's current practices.

3. Recommendations for the Domestic Monitor Program

We recommend that the DEA expand the DMP data collection by incorporating STRIDE data into price and purity calculations. We recommend that DEA modify the DEA Form 7 to enrich DMP and STRIDE data and that DEA use statistical models to improve inference about trends in the price of heroin. This section details these recommendations.

3.1 Use of Statistical Models

We recommend that DEA use statistical procedures to strengthen inferences about trends in heroin prices and purity. We explain this recommendation using an illustrative analysis of DMP data. This illustration is based on a construct: price per pure milligram. This construct may seem strange at best or irrelevant at worst because heroin is not priced this way. Instead, the nominal price for a bag of heroin (or equivalent transaction unit, such as balloons or capsules) remains constant at $5, $10, or $20 while the amount purchased per bag varies. A natural way to track heroin prices might be to report the amount of heroin in a fixed price bag. This is a cumbersome way to track prices, however, because the sales unit is not the same from place to place or even from time to time in the same place. Developing price estimates based on a pure milligram of heroin has an advantage in that a pure milligram unit neither varies from place to place nor from time to time. It is a universal constant. Furthermore, if the price per pure milligram is known (say $1.00 per pure milligram), then estimating the purity of a $10 bag (25% in a standard 40 milligram bag) is straightforward.[8] Consequently, the following discussion is based on the construct of price per pure gram.[9]

---

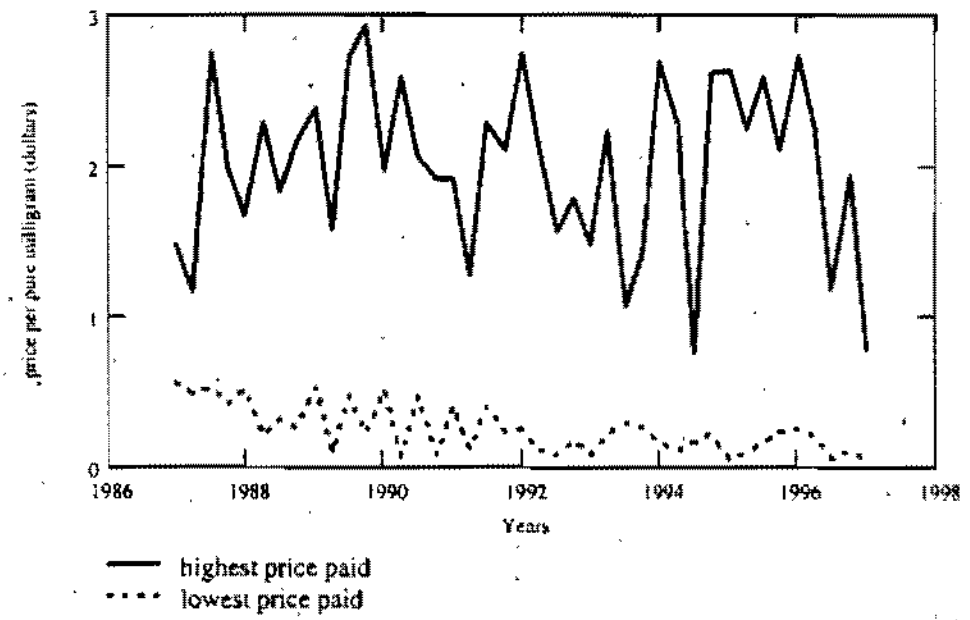
8 The logic is that, when heroin costs $1 per pure milligram on average, then a $10 bag should contain about 10 pure milligrams on average. If a $10 bag typically contains 40 bulk milligrams, then a typical bag is about 25 percent pure.

9 This same argument for analyzing price per pure milligram was made by Westrate and Cooper (1992).

DEA currently limits its analysis of the DMP to simple statistical tabulations and graphs, typically reporting the means and ranges of price and purity for all DMP samples and for samples from individual cities. Unfortunately, simple calculations do not provide the best measure of trends.[10]

Figure 1 shows the quarterly range in price per pure milligram of heroin based on DMP and comparable STRIDE data for New York City. The data include cases where the amount purchased was between 0.001 and 1.0 pure grams of heroin. It is impractical to compute a price per pure milligram for smaller purchases. Purchases in excess of 1 pure gram are unlikely to represent retail purchases, and indeed, even a 1-gram purchase would be an atypical retail-level buy. The data also exclude a few cases where the estimated price per pure milligram exceeded $3 because these were well outside the range of typical purchases. As shown in figure 1, the price ranges widely. The lower limit apparently has a downward trend, but in general, trends in price and purity cannot be readily detected. We seek to find better ways to represent these data.

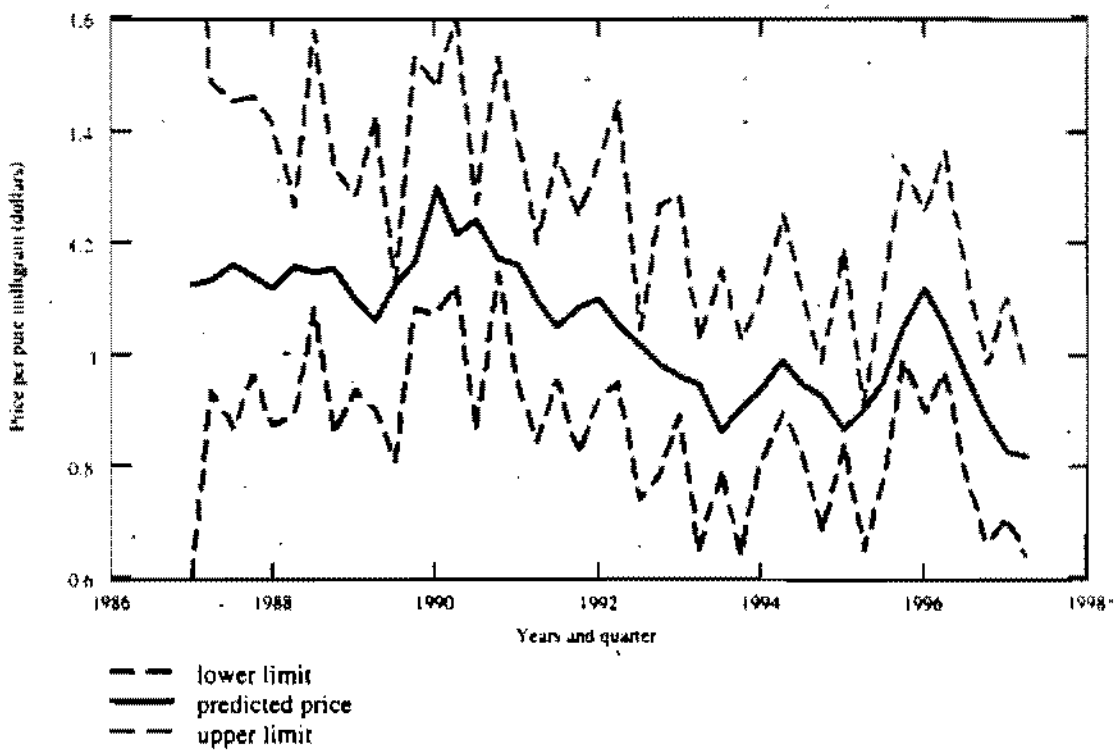
Figure 1: Low and High Price Range of Heroin in New York City



10 The Illegal Drug Price/Purity Report is unclear about sources. Some tables identify the source as STRIDE. According to Westrate and Cooper (1992), ranges reported in the report are based on the informed opinions of field agents. We are uncertain whether or not those reporting practices have changed. For illustrations, however, this report assumes that estimates are based on STRIDE or DMP data.

Figure 2 reports the average price per pure milligram and a confidence region around that average. The confidence region represents a range such that we are 95% certain that the average price falls within the range described by the upper and lower limits. Providing a comparatively clear picture of decreasing price for heroin, figure 2 is more informative than figure 1. Prices appeared to be roughly $1.10 to $1.40 per pure milligram in the late 1980s and closer to $0.80 to $1.00 per pure milligram by the middle 1990s. Still, this approach suffers from a serious limitation. DMP purchases vary markedly from transaction to transaction within the same quarter and across years. Sometimes the DEA buyer is lucky and strikes a good deal, while at other times he is cheated. Sometimes he buys heroin in areas where a price premium is the norm, and at other times he buys in places where heroin is relatively inexpensive. Although this variation from purchase to purchase reflects real market behavior, it results in wide confidence intervals that account for variation in what the purchaser buys as well as what he pays for it. The confidence interval would be narrowed if we could somehow standardize the item that the purchaser buys and then just estimate the variation in price for that standardized item.

Figure 2: Trends in Average Price per Pure Milligram of Retail Heroin in New York City



Recognizing this problem, several researchers have developed more sophisticated methods for analyzing purchase data that accomplish this standardization.[11] These methods build on the observation that price paid per pure milligram of heroin tends to decrease as the amount of heroin and its purity increase. Because the amount of heroin bought in a DMP purchase varies from sale to sale, the price paid per pure milligram also varies widely from sale to sale. However, variation does not always occur. A buyer will pay the same price per bag and he will receive the same amount of heroin per bag, regardless of whether he buys one or two bags of the same brand of heroin from the same dealer. However, we expect price variation (price per pure milligram) across brands because quality varies from brand to brand. We also expect price variation between $25, $20, and $10 bags because the cost of dealing with small bags is higher per unit of heroin sold in smaller than in larger lots.

Researchers have used statistical analysis to *explain* this variation and, based on that explanation, to *predict* what the price would have been had all DMP purchases been made at the same *standard amount*. This prediction can be used to estimate the average price per milligram of pure heroin, a confidence interval for that estimate, and the standard error for prices paid—all for the standardized amount.[12] The standard amount is simply a designated amount (say 200 milligrams of bulk heroin at 40 percent purity) representing street purchases and serving as a convenient benchmark for estimating prices.

To illustrate, consider the relationship between the amount purchased and the amount paid. Each X marked in figure 3 represents DMP purchases made in New York City during the first quarter of 1997. The solid line shows an estimate of the relationship between amount purchased and price paid based on statistical analysis of all DMP and comparable STRIDE purchases between 1987 and the second quarter of 1997. Obviously, the line does not describe the data points

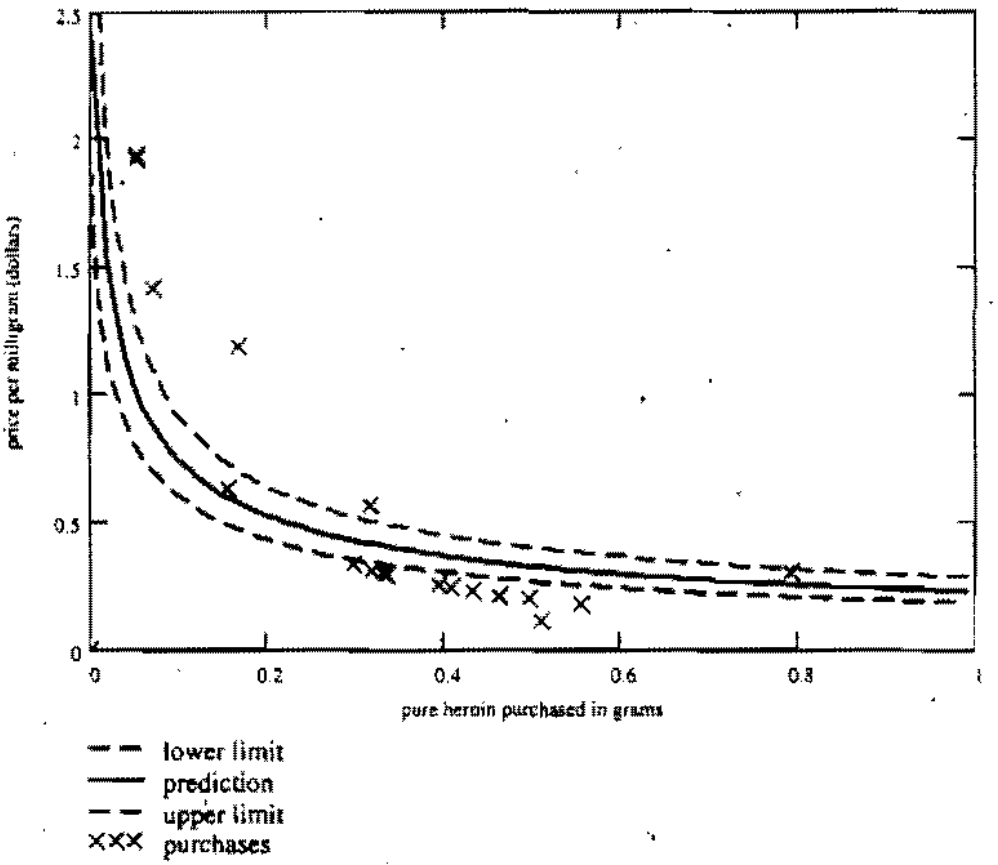
---

11 Rhodes, W. Hyatt, R. and Scheiman, P. "The Price of Cocaine, Heroin and Marijuana, 1981-1993." *The Journal of Drug Issues* 24 no 3 (1994): 383-402. Caulkins, J. and Padman, R. "Quantity Discounts and Quality Premia for Illicit Drugs." *Journal of American Statistical Association* 88, no 423 (1994): 748-57. Caulkins, J. *Developing a Price Series for Cocaine*. Santa Monica, CA: Rand, MR-317-DPRC.

12 An estimate of average price paid is a *point estimate*. It is unlikely that the point estimate is perfectly accurate because it is based on a sample. The confidence interval is a range such that, based on probability theory, we expect that the true average price falls within that range with 95 percent certainty. It may fall outside that range, but the likelihood of that is small. The standard error represents the variation in prices paid about the average. Plus or minus two standard deviations accounts for roughly 95 percent of all prices paid for heroin.

exactly, but the solid line is a best fit of the data based on statistical criteria. A simple inspection of the data provides a similar picture.[13] For example, the curve shows that the average price for an 80 pure milligram purchase (200 grams of bulk at 40 percent purity) is about 50.90 per pure milligram. The broken lines that appear above and below the solid line provide a confidence interval.

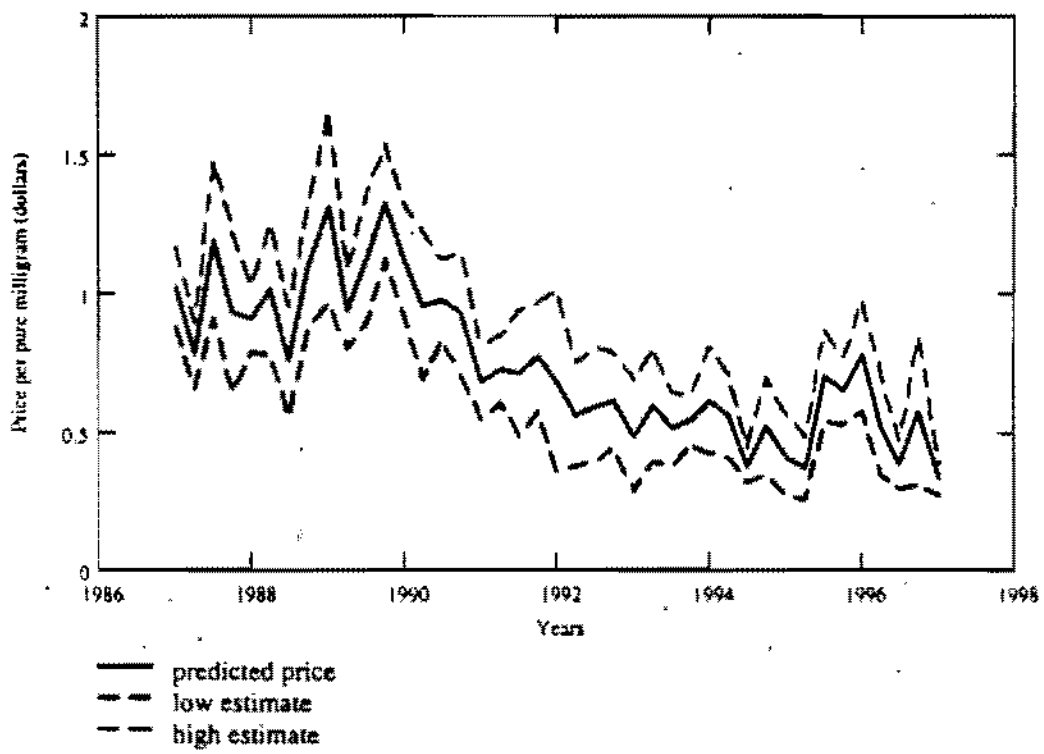
Figure 3: Amount of Heroin Purchased and Amount Paid in New York City (1997 Qtr. 1)



13 The actual purchases seem to lie above the line for small amounts of heroin and below the line for amounts around 400 milligrams. Part of the explanation for this is that the statistical model includes purity as an explanatory variable. Purity tends to be lower for small amounts than for large amounts, but the lines are drawn after setting purity to a constant 40 percent. A three-dimensional figure would solve this discrepancy, but three-dimensional figures are difficult to display and interpret.

DEA is less concerned with an estimate of heroin prices for a given quarter than with trends in heroin prices over time. Figure 4 shows the trend in estimated heroin prices for a standardized purchase in New York City. Conceptually, the first quarter of 1997 price estimate for an 80 pure milligram purchase, as reported in figure 3, was transferred to figure 4 to provide one point on the trend. This process was repeated for other quarters. The solid line shows the trend, and the broken lines show a 95 percent confidence interval around that trend. Statistical tests are available to determine whether prices change from quarter to quarter and from year to year. Compared with figure 2, figure 4 provides a clearer view of trends in heroin prices on New York City streets.

Figure 4: Trends in the Average Price per Pure Milligram of Retail Heroin in New York City Based on a Regression Model



We recommend that DEA adopt a regression model for estimating the level and trend in heroin prices. The model presented here illustrates the recommended approach, but it is not intended to be a best model. In fact, we will modify the model later in this report.

Estimation of a regression model requires specialized statistical skills that may not be internal to DEA. We recommend that DEA contract with an econometrician or an organization that can provide an econometrician to develop a suitable regression and basis for statistical inference. DEA might require the econometrician to provide computing software designed to allow DEA to update the regression results, statistical tests, and figures on a quarterly basis without intervention by the econometrician. Spreadsheets would be suitable.

On a quarterly basis, DEA should update the statistical model, the statistical inferences, and graphs by adding new data, making minor changes to the program, and running the program. On a periodic basis (say every three years), DEA should contract to have the model examined by an econometrician to determine whether its basic structure should be modified to account for significant changes in heroin drug markets.

3.2 Assess the Purity of Heroin as a Measure

Figures appearing in the previous section represent trends in the price per pure milligram of heroin. For reasons explained earlier, price per pure milligram may be the most useful way to monitor changes in heroin's availability. DEA is more interested in monitoring heroin's purity, however, and this section discusses how that might be done.

Getting direct measures of heroin's purity, based on DMP data, is straightforward: We simply average across DMP samples within a city and period. Interpreting resultant trends is more difficult, however. The problem is that the amount of bulk in a $10 bag of heroin varies from place to place and from time to time. Table 1 illustrates this variation for three cities.

Table 1: Median Bulk Weight per Bag of Heroin Across Cities and Over Time

Year	New York	San Francisco	Chicago
1993	40 mg	52 mg	59 mg
1994	43 mg	53 mg	67 mg
1995	48 mg	81 mg	39 mg
1996	45 mg	96 mg	58 mg
1997	52 mg	90 mg	106 mg

If bulk heroin per bag remained constant over time, then trends in the purity of those bags would seem unambiguous. Higher purity would imply greater availability, and lower purity would imply lower availability. (As used here, the term *greater availability* means that the amount of heroin provided in a fixed-price bag has increased.) The interpretation is more difficult when a bag's bulk weight increases because then a constant purity, or even a declining purity, could be consistent with increased availability. Likewise, when a bag's bulk weight decreases, a constant purity, or even an increasing purity, could be consistent with decreased availability. Higher or lower purity across cities does not provide an unambiguous measure of the relative availability across those cities; increasing or decreasing purity does not provide an unambiguous measure of heroin's relative availability over time.

There is one additional problem when interpreting purity. If we are correct, heroin users rarely make $100 purchases, but low-level dealers frequently make such purchases. The low-level dealer might simply resell the ten bags in smaller lots at a price greater than $10 per bag, or he might dilute the heroin and repackage it in more than the original ten $10 bags. In the latter case, the purity is almost certainly lower than the purity reflected by DMP samples. The problem is that simple tabulations of DMP data do not control for the level in the distribution chain at which the heroin is transacted.

A different way to monitor purity is to use the price estimates discussed in section 3.1. Recall that those estimates provide a measure of the price per pure gram of heroin sold at retail. For

example, the estimate might imply that a pure gram of heroin costs about $1 per milligram bought at retail. If we adopt a standard weight of 40 milligrams bulk per bag, then on average the purity for a $10 bag would be 25 percent (ten pure milligrams can be purchased for $10 and ten pure milligrams is 25 percent of forty bulk milligrams.) Thus, the price estimates already provide a means to track the average purity of heroin assuming a constant bulk size for a street-level bag.

This approach is easily modified to recognize that the size of a bag varies from city to city. The price estimate for a city tells how much pure heroin is contained in a typical $10 bag, and thus, estimates of bulk content for bags in a city implies the bag's purity. Similar adjustments would control for temporal changes in the bulk size of bags in any city.

There are other approaches to providing estimates, but first it is prudent to ask: Why does the DEA want to monitor the purity of heroin? If the purpose is to monitor heroin's availability, then price per pure milligram would seem to be the better barometer. Of course, there are other reasons for monitoring purity. For most users, low purity heroin is only suitable for injection, while high purity heroin might be injected or used for insufflation. Public authorities are duly concerned that the availability of high purity heroin portends a new heroin epidemic as users start with snorting and progress to needle use. While that concern is well placed, we are uncertain what a change from (say) 50 percent to 60 percent purity says about the risk of a new epidemic. Public authorities might also be concerned that a sudden change in the purity of heroin could pose a health risk for unsuspecting users. This concern also seems well placed, but trend analysis—which is based on typical purchases—is not a good way to identify idiosyncratic purchases of an occasional highly pure sample of heroin. Furthermore, using the DMP to monitor the purity of heroin sold to users still runs into the inescapable problem that the DMP probably does not reflect the quality of heroin used by typical users.

We do not recommend that the DEA abandon its attempt to monitor the purity of heroin. Such a recommendation would be silly. Federal, State, and local authorities—as well as researchers—find purity to be an important measure of heroin's availability. However, we recommend that DEA consider why it wants to monitor heroin purity, acknowledge the

limitations of monitoring purity with DMP data, and develop approaches that provide best estimates of purity given the reasons for monitoring and subject to the DMP's limitations. .

3.3 Capture Additional Purchase Information

The essence of statistical modeling is to explain variation in heroin prices in terms of factors that change from purchase to purchase (such as amount purchased) and then to predict what the prices would be when those factors are set at a standard amount (200 milligrams of 40 percent purity in our example). The more variation that can be explained, the better the trend estimates. This need to explain variance raises the question: What else explains why the price of heroin varies from sale to sale? Little is known about drug market dynamics, so reasons for this variation are speculative.[14]

Statistical modeling attempts to explain how heroin prices vary by identifying the conditions that cause variation. Curve fitting then removes much of that variation by reporting the estimated price when those conditions are set to a standardized purchase, and trend analysis is based on that standardized purchase. The greater the level of standardization, the narrower the confidence interval. DEA should consider ways to increase precision of the estimates by collecting and analyzing additional data about DMP purchases.

One inexpensive way to capture additional data is to include non-DMP STRIDE records in reports otherwise based exclusively on the DMP. This has two advantages. STRIDE data provide information about street-level drug sales that are missed by the DMP. Recall that, in theory, the DEA lab requires 800 milligrams of bulk heroin to assign a signature to a DMP purchase, so DEA cooperating sources are instructed to purchase in bundles larger than those typical of street sales. STRIDE includes a number of lower-level purchases, the availability of

14 For example, price and purity may depend on the relationship between the buyer and seller. When the seller knows the buyer, the selling price is likely to be lower because the seller incurs less risk and he may have incentives to encourage repeat business. When the seller does not know the buyer, the selling price is likely to be inflated to cover additional risk, and the product's quality and purity may be lower because repeat business is less likely. Field intelligence agents, however, report that only quality varies—not price per package—regardless of number of packages purchased. In New York City, for instance, they observe that heroin is sold in bags, and each bag always costs $10, whether purchased alone or in a bundle of 10

which can improve the statistical modeling.[15] In fact, the curves drawn in figures 3 and 4 are based on a combination of DMP and STRIDE data. We recommend that the DEA incorporate STRIDE data routinely into statistical estimation procedures.[16]

Another way to capture more information about factors that affect price variation is to ask DEA agents and their cooperating sources to provide additional information about the purchase. There are practical limits because compliance among agents is already mixed. Increasing their reporting burden may lead to less compliance and more data problems. DEA needs to be judicious about data demands made on the agents. Nevertheless, a few variables, including some discussed below, would seem to be relatively easy to incorporate into DEA Form 7.

DEA agents provide addresses where purchases take place, and the DMP analyst currently maps those addresses to determine whether or not the purchases are clustered or spread over the city. Figure 5 shows a map for New York City DMP purchases made during the third and fourth quarters of 1996 and the first quarter of 1997. Purchases seem to cluster in Ft. Washington, East Harlem, South Bronx, and Brooklyn. Over time, similar maps should allow the DEA to formulate at least crude measures of drug markets. As mentioned previously, prices seem to vary from market to market, so identifying the markets where the DMP sample is purchased could provide an additional means of learning about the variation in prices. This would require no additional work for the agents.

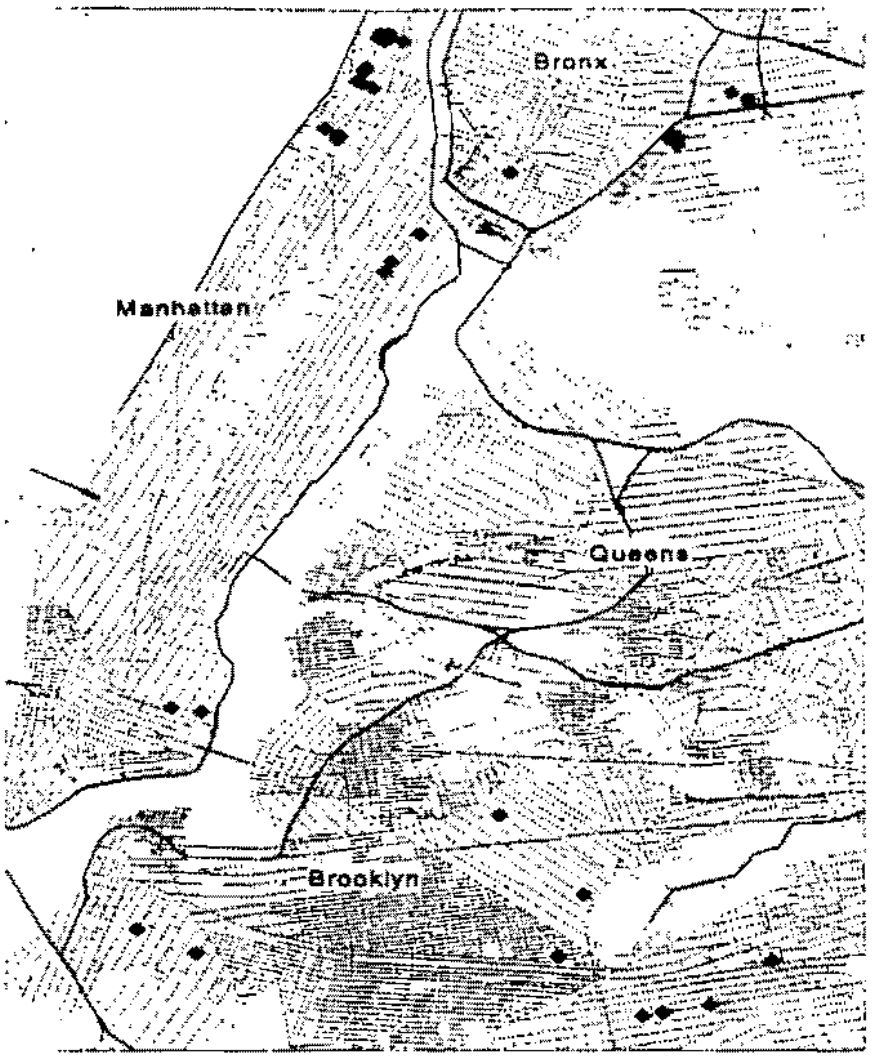
---

15 The statistical procedure is multiple regression analysis. A regression will generally be more precise when it is based on more data than when it is based on less data. Moreover, the regression will be more precise when there is more variation in the independent variable (drug amount in this case) than when it is based on less variation. Including STRIDE data in the analysis both increases the amount of data and increases the variation in the independent variable.

16 New York City agents said that non-DMP purchases in STRIDE are inherently different from DMP purchases. Non-DMP purchases often arise from repeat, large-scale transactions as agents attempt to build a legal case; whereas, DMP purchases are more likely to be one-time buys, so the price paid for a DMP purchase is likely to be somewhat higher than the price paid for a non-DMP purchase. Additionally, non-DMP purchases may be samples sold at a lower price to induce the buyer to make a larger purchase. Our analysis of combined DMP and non-DMP samples reaches the opposite conclusion. Non-DMP samples in the first quarter of 1997 sold for about $0.21 per milligram more than did a DMP purchase of the same weight. This does not mean that the DMP samples cannot be combined with the non-DMP samples, but the two should be distinguished by the statistical analysis.

Note that specimens sometimes contain no heroin. At least in New York City, sellers sometimes make such sales with the intention of making good on the sale if the buyer complains. Of course, DEA buyers are not in a position to complain.

Figure 5: Location of DMP Purchases in New York City (July 1996-March 1997)



DEA might ask agents to provide additional information when they report on purchases. The questions need not be demanding, but they could help to explain more about the factors that cause prices to vary from transaction to transaction. For example, a few questions could provide information on the following important elements:

- Buyer-seller relationship. Had the agent (or the cooperating source) purchased from this seller within the last year? Had he done so more than once? As mentioned earlier, we believe that prices are likely to be lower when the buyer and seller know each other, so the buyer and seller relationship should help explain variation in prices.

- Sale location. Was the purchase made: In an open-air setting? In a housing project? In another setting that specializes in the sale of illicit drugs? At least in some cities, these areas serve different markets. Open-air settings are necessarily available to a larger number of buyers. Housing projects tend to provide more closed settings. We presume that prices are lower in closed settings because the seller is more protected.

- Weekly cost. How much does the cooperating source spend per week on his or her heroin? We presume that a frequent buyer of heroin will be more skilled at buying heroin than is a person who buys less frequently, and that sellers are more likely to know and trust established users.

Note that we do not recommend this expansion in data collection and analysis just for the sake of learning more about drug markets. Our principal reason for making this recommendation is to improve the quality of estimates and to provide DEA with better means to track the price, purity, and source area of heroin. For example, a change in the characteristics of the cooperating source might change the price, so controlling for cooperating source characteristics would allow DEA to identify spurious price changes. Although DMP purchases and other purchases included in STRIDE are not selected randomly, a regression model based on these additional variables could help to control for systematic variation from purchase to purchase, ameliorating problems stemming from nonrandom sampling.

What specific information should be included in the narrative? We illustrated some data that seem useful, but we doubt that this illustration is comprehensive. Also, inter-site variation might exceed intra-site variation. Sources in New York, for example, did not feel that the distinction between an open-air setting and a closed setting made any difference in the price or quality of drug, nor did they feel that the buyer-seller relationship was relevant. Although their judgment may be correct, markets in New York City may be different from markets in other cities. For example, in New York City, cooperating sources seldom know the sellers; in St. Louis, cooperating sources almost always know the sellers.

We recommend that DEA consult with agents, perhaps through a short survey, to identify factors that may affect the price and purity of heroin. This expert opinion could be incorporated into a formalization of information otherwise supplied in the narrative of DEA Form 7. Statistical testing would then identify which factors were and were not important, thereby allowing DEA

to adopt a final revised Form 7. We recommend also that DEA continue to consult with the NIJ about market dynamics. Future ADAM data analysis could reveal whether or not important market factors (such as the buyer-seller relationship) should be captured. Our preliminary analyses reveal heroin purchases vary by region on several characteristics, such as sales connections (e.g., street, house, or phone/beeper) and location (indoors versus outdoors), as shown in table 2.

Table 2 tabulates responses from heroin users who were arrested in four cities. Apparently, typical heroin transactions vary across these DUF sites. Most sales are outdoors in Chicago, while nearly half are indoors in San Diego. About half the users bought from three or more different dealers per week in New York, while only a quarter bought from three or more dealers in San Diego. Use of a beeper is common in Portland but rare in Chicago. Nearly half the Portland users spent $50 or more on their last purchase, whereas fewer than one-quarter spend as much in the other three cities. These findings show considerable inter-site and intra-site variation in heroin purchasing habits, and we recommend that DEA modify its Form 7 to capture such variation.

Table 2: DUF Heroin Addendum (1995 Qtrs. 3 and 4, 1996 Qtrs. 1 and 2)

	New York (n=289)		Portland (n=187)		Chicago (n=149)		San Diego (n=106)	
	n	%	n	%	n	%	n	%
Usual Location								
Indoors	83	28.82%	56	30.11%	13	8.72%	51	48.57%
Outdoors	205	71.18%	130	69.89%	136	91.28%	54	51.43%
	288	100.00%	186	100.00%	149	100.00%	105	100.00%
Different Dealers (past week)								
0	7	2.45%	23	12.64%	3	2.07%	14	13.21%
1	60	20.98%	47	25.82%	40	27.59%	33	31.13%
2	66	23.08%	28	15.38%	28	19.31%	29	27.36%
3 or more	153	53.50%	84	46.15%	74	51.03%	30	28.30%
	286	100.00%	182	100.00%	145	100.00%	106	100.00%
Connections								
Street	237	82.87%	106	56.99%	141	94.63%	32	30.19%
House	97	34.04%	52	27.96%	8	5.37%	39	36.79%
Phone	25	8.74%	66	35.48%	6	4.03%	52	49.06%
Beeper	23	8.04%	79	42.47%	3	2.01%	26	24.53%
Shooting gallery	19	6.64%	6	3.23%	-	-	5	4.72%
Heroin Most Often Used								
Powder	287	99.31%	3	1.65%	146	97.99%	8	7.62%
Black tar	1	0.35%	179	98.35%	2	1.34%	96	91.43%
Synthetic	1	0.35%	-	-	1	0.67%	1	0.95%
	289	100.00%	182	100.00%	149	100.00%	105	100.00%
Last Purchase								
Less than $20	79	27.72%	20	11.49%	42	28.77%	45	45.00%
$20-$29	77	27.02%	41	23.56%	38	26.03%	20	20.00%
$30-$49	73	25.61%	39	22.41%	34	23.29%	13	13.00%
$50 or more	56	19.65%	74	42.53%	32	21.92%	22	22.00%
	285	100.00%	174	100.00%	146	100.00%	100	100.00%

*Top 4 of 6 (excluding n=88 Washington, D.C. and n=66 San Antonio)

Finally, regarding this recommendation, we suggest that DEA Form 7 be modified for *all* purchases, not just DMP purchases. This would impose few new costs to agents. It would require a redesign of STRIDE, and this may requirement substantial reprogramming of the STRIDE system.

Although expanding the DEA Form 7 to include a checklist would seem to impose little additional burden, field agents only grudgingly cooperate with the DMP program. Any expansion would be seen as an imposition. Furthermore, when the Intelligence Branch previously asked DEA agents to complete a simple addendum to Form 7, they refused. This does not bode well for expanding the DEA Form 7, and members of the Intelligence Branch have opined that this recommendation is impractical.

Nevertheless, augmented data from the DEA Form 7 could greatly improve estimates of price, purity, and source area without imposing more than a trivial amount of additional work on field agents. If there is a way for DEA to gain agent cooperation, we highly recommend that it take the necessary steps.

3.4 Make the DMP Sample More Like a Street-level Sample

DEA expects the DMP to serve two purposes: to provide estimates of the price and purity of heroin, and to provide estimates of the source area of heroin sold in the U.S. This raises a conflict because the ideal way to select a DMP sample for estimating price and purity is not ideal for learning about signatures, and vice versa. Recall that DEA instructs its cooperating sources to buy $100 of heroin per purchase (or $150 per purchase in St. Louis). The reason that DEA requires a sizable purchase is to ensure that the lab can derive a signature for each DMP exhibit. However, this seems to be much more than a typical heroin addict spends per purchase (see table 2), so the DMP purchases may not represent street-level purchases.

DEA told us that it places the highest priority on estimating heroin signatures. That being the case, DEA probably should make no radical changes in instruction given to agents about making

heroin purchases (i.e., spend $100 on ten $10 bags). Nevertheless, this section discusses some consequences of the $100 purchase rule and recommends that DEA consider a different approach.

The DEA lab estimates that the minimum amount of heroin required to derive a reliable signature is 800 bulk milligrams, but that estimate may be too conservative.[17] The dotted line in figure 6 reports the cumulative percentage of DMP samples that contained specified amounts of bulk heroin.[18] About half contained fewer than 425 milligrams of bulk heroin. We truncated the figure at 1 gram, but it is obvious that most samples contained less than what the lab indicates is the requisite amount of heroin for signature analysis.

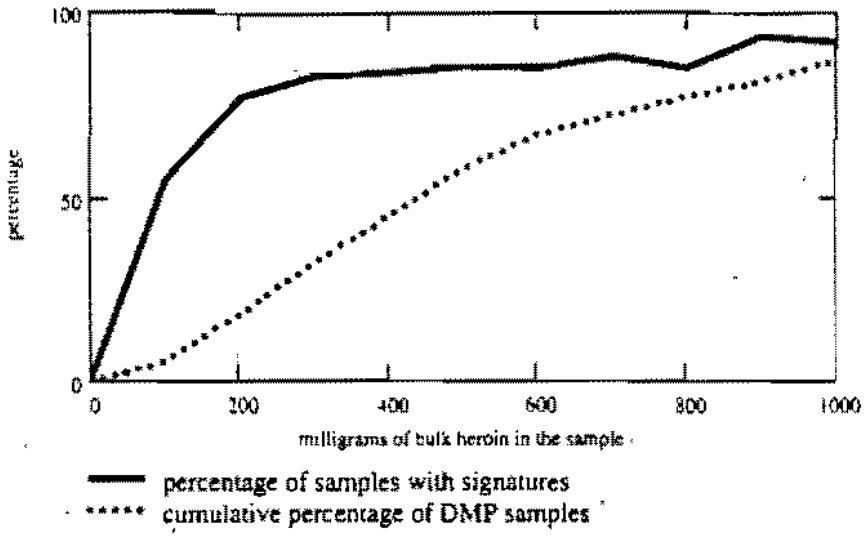
The solid line in figure 6 shows the proportion of DMP samples that received a signature as a function of the amount of bulk heroin provided in a sample. The figure suggests that a cut-off much less than 800 milligrams of bulk heroin would not compromise the lab's ability to derive a signature. The probability of getting a signature is better than 0.50 when a sample contains 100 bulk milligrams. The probability does not increase much after 300 milligrams: better than 85 percent of samples with 300 or more milligrams have signatures. Apparently, 800 bulk milligrams of heroin is not a necessary amount for reliable lab analysis.

---

17 In fact, the DMP seems to operate under a more stringent criterion: *Ideally, each sample should be at least 1.5 grams net weight (including adulterants and diluents) and should have a purity of at least 3.0 percent. A sample of this minimum weight and purity has a pure heroin weight of at least 45 milligrams.* Source: Drug Enforcement Administration, *Domestic Monitor Program, 1995 Annual Summary: Drug Intelligence Report*, Reston, VA: December 1996, p. 95.

18 We collapsed the amounts into ranges 1-10 milligrams, 11-20 milligrams ... 91-100 milligrams, 101 to 200 milligrams, 201-300 milligrams, and so on. The percentages are based on those ranges. There are some apparent data errors. Of the 5,304 DMP samples, 291 had no heroin, yet a signature was recorded for 21 of those 291.

Figure 6: Percentage of DMP Samples With Signatures as a Function of Bulk Heroin



Why does the lab suggest a threshold of 800 bulk milligrams? Our assumption is that DEA chemists understandably take a conservative view of their assay needs. After all, their principal concern is to provide best estimates of the source of heroin sent to them for analysis, and this position is consistent with the priority that DEA places on heroin signatures. This conservative position may be less than optimal for the DEA's DMP program, however. Our recommendation is that DEA revisit this issue.

A lower target threshold would allow DEA to revise the amount of heroin it asks its agents and their cooperating sources to purchase at a given time. Our analysis of DMP data suggests that, between 1995 and 1997, a median $10 bag of heroin contained about 50 milligrams of bulk heroin in New York, about 90 in San Francisco, and about 75 in Chicago. (The median amount varies from place to place and over time in the same place.) Our analysis of DUF data shows that a two-bag purchase is typical, but that a five-bag purchase is not uncommon. Considering the results from figure 6, then, DEA might consider the purchase of five bags as a compromise between the need to buy representative samples at street prices and the minimum amount of heroin needed to support a signature analysis.

This recommendation is a simple one. If the DMP sample is intended to represent street-level purchases of heroin, then the process by which DMP samples are purchased should mimic the process by which heroin addicts make their purchases. A practical constraint is that the lab must have a sufficient amount of heroin for chemical assay, and, understandably, this need drives the DMP's design for collecting heroin samples. The evidence presented here suggests that DEA may have set a threshold for heroin samples that is too conservative. A lower threshold would come closer to mimicking the behavior of heroin addicts without unduly risking the quality of the signatures. When a signature cannot be assigned, DEA should adopt imputation routines, which will be discussed in the context of the HSP program.

We raised the issue of the size of street-level purchases with DEA agents in New York City and St. Louis. Retail sales in New York City have followed the same pattern for years: $10 bags are sold in 10-bag bundles. Small operations may sell loose bags, which are often of lower quality. St. Louis agents distinguish among types of heroin users, associating smaller buys (e.g., two to three capsules) with a different caliber of informant (i.e., "low life boosters") than are usually employed for DMP buys. At issue is which groups are representative of typical heroin users. The convenience of purchasing a fixed amount (e.g., a 10-bag bundle) may argue for retaining current practices, but this imposes a risk of distorting estimates of prices paid by typical heroin users.

The unsettling fact is that the opinions of these agents appears to contradict the few studies that have examined the purchasing habits of heroin users. We cannot resolve the issue here, but DEA should seek some resolution, perhaps by consulting with NIJ sources familiar with DUF and other heroin data sources.

3.5 Amend Site Location Instructions

Given variation in heroin prices from market to market within any city, DEA attempts to collect a representative sample of heroin prices by instructing field agents to vary their purchases across local markets. This means that during one quarter of data collection, agents buy heroin in

markets A, B, and C. In the second quarter, they might buy in markets B, C, and D. And in the third quarter they might buy in markets C, D, and E.

We understand the desire to spread purchases across markets so that no small set of markets dominate the DMP. However, this attempt to represent multiple retail markets conflicts with the objective of using the DMP to develop a time-series of heroin prices and purity. To explain, suppose that markets A, B, C, D, and E were sorted so that market A is the low-priced market and market E is the high-priced market. Suppose furthermore that average heroin prices remained constant over a three-quarter period. In quarter 1, the sample is drawn from markets A, B, and C. In quarter 2, it is drawn from B, C, and D and in quarter 3 from C, D, and E. Even though average heroin prices remained fixed, the DMP would show an increasing trend.

Furthermore, the quest for diversity may make the DMP less representative, not more representative, of heroin purchases in an area. Continuing with the above illustration, suppose that market A accounts for 96 percent of all heroin sales, and markets B, C, D, and E account for 1 percent each. By underrepresenting market A, instructions to diversify purchases could provide a distorted view of heroin prices.

We recommend that DEA amend its instructions to agents to impose greater uniformity in how the sample is selected from quarter to quarter. That is, variation within a quarter should be encouraged.[19] For example, New York agents might be encouraged to continue to make their buys in Ft. Washington, East Harlem, South Bronx, and Brooklyn. However, they should be encouraged to buy in these four places every quarter.

This is another illustration of imposing standardization on the sample. There are inherent limitations to standardization, such as market access and evolution. Practically, individual cooperating sources may be able to make DMP purchases in one market but not in another. Also,

---

[19] An historical problem is Headquarters' inability to authorize DMP expenditures in a timely fashion, a problem that has sometimes forced agents to bunch purchases in order to achieve the quarter's quota for purchases. Procedures recently adopted by DEA should rectify this problem.

This regression is only for purposes of illustrating the approach. If DEA were to adopt regression-based imputation procedures, it should develop those procedures using more care than was used to develop these illustrations. The illustration, nevertheless, shows that use of imputations changes the apparent distribution of heroin by source area.

Table 3 shows the consequences of imputing signatures for the retail seller data. The first column identifies the year when the samples were collected—1993 through the first two quarters of 1997. The second column identifies the source area: SA, MEX, SEA or SWA. The third column identifies the reported distribution by source area for DMP samples with known signatures. Column four reports the imputed signatures for DMP samples when the actual signature was unknown. The last column combines the known signatures with the imputed signatures to provide an estimate of the source area for the retail seller sample.

Table 3: Source Area Distribution of Retail Seller Sample After Imputations

Year	Source	Known signatures	Only imputed signatures	Known and imputed signatures combined
1993	SA	12.6%	20.7%	16.1%
	MEX	50.5%	27.4%	41.5%
	SEA	28.0%	39.5%	32.3%
	SWA	8.9%	12.5%	10.1%
1994	SA	27.9%	33.7%	30.6%
	MEX	44.3%	31.4%	40.0%
	SEA	25.7%	32.1%	26.8%
	SWA	2.2%	2.8%	2.7%
1995	SA	37.2%	52.3%	41.4%
	MEX	53.5%	32.7%	46.2%
	SEA	8.8%	14.1%	11.0%
	SWA	0.6%	0.9%	1.4%
1996	SA	44.3%	55.1%	47.1%
	MEX	44.1%	29.1%	39.8%
	SEA	9.7%	13.3%	10.7%
	SWA	1.8%	2.5%	2.4%
1997	SA	51.3%	62.6%	52.5%
	MEX	41.3%	26.2%	38.4%
	SEA	4.6%	7.0%	5.4%
	SWA	2.9%	4.3%	3.7%

In 1996, the percentage of DMP purchases attributed to SA heroin increases from 44 percent before imputations to 47 percent after imputations. This slight increase happens because 55 percent of the unknown samples are imputed to be from South America. Similarly, the source area falls from 44 percent to 40 percent for Mexican heroin, and it changes from 12 to 13 percent for SEA and SWA combined.

The changes are roughly consistent over time. Imputations cause the proportion of SA and SWA/SEA heroin to increase and the proportion of MEX heroin to decrease. Moreover, while the imputed corrections tend to be modest, they are sometimes large. In 1995, for example, Mexican heroin fell from 54 to 46 percent of the retail seller sample.

We recommend that DEA adopt a regression-based approach to impute the source area when the Special Testing and Research Laboratory is unable to assign a signature. We believe that imputations would be improved if the laboratory were to cooperate with statisticians, but if the laboratory is unwilling or unable to do so, we recommend that the imputations be conducted without that cooperation.[29]

During discussions with staff from the Intelligence Branch, the recommendation about imputations was controversial, and Intelligence Branch staff were reluctant to endorse it. Nevertheless, the need for imputing signatures is both compelling and inescapable. It is compelling because signatures are frequently unknown, and, when imputations are made, they can cause dramatic shifts in the apparent source country distribution. It is inescapable because failure to explicitly impute signatures defaults to an implicit imputation. That is, when DEA discards samples that lack signatures, it implicitly says that the distribution of samples with unknown signatures is the same as the distribution of samples with known signatures.[30] This is unlikely to be true and needlessly ignores data. Statistical analysis provides a more justifiable approach, and, for that reason, we continue to recommend the use of imputations.

4.3 Adopt Weighting Procedures for the HSP Sample

We argued earlier than the DEA should adopt weighting procedures for analyzing DMP samples. The same is true for analysis of the signature data. Table 4 extends table 3 by weighting the DMP signature data.

---

29 Lab staff told us that, when they assign a signature, they are 95 percent confident that the assignment is accurate. For DEA's principal purposes, however, it may be preferable to have the lab record results from chemical assays that are informative but not definitive. A statistician could work those results into imputation routines.

30 An illustration may help make this point. Suppose that 70 percent of heroin comes from South America and that the other 30 percent comes from Mexico. Suppose that in a sample of 100 specimens, chemical assay determines that 30 are from Mexico, that 50 are from South America, and the other 20 have unknown signatures. Without making imputations, we would conclude that 38 percent of heroin comes from Mexico and 62 percent comes from South America. Suppose, however, that the 20 samples lacking a signature come from East Coast cities where every other sample is from South America, and that West Coast cities (where Mexican heroin dominates) contribute no samples that lack signatures. A best guess (that is, an imputations) is that the 20 samples that lack signatures are from South America and, consequently, that South America accounts for 70 percent of heroin sold in the United States. The use of imputations yields a more accurate answer. In practice, imputation routines would be more detailed than by this illustration.

Table 4: Source Area Distribution of Retail Seller Sample After Imputations and Weighting

Year	Source	Known signatures	Only imputed signatures	Known and imputed signatures combined	Final estimates using STRIDE weights	Final estimates using DAWN weights
1993	SA	12.6%	20.7%	16.1%	20.6%	21.7%
	MEX	50.5%	27.4%	41.5%	33.8%	30.5%
	SEA	28.0%	39.5%	32.3%	35.9%	35.7%
	SWA	8.9%	12.5%	10.1%	9.7%	12.1%
1994	SA	27.9%	33.7%	30.6%	44.2%	42.1%
	MEX	44.3%	31.4%	40.0%	30.0%	25.8%
	SEA	25.7%	32.1%	26.8%	22.5%	28.7%
	SWA	2.2%	2.8%	2.7%	3.4%	3.4%
1995	SA	37.2%	52.3%	41.4%	54.8%	53.7%
	MEX	53.5%	32.7%	46.2%	25.6%	29.6%
	SEA	8.8%	14.1%	11.0%	14.4%	14.0%
	SWA	0.6%	0.9%	1.4%	5.2%	2.8%
1996	SA	44.3%	55.1%	47.1%	57.7%	56.4%
	MEX	44.1%	29.1%	39.8%	28.9%	29.1%
	SEA	9.7%	13.3%	10.7%	11.7%	11.8%
	SWA	1.8%	2.5%	2.4%	1.8%	2.6%
1997	SA	51.3%	62.6%	52.5%	64.7%	61.6%
	MEX	41.3%	26.2%	38.4%	22.6%	26.5%
	SEA	4.6%	7.0%	5.4%	6.0%	5.5%
	SWA	2.9%	4.3%	3.7%	6.8%	6.4%

These weights are crude, and DEA should seek to develop better ones, but they illustrate important points. First, the weighted data suggest that SA heroin is a larger percentage of the U.S. heroin market than is suggested by the unweighted data. The imputed but unweighted data suggest that SA heroin comprised 47 percent of the 1996 U.S. market; after weighting, the share of SA heroin appears to be 56 percent (based on DAWN weights) to 58 percent (based on STRIDE weights). The imputed but unweighted data suggest that Mexican heroin accounts for 40 percent of the 1996 U.S. market. However, the share of Mexican heroin is probably closer to 29 percent (based on DAWN or STRIDE). Note that before imputation and weighting, 44 percent of the heroin seemed to come from Mexico, but after imputations and weighting the estimate is about two-thirds that amount. Clearly, imputation and weighting make a difference in the inferences drawn from the HSP.

Table 5 is based on a random sample of seizures within the U.S. The table identifies the year, the source region, the distribution before imputations and weighting, the distribution after imputation but before weighting, and the distribution after imputations and weighting by the amount of heroin in the seizure. Using 1996 as an illustration, SA heroin was 40 percent of the dealer sample. After imputations, this percentage increased to 41 percent. The relatively modest change results from the fact that only 7 percent of the cases required imputations during 1996. After weighting by the amount of heroin in the samples, the estimates suggest SA accounted for about 52 percent of the heroin seized from dealers. Mexican heroin accounted for about 25 percent, and SWA/SEA accounted for the remaining 23 percent.

Table 5: Source Area Distribution of Dealer Sample After Imputation and Weighting

Year	Source	Known signatures	Only imputed signature	Known and imputed signatures combined	Final estimates using pure amount of heroin as weights
1993	SA	17.5%	29.5%	19.7%	22.0%
	MEX	37.3%	17.6%	33.6%	23.3%
	SEA	36.3%	42.3%	37.4%	40.9%
	SWA	9.0%	10.6%	9.3%	13.8%
1994	SA	37.6%	49.9%	39.4%	40.8%
	MEX	39.1%	23.0%	36.7%	17.6%
	SEA	17.8%	20.9%	18.2%	27.6%
	SWA	5.6%	6.3%	5.7%	14.0%
1995	SA	44.4%	50.4%	45.1%	62.1%
	MEX	30.6%	20.1%	29.3%	14.0%
	SEA	16.2%	18.9%	16.5%	15.0%
	SWA	8.8%	10.6%	9.0%	9.0%
1996	SA	39.8%	57.9%	41.1%	52.2%
	MEX	45.1%	23.8%	43.8%	25.2%
	SEA	9.7%	11.9%	9.9%	9.6%
	SWA	5.3%	6.4%	5.4%	13.1%

The distribution by source area for retail sales is similar to the distribution by source area for dealer seizures for 1996. (1997 data were not available for dealer and importer samples.) SA heroin was about 56 percent of retail sales and it was 52 percent of dealer seizures. Mexican heroin was 29 percent of retail sales, and 25 percent of dealer seizures. SEA/SWA retail sales were 14 percent of retail purchases and 23 percent of dealer seizures.

How do the findings reported in table 4 compare with findings based on heroin seized as it enters the country? Table 6 reports the signatures for imports.

Table 6: Source Area Distribution of Importer Sample After Imputation and Weighting

Year	Source	Known signatures	Only imputed signatures	Known and imputed signatures combined	Final estimates using the amount of pure heroin as weights
1993	SA	40.1%	41.3%	39.9%	20.4%
	MEX	5.8%	2.7%	5.0%	2.4%
	SEA	48.9%	50.4%	49.7%	73.9%
	SWA	5.3%	5.6%	5.3%	3.2%
1994	SA	52.8%	53.5%	52.2%	35.8%
	MEX	4.5%	4.7%	4.6%	1.2%
	SEA	41.3%	40.5%	41.7%	60.3%
	SWA	1.4%	1.3%	1.5%	2.6%
1995	SA	74.9%	74.9%	73.9%	77.8%
	MEX	9.5%	9.5%	9.8%	3.5%
	SEA	13.6%	13.6%	14.1%	17.2%
	SWA	2.0%	2.0%	2.1%	1.5%
1996	SA	72.7%	72.7%	71.4%	62.7%
	MEX	10.3%	10.3%	10.9%	10.7%
	SEA	12.5%	12.6%	13.0%	10.6%
	SWA	4.4%	4.4%	4.7%	16.1%

The third column provides the distribution by source area before making imputations and the fourth provides the distribution for the sample that required imputations. The fifth column provides a composite—our best estimate of the distribution of seizures of imports. The final column weights each seizure by the amount of heroin it contained.

Comparing tables 4 and 6, heroin that is seized when it enters the country appears to be roughly consistent with the amount of heroin that is used in the country, but there are discrepancies from year to year. According to the retail seller data, SA heroin accounted for about 56 percent of heroin used in the U.S. during 1996. According to the importer data, it should have accounted for about 63 percent.[31] These estimates are roughly consistent, but the same is not true of the estimates for Mexican heroin. According to retail seller data, Mexican heroin accounts for 29

31 Possibly, the U.S. is a transit point for drugs going to other countries. This would cause the distribution of source area for airport seizures to differ from the source area for retail sales. It seems unlikely that much heroin transits the U.S. destined for foreign sources, but a closer inspection of passenger and freight destinations should establish the scale.

percent of consumption, but according to importer data, it should account for about 11 percent. The estimates for SEA/SWA are also inconsistent. Based on the retail seller data, 14 percent of consumption comes from SEA/SWA heroin, but SEA/SWA is about 27 percent of seizures. Treating estimates based on the DMP as accurate, Mexican heroin has the least risk and SEA/SWA heroin has the greatest risk of being seized when imported into the country.

Comparing the results from the importer sample and the other two samples is tenuous because of lumpiness in the importer data. The data contain relatively few SEA/SWA seizures and those seizures tend to be comparatively large. This means that one or two more seizures from SEA/SWA can have dramatic effects on the importer estimates for any year. Examining the retail seller sample, the percentage of heroin from SEA/SWA decreases fairly steadily from about 48 percent in 1993 to about 12 percent in 1997. The same is true of the dealer sample, where SEA/SWA heroin decreases fairly steadily from about 55 percent in 1993 to about 23 percent in 1996. In contrast, SEA/SWA heroin is 77 percent of importer seizures in 1993, 63 percent in 1994, 19 percent in 1995, and 27 percent in 1996. A single year may be too short of a reporting period for estimating the share of SEA/SWA heroin in the importer data. A three-year moving average would provide a trend that is more consistent with the retail seller sample and the dealer sample.

4.4 Develop Improved Sampling Procedures for Dealer Data

DEA should adopt a new sampling strategy for the dealer sample. DEA currently collects a simple random sample of seizures from dealers. Although this is not an unreasonable approach, it is probably not the best one because a simple random sample will provide measurement error that is needlessly large. The DEA should consider three principles when selecting this sample.[32]

32 There exists a fourth principle. Other things equal, samples should be larger in regions where the source of heroin is heterogeneous and smaller in regions where the source is homogeneous. In fact, little is likely to be gained from implementing this fourth rule.

The first principle is that the standard error of measurement would be smaller if the data were stratified by sections of the U.S. Stratification simply means that DEA should section the country into regions and sample within those regions. The source area for heroin is likely to be more homogenous within each section, and based on sampling theory, a sample that has more homogeneity within strata (sections) will yield smaller sampling errors than will a simple random sample. The most natural way to do this would be to treat samples that come to each DEA regional lab as having come from a unique section of the country. This is DEA's current practice and should be maintained.

The second principle is that every drug seizure should have a selection probability proportional to the seizure's size (i.e., the amount of pure heroin it contains). That is, after stratifying by section, the probability of selecting a 0.5 kilogram seizure should be twice as large as the probability of selecting a 0.25 kilogram seizure. Given the objective of estimating the proportion of within-country seizures that come from different sources, sampling proportional to size (the technical term for this kind of sampling) will provide for smaller standard errors of measurement.

Practical limitations prevent DEA's implementing this principle in full. Sampling is done at the regional lab, but at the time the sample is selected, lab personnel do not know the amount of heroin contained in a seizure. This requires chemical analysis, and, according to DEA personnel, chain-of-custody requirements preclude sampling after completing chemical analysis. Nevertheless, lab personnel should be able to estimate bulk weight, exclusive of packaging, and sample based on that bulk. Sampling rules could be fairly simple: Select every seizure over 1.0 kilograms, one of every two seizures between 0.5 kilograms and 1.0 kilogram, and one of every five seizures less than 0.5 kilograms.[33] These selection rates are for illustration; the actual rates would depend on the desired sample size, which in turn is determined by the desired accuracy of the estimates.

33 Lab personnel currently receive a list of randomly selected specimen identification numbers to use for sampling. This practice could continue, but the list would be modified to accomplish the purposes of sampling. Using the illustration, the list would be ignored for samples exceeding 1.0 kilograms, the list would be used for specimens between 0.5 and 1.0 kilograms, and a second version of the list would be used for specimens below 0.5 kilograms.

The third principle is that the standard error of the estimate will decrease as the sample size increases. DEA should decide the level of accuracy it requires of the dealer sample and set the sample size accordingly. Alternatively, DEA could set a budget ceiling and select the largest sample that is consistent with that budget. A sampling statistician should be able to estimate the relationship between sample size and accuracy based on STRIDE data and to establish random selection procedures to assure that accuracy.

5. Recommendations for Integrating the DMP and HSP With Other Federal Data Collection Efforts

We recommend that DMP and HSP be integrated with other Federal data collection efforts, to include programs conducted under NIJ and SAMHSA; further, we recommend that data comprehensiveness and applications be reassessed.

5.1 Integrate the DMP With the ADAM Program

NIJ currently runs the DUF program, which is soon to be expanded to the Arrestee Drug Abuse Monitoring (ADAM) program. ADAM will collect urine samples (to determine recent drug use) and administer questionnaires about self-reported substance abuse among arrestees in up to 75 urban areas and in a sample of other areas. The principal purpose of ADAM is to track substance abuse among arrestees.[34]

ADAM follows a basic 10 to 20 minute interview protocol, but the program includes add-on instrumentation for topics ranging from psychosocial functioning to gangs and violence. One planned module is for drug markets. At this time, this is the only module for which there are no draft questions, but we presume that questions will be similar to those that NIJ developed for its crack, cocaine, and heroin addenda. According to the ADAM Project Director, NIJ will probably field the questions about drug markets on a quarterly basis.

DEA can satisfy two broad interests with ADAM. The first is that the ADAM module on drug markets taps into the same issues relevant to the DMP. Standard ADAM questions under development will include questions about the price and perceived quality of heroin. The addenda dealing with the purchase of crack, powdered cocaine, and heroin includes questions that are

34 The DUF program has many critics who complain that DUF is not a probability sample so it is difficult to know what the DUF sample represents. ADAM will improve on the DUF design by providing a basis for probability samples within each of the ADAM sites and by providing synthetic estimates for the entire country. Abt Associates has been contracted to design and implement ADAM.

very specific about purchasing habits such as the buyer-seller relationship, the place where the purchase occurred, and the amount bought. An analysis of these data could provide important answers to the questions raised earlier about what factors affect variation in the price of heroin.

For example, we suggested earlier that it would be helpful to know the size of purchases made by heroin addicts because DEA should attempt to mimic those purchases to model retail-level markets. If the 10-bag bundles purchased by DEA cooperating sources proved to be atypical of purchases made by heroin addicts, then DEA might decide to change the instructions offered to agents about purchase sizes. Or, if ADAM shows changes in heroin market characteristics, then DEA might modify instructions for agents to make purchases in different places.

These recommendations suggest that ADAM could inform DEA and indicate ways to improve the DMP. The converse is also true. Through DMP, DEA could inform NIJ and its ADAM program. ADAM can monitor trends in heroin use in terms of whether users inject or snort, and whether they use heroin alone or in combination with other drugs. Explaining usage trends is complicated, but certainly the price and purity of heroin provide part of the explanation. By providing standardized price series, DEA could assist law enforcement in explaining local drug use trends.

Because ADAM is in its formative stages, we recommend that DEA continue to consult with NIJ about the development of the drug market interview module and how it might be administered to the joint advantage of DEA and NIJ. In turn, DEA should reach an agreement with NIJ to provide local researchers with DMP-based price series.

There is an additional area in which NIJ and DEA could work to their mutual advantage. NIJ recently established a Crime Mapping Center to help State and local authorities map crimes and calls for service. The mapping of drug markets has played a prominent role. NIJ and DEA could cooperate in this new domain to provide a better empirical picture of drug markets in U.S. cities. We recommend that DEA consult with NIJ about the mapping project.

5.2 Integrate the DMP With the NHSDA

The National Household Survey on Drug Abuse is a national probability sample of alcohol, cigarette and drug use among members of households. The survey reaches very few heroin addicts, and most researchers agree that the NHSDA probably tells little about addict behavior. It does, however, reach most initiates of illicit drugs, including heroin.

Policy analysts are often interested in determining factors that affect drug use, including whether or not the price and purity of a drug like heroin affects initiation and continued use, and whether high purity heroin induces experimentation. Two problems arise when trying to answer this question. The first is that the NHSDA does not identify places where the interviews took place, so there is no ready way to associate NHSDA respondents with the prevailing price of heroin. The second is that DEA does not provide a standardized price series for illicit drugs, including heroin.

Of course, much of this report is about correcting the second problem, which leaves the issue of place. SAMHSA is unwilling to provide place identifiers in the NHSDA to researchers because provision of place identifiers can compromise the NHSDA's promises of confidentiality. However, they are willing to match data (such as prices) with places in the NHSDA, sanitize the resulting file for public release, and provide the matched/sanitized file to policy researchers.[35] We recommend that DEA meet with SAMHSA to reach an agreement for routine matching of price data and NHSDA data.

5.3 Assess the Comprehensiveness of DMP and HSP Data Sources

We attempted to match DEA data across several sources. Our objective was to ensure that records that appeared in one source also appeared in another. A successful match would have provided some assurance that the sources were comprehensive.

---

35 Abt Associates is negotiating a contract with SAMHSA to gain access to multiple years of NHSDA data to match with price data.

Although each agency maintains its own records, a unique Federal Drug Identification Number (FDIN) is issued by the El Paso Intelligence Center for each seizure. The FDSS uses FDINs to link records across diverse information sources; otherwise, records associated with a single seizure would appear as multiple occurrences when multiple agencies contributed to a common database. For example, the Coast Guard might make an initial seizure. It might then pass that seizure to the Customs Service, which might pass the same seizure to the DEA for analysis. Each of these three Federal agencies would include that seizure in its database, but this poses no problem of overcounting seizures given the unique FDIN. DEA assembles the data files from each agency, extracts the seizures over 200 grams, eliminates duplicate seizures, and stores the results in the FDSS. The FDSS is considered the authoritative source for large-scale seizure information.

We reasoned that we should be able to match the HSP data for large seizures with other data files such as the FDSS. If we could not do that, then we would have to judge the HSP data as being incomplete. DEA provided us with FDSS data from the Customs Service for that purpose.

We were unable to match the data. Part of the problem is that the Customs Service did not provide the FDIN on its contribution to the FDSS system. We reasoned that we should, nevertheless, be able to match the Customs Service's data with the HSP data based on the date and the amount of the seizures. We were unable to make the expected matches. We were forced to abandon the exercise.

We recommend strongly that DEA conduct an internal review of these data files. The exercise requires so many iterations of data extraction and so much basic knowledge of largely undocumented systems that an outsider is at a serious disadvantage when attempting this exercise.

5.4 Consider Other Ways To Use the DMP and HSP Data

According to the DEA, "Together with the Heroin Signature Program (HSP), the DMP is utilized to supplement the information developed through investigations of drug production and seizure

data in the formulation of a comprehensive assessment of heroin trafficking trends."[36] We reviewed DEA reports using the DMP and HSP and discussed local use of the DMP data with sources in New York City and St. Louis. Beyond this, we did not attempt to catalogue how the DMP and HSP data are used for intelligence activities.

The DMP and HSP appear to have no special standing; other intelligence collection appears to be treated as more important in painting a picture of heroin trafficking in the country. We suspect that the DMP and HSP's standing in intelligence gathering would increase if the DMP and HSP were restructured following some of the recommendations made in this report. It has been difficult historically to infer much about changes in the price and purity of heroin because of the wide ranges reported by DEA. Improved data collection and revised analytic procedures could enhance the information provided by the DMP, perhaps increasing the utility of price and purity data in intelligence and policy making activity. Likewise, it has been difficult to know what to make of the HSP data because it is a conglomeration of data from various sources, subject to virtually no rigorous analysis. By restructuring the HSP data collection and analysis, DEA could enrich the information provided to authorities who need source area information for intelligence and policy making activity.

We illustrate one new use of the HSP data for a pressing purpose. The Office of National Drug Control Policy has established performance standards for agencies pursuing drug control missions. The performance measurement system establishes targets for five goals and multiple objectives. Many of the objectives that pertain to eradication and seizures require measures of the flow of drugs from the producing nations, to the transshipment zones, to the Nation's borders, and across the States.

It is very difficult to know these flows with precision, but a performance system is meaningless without some estimates. Consequently, there exists an Interagency Working Group to coordinate the development of flow models, and the Counter Narcotic Committee (CNC) has been charged with coordinating the development of a flow model that will be acceptable to all the cognizant

36 DEA (1997), p 7.

agencies. The CNC has made progress developing a cocaine flow model. It has made little headway developing a heroin flow model. Our illustration demonstrates how the HSP can inform that process.

According to table 4, during 1996 roughly 56 percent of the heroin sold on U.S. streets came from South America. According to best estimates, 10 to 12 metric tons of heroin were consumed in the U.S. during 1995.[37] Although both estimates are rough, if we accept them as true, they imply that Colombia must have the capacity to supply 5.5 to 6.7 metric tons of heroin to the U.S. Production estimates are also rough, but according to our calculation based on International Control Strategy Narcotics Report (INCSR) data and other sources, Colombia could have supplied about 5.6 metric tons after accounting for seizures. These estimates are remarkably consistent.[38]

If this estimation method makes sense, then we should be able to make comparable estimates for Mexican heroin. According to table 4, Mexico accounted for about 29 percent of the U.S. domestic heroin market in 1996. Supplying this share of the domestic U.S. market would require Mexico to produce at least 2.9 to 3.5 metric tons of heroin. According to our calculations based on INCSR data, Mexico exported a maximum of 4.9 metric tons in 1996. Even after accounting for seizures, Mexico probably provided about 4.8 metric tons to the United States. Mexico seems to be providing more heroin to the U.S. than can be accounted for by consumption figures. Nevertheless, these estimates are not wildly discrepant, and some of the difference would be explained if we knew how opiate and opiate products were used in Mexico.

Crude as it may be, this illustration shows that the HSP data can be used to develop a credible flow model of heroin from the producing nations to the U.S. There is a great need for improvement. Because there are no heroin counterparts to Operation Breakthrough, what authorities know about production capacity of poppy fields in Colombia and Mexico is inferred from knowledge of production in Southwest and Southeast Asia. These inferences may be

37 Rhodes, Langenbahn, and Scheiman, 1997.

38 Rhodes, W., Nelson, A. and Stewart, E. *Modeling Illicit Drug Flows*, memorandum for the Office of National Drug Control Policy, 1998.

wrong. Little is known about consumption in the source nations, but the use of heroin in Mexico is probably not trivial. It is difficult to know exactly how much Colombian and Mexican heroin is destroyed in the producing countries or intercepted at the U.S. borders or within the U.S. The consumption estimates are, at best, approximate. Nevertheless, this illustration shows how the HSP data could be used to provide at least the beginnings of a flow model, and even this beginning would not be possible without making better use of the HSP data.

6. Summary

Based on their 1997 conference, the DEA working group recommended several ways to improve the DMP and HSP: provide statistical information, including significance testing, in the Heroin Signature Report; expand purchase and seizure samples to include State and local law enforcement; obtain ONDCP funding to ensure comprehensive data collection programs; and review all intelligence programs regarding origin, purity, arrestee use, and use patterns.[39] Except for using State and local data, our recommendations are consistent.

6.1 Improve the DMP

Expanding data collection by asking the division offices to make more purchases, or by asking the district offices to make purchases, probably would be unproductive. Instead, we recommend that DEA expand the data collection by incorporating STRIDE data into the price/purity calculation.

Although we do not recommend an increase in the number of DMP purchases, we do recommend changes in how DEA collects their samples. DEA should consider whether or not the DMP samples should comprise fewer packages (i.e., less than 10 bags), the objective being to have DMP purchases simulate purchases made by most heroin users. We recommend that DEA modify Form 7 by incorporating a checklist of data items describing the purchases. Also, we recommend that DEA standardize the way that purchases are made from quarter to quarter, especially in terms of location.

We also recommend changes in how the DMP samples are analyzed. Multiple linear regression can provide a more rigorous method for analyzing trends in the price and purity of heroin. The data should be weighted as necessary to provide local, regional, and national estimates.

---

19 Drug Enforcement Administration. *Heroin: It Never Went Away*. Reston, VA. February 1997.

6.2 Improve the HSP

We suggest that DEA classify HSP samples into at least three groups—imports, dealers, and street-level—and sample within each of these groups. The sample size should be sufficiently large to satisfy DEA's needs for accuracy and, of course, to stay within an allotted budget. Within each of the three groups, the sample should be selected to minimize the estimates' standard error, again subject to budgetary and logistic constraints.

The three samples should be analyzed separately. Working in conjunction with the lab, DEA analysts would develop routines for imputing source area when signatures are unavailable. Weights would be applied, as appropriate, to provide profile or source areas for heroin seized entering the country, heroin seized within the U.S., and heroin sold on the streets.

6.3 Integrate DMP and HSP With Other Federal Data

Findings from the DMP and HSP can inform, and in turn be informed by, other data collection efforts. Integrating the DMP with ADAM seems useful both to the DEA and NIJ. Several SAMHSA datasets, especially the NHSDA, would benefit from a linkage with the DMP. The HSP could be instrumental in CNC's flow modeling of illicit drugs.

6.4 Establish an Analysis Team To Address DMP/HSP Issues

Intelligence personnel seem to draw a distinction between collecting data for intelligence activity and collecting data for statistical analysis, including trend analysis. DEA understandably emphasizes the former, which is most important for DEA's operational missions, but we encourage DEA to reevaluate its use of the latter.

A necessary step is to employ a statistician on several tasks. For example, we would like to know about the confidence limits for signature analysis. We would like to know whether or not relaxing the 95 percent certain requirement for a signature would provide better inferences. We

would like to have good imputation routines. Researchers trained in statistical modeling might be able to argue for the utility of knowing these things, and could help DEA establish standards and routines.

The current director of the DMP, although a highly capable DEA analyst, is not a statistician. He produces maps of drug purchases to judge whether or not agents are complying with instructions from headquarters, and he tabulates the DMP data. However, it seems unlikely that he would be able to conduct the analyses recommended in this report.

Improving the quality of the DMP and HSP is not just a matter of collecting better data (as important as that is), but moreover of making better use of the data that are collected. DEA should augment its staff to include analysts trained in statistical modeling to work with the DMP and HSP data. Non-DEA staff at Abt Associates, at Rand, and elsewhere have worked with DEA data and have developed innovative ways to analyze and use those data. Because it is difficult to develop this expertise in an operational agency, such as the DEA, we recommend that DEA consult or contract with such external groups. Consistent with this recommendation, we suggest that DEA engage in information sharing relationships with NIJ and SAMHSA.

Estimating Heroin Availability

April 4, 2000

Prepared for
Office of National Drug Control Policy

Prepared by
William Rhodes
Mary Layne
Patrick Johnston

Introduction

In December, Abt Associates delivered[1] a model for estimating international cocaine movement – the Sequential Transition and Reduction (STAR) Model. The STAR model builds on the notion of sequential reduction: the model begins with the amount of cocaine production potential in the source zone; reduces it as cocaine is seized or consumed in the source zone, transit zone and at U.S. borders; and finally provides an estimate of cocaine entering the United States. This global production model advances our understanding of international cocaine trafficking by integrating disparate models and estimates of the movement of cocaine into the United States.

The modeling approach used for heroin differs from that for cocaine. While the bulk of cocaine production is destined for the United States, less than five percent of worldwide heroin/opiate production is sent to the United States,[2] so developing a sequential production model is impractical. Also, dissimilar data are collected for heroin and cocaine. For example, heroin has no counterpart to the Interagency Assessment of Cocaine Movement (IACM), so we know less about the dynamics of heroin movement. On the other hand, cocaine has no counterpart to the DEA's Domestic Monitor Program (DMP) and Heroin Signature Program (HSP). A heroin availability model must differ from a cocaine availability model, because it is constructed from a different empirical base.

This section presents a model of the movement of heroin into the United States. Like its cocaine counterpart model, the heroin flow model seeks to weave together and reconcile various estimation systems into one comprehensive model. It is an important step toward structuring what is currently known about the ways that suppliers provide heroin to the United States. Nevertheless, we do not consider the model as final, because data about heroin trafficking continues to grow, and modeling improvements will follow from better data.

Model of Heroin Availability

Figure 1 is an overview of the heroin flow model developed in the rest of this report. Note that the heroin flow model starts with consumption estimates, while its cocaine counterpart begins with production estimates. These consumption estimates come from the most recent version of a biennial report that Abt Associates has prepared for the Office of National Drug Control Policy for nearly a decade.[3] Based on an analysis of data from the Heroin Signature and Domestic Monitor Programs, we partitioned the source of that consumption into four production areas: South America, Mexico, Southeast Asia and Asia.[4]

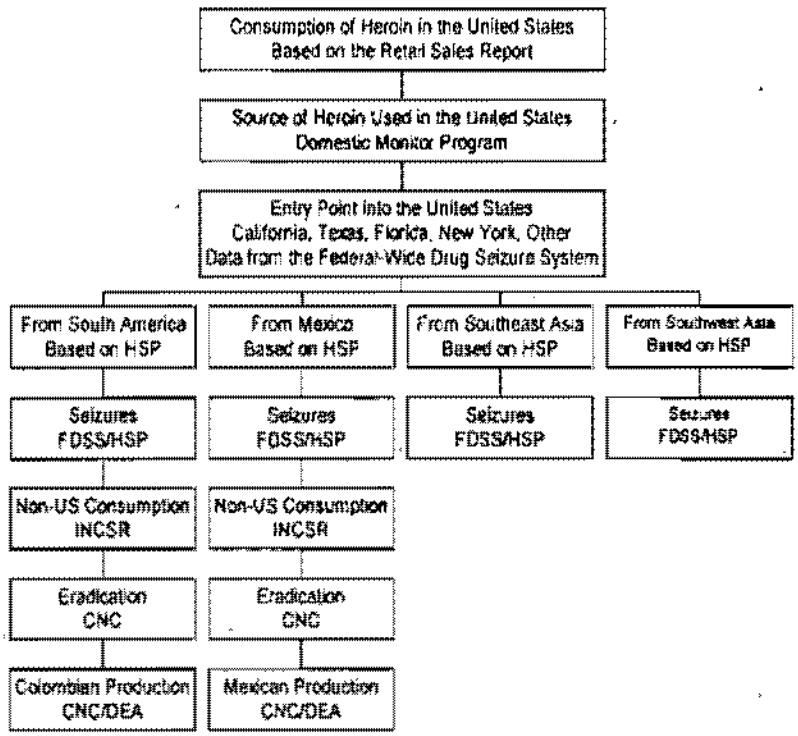
The Federal-Wide Drug Seizure System (FDSS) provides the best estimates of where heroin enters the United States.[5] As shown subsequently, most seizures were in California, Texas (and Arizona), Florida (and Puerto Rico), and New York (including New Jersey) so the figure identifies those four principal entry points. The source country of those seizures is estimated from the Heroin Signature Program (HSP).

According to reports by the Community Epidemiological Working Group (CEWG) and the U.N. World Drug Report, heroin consumption is minimal within South America and Mexico. Consequently, most South American and Mexican heroin is probably destined for the United States.

In summary, the heroin model develops a consumption-based estimate of the amount of heroin that is produced in South America and Mexico. After accounting for seizures, U.S. consumption of South American heroin should roughly equal South American production. Likewise, U.S. consumption of Mexican heroin should be approximately equal to Mexican production. But only a small proportion of Asian heroin gets consumed in the United States, so there is no practical way to equate U.S. consumption of Asian heroin to Southeast and Southwest heroin production.

Figure 1

Overview of a Heroin Flow Model



The Crime and Narcotics Center (CNC) provides a production-based estimate of the heroin production potential in Colombia and Mexico. After accounting for seizures and other leakage, the supply-based estimates should agree with the consumption-based estimate at least roughly – if not, something is wrong with the consumption model, with CNC's production estimates, or both. CNC also estimates potential production for Southeast and Southwest Asia, but there is no apparent way to tie a consumption-based model into those estimates.

U.S. Consumption

For nearly a decade, Abt Associates has produced estimates of the amount of illicit drugs consumed in the United States. Early estimates were crude, but the methodology has improved over time as new data have become available. Table 1 summarizes our most recent estimates.

To estimate the amount of heroin used in the United States, we begin with an estimate of the number of heroin users in the United States. Those users fall into two classes: occasional users (who use less than once per week) and hardcore users (who use at least once per week).[6] Hardcore users seem to use seventy to eighty percent of the heroin, so estimates of the number of hardcore users play an especially important role here.

To estimate the number of hardcore heroin users, we begin with data from the Drug Use Forecasting (DUF) system (now the Arrestee Drug Abuse Monitoring system). The National Institute of Justice has collected those data on a quarterly basis since 1988. The estimation procedure has several steps, which are described in a companion report,[7] the "retail sales" report. Estimates of the number of occasional heroin users were tabulated from the National Household Survey on Drug Abuse (NHSDA). No estimates can be precise, of course, but there seems to be somewhat more than 900,000 hardcore heroin users and somewhat fewer than 500,000 occasional heroin users during the late 1990s.

Unfortunately, the DUF interview does not ask a person how much he or she spent on a specified drug, but rather, it asks how much he or she spent on all drugs. We developed a regression model to infer the amount that is spent on heroin. The dependent variable in that model is dollars spent. The independent variables are the number of days during which the respondent used heroin, cocaine, marijuana and other drugs. Some additional assumptions – explained in the retail sales report – are overlaid on those inferences.

Results from that analysis suggest that hardcore heroin users spend somewhat more than $200 per week on heroin use. (All dollar estimates have been converted to 1998 dollar equivalents.) As explained in the retail sales report, this estimate may be low, because it is the estimated median rather than the estimated mean. The median seemed preferable because the data were highly skewed and because the $200 seemed to comport with estimates reported in an unfortunately sparse literature. We had no information on expenditures by occasional users, so we assumed $50 per week.

One additional adjustment is required. Heroin is often earned as income in kind, mostly when heroin users are themselves dealers (or dealers' helpers) who take their earnings in trade rather than dollars. Although estimates are uncertain, we assume that purchased heroin should be increased by 22 percent in the late 1980s, and by about 11 percent in the late 1990s, to reflect income in kind. The retail sales report provides justification.

Multiplying the number of heroin users by the amount typically spent on heroin suggests that, during the late 1990s, about $12 billion was spent on heroin every year. Adjusting for income in kind would increase the dollar equivalent expenditure to about $13 billion.

Table 1

Summary of Calculations Used to Derive Estimates of the Amount of Heroin Used in the United States

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Hardcore Heroin Users (thousands)	923	886	797	681	630	694	795	855	917	935	980	977	977
Occasional Heroin Users (thousands)	170	150	140	395	304	230	281	428	455	597	253	484	514
Median Weekly Expenditure	$446	$446	$417	$364	$308	$266	$236	$226	$221	$219	$214	$211	$209
Total Expenditure (billions)	$21.8	$20.9	$17.6	$13.8	$10.9	$10.2	$10.5	$11.2	$11.7	$12.2	$11.6	$12.0	$11.9
Price per Pure Gram	$3,153	$2,407	$2,378	$2,377	$1,925	$1,468	$1,131	$1,089	$1,048	$1,029	$1,029	$1,029	$1,029
Total Amount (MT)	8.5	10.5	8.8	6.8	6.5	7.9	10.5	11.4	12.4	13.1	12.5	12.9	12.9

Source: "What America's Users Spend on Illegal Drugs, 1988–1998." Report submitted to ONDCP by Abt Associates Inc., Nov. 23, 1999.

All dollars are expressed as 1998 dollar equivalents.

Although the above method provides an estimate of the expenditure on heroin purchased in the United States, it does not tell us the total weight of heroin used in the United States. If we knew the price paid per pure gram purchased, we could divide that price into the total expenditure to get a measure of purchased weight.

Fortunately, for nearly a decade, Abt Associates has produced estimates of the price paid at retail for a pure gram of heroin. Those estimates are based on a statistical analysis of the System to Retrieve Drug Evidence (STRIDE) and the Domestic Monitor Program (DMP) data. The methodology is described in detail in our recent price series report[8] for ONDCP and in the recent retail sales report. Toward the latter part of the 1990s, the price of heroin has been somewhat higher than $1.00 per pure milligram. Dividing the amount of expenditures by the typical price paid for heroin, and adjusting for income in kind, we get an estimate of the total amount of heroin used in the United States. In the second half of the 1990s, Americans seemed to use 12 to 13 metric tons of pure heroin per year.[9]

Determination of Source Area

The Drug Enforcement Administration supports two programs – the Heroin Signature Program and the Domestic Monitor Program – to determine the source area (South America, Mexico, Southeast Asia and Southwest Asia) of heroin sampled at three points: seizures at ports of entry, a random sample of other seizures and purchases, and DMP purchases.[10] We included all samples weighing less than one gram in a *retail-level sample*, comprising all the DMP data and several purchases from the random sample. We used that retail-level sample to estimate the sources of heroin used in the United States.

Our inferences are based on the retail-level sample, rather than an importation-level sample, because the retail-level sample comes closest to representing heroin actually consumed in the United States. Still, raw data tabulations are not very useful, for two reasons. First, some of the retail level samples have too little drug to afford a signature, so the source area is unknown. This creates some problems, because Mexican heroin is easily identified and therefore is rarely classified as unknown. To prevent Mexican heroin from being over-represented in the data, we developed imputation routines for assigning a signature to every sample in the retail level data where an imputation seemed justified. Second, the Domestic Monitor Program oversamples in places where heroin use is relatively rare. (For example, St. Louis has a quarterly sample size of 10 purchases, while Baltimore has the same sample size but many more heroin users and purchases.) We developed a weighting procedure so that the signature program would represent a national estimate.

We have been unable to classify about 10% of the heroin seized and purchased since 1995. These unclassified samples are reported as unknown (UNK) in Table 2, which details estimates for the percentage of heroin from each source area. Because data were not available for 1998 and later, the 1998 and 1999 estimates are projections – that is, they are the averages for 1995 through 1997.

Year	Mexico	S. America	SE Asia	SW Asia	Unknown
1993	26.2	13.1	17.6	9.1	34.1
1994	25.6	27.6	21.4	3.8	21.6
1995	26.4	46.6	11.6	2.6	12.7
1996	26.1	51.2	11.6	4	7.1
1997	22.8	52.5	10	5.6	9.1
1998	25.1	50.1	11	4.1	9.6
1999	25.1	50.1	11	4.1	9.6

Sources: Unpublished analysis of data from the Heroin Signature Program and Domestic Monitor Program

If we are correct about these percentages, and if we are correct that between 1995 and 1998 about 12 to 13 metric tons of heroin was used per year in the United States, then we can derive estimates of the amount of heroin that comes from each area (Table 3). We do not provide earlier estimates, because the unknown signature category is comparatively large before 1995.

Table 3

Estimated Amount of Heroin from Each Source Area (metric tons)

	1995	1996	1997	1998
Mexico	3.0	3.2	3.0	3.1
South America	5.3	6.3	6.9	6.2
Southeast Asia	1.3	1.4	1.3	1.4
Southwest Asia	0.3	0.5	0.7	0.5
Unknown	1.4	0.9	1.2	1.2
Total	11.4	12.4	13.1	12.5

Source: See Table 1 and Table 2.

According to these calculations, U.S. consumers use somewhat more than 6 metric tons of South American heroin and somewhat more than 3 metric tons of Mexican heroin. However, the South American and the Southeast and Southwest Asian estimates might be higher depending on how the unknown signatures are partitioned across the data.

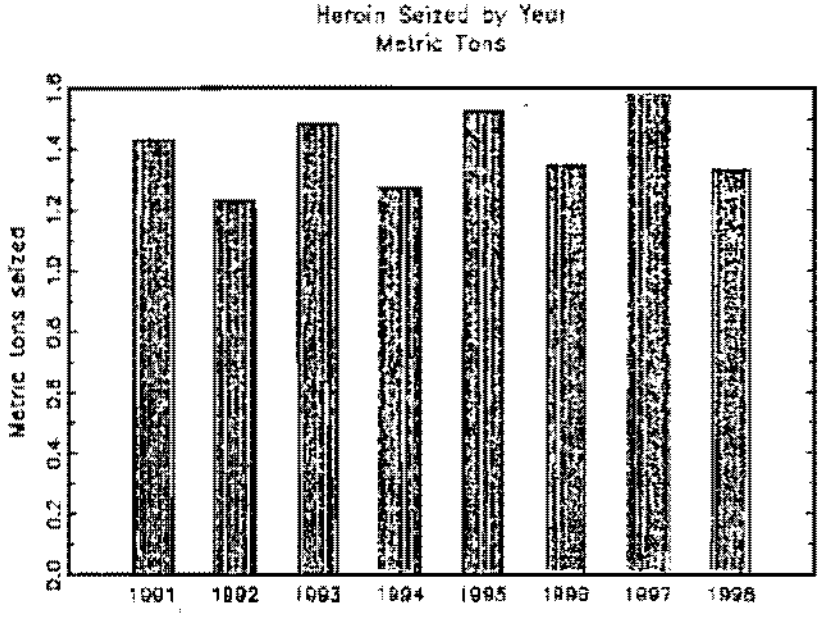
Seizure Levels

Seizures reduce the amount of heroin available for consumption, so the flow model requires estimates of the amount of heroin seized by U.S. and other authorities. We tabulated heroin seizures reported in

the FDSS from 1991 through the first half of 1998. Results appear in Figure 2. To provide greater comparability between 1998 and earlier years, we interpolated seizures for the entire year by doubling seizures from the first half of 1998. The figure reflects that interpolation.

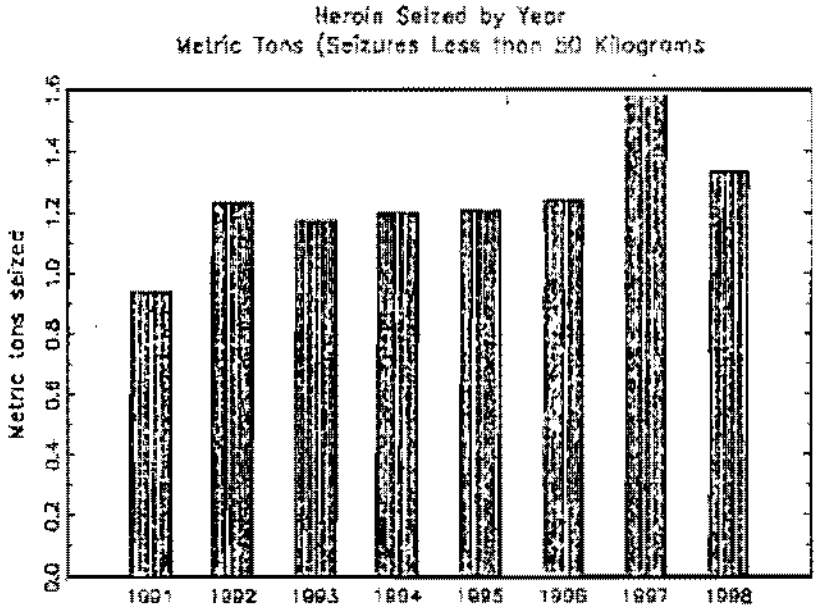
Figure 2

The figure seems to show that seizures have varied between about 1.2 and 1.6 metric tons from 1991 through 1998. There is no apparent trend.



There is a second useful way to look at these data. Between 1991 and 1998, 99.2 percent of all seizures were less than 10 kilograms. Likewise, 99.7 percent of all seizures were less than 20 kilograms and 99.9 percent of all seizures were less than 50 kilograms. If we exclude all seizures larger than 50 kilograms from the tabulation, the trend has a different appearance, shown in Figure 3.

Figure 3



Discarding seizures greater than 50 kilograms leads to the conclusions that seizures have remained fairly constant at about 1.2 metric tons. Apparently, exceptionally large seizures can occasionally lead to spikes in the seizures observed during any year, distorting the trend. When large seizures are included in the estimates, then, an average seizure rate of 1.3 metric tons may be more representative of law enforcement success at preventing heroin from entering the United States.

In fact, when imported into the United States, heroin is typically less than 80 percent pure.[1] According to the HSP data (for seizures at the importation level only), South American heroin has been about 80 percent pure since 1995, while Mexican heroin has been about 44 percent pure. Heroin from Southeast and Southwest Asia has typically been 70 to 75 percent pure. Thus the 1.3 metric tons of bulk heroin probably translates into somewhat more than 1 metric ton per year of pure heroin seized while entering the United States.

Importation Points

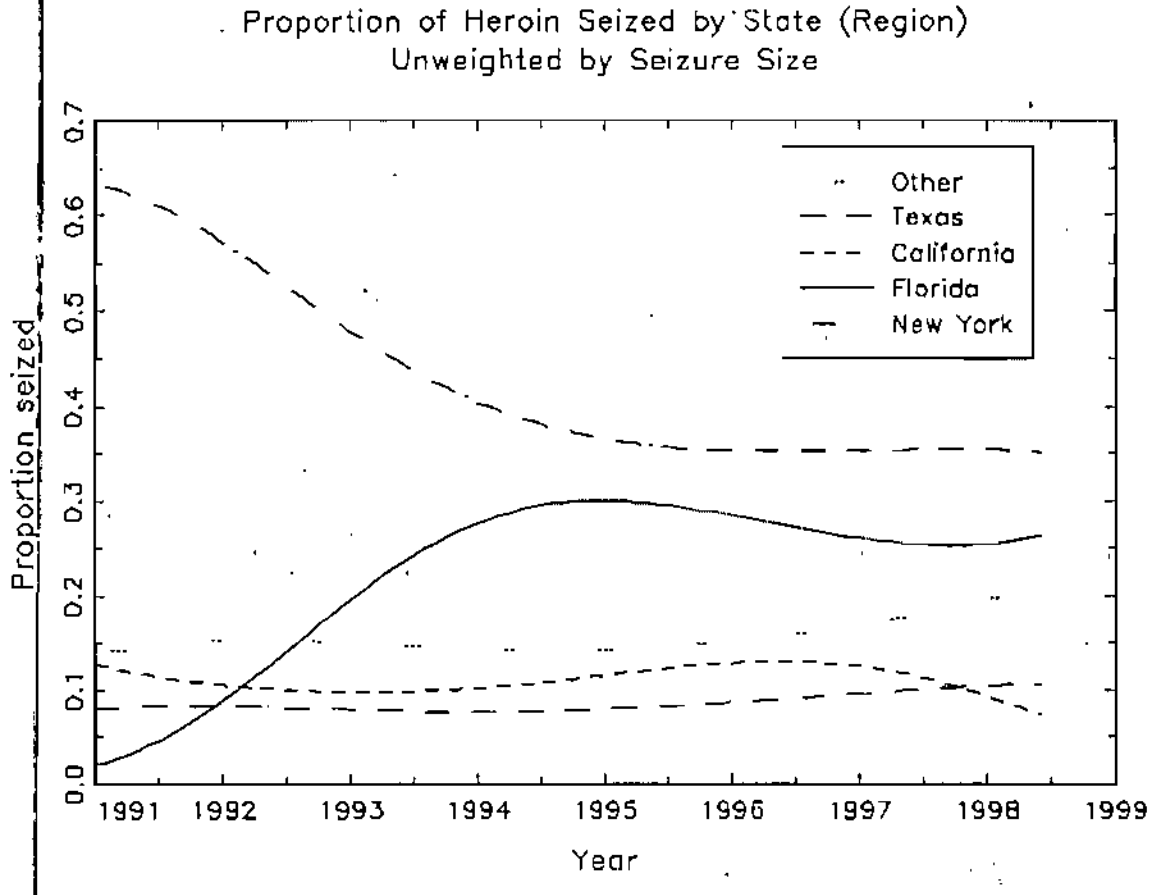
Where do these seizures occur? Most seizures happen in one of four importation areas, defined:

- New York (includes New Jersey)
- Florida (includes Puerto Rico)
- California
- Texas (includes Arizona)

The rest of the seizures occur throughout the United States. Figure 4 shows trends in where seizures have happened.

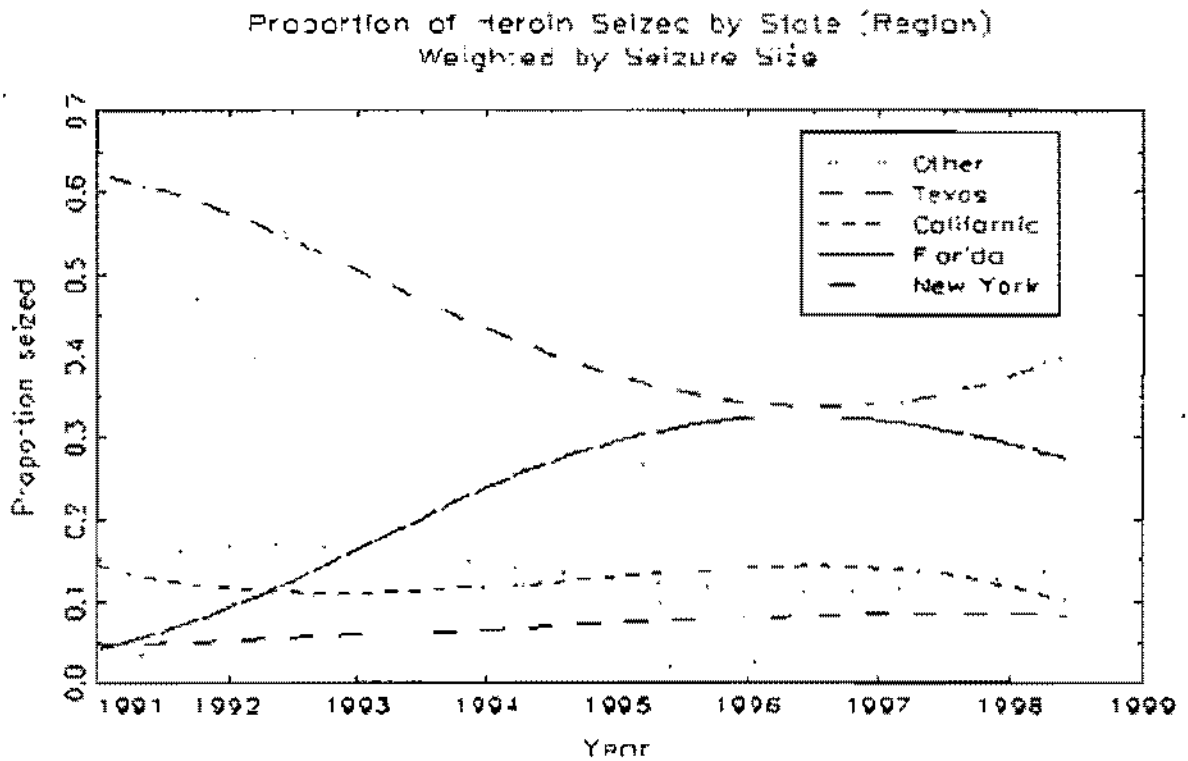
The curves shown in Figure 4 are a smoothed representation of how the location of seizures changed over time. The methodology used to develop these curves is reported in Appendix A. The figure shows that the proportion of seizures made in New York, represented by the highest line in this figure, decreased precipitously from 1991 through 1995 and then stabilized. Most of that reduction was balanced by a dramatic increase and then stabilization of seizures made in Florida.

Figure 4



A second useful way to look at seizures is to weight the seizure by the amount of heroin involved in the shipment. Figure 5 reports results after weighting.

Figure 5



Subsequent to the preparation of figures 4 and 5, the Office of National Drug Control Policy provided updated tabulations of seizure data. These are displayed in table 4.

Table 4 Annual Heroin Seizures by Region of the United States (kilograms)

Year	Number of Seizures	Amount of Seizures	Other	Florida	NY/NJ	Calif.	Texas
1989	697	1,293	207	10	845	188	43
1990	743	669	137	13	434	70	16
1991	869	1,432	193	24	556	627	30
1992	1,093	1,233	274	153	531	93	81
1993	1,140	1,481	375	173	709	167	57
1994	1,043	1,268	270	220	568	149	62
1995	1,153	1,524	264	363	574	168	135
1996	1,249	1,343	225	382	468	163	106
1997	1,480	1,586	241	474	551	231	90
1998	1,228	1,448	297	330	534	150	136
1999*	1,062	1,137	229	215	365	175	153

* Imputed by doubling first six months

Source: FDSS, provided by Michael Cala, ONDCP

Both figures tell similar stories. The only difference is that the second figure suggests that more heroin was being shipped to New York during 1998 than was true in 1996 and 1997. This may be true, or given the contrary findings from the previous figure and the table, it may be that a few especially large shipments have distorted the trend. Also, the smoothing procedure can distort trends at the end of the period. It would be prudent, therefore, to discount the apparent change of trends in New York and Florida observed in 1998.

At any rate, one point is clear: By 1995, seizures had decreased markedly in New York, and they had increased correspondingly in Florida. There was little change in seizures in the rest of the nation. To the extent that seizures reflect where heroin enters the United States, the geographic movement of heroin into the United States has been relatively stable since 1995. Figures 4 and 5 imply that less heroin has been moving through New York and more heroin has been moving through Florida. A contrary conclusion would be that the same amount of heroin has been moving through New York, while more heroin has been going through Florida. Given the findings reported in Figures 2 and 3, however, total seizures have remained about the same, so Florida seizures must have displaced New York seizures.

Movement of Heroin from Source Areas into the United States

Table 5 reports the estimated source of heroin that was seized in the five areas identified in the previous figure. This table is based on seizures made at airports, at the borders, and through the mail. The probability that a shipment is seized likely varies across conveyance mode and geographic location, so a simple tabulation of seizure data would be a biased representation of where heroin enters the United States. To make the tabulations more representative of heroin imports, we weighted the data so that the source area of heroin *seized* was the same percentage as the source area of heroin *used* in the United States.[12] Estimates of the source areas of heroin in the United States have been reported already in Table 3.

Table 5

Estimated Percentage of Heroin Entering the United States by Importation Point for Each Source Area

Source Area	Importation Point				
	California	Florida	New York	Texas	Other
Mexico	62.4	0.0	0.0	69.2	53.2

South America	7.1	85.9	60.3	13.0	7.6
Southeast Asia	5.5	0.3	22.9	7.0	17.3
Southwest Asia	0.0	0.4	8.9	0.0	9.7
Unknown	4.9	13.5	7.9	10.6	12.2
Total	100.0	100.0	100.0	100.0	100.0

Table 5 should be read down its columns. For example, an estimated 82 percent of the heroin that entered the U.S. through California came from Mexico. Almost 86 percent of the heroin that entered through Florida came from South America.

Table 6 reports the estimated percentage of heroin from each source region that entered the United States through each of the five importation areas. This table should be read across its rows.

Table 6

Estimated Percentage of Heroin Entering the United States by Source Area for Each Importation Point

Source Area	Importation Point					
	California	Florida	New York	Texas	Other	Total
Mexico	64.3	0.0	0.0	16.3	19.4	100.0
South America	2.8	52.9	41.3	1.5	1.4	100.0
Southeast Asia	9.9	1.0	71.2	3.8	14.4	100.0
Southwest Asia	0.0	3.1	75.0	0.0	21.9	100.0
Unknown	10.0	43.3	28.3	6.7	11.7	100.0

If weighted seizures are a good reflection of where heroin enters the United States, then 64.3 percent of Mexican heroin enters through California and 16.3 percent enters through Texas. That is, more than 80 percent of Mexican heroin probably comes across the Southwest border, and the rest of Mexican heroin enters the United States through other diverse locations. More than half of South American heroin enters the United States through Florida, and most of the rest comes through New York. Almost three-quarters of Southeast Asian heroin enters through New York and the rest goes through diverse places. Three-quarters of the Southwest Asian heroin also seems to enter through New York City, and the rest goes through various places. The increased role of South America as a supplier of heroin explains why Florida has become an increasingly important heroin importation point.

Table 7 provides another useful way to summarize these data. Multiplying the percentages by source area (table 6) by the amounts per source area (table 3) provides an estimate of metric tons moved through each importation point by source area. To develop this estimate, we average across the five years reported in table 3. Year-by-year seizures are not shown because episodic large seizures can distort trends from one year to the next.

Table 7

Estimated Amount of Heroin (Metric Tons) Entering the United States by Source Area and Importation Point, 1995-1998

Source Area	Importation Point					
	California	Florida	New York	Texas	Other	Total
Mexico	2.0	0.0	0.0	0.5	0.6	3.1
South America	0.2	3.3	2.6	0.1	0.1	6.2
Southeast Asia	0.1	0.0	1.0	0.1	0.2	1.4
Southwest Asia	0.0	0.0	0.4	0.0	0.1	0.5
Unknown	0.1	0.5	0.3	0.1	0.1	1.2
Total	2.4	3.8	4.2	0.7	1.1	12.3

If we are correct that Americans used about 12.3 metric tons of heroin per year between 1995 and 1998, then table 7 gives some idea of how much heroin from each source moves into the country through each region of the United States. Of course, there exists considerable uncertainty in estimates that provide this much detail.

Almost 10 percent of the heroin was classified as unknown – that is, DEA chemists could not assign a source area to that heroin. Note that, excluding the unknown category, virtually all heroin seized in Florida came from South America. It seems reasonable to suppose that most of the 13.5 percent of the heroin seized in Florida and identified as "unknown" also came from South America. This same reasoning cannot be applied to other places where South America is not the dominant supplier, but it does suggest that South America's share of the U.S. market may be greater than is indicated by tables 3 and 7.

CNC Potential Production Estimates

How do our estimates of the amount of heroin from the producer nations compare with CNC's reports of production potential? Since 1995, CNC has estimated the production potential of South America at between 6.1 and 7.5 metric tons. (These estimates are after subtracting eradication losses from total hectares.) Unfortunately, estimates are of uncertain accuracy because the assumed conversion ratios from poppy to opium is based on intelligence fieldwork in Southeast and Southwest Asia. We cannot know for sure whether or not those conversions apply to South America. Nevertheless, we must take these estimates as the best currently available.

According to our consumption estimates, Americans consume somewhat more than 6 metric tons of heroin from South America, and United States authorities seize about 0.75 metric tons. Our consumption/seizure estimates exceed South America's production capacity, but the difference is not great.[13] This suggests that the estimated 12 to 13 metric tons of total domestic heroin consumption is about right if somewhat high.

Since 1995, CNC's estimates of the production potential for Mexico vary over time between 4.3 and 6.0 metric tons. According to our estimates, Americans consume somewhat more than 3 tons of Mexican heroin and another 0.34 metric tons are seized by U.S. or Mexican authorities.[14] The consumption-based estimates are less than the production-based estimates. The Mexican production estimates suggest that the estimated 12 metric tons of domestic heroin consumption is too low.

CNC's production estimates for Mexico are inconsistent with our consumption estimates. There seems to be no ready reconciliation, but speculation may be helpful. CNC emphasizes that its estimates are for *potential production*, and actual production may differ. Perhaps Mexico's production is well below its potential, but it is difficult to reason why potential production would be consistently less than realized production. A better explanation comes from CNC's warning that:

> The wide variation in processing efficiency achieved by traffickers complicates the task of estimating the quantity of cocaine or heroin that could be refined from a crop. These variations occur because of differences in the origin and quality of the raw material used, the technical processing method employed, the size and sophistication of laboratories, the experience of local workers and chemists, and decisions made in response to enforcement pressures. (INCSR, 1999)

CNC's assumptions may overstate Mexico's production efficiency. This is speculation, of course, but we observe that heroin imports are about 44 percent pure when from Mexico, 80 percent pure when from Colombia, and 70 to 75 percent pure when from Southeast and Southwest Asia. Because CNC makes the same assumptions about production efficiency for Mexico as it does for the rest of the world, the potential production may overstate Mexico's actual production.

Suppose that Mexican production were 0.59 as efficient as is assumed by CNC. (The 0.59 comes from dividing 0.44 purity by 0.75 purity.) Then an estimate of Mexico's actual production would be

between 2.5 and 3.5 metric tons, numbers that agree with the consumption estimates. Using this same argument, we might assert that Colombian production is 1.07 times more efficient than is assumed by CNC. This would lead to a higher estimate of Colombia's production, which would be more consistent with the consumption estimates. This reasoning is speculative, but not unreasonable in the face of having no reliable data about the actual production efficiency in Mexico and Colombia.

Non-U.S. Consumption

How much heroin is consumed within Mexico and within South America? What other reductions occur in the production and distribution systems? Unfortunately the answers to these questions are all but unknown.

Perhaps the most useful published information about consumption comes from reports of the Community Epidemiological Working Group (CEWG). The CEWG is focused on the United States, of course, but most of its reports include sections on consumption in other nations. These reports are seldom quantitative, because nations outside the United States rarely have data collection systems affording estimates of domestic consumption. Based on CEWG assessments, we assume that the consumption of heroin within South and Central America is negligible. Most heroin produced in South and Central America is probably destined for North American markets.

Canada is a bigger problem. According to CEWG reports, heroin is seen as a major drug problem, at least in Vancouver and Toronto. But we do not know the amount of heroin used in Canada; nor do we know the source.[15] It seems reasonable to assume that some South American and Mexican heroin is shipped to Canada, but we do not yet have an estimate of the amount.

Conclusions

Table 8 summarize the calculations made in this report. The table reports estimates for 1995 through 1998. CNC potential production estimates are not available for earlier years; anyway, estimates of Colombia's contribution to consumption are uncertain for the period before 1995. Because of year to year measurement error, we have provided a column that averages over the four years.

On a yearly basis, over this period, Americans consumed about 12.3 metric tons of heroin. About 50 percent (6.2 metric tons) came from Colombia and about 25 percent (3.1 metric tons) came from Mexico. Seizures account for about 0.75 metric tons from Colombia, so Colombia would need to produce about 6.9 metric tons to satisfy the U.S. market. Only about 0.3 metric tons are seized from Mexico. So Mexico would need to produce about 3.4 metric tons to meet U.S. demand.

According to CNC, Colombia has the potential to produce about 6.4 metric tons, which comes close to satisfying the estimated demand. In fact, with an efficiency adjustment, the four-year consumption estimate is almost identical to the four-year adjusted production estimate. Also, according to CNC, Mexico has a production capacity of 5.3 metric tons. This estimate is considerably higher than the consumption estimate of 3.4 metric tons required to satisfy the U.S. demand. Application of the efficiency adjustments to Mexico brings consumption (3.4 metric tons) into agreement with production potential (3.1 metric tons), but that adjustment is speculative.

Our best estimate is that roughly 12 to 13 metric tons of heroin are used in the United States during a given year, and that the level of use has not changed appreciably during the last several years. (The

number of heroin users may have changed, because relatively inexpensive and high purity heroin may have attracted occasional users, but occasional users account for a low proportion of heroin use.) The level of use could be different, of course, but if it were much higher or much lower than 12 metric tons then we could not account for production potential in South America and Mexico, all of which is presumably exported to the United States.

We have to be concerned that CNC deems its production estimates to be uncertain. One reason to question the estimates is that the production process (the rate at which poppy is converted into heroin) has never been studied (or at least documented) for South America and Mexico, and instead, the South American and Mexican production processes are assumed to be the same as those outside the Americas. Of course there is room to be critical of the consumption-based estimates as well. We cannot be sure of the number of hardcore and occasional users, of the amount of money they spend on drugs, of the prices they pay and consequently of the amount they use. Any one of the component parts of the estimates could be wrong; perhaps all of them are wrong. The fact that the consumption-based estimates are so close to the supply-based estimates is compelling but not convincing evidence that this heroin flow model provides an accurate profile of how much heroin enters the United States, how it gets here, and where it comes from.

Table 8 Summary of Calculations

	1995	1996	1997	1998	Four Year Average
Metric tons consumed:	11.4	12.4	13.1	12.5	12.3
Percentage from Colombia[1]	46.6	51.2	52.5	50.1	50.1
Percentage from Mexico[2]	26.4	26.1	22.8	25.1	25.1
Metric tons from Colombia[2]	5.3	6.3	6.9	6.2	6.2
Metric tons from Mexico[3]	3.0	3.2	3.0	3.1	3.1
Seizures:					
Metric tons from Colombia[4]	0.75	0.75	0.75	0.75	0.75
Metric tons from Mexico[4]	0.24	0.25	0.48	0.32	0.32
Total consumption and seizures:					
Metric tons from Colombia	6.1	7.1	7.7	7.0	6.9
Metric tons from Mexico	3.2	3.5	3.5	3.4	3.4
CNC Potential Production Estimates:					
Metric tons from Colombia[5]	6.5	6.3	6.6	6.1	6.4
Metric tons from Mexico[5]	4.8	5.4	5.3	5.3	5.3
Efficiency Adjusted Productions Estimates[6]					
Metric tons from Colombia	7.0	6.7	7.1	6.5	6.8
Metric tons from Mexico	2.7	3.2	3.1	3.5	3.1

Source:

1. Table 1
2. Table 2
3. Table 3
4. See discussion on seizures.
5. International Control Strategy Report, March 1999
6. See discussion on efficiency adjustments.

Endnotes

1. Layne, M., R. Johnson, and W. Rhodes, "Estimating Cocaine Availability," Abt Associates Inc., Cambridge, MA, December 1999.

2. Between 1994 and 1998, CNC reports that worldwide heroin production has ranged between 300 and 350 metric tons. Consumption in the United States in probably close to 12 metric tons, suggesting that U.S. consumption is less than 5 percent of heroin produced worldwide. See Rhodes, W., M. Layne, P. Johnston and L. Hozik, "What America's Users Spend on Illegal Drugs, 1988-1998." Report submitted to the Office of National Drug Control Policy by Abt Associates Inc., November 23, 1999.

3. Rhodes, W., M. Layne, P. Johnston, and L. Hozik. "What America's Users Spend on Illegal Drugs: 1988-1998." Report submitted to ONDCP by Abt Associates Inc., November 23, 1999.

4. Neither the Domestic Monitor Program nor the Heroin Signature Program provides probability samples. Using those data sources as the basis for partitioning consumption by source area requires mathematical modeling and statistical analysis. That approach is described in detail in a report for the Drug Enforcement Administration: Rhodes, W., L. Truitt, R. Kling, and A. Nelson. "The Domestic Monitor Program and the Heroin Signature Program: Recommendations for Changes," Abt Associates Inc., Cambridge MA, June 30, 1998. Calculations reported in this report, which were updated from that earlier report, are available by request from the authors.

5. Use of the FDSS data does not imply that seizures accurately reflect the source area of heroin entering the United States. For example, Mexican heroin seems to have a lower seizure rate compared with heroin from the rest of the world. See W. Rhodes, et al., "The Domestic Monitor Program and the Heroin Signature Program: Recommendations for Changes," Abt Associates Inc., Cambridge, MA, June 30, 1998.

6. Much of the data used to estimate the number of hardcore users comes from the Drug Use Forecasting System, a quarterly survey of arrestees conducted by the National Institute of Justice in twenty-four cities. The DUF interview does not ask about "weekly" heroin use, but it does ask about the number of days that a respondent used heroin during the month before the interview. Assumptions are that an answer of "more than 10 days " means at least weekly.

7. Rhodes, W., M. Layne, P. Johnston, and L. Hozik, "What America's Users Spend on Illegal Drugs: 1988-1998." Report submitted to ONDCP by Abt Associates Inc., November 23, 1999.

8. Johnston, P., W. Rhodes, K. Carrigan, and E. Moe, "The Price of Illicit Drugs: 1981 through the Second Quarter of 1998." Report submitted to ONDCP by Abt Associates Inc., February 1999.

9. Estimates pertaining to the late 1980s and early 1990s may be too low.. The problem is that heroin retail markets appear to be bifurcated with low purity heroin (suitable for injection) available at relatively high unit price and high purity heroin (suitable for injection or snorting) available at comparatively low unit price. The "retail" price is a mixture of these two prices. A special addendum to the DUF data tells much about heroin purchase patterns in the middle and late 1990s, but there are no comparable sources for earlier years. Consequently estimating heroin prices is more uncertain for earlier years. Alternative ways of computing heroin prices lead to lower prices during that early part of the study period. If we had adopted those lower prices, then the amount of heroin consumed would have been correspondingly higher during those years. See W. Rhodes, S. Langenbahn, R. Kling and P. Scheiman, "What America's Users Spend on Illegal Drugs, 1988-1995," Office of National Drug Control Policy, Fall 1997.

10. The Domestic Monitor Program and the Heroin Signature Program are sometimes criticized because they lack a probability sampling basis. A second criticism, frequently made, is that the Domestic Monitor purchases are made mostly (but not exclusively) in open-air settings, so DMP purchases may not represent all purchases made in the city. In a review for the Drug Enforcement Administration, Abt Associates demonstrated how the data could be weighted and analyzed to reflect purchases made across the country. The fact that purchases come mostly from outdoor settings remains problematic, although agents interviewed by the Abt researchers felt that heroin sold in indoor and outdoor settings did not differ. Details are provided in W. Rhodes, L. Truitt, R. Kling and A. Nelson, "The Domestic Monitor Program and the Heroin Signature Program: Recommendations for Changes." Report submitted to the Drug Enforcement Administration by Abt Associates Inc., June 30, 1998.

11. Coomber argues that this dilution of imported heroin results from the heroin production process. Thus purity probably varies from source area to source area. South American heroin appears to be the most pure; Mexican is the least pure. Coomber, R., "The Cutting of Heroin," *Journal of Drug Issues, 29 (1), 1999: 17-35.*

12. Calculations began with all the seizure reports contained in the Heroin Signature Program data file. These reports are not comprehensive of all seizures at ports of entry, but we have no reason to believe this is a biased sample of seizures. From this file we selected all reports where: (1) the seizure occurred at an airport, at the border, or through the mail; (2) the seizure happened in 1995 or later; and (3) the seizure involved less than ten kilograms. Each report was characterized by the amount of pure heroin seized, and then the sample was weighted so that the distribution by source country for the seizure data matched the distribution by source country for the consumption data. For example, if 10 percent of the seizures came from South America while 15 percent of consumption came from South America, we weighted the seizures from South America by 15/10 or 1.5. By source area, the weights were:

0.73 for unknown

2.67 for Mexico

0.87 for Southeast Asia

1.32 for Southwest Asia

1.67 for South America

As a practical matter, then, this weighting gives much greater emphasis to Mexican heroin and somewhat more emphasis to South American heroin.

13. Between 1995 and 1998, CNC estimated Colombia's maximum production potential at 6.6 metric tons. It did not grow to 7.5 metric tons until 1999. Colombian authorities never seized more than 0.15 metric tons during this period.

14. According to the 1999 INCSR, Mexican authorities have seized between 0.14 and 0.38 metric tons of heroin (or opium equivalent) every year since 1995. Given what U.S. authorities seize, Mexican traffickers would seem to lose about 0.34 metric tons per year.

15. The Canadian Center on Substance Abuse reports that 5.9 percent of Canadians tried heroin at some time; 1.1 percent of the population used heroin during 1994. Canadian Center on Substance Abuse, *Canadian Profile 1999 Illicit Drugs*, downloaded from the Internet www.ccsa.ca/cp99.11.htm, November 11, 1999.

Abt Associates Inc.

Cambridge, MA
Lexington, MA
Hadley, MA
Bethesda, MD
Washington, DC
Chicago, IL
Cairo, Egypt
Johannesburg, South Africa

What America's Users Spend on Illegal Drugs, 1988-1998

Final Report

June 2, 2000

Prepared for
Office of National
Drug Control Policy

Prepared by
William Rhodes
Mary Layne
Patrick Johnston
Lynne Hozik

Table of Contents

Executive Summary

Since 1991, the Office of National Drug Control Policy has published a biennial report on expenditures by Americans on illegal drugs and on legal drugs used illegally. This version of that biennial report provides estimates of cocaine, heroin and marijuana consumption from 1988 through 1998 and projects estimates for 1999 through 2000. For the first time, it provides comparable estimates for methamphetamine. This version improves and updates estimates of the supply of cocaine to the United States, and for the first time, provides estimates of the supply of heroin to American consumers. Finally, this version reports improved and updated estimates of trends in the domestic price of cocaine, heroin, methamphetamine and marijuana.

We used two approaches to make these estimates. First, from a consumption-based approach, we investigated the dollar expenditures by Americans on illicit drugs. We estimated that:

- In 1998, Americans spent $65 billion on these drugs (Table A):[1]
  - $39 billion on cocaine
  - $12 billion on heroin
  - $1.5 billion on methamphetamine
  - $11 billion on marijuana
  - $2.3 billion on other illegal drugs
- Between 1988 and 1998, expenditures on cocaine appear to have fallen. This trend results partly from a decrease in the number of users, but mostly from a decrease in cocaine's street price.
- Heroin expenditures fell from 1988 to the middle of the 1990s. Heroin expenditures appear to have increased since then.
- Trends in methamphetamine purchases are imprecise because of significant measurement problems. While expenditures may have fallen due to changes in the consumer price index, consumption levels have remained about the same over the last decade.
- Between 1989 and 1998, expenditure on marijuana increased slightly (as marijuana prices increased) then decreased slightly (as marijuana prices fell).
- Between 1989 and 1998, expenditures on other illicit drugs, and on legal drugs used illicitly, remained fairly constant.

A second approach to estimating the retail sales value of illicit drugs consumed in the United States is to estimate the amounts supplied to the domestic market. To approximate cocaine's availability for

consumption in the U.S., we developed three types of estimates: Cultivation Estimates, Event-Based Estimates, and the Border Allocation Model Estimates. See Table B.

- The cultivation estimates are high relative to our consumption estimates. Also, they decrease from 588 metric tons (1996) to 406 metric tons (1998), and that trend is not reflected in other measures of cocaine use.

- After 1996, the event-based estimates are smaller than the consumption estimates: 204 metric tons in 1997 and 267 metric tons in 1998. Moreover, their variability is not reflected in other data about cocaine use.

- The third method – the Border Allocation Model – begins with consumption estimates, so it yields the same estimates as the consumption approach.

- Roughly 12 to 13 metric tons of pure heroin entered the United States between 1995 and 1998. Because heroin is roughly 80 percent pure when imported into the U.S., the 12 to 13 pure tons represents 15 to 16 bulk tons.

- It was not practical to develop supply-based estimates for methamphetamine and marijuana.

Consumption-based and supply-based estimates do not always agree about the amount of cocaine shipped into the United States. According to consumption-based estimates, Americans used 291 metric tons in 1998; according to the cultivation estimates, 406 metric tons could have entered the States in 1998. We expected cultivation estimates to be higher than consumption estimates, however. The cultivation estimates do not fully account for consumption outside the U.S., for unknown quantities seized by State and local authorities, and for unknown amounts otherwise lost through the production and transshipment process. Therefore the cultivation estimates must exceed the amount actually available for consumption.

In contrast, after 1996, the event-based estimates are lower than the consumption estimates. This relationship was expected, because the events understate the flow of cocaine into the United States. Thus, the event-based estimates should provide a lower limit on U.S. consumption.

Consumption-based estimates do not fully agree with supply-based estimates for heroin, but the differences are not great. Colombia seems to produce somewhat less heroin, and Mexico seems to produce somewhat more heroin, than can be accounted for by the consumption-based estimates. This difference might be explained by incorrect information about processing efficiencies in Colombia and Mexico, because estimates of processing efficiencies are based on Southwest and Southeast Asia studies.

Although these estimates are imprecise, they are sufficiently reliable to conclude that the trade in illicit substances was somewhat less than $70 billion per year during the latter part of the 1990s, according to consumption-based estimates (Table A).[2] The costs to society from drug consumption, however, exceed the amounts spent on drug abuse. Drug use fosters crime; facilitates the spread of catastrophic health problems, such as hepatitis, endocarditis, and AIDS; and disrupts personal, familial, and legitimate economic relationships. The public bears much of the burden of these indirect costs because it finances the criminal justice response to drug-related crime, a public drug-treatment system, and anti-drug prevention programs.

Table A
Total U.S. Expenditures on Illicit Drugs, 1988-2000 ($ in billions, 1998 dollar equivalents)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Cocaine	$76.9	$70.8	$61.3	$55.0	$49.4	$45.9	$42.2	$43.0	$41.3	$41.8	$39.0	$37.1	$36.1
Heroin	$21.8	$20.9	$17.6	$13.8	$10.9	$10.2	$10.5	$11.2	$11.7	$12.2	$11.6	$12.0	$11.9
Methamp	$2.4	$2.4	$2.4	$2.0	$1.6	$1.7	$2.1	$2.5	$2.1	$1.8	$1.5	$1.7	$1.6
Marijuana	$11.3	$11.1	$13.5	$12.8	$12.5	$11.2	$11.4	$9.3	$9.0	$10.1	$10.7	$10.2	$10.4
Other Drugs	$3.3	$2.8	$2.2	$2.3	$1.5	$1.5	$2.6	$2.7	$2.7	$2.5	$2.3	$2.3	$2.3
Total	$115.	$108.	$97.0	$85.9	$75.9	$70.5	$68.6	$66.8	$66.8	$68.4	$65.0	$63.2	$62.4

Columns may not add due to rounding. Estimates for 1999 and 2000 are projections.

Sources: See Tables 1 through 8.

Table B
Supply-Based Estimates of Cocaine and Heroin Available for Consumption in the U.S. (pure metric tons)

Cocaine	1995	1996	1997	1998
Cultivation Estimates		588	475	406
Event-Based Estimates		349	204	267
Border Allocation Model		288	312	291
Heroin	11.4	12.4	13.1	12.5

Source: Table 14

What America's Users Spend on Illegal Drugs

In 1997, the Office of National Drug Control Policy (ONDCP), working with Abt Associates Inc., reported that Americans spent an estimated $57 billion to $91 billion per year between 1988 and 1995 for illicit drugs and for licit drugs used illegally. New data and a revised methodology have enabled us to improve those estimates, extend them through 1998, and project them into the year 2000.

To estimate the retail sales value of illicit drugs consumed in the United States, we examined both the demand for and the supply of drugs. The demand, or *consumption approach*, estimates the number of drug users, how much they spend on drugs, and the amount of drugs they consume. The *supply* approach estimates the volume of drugs available for consumption. To determine the amount of drugs available in this country and the retail value of these drugs, we estimated the amount of base crop raised in producer countries, and reduced it by the amounts lost, seized, or consumed in other countries and by the amount seized in the United States. We then multiplied the result by retail prices.

For a number of reasons, neither of these approaches yields precise estimates of the yearly retail value of the illegal drug trade. First, the secretive nature of drug crop production and manufacturing prevents accurate assessments of drug production. Second, with some exceptions, drug dealers and their customers transact business away from public view. Finally, drug users often misrepresent their drug use when interviewed. For these reasons, estimates of retail expenditures are based on the best available data, although those data are seldom as complete or accurate as we desire. Also, the data lack a probability-sampling basis, so we cannot provide probabilistic confidence intervals.

Because of these complexities in drug use monitoring, we encourage an evaluation of our findings in three ways. First, the reader can compare our estimates with those reported elsewhere. Second, the reader should consider whether or not the two independent approaches used in this report (supply-based and consumption-based) reach similar conclusions about the amount American drug users spend on drugs. Finally, our calculations can be replicated using alternative assumptions the reader finds more plausible than the ones we used. The report is divided into two sections. Section I reports estimates derived using the consumption approach. Section II reports estimates for cocaine and heroin derived from the supply approach, and it reconciles the differences between the two approaches. Technical material appears in appendices.

1 Consumption Approach

Cocaine and Heroin

Between 1989 and 1998, American users spent $39 billion to $77 billion yearly on cocaine and $10 billion to $22 billion yearly on heroin. To arrive at these estimates, we multiplied the number of users by their typical expenditures, and then converted the resulting estimates to 1998-dollar equivalents. Most of the downward trend results from changes in the consumer price index.

The Number of Cocaine and Heroin Users

The National Household Survey on Drug Abuse (NHSDA), the Nation's most comprehensive survey of drug use, measures drug use among the American household population age 12 and older, as well as among people living in group quarters and the homeless.[3] The NHSDA misses a part of the population that may he a key to determining the extent of drug use: those hardcore drug users who, although not homeless, are too unstable to be eonsidered as part of a household, or who, if part of the household, are unlikely to answer surveys.[4]

This less-stable population of hardcore drug users is, however, well-represented in data colleeted by the Drug Use Forecasting (DUF) program, which questions a random sample of arrestees in 24 eentral city jails and loekups about their drug use.[5] DUF also asks arrestees to voluntarily produce samples for urinalysis. This helps to confirm whether the interviewees have used any of up to 10 types of drugs during the two to three days before the interview. Although urinalysis is subject to error and tells us nothing about the frequeney of drug use, it adds eredence to estimates of drug use when self-reports are unreliable.

The *hardcore user* is identified in the NHSDA as one who used cocaine at least one or two days a week every week during the year before the survey, or one who used heroin on more than 10 days during the month before the survey. In this analysis, hardcore users in the DUF data are defined as those who admitted using cocaine or heroin on more than 10 days during the month before being arrested.[6] *Occasional users* are identified in the NHSDA as those whose drug use was less frequent than the hardcore drug use eriteria described above. Occasional use cannot be estimated from DUF.[7]

Appendix A explains how we used data from the NHSDA and DUF, as well as other sources, to estimate the number of drug users in the United States. The rest of this section provides an overview and reports findings.

According to one estimate, hardcore drug users seem to account for about three-quarters[8] of all cocaine used in the United States, so understanding hardcore consumption patterns is crucial to estimating expenditures on cocaine. The concentration of heroin consumption is probably similar. The calculations start by estimating the number of hardcore users who are arrested during the year. This number is then divided by the average number of arrests that hardcore users generate during the year. For example, if hardcore users account for 2 million arrests per year, and if hardcore users are arrested an average of 0.5 times per year, then there must be 2 million divided by 0.5, or 4 million, hardcore users in the nation. We then subtract estimates of hardcore users in jails and prisons, because they are unlikely to use heroin or cocaine heavily while incarcerated. The trick, of course, is to obtain reasonable estimates of both the number of hardcore users who are arrested during each year and the average number of arrests that they generate during the year (see Appendix A).

Once estimates of the number of hardcore users are available, the next step is to estimate how much they spend on cocaine and heroin. The best way to learn this information is to ask the users, and studies sponsored by ONDCP, the National Institute on Drug Abuse, and the National Institute of Justice provide data (see Appendix B). An estimate of the retail sales value of illicit drugs consumed by heavy users follows from multiplying estimates of typical expenditures by estimates of the number of hardcore users.

Estimates of expenditures by hardcore users are then converted to units measured in kilograms of heroin and cocaine, so that amount consumed can be compared with the amount of drugs trafficked into the country. This requires an estimate of the prevailing retail prices for illicit substances. Here, too, ONDCP and other agencies have sponsored research leading to estimates of what substance abusers pay for drugs on the streets (see Appendix C). Dividing the estimate of retail sales value by the prevailing price paid by users gives an estimate of the total amount of drugs purchased, and this amount can be converted readily into metric ton units.[9]

This explains the derivation of estimates of drugs used by hardcore users, but while hardcore users probably account for at least three-quarters of the cocaine and heroin used in this country, they do not account for all illicit drug consumption. One view is that the National Household Survey on Drug Abuse understates the number of hardcore drug users and the amount that they spend, but that the NHSDA provides a reasonably accurate estimate of the amount of more casual drug use. Thus, this report complements expenditures by hardcore users on cocaine and heroin based on DUF data with expenditures on these substances by more casual users based on the NHSDA.

This report provides preliminary estimates of methamphetamine use, based mostly on DUF data, and using estimation procedures similar to those used to estimate cocaine and heroin use. Finally, estimates for marijuana use and for other illicit drugs (excluding cocaine, heroin, marijuana, and methamphetamine) come from the NHSDA, with some adjustments for under reporting.

Table 1 provides estimates of the number of hardcore and occasional cocaine and heroin users derived from the NHSDA and the DUF data. (Users of other drugs will be discussed later.) Because the NHSDA was not administered in 1989, the 1989 NHSDA estimates used in this report are the average of 1988 and 1990 data; also, SAMHSA changed the survey in 1994, and statistics from earlier years were adjusted by SAMHSA to take these changes into account. Estimates for 1998 through 2000 are projections based on trends observed in earlier years.[10]

Excluding persons in custody, between 1988 and 1998, about 3.2 million to 3.9 million Americans were hardcore users of cocaine and approximately 2.9 million to 6.0 million were occasional users. Another 630,000 to 980,000 Americans were hardcore users of heroin, and 140,000 to 600,000 were occasional users. Considering the overlap between hardcore cocaine users and hardcore heroin users, the estimates suggest that there were about 3.3 million hardcore users of heroin or cocaine in 1998.[11] Although imprecise, these estimates are consistent with reported estimates derived by others using different methodologies and data.

For example, Rhodes, Langenbahn, Kling and Scheiman[12] provided one national estimate of 508,000 hardcore heroin users, and a second national estimate of 582,000 hardcore heroin users. The authors explain why both estimates probably understate the true number. We are aware of only one other national estimate of heroin addicts, by Hamill and Cooley,[13] who concluded there were 640,000 to 1.1 million heroin addicts in 1987. These estimates are roughly consistent with our 1988 estimate of 920,000 hardcore heroin users.

Simeone, Rhodes and Hunt[14] estimated that there were about 300,000 hardcore cocaine/heroin users in Cook County in 1995. Assuming a constant proportionality between the number of hardcore users in a population and the number of emergency room admissions attributed to them, an extension of the Simeone, Rhodes and Hunt estimates suggest there are about 4.0 to 4.5 million hardcore users in the nation. Although such an assumption of proportionality rests on shaky grounds, it nevertheless leads to estimates of a magnitude remarkably close to the 3.3 million estimate used in retail sales calculations.

The Substance Abuse Mental Health Services Administration estimated that about 3.6 million Americans have a severe need for substance abuse treatment exclusive of treatment for alcohol abuse.[15] SAMHSA

derived this estimate by identifying someone as needing treatment if he met one of four criteria and then inflating the estimates to account for undercounting in the NHSDA.[16] Because the inflation factor is only 20 to 30 percent, it seems likely that SAMHSA's estimates of the number of cocaine and heroin users who need treatment would be smaller than the estimates given here for weekly heroin and cocaine users. SAMHSA does not report the need for treatment by type of drug, but we applied the SAMHSA algorithm to the NHSDA data as best we could and inflated the resulting estimate by 25 percent.[17] The result was that 920 thousand cocaine users needed treatment, as did 130 thousand heroin users and 59 thousand people who used both heroin and cocaine. Thus, SAMHSA estimated that almost 1.2 million people need treatment for cocaine abuse, and almost 190,000 need treatment for heroin addiction.

Not all weekly users of cocaine need treatment, so an estimate of 3.4 million weekly users (1996) may conceivably be consistent with SAMHSA's estimate of 1.2 million who need treatment. Similarly, weekly heroin use may not indicate a need for treatment, so an estimate of 190 thousand heroin addicts could conceivably be consistent with our estimate of 900 thousand weekly heroin users. Although conceivable, these differences are so large that they tax credulity. There are three problems. The first is that, from the view of our calculations, a 20 to 30 percent inflation factor is insufficient to approximate the number of hardcore users *not* represented by the NHSDA. A second problem is that the SAMHSA estimates suggest that at a maximum, about 25 percent of all people who need treatment for substance abuse are current users of heroin or cocaine. In fact, all 17 CEWG (Community Epidemiological Work Group) sites[18] report more than 25 percent of their treatment admissions are for cocaine or heroin, and 11 of 17 report that more than half their admissions are for cocaine or heroin. Although not all people who need treatment actually receive treatment, we would expect a closer correspondence between those who need treatment for cocaine and heroin, and those who receive treatment for those substances. Third, according to the Treatment Episode Data Sets (TEDS), roughly 200,000 heroin users and another 250,000 cocaine users received treatment per year between 1993 and 1997.[19] SAMHSA's estimates are inconsistent with TEDS. Thus, even after attempts to inflate estimates based on the NHSDA, the estimates seem to understate the number of hardcore heroin and cocaine users, and consequently, the SAMHSA estimates cannot be reconciled with our estimates.

Table 1
Estimated Number of Hardcore and Occasional Users of Cocaine and Heroin (Thousands), 1988-2000

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
NHSDA [1]													
Cocaine Hardcore	1,100	980	850	806	829	615	734	582	608	682	595	490	445
Cocaine Occasional	6,000	5,300	4,600	4,478	3,503	3,332	2,930	3,082	3,425	3,487	3,216	2,411	2,155
Heroin Occasional	170	150	140	359	304	230	281	428	455	597	253	484	514
DUF [2]													
Cocaine Hardcore	3,323	3,025	2,761	2,767	2,844	3,042	3,000	3,264	3,106	3,162	3,045	3,103	3,103
Heroin Hardcore	923	886	797	681	630	694	795	855	917	935	980	977	977
Composite													
Cocaine Occasional	6,000	5,300	4,600	4,478	3,503	3,332	2,930	3,082	3,425	3,487	3,216	2,411	2,155
Heroin Occasional	170	150	140	395	304	230	281	428	455	597	253	484	514
Cocaine Hardcore [2]	3,873	3,515	3,186	3,170	3,259	3,350	3,367	3,555	3,410	3,503	3,343	3,348	3,325
Heroin Hardcore	923	886	797	681	630	694	795	855	917	935	980	977	977

Columns may not add due to rounding
Sources: NHSDA 1988, 1990 through 1998; DUF 1988 through 1998; Uniform Crime Reports (UCR) 1988 through 1997.

[1] The NHSDA was not administered in 1989. Estimates are the averages for 1988 and 1990.

[2] Due to sample overlap, the estimated number of composite hardcore cocaine users is derived from the sum of DUF hardcore and one half of NHSDA hardcore cocaine users.

Trends in Drug Use

If the prevalence estimates have some justification, what can be said about trends? Because the estimates presented in Table 1 are based on a consistent methodology from 1988 through 1997, they can be compared meaningfully from year to year. We do not know the standard errors for these estimates, however, so we lack a probability basis for judging whether or not changes are statistically significant. Our estimates seem to show a decrease in the number of hardcore cocaine users from 1988 to 1991. Thereafter, the estimated number of hardcore cocaine users fluctuates from year to year but follows no strong trend. Estimates of

occasional use from the NHSDA show a consistent downward trend. Table 1 shows a decrease and then an increase in hardcore heroin use. This recent increase in hardcore heroin use has a counterpart in the NHSDA, which also reports a recent increase in heroin use among household members.

Because trends in drug use are often disputed, it may be helpful to discuss whether or not other evidence is consistent with our findings. Hardcore drug users are frequently in trouble with the law, so a temporal change in incarceration practices will necessarily have a large effect on them. Based on estimates explained in Appendix A, the increase in prison populations between 1988 and 1998 would have incapacitated an additional 200,000 hardcore cocaine users and an additional 72,000 hardcore heroin users. These are sizable yet conservative numbers, because they do not take into account inmates and detainees under the supervision of local correctional authorities.

The AIDS epidemic provides another reason for expecting a decrease in heavy drug use, especially by heroin users, but also for others who inject drugs. According to the Centers for Disease Control[20] 217,000 injection drug users had been diagnosed with AIDS as of 1998, and 87,000 had died of the disease. Having AIDS does not preclude substance abuse, of course, but advanced AIDS must make it all but impossible to support heavy use of heroin. Adding together hardcore heroin users who are incarcerated and hardcore heroin users who have died implies about 150,000 fewer hardcore heroin users at the end of the decade than at the beginning of the decade. The figure may be closer to 200,000 when we consider heroin users with advanced AIDS.

If no other factors affected hardcore drug use, we would expect a decline in hardcore cocaine users and, especially, hardcore heroin users, from 1988 to 1998. Offsetting these trends toward less use, however, is an apparent recent increase in heroin use by people who do not inject. This might result from the increased availability of higher purity heroin. Recent tabulations based on the National Household Survey on Drug Abuse and the Monitoring the Future Survey have suggested renewed drug use by youths.[21] Nevertheless, this increase is a relatively recent phenomenon, and it followed a decrease in earlier years. It is difficult to believe that these youth could have progressed to heavy use as of 1998, and certainly they could not account for much of the increase in treatment episodes for heroin – where fewer than 5 percent of patients are under twenty years old.[22]

Finally, according to the Substance Abuse and Mental Health Services Administration, emergency room mentions for cocaine use have increased from about 80,000 in 1990 to about 161,000 in 1997. Emergency room mentions for heroin grew from about 34,000 in 1990 to 72,000 in 1997. A naïve observer might infer that cocaine and heroin use doubled between 1990 and 1997, but this is almost certainly wrong.

Little is known about the dynamics of emergency room use by hardcore cocaine and heroin users, but some speculation might be helpful. According to the 1997 DAWN (Drug Awareness Warning Network) report, dependence is the dominant drug use motive for heroin and cocaine users seeking emergency room assistance – 86 percent for heroin mentions and 68 percent for cocaine mentions. Either chronic effects, withdrawal or seeking detoxification are the typical reasons for going to the emergency room – 62 percent for heroin mentions and 50 percent for cocaine mentions.[23] Addicts are more likely to seek treatment as they age, and treatment episodes seem to become more frequent over time.[24] For this reason alone, we would expect to see emergency room mentions increase even if the number of hardcore heroin and cocaine users did not change. Furthermore, we suspect that hardcore heroin and cocaine users will develop an increasing number of chronic health conditions as their addictions advance and as they age. This, too, can account for an increase in emergency room mentions. While DAWN can be very valuable for detecting short-term changes in specific jurisdictions – such as a spike in overdose deaths – it would seem to have little or no value as a tool for monitoring long-term trends in the prevalence of substance abuse.

Average Amount Spent on Cocaine and Heroin

DUF interviews from 1989 and later asked respondents how much they spent on drugs during a week. The question did not separate cocaine from heroin spending or exclude other drugs, so we must infer how much was spent on cocaine and how much was spent on heroin. Also, some respondents gave answers that were implausibly large, so based on the methodology explained in Appendix B, we adjusted estimates to moderate the effect of extreme values. Because of a change in questionnaire design, DUF does not provide comparable estimates after 1995. Estimates for 1996-2000 are just the 1995 estimates adjusted for inflation.

Table 2 provides estimates of the median expenditure on cocaine and heroin. Based on evidence presented in Appendix B, using the median expenditure in retail sales calculations has a greater justification than using a mean expenditure. All estimates were converted to 1998 dollar equivalents based on the consumer price index.[25]

In 1998, hardcore cocaine users spent $191 a week on cocaine, and hardcore heroin users spent $214 a week on heroin (Table 2). These DUF estimates lack precision, but they are reasonable considering other data about expenditures on illicit drugs. For example, an analysis of data from a special addendum[26] to the 1998 DUF instrument in 1995 gives some information for the heroin numbers.[27] Based on the median, hardcore heroin users spent $140 per week; based on the mean, they spent $330 per week. The mean is probably too

high, because it likely includes purchases by some users who intend to resell part of the lot.[28] Appendix B provides a review of expenditure patterns reported by other researchers.

Of course, occasional users spend less per week than do hardcore users. Based on NHSDA data, occasional cocaine users spent $19 per week in 1988, $23 in 1989, $27 in 1990, $30 in 1991, $34 in 1992, and $35 in 1993. More recent estimates are unavailable. No such estimates are available from the NHSDA for occasional heroin users. For them, we assumed a weekly expenditure of $50 per week.

Table 2
Weekly Median Cocaine and Heroin Expenditures Reported by Arrestee Hardcore Users, 1989-2000 (dollars, 1998 dollar equivalents)

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Cocaine												
Median	$352	$331	$292	$255	$229	$210	$202	$198	$195	$191	$188	$186
Heroin												
Median	$446	$417	$364	$308	$266	$236	$226	$221	$219	$214	$211	$209

Sources: DUF 1989 through 1994

Total Expenditures on Cocaine and Heroin

Between 1988 and 1998 American users spent $39 billion to $77 billion yearly on cocaine and $10 billion to $22 billion yearly on heroin (Table 3). We derived these estimates by multiplying the number of hardcore and occasional users in Table 1 by the median expenditures in Table 2 (and the figures cited earlier for occasional users) and adding the results.

How the Estimates are Affected by Varying the Assumptions

The estimates of expenditures may vary due to assumptions made about the number of hardcore and occasional users and about their average expenditures. Because hardcore users account for the bulk of drug spending, estimates of total expenditures are especially sensitive to the accuracy of estimates of expenditures by hardcore users. Consequently, we tested how sensitive our expenditure estimates are to assumptions made about the number of hardcore users and their typical expenditures. Because the factors that entered the

calculations were not derived from probability samples, it is impractical to develop a statistically based margin of error.

First, we determined how the expenditure estimates would be affected if we used lower or higher estimates of the number of users than were reported in Table 1. Because the retail sales estimates are roughly proportional to the number of hardcore users, if the estimate of hardcore users is off by plus or minus 25 percent, then the retail sales estimates would be off by the same proportion.

Second, we determined how the expenditure estimates would be affected if we varied our assumption about typical drug expenditures. Some studies reported in Appendix B are based on reported expenditures by cocaine users entering treatment, and those users have much higher expenditure patterns than are assumed in the retail sales calculations. If these expenditures were considered typical, the retail sales value of cocaine would be two to four times the amount reported here. This seems an implausibly large expenditure that would exceed not only available income for most users,[29] but the value of the supply of the drugs as well. (For a further discussion of this topic, see Appendix B.)

Although an average expenditure figure based on a treatment population is certainly too high, it might be realistic to adopt the average (rather than the median) drug spending numbers reported by DUF as a high estimate. Then, the composite totals on both cocaine and heroin use would be 60 to 80 percent greater than estimates based on the median expenditure patterns. For the reasons we cited above, it is doubtful that expenditures in the United States approach this high estimate.

At the opposite extreme, hardcore users who report their use in the NHSDA appear to consume less than half as much cocaine as hardcore users represented in the DUF data. Their expenditures might be considered a low estimate of typical cocaine spending by hardcore users. Giving more weight to the NHSDA expenditure figures would reduce the amount reported in Table 3 by half. However, it is difficult to reconcile estimates that are half as large with the amount of heroin and cocaine that enters the country.

Other analysts have made clever use of available data to derive their own estimates of retail expenditures on cocaine and heroin. Even after adjusting for the limitations of these other studies, our estimates are higher than theirs, perhaps suggesting that – if anything – we might adjust our estimates downward.[30] But, for reasons noted above, a large downward adjustment seems unwarranted.

Table 3
Total Expenditures on Cocaine and Heroin, 1988-2000 ($ in billions, 1998 dollar equivalents)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Cocaine													
heavy use	$71.0	$64.4	$54.8	$48.1	$43.2	$39.8	$36.8	$37.4	$35.1	$35.5	$33.1	$32.7	$32.1
occasional	$5.9	$6.3	$6.5	$7.0	$6.2	$6.1	$5.3	$5.6	$6.2	$6.3	$5.9	$4.4	$3.9
total	$76.9	$70.8	$61.3	$55.0	$49.4	$45.9	$42.2	$43.0	$41.3	$41.8	$39.0	$37.1	$36.1
Heroin													
heavy use	$21.4	$20.5	$17.3	$12.9	$10.1	$9.6	$9.8	$10.0	$10.6	$10.6	$10.9	$10.7	$10.6
occasional	$0.4	$0.4	$0.4	$0.9	$0.8	$0.6	$0.7	$1.1	$1.2	$1.6	$0.7	$1.3	$1.3
total	$21.8	$20.9	$17.6	$13.8	$10.9	$10.2	$10.5	$11.2	$11.7	$12.2	$11.6	$12.0	$11.9

Since weekly expenditures from DUF data were not available for 1988, we used the 1989 amounts as proxies for 1988 in calculating total expenditures.

Sources: See Tables 1 and 2.

Accounting for Income in Kind

Our expenditure estimates reflect money that actually changed hands at the retail level. But drugs are often obtained as "income in kind," sometimes as payment for serving a role in the distribution chain and sometimes as payment for sex. For reasons explained in Appendix B, we assume that hardcore users of heroin received 22 percent of their drugs as in-kind payment in 1988, but that this percentage fell linearly to 11 percent as of 1995 because of changes in the way that heroin was distributed.[31] We assumed that users of cocaine received 11 percent of their cocaine as income in kind throughout the period.

If we monetize in-kind payments at street prices, then the 1998 dollar expenditure on cocaine would increase by about $4 billion, and the 1998 dollar expenditure on heroin would increase by about $1.5 billion. These

totals are not reflected in Table 3, but we do take them into account later when we estimate the bulk amounts of cocaine and heroin used in America.

How Much Cocaine and Heroin is Consumed?

To estimate how much cocaine and heroin Americans consume, we used data from the System to Retrieve Drug Evidence (STRIDE) to estimate the street prices paid for cocaine and heroin. These data come from laboratory analyses of purchases by Drug Enforcement Administration agents, other Federal agents, and some State and local agents. The price varies with the size of the purchase lot. Cocaine is much less expensive when bought as a large lot than when purchased as a smaller lot. This is also true of heroin. Therefore, to estimate the average street price of illicit drugs, it is necessary to know how much a typical buyer purchases each time he makes a purchase. The larger the quantity of drugs purchased, the lower the per unit price. There is scant evidence on this topic. Appendix C details our assumptions.

The price of cocaine fell sharply throughout the early 1980s (not reflected in table), increased during 1990, and then declined again into 1998 (Table 4). Most of the decline after 1990 is caused by an increase in the consumer price index. The price of heroin also fell throughout most of the 1980s and the mid 1990s. It has remained relatively constant as of 1995.

Table 5 shows estimates of the amount of cocaine and heroin that was consumed based on the expenditures reported in Table 5 (adjusted to account for drugs earned as income in kind) and the retail prices reported in Table 4. According to the data for the 1988 to 1998 period, cocaine users consumed somewhere between 270 and 400 metric tons of pure cocaine each year. The level of consumption has stayed close to 300 metric tons throughout the 1990s. Heroin users consumed between 7 and 13 metric tons of pure heroin each year during the same period. Consumption has been close to 13 metric tons during latter part of the decade.

Because estimates are not totally accurate, trends are uncertain. However, it appears that the amount of cocaine consumed in the United States has changed very little over the last eight years. The estimates are somewhat higher in 1988 and 1989 than in later years, but given the margin of error in these estimates, no strong trend is apparent. Total expenditure on cocaine has fallen over time, but this is attributable almost exclusively to using the consumer price index to inflate past expenditures.[32]

Trends in heroin use may be different. The amount of heroin used seems to have decreased from 1988 and 1989 into the early 1990s. Thereafter, heroin consumption may have increased. As already noted, there seem

to be fewer heroin addicts in the middle 1990s than there were at the end of the 1980s. The HIV virus and AIDS have taken a toll, and many users have been incarcerated. Yet, prices have fallen so much that remaining users have been able to purchase much more than they did in the past, and these lower prices may have attracted new users into the market.[33]

Other studies provide comparable estimates. Using a much different estimation methodology, Rand researchers estimated that about 451 metric tons of cocaine entered the United States in 1989.[34] This compares with our estimates of 394 metric tons. The Rand researchers estimate that 7.8 metric tons of heroin entered the States in 1991.[35] Our estimate is 6.8 metric tons.

Table 4
Retail Prices Per Pure Gram for Cocaine and Heroin, 1988-2000 (dollars, 1998 dollar equivalents)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Cocaine	$213	$199	$251	$204	$201	$172	$153	$157	$159	$149	$149	$149	$149
Heroin	$3,153	$2,407	$2,378	$2,377	$1,925	$1,468	$1,131	$1,089	$1,048	$1,029	$1,029	$1,029	$1,029

Source: STRIDE 1981 through 1998

Table 5
Total Amount of Cocaine and Heroin Used, 1988-2000 (in metric tons)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Cocaine	401	394	271	299	273	296	305	304	288	312	291	276	269
Heroin	8.5	10.5	8.8	6.8	6.5	7.9	10.5	11.4	12.4	13.1	12.5	12.9	12.9

Sources: See Tables 1 through 4.

Methamphetamines

We applied the computing algorithms used to derive estimate for cocaine and heroin to the problem of getting estimates for methamphetamines. When applied to methamphetamines, the approach does not work as well, for reasons that are discussed in this section. Nevertheless, the calculations are sufficiently accurate to provide rough measures of the number of heavy users as well as of the scale of expenditures and amount used. Calculations are summarized in Table 6.

According to our calculations, there are probably between 300,000 and 400,000 hardcore users of amphetamines. As before, a hardcore user is someone who uses a drug on more than ten days per month. The estimate is technically about amphetamines, because that is the question posed in the DUF interview. Hereafter, however, amphetamine users are assumed to be methamphetamine users. This assumption is justified by the observation that in 1997, more than 96 percent of those who tested positive for amphetamines were confirmed by a second test to be positive for methamphetamine.

This estimate is tentative for two reasons. The first is that methamphetamine use is rare among arrestees in many cities, so the estimates are really based on the experiences of a few cities, and those experiences are then prorated across the nation. The fact that so few cities account for the estimates may impart additional uncertainty to the calculation. The second reason for skepticism is that the estimates vary markedly from year to year. Most of that year to year variation is hidden in Table 6 because a three-year moving average was applied to smooth the data.

Combining the DUF data from all years, hardcore amphetamine users spend about $90 per week on their use of methamphetamines. The table shows the $90 after adjustment by the consumer price index from 1989 to 2000. Because the sample size is relatively small, we did not attempt to determine a trend in expenditures, but rather, we assumed the $90 estimate applied to all years.

The estimate of total revenue comes from multiplying the number of hardcore users by their weekly expenditure, and then multiplying by 52 to determine a yearly expenditure. The result was multiplied by 4/3 (the reciprocal of 0.75) to account for occasional users. Methamphetamine users currently spend somewhat less than $2 billion per year on methamphetamine use. The next step was to estimate the price of methamphetamine. Appendix C explains the price derivation, and that the price estimate is probably too high or too low over the entire reporting period. It is difficult to know which. The final step is to divide total revenue by the price per pure gram. This estimate does not include the amount consumed by casual users.

If those casual users account for roughly 25 percent of consumption, then the estimate might be increased to about 9 to 16 metric tons. As noted, seeking precision would be quixotic; these estimates are best treated as matters of scale with a wide (but unknowable) confidence interval.

There is scant evidence to support any secondary check on these calculations. According to the TEDS data, 15 to 18 percent of treatment admissions between 1992 and 1997 identified cocaine as the primary drug of abuse. Methamphetamine was the primary drug for between 1.0 percent (1992) and 3.6 percent (1997) of admissions. If we take the 1997 numbers to imply that there were 5 hardcore cocaine users for every 1 hardcore methamphetamine user, and if we accept the estimates of the number of hardcore cocaine users from earlier, then there would be about 700,000 hardcore methamphetamine users. That is about double the estimate reported in Table 6. If we take the 1992 numbers to imply that there were roughly 15 hardcore cocaine users for every hardcore methamphetamine user, and if we again use the earlier estimates of hardcore cocaine users, we would say there are about 230,000 hardcore methamphetamine users, somewhat more than half of the number that we actually estimate. Perhaps there is some comfort here that the scale is about right, but precision is elusive.

Assuming the scale is about right, what can be said about the trend? The TEDS data show an increase in admissions with methamphetamine named as the primary drug of abuse. Just 1.0 percent of admissions in 1992 and 1.3 percent of admissions in 1993 were for methamphetamines. This compares with 2.6 percent in 1996 and 3.6 percent in 1997. We do not see those trends reflected in Table 6. This may be because hardcore users can take years to enter treatment for the first time, but after their first admission, subsequent admission happen more frequently. Thus, a relatively constant number of hardcore methamphetamine users between 1989 and 1999 could be consistent with an increase in treatment admissions.

Drug prices might be considered a barometer of the availability of an illicit substance, which in turn partly determines the number of hardcore users. Rhodes, Johnson and McMullen[36] report that the proportion of hardcore methamphetamine users in five jails, which had an appreciable number of methamphetamine users, showed cyclical behavior between 1989 and 1998. The proportion fell through 1991, and it then increased to a new peak in 1994. Thereafter, the proportion decreased. Rhodes, Johnson and McMullen show that prices moved in the opposite direction (up when use when down, and down when use was up) throughout this period, reinforcing the inference that prices are a barometer of methamphetamines' availability.

Table 6
Calculation of Total Methamphetamine Consumption, 1989-2000

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Number of Hardcore Users (thousands)	386	339	290	314	389	479	414	376	310	356	356	356
Median weekly expenditure	$118	$112	$108	$105	$102	$99	$96	$93	$91	$90	$87	$87
Price per pure gram	$207	$227	$194	$229	$215	$192	$184	$171	$167	$140	$140	$140
Total expenditures (billions)	$2.4	$2.0	$1.6	$1.7	$2.1	$2.5	$2.1	$1.8	$1.5	$1.7	$1.6	$1.6
Metric tons	11.5	8.7	8.4	7.5	9.6	12.8	11.3	10.7	8.9	11.9	11.6	11/6

Sources: NHSDA 1988, 1990 through 1997; STRIDE 1981 through 1998; DUF 1989-1998; Uniform Crime Reports 1988-1997.

Marijuana

In this section, we estimate the dollar value of marijuana consumption by multiplying the following factors: number of users in the past month, by the average number of joints used in the past month, by the average weight per joint, by the cost per ounce. Calculations are summarized in Table 7.

Number of Marijuana Users

More Americans use marijuana than either cocaine or heroin. During 1998, for example, about 11 million Americans used marijuana or hashish at least once in the month before the NHSDA. This number is about the same as it was in 1988: 11.6 million. The trend was for decreasing use into the early 1990s and then increasing use into the late 1990s.

Average Number of Joints Used Each Month

We calculated an individual's total number of joints used each month by multiplying the number of days of marijuana use in the past month by the number of joints used per occasion. For those without valid answers for these questions, we imputed the total monthly use (see Appendix D). In 1995 the NHSDA stopped asking respondents about the number of joints and amount of marijuana used in the last month. Because marijuana

users reported using an estimated 18.7 joints per month in 1994, we assumed the same was true for years after 1994.

Average Amount of Marijuana Used

The average amount of marijuana used in the past month was calculated from several questions in the survey (see Appendix D). This number has changed little over time - about 0.014 ounces per joint.

However, the average number and weight of joints used by those who smoke marijuana cannot tell the entire story about trends in marijuana use, because marijuana's THC content has changed over time. Delta-9 tetrahydrocannabinol (THC) is marijuana's primary psychoactive chemical. According to a study conducted at the University of Mississippi,[37] the average THC content of sinsemilla was at a relative peak in 1990 and 1991. That average fell from 10.5 percent in 1991 to 8.6 percent in 1992, and to 6.0 percent in 1993. The THC content of commercial-grade marijuana remained fairly constant at less that 4.0 percent from 1985 to 1992, but jumped to about 5.4 percent in 1993. According to the 1995 National Narcotics Intelligence Consumers Committee (NNICC) report, the THC content of commercial grade marijuana averaged 3.3 percent, and the THC content of sinsemilla averaged 6.7 percent, in 1995; according to the 1997 NNICC report, the commercial grade content was 5.0 percent, and the sinsemilla content was 12.2 percent. Because we do not know the mix of sinsemilla and commercial-grade marijuana used by the typical user, we cannot know, for certain, whether users are smoking more or less marijuana as measured by THC content.

Price

Price is the final factor in calculating the total value of marijuana consumption (see Appendix D). Marijuana prices were roughly $350 per ounce in the late 1980s. These prices are for a one-third ounce purchase, which appears to be a typical purchase size by frequent users. They jumped to closer to $450 per ounce during the early 1990s. Throughout the rest of the decade, prices were considerably lower. The price trends appear to be roughly consistent with trends in THC content. That is, marijuana prices were relatively low in the late 1980s when sinsemilla's THC content was comparatively high. Excluding 1990, prices were comparatively high in the early 1990s when THC content was low. Low prices toward the end of the 1990s correspond to high THC content. Taken together, these two trends suggest that marijuana was more difficult to buy in the early 1990s than it was before and than it has been since the early 1990s.

Table 7
Calculation of Total Marijuana Consumption, 1988-2000

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Number of Users (millions)	11.6	10.9	10.2	10.4	9.7	9.6	10.1	9.8	10.1	11.1	11.0	11.4	11.7
Joints used per month	16.9	17.3	17.6	16.6	17.2	17.8	18.7	18.7	18.7	18.7	18.7	18.7	18.7
Weight of a joint (ounces)	0.0134	0.0135	0.0137	0.0135	0.0134	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136
Price per ounce, 1/3 ounce purchase	$357	$364	$459	$457	$465	$403	$369	$310	$293	$297	$320	$293	$293
Total expenditure for the year ($ in billion dollar equivalents)	$11	$11	$14	$13	$12	$11	$11	$9	$9	$10	$11	$10	$10
Metric Tons	894	866	837	793	761	791	874	848	874	960	952	982	1009

Sources: NHSDA 1988, 1990 through 1998; STRIDE 1981 through 1998.

Total Consumption Estimates

The factors required to calculate total marijuana consumption are shown in Table 7. In 1998, we estimate that average users consumed 18.7 joints a month. The average amount of marijuana used per joint equaled 0.0136 ounces.[38] At a retail price of $320 an ounce, these users spent an average of $81 each month ($980 a year) on marijuana. This number, multiplied by the 11 million monthly users, yields a consumption estimate of $11 billion for the year.

These estimates may be low. Users are likely to under report socially disapproved behaviors, even when those behaviors are legal.[39] They would seem to have even more incentive to under report illegal behaviors.[40] Given under reporting rates for tobacco and alcohol use, it might be reasonable to inflate marijuana estimates by about one-third. On the other hand these estimates could be too high. Joints are frequently shared, and it seems plausible that these calculations double count some consumption. At any rate, our estimates of total spending are in line with estimates by others.[41]

Other Drugs

Most of the money spent on illicit drugs in America is spent on cocaine, heroin, marijuana, and methamphetamine. However, expenditures on other illicit substances (inhalants and hallucinogens) and on licit substances consumed illegally (other stimulants, sedatives, tranquilizers, and analgesics) is not small. Much of this drug use appears to be reported to the NHSDA.[42] We do note, however, that the NHSDA undoubtedly misses some users, and those who are reached probably have an incentive to misrepresent their consumption.

Table 8 shows the number of respondents who, according to the NHSDA, used these other drugs between 1988 and 1998. To complete the table, estimates for 1999 and 2000 were set to the 1998 estimate. Those respondents who admitted use during the year were asked how frequently they used the drug.[43] We then used these data to compute an average number of days a year that the respondents used a drug.[44] Since the survey lacks information about the number of doses taken on days that the drug was used, we assumed that each day of use resulted in a single dose. This is most certainly an underestimate.

It is difficult to determine prices per dose. Both the Drug Enforcement Administration's (DEA) Illegal Drug Price/Purity Report and the National Institute on Drug Abuse's Community Epidemiological Working Group

(CEWG) provided wide ranges.[45] For current purposes, we assumed that each dose costs $5, a price that was consistent with those reported by the DEA and the CEWG. These street prices may be too high, however, because many of the legal drugs were likely to have been purchased at prescription prices and diverted to illegal use.

To estimate the yearly expenditures on these drugs, we multiplied three factors: the number of users, by the average number of doses per year, by the price per dose. Our best estimate is that Americans spent between $1.5 billion and $3.3 billion on other drugs during each of the last eleven years (Table 8).

These estimates are imprecise for the reasons noted above. However, even if we halve or double the estimates to reflect uncertainty, drugs other than cocaine, heroin, marijuana and methamphetamines must be a relatively small part of the total expenditure that Americans make on illicit substances and on legal substances consumed illegally.

Conclusion about Consumption

According to the consumption-based procedure, Americans spent about $65 billion on heroin, cocaine, methamphetamine, marijuana, and other illegal drugs in 1998: $39 billion on cocaine, $12 billion on heroin, $11 billion on marijuana, $1.5 billion on methamphetamine, and $2.3 billion on other illegal drugs (Table 9). Table 9 appears to show a substantial decrease in expenditures on illicit drugs between 1988 and 1998. Most of this change is attributable to inflation as reflected in the consumer price index. This decrease may not be apparent to hardcore users, because illicit drug consumption is a predominant part of their market basket (illicit drugs are not part of the market basket used to compute the CPI), while the nominal price of heroin and cocaine have fallen or remained about the same since 1988, and the price of marijuana has fallen since 1992. On the other hand, these decreased expenditures may have very real consequences for dealers, who probably have market baskets that are much more like that of typical American consumers.

In this section of the report we examined the use of drugs, that is, the demand for illicit drugs and for licit drugs used illegally. In the next section, we examine the availability of illegal drugs in the domestic market. Comparing the amount of drugs consumed (from this section) with the amount of drugs available for consumption (the next section) provides additional confirmation that consumption based estimates are credible.

Table 8

Other Drugs: Total Yearly Users (thousands) and Expenditures ($ in billions, 1998 dollar equivalents), 1988-1998

Drug Used	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Number of Users													
Inhalants	2,441	2,327	2,212	2,379	1,889	1,940	2,213	2,308	2,427	2,329	2,009	2,009	2,009
Hallucinogens	3,200	2,775	2,350	2,562	2,530	2,479	2,725	3,416	3,602	4,063	3,565	3,565	3,565
Stimulants	2,698	3,009	2,319	2,010	1,478	1,774	1,419	1,656	1,896	1,687	1,489	1,489	1,489
Sedatives	1,376	1,184	991	946	702	702	736	666	678	638	522	522	522
Tranquilizers	4,124	3,250	2,376	3,143	2,380	2,380	2,405	2,210	2,430	2,122	522	522	522
Analgesics	5,342	5,164	4,986	5,063	4,560	4,560	4,247	4,102	4,510	4,210	4,070	4,070	4,070
Expenditures	**$3.3**	**$2.8**	**$2.2**	**$2.3**	**$1.5**	**$1.5**	**$2.6**	**$2.7**	**$2.7**	**$2.5**	**$2.3**	**$2.3**	**$2.3**

Source: NHSDA 1988, 1990 through 1998

Table 9
Total Expenditures on Illicit Drugs, 1989-2000 ($ in billions, 1998 dollar equivalents)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Cocaine	$76.9	$70.8	$61.3	$55.0	$49.4	$45.9	$42.2	$43.0	$41.3	$41.8	$39.0	$37.1	$36.1
Heroin	$21.8	$20.9	$17.6	$13.8	$10.9	$10.2	$10.5	$11.2	$11.7	$12.2	$11.6	$12.0	$11.9
Methamp	$2.4	$2.4	$2.4	$2.0	$1.6	$1.7	$2.1	$2.5	$2.1	$1.8	$1.5	$1.7	$1.6
Marijuana	$11.3	$11.1	$13.5	$12.8	$12.5	$11.2	$11.4	$9.3	$9.0	$10.1	$10.7	$10.2	$10.4
Other Drugs	$3.3	$2.8	$2.2	$2.3	$1.5	$1.5	$2.6	$2.7	$2.7	$2.5	$2.3	$2.3	$2.3
Total	$115.7	$108.0	$97.0	$85.9	$75.9	$70.5	$68.6	$66.8	$66.8	$68.4	$65.0	$63.2	$62.4

Columns may not add due to rounding error.
Sources: Tables 1 through 7

2 The Supply Approach

A second approach to estimating the amount that Americans spend on illicit drugs is to estimate the value of shipments *supplied* to domestic markets. This section discusses the information and assumptions we used to estimate the supply of cocaine and heroin to the United States. For reasons discussed below, it is not practical to develop estimates for marijuana, methamphetamine, or other illegal drugs.

Cocaine

The production process that converts coca plants to cocaine starts with harvesting the coca leaf and chemically treating it to create coca base, which is normally conducted within the source growing area. The base is then shipped to cocaine laboratories, and from there is shipped either directly or via a transshipment country to consumer countries. This section provides an empirical description of this production and distribution process. Although we use the best data available, pieces of the flow model remain. Future research will be conducted to bridge the gaps in the flow model and reduce the uncertainty in the estimates.

The process for estimating cocaine supply has been evolving over the past ten years. Since 1990, ONDCP has estimated the supply of cocaine by beginning with the potential cocaine production estimate and sequentially decreasing this amount by subtracting losses. In 1996, a U.S. intelligence-working group initiated an event-based process for estimating the amount and routes of cocaine departing South America. In March 2000, the Crime and Narcotic Center integrated data on potential cocaine production estimates with Western-hemisphere consumption estimates to calculate the amount of cocaine available for the non-U.S. markets. Our approach was to design a cocaine flow model, which standardized the terms and measures, and so various existing figures (e.g., potential production, domestic consumption estimates) could be integrated into one complete and coherent set of flow estimates. This model is referred to as the Sequential Transition and Reduction (STAR) model.

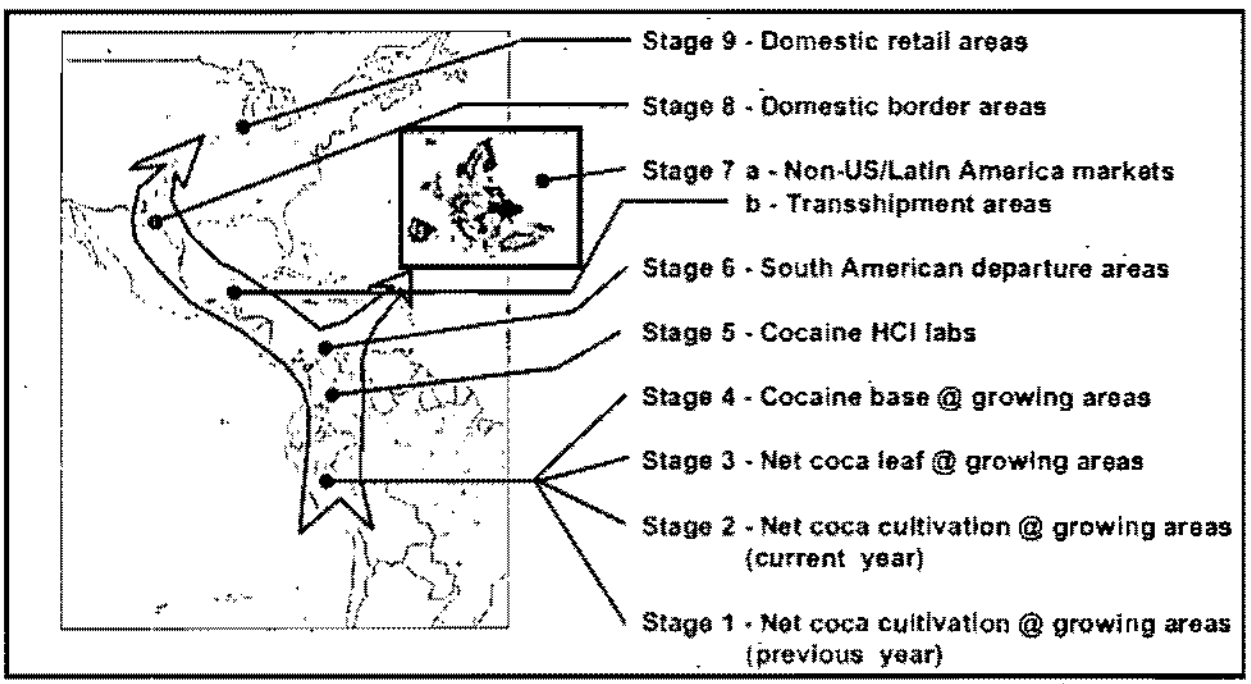
The STAR model incorporates diverse estimates of the production and distribution of cocaine into one cohesive, connected model. The model hinges on the notion of a transition, or movement, of cocaine from one stage in the production/distribution process to the next stage in that process. A transition is a computational link between stages that, after accounting for reductions (seizures, losses, etc.), converts drug (or drug precursor) at one stage into drug at another stage. Details regarding this model are available in a

companion report.[46] Readers should consult that report for specifics; a summary follows.

Description of Stages

This model establishes a coherent set of stages, established on the basis of existing supply-reduction strategies, which conform to the trafficker's patterns in cultivation, production, transshipment, and distribution. Mathematically, the model links supply estimates at each stage by transition matrices that account for conversions in cocaine state, reductions such as consumption and seizures, and geographic routing of the cocaine. In this way, the model contains a consistency between the "micro" flow within a geographic region and the "macro" estimates of cocaine supply between stages. Figure 1 presents a geographic presentation of the nine stages of movement describing cocaine supply.

Figure 1: Description of stages in the flow of cocaine from source to street



Each of the stages can be described as follows:

- Stage 1, net coca cultivation for the previous year: expressed in hectares and is distributed among the various coca-growing areas of the Andean Ridge.
- Stage 2, net coca cultivation for current year: is expressed in hectares and is calculated from taking the previous stage and accounting for new growth and reductions from eradication and field abandonment in the various growing areas.
- Stage 3, net leaf tonnage: is expressed in metric tons and is determined by applying leaf-yield conversions to the previous stage, then accounting for leaf seizure and consumption reductions.
- Stage 4, cocaine base: is expressed in metric tons of cocaine base and is determined by applying

alkaloid-content and lab processing efficiency figures to the previous stage and accounting for cocaine-base seizure reductions.

- Stage 5, At HCl labs: is expressed in metric tons of cocaine, is measured at the HCl labs distributed within South America, and accounts for losses of cocaine-HCl at the labs.
- Stage 6, At the departure areas of South America: is expressed in metric tons of cocaine, is measured at the South American departure areas, and is reduced by South American seizure and consumption losses.
- Stages 7a and b, Transshipment area and world markets: After departure from South America, cocaine is smuggled toward its markets in the United States, Canada, Europe, and the rest of the world. Most of the cocaine destined for the United States is initially smuggled to transshipment locations (Stage 7a) in Mexico, Central America, and the Caribbean islands including the Bahamas and the Antilles. Additionally, cocaine is shipped to non-U.S./Latin American markets overseas and in Canada (Stage 7b). Cocaine estimates at both stages 7a and 7b were reduced by en-route losses due to en-route seizures and consumption in the transshipment countries.
- Stage 8, U.S. border: From the transshipment areas, cocaine moves across the U.S. border, after accounting for seizure losses at the U.S. border.
- Stage 9, U.S. retail locations: from the border, cocaine is transported to retail markets in the United States, after accounting for domestic seizures.

Although the STAR Model theoretically provides a complete and coherent set of connected stages, input data was not always available. As a result, a discontinuity in the model does exist; specifically at the point between Stages 5 and 6, due to the lack of historic data describing consumption in South America. A recent CNC estimate of 1999 consumption in South America ranged between 120 and 175 metric tons, nearly a quarter of the 1999 potential cocaine production. A stage-by-stage estimate of cocaine availability will now be discussed.

Cultivation to South American departure

The STAR model starts with data on cultivation and cocaine processing. CNC uses statistical survey methods, similar to those employed by agricultural organizations estimating the size of licit crops, to estimate the quantity of coca under cultivation in Colombia, Peru and Bolivia. CNC's survey randomly samples potential growing areas, placing a higher sampling probability on known growing regions, and satellites and airplanes then photograph the selected areas. CNC analysts interpret the resulting images to develop country-wide coca crop estimates. The uncertainty in this approach has been estimated by CNC to be +/-10%.

Operation Breakthrough, a series of studies done by the DEA, provided estimates of production efficiencies for converting from coca leaf into cocaine in Peru, Bolivia, and Colombia. CNC has modified these factors periodically, to adjust for slight changes in coca variety and processing techniques. The three critical factors in calculating cocaine production from the cultivation estimates are the leaf yields, alkaloid content of the coca leaf, and the base processing efficiency. These factors can have significant uncertainty, as was seen in

1999, when the Colombian leaf and processing factors were adjusted, resulting in a 160% increase in the estimate of Colombian potential production.

Figure 2 depicts changes in the distribution of Andean potential production. The figure includes two lines for Colombia, the lower one representing earlier CNC estimates for Colombia and the higher one representing CNC estimates revised as of March, 2000. For the years with revised estimates, potential production increased by 188% (1995), 173% (1996), 180% (1997), and 164% (1998). This large estimation uncertainties result when there are dynamic changes occurring in the cocaine flow process, as was the case with the shift in coca cultivation from Bolivia/Peru to Colombia.

Figure 2
Andean Potential Cocaine Production Estimates, 1990-1999 (pure metric tons)

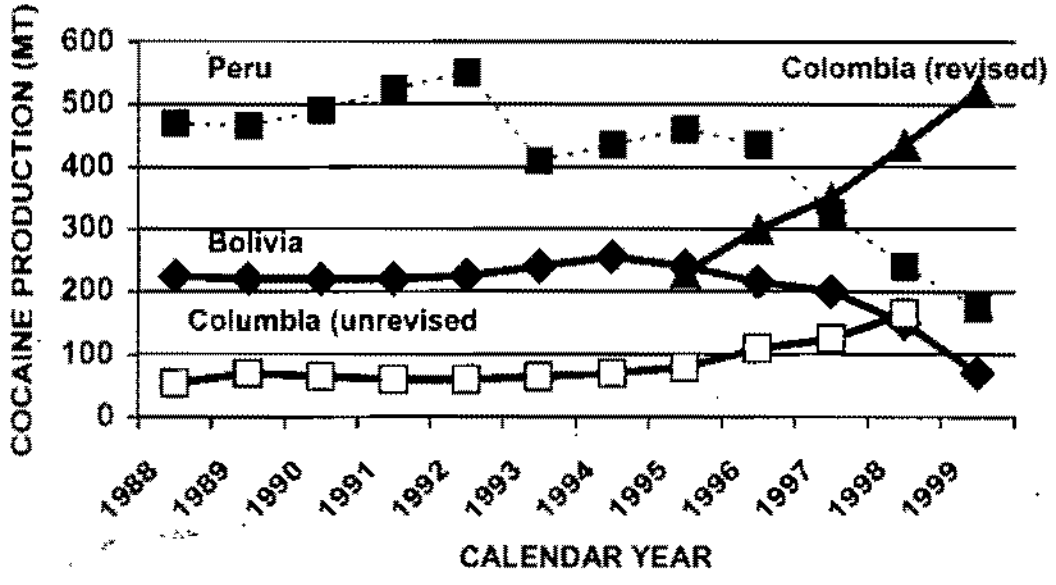


Table 10 shows the estimation of cocaine and its precursors, from cultivation to production. The reader should be aware that these figures will be lower than the annual potential production estimates because they account for losses such as leaf seizures and spoilage, base seizures, and HCl seizures in South America. The STAR Model estimates for cocaine at the various stages is discontinuous from Stage 5 (at the HCl labs) to Stage 6 (at the South American departure areas) because that transition requires an estimation of South American cocaine consumption, which is currently not available.

Table 10: Net cocaine produced for illicit markets (units as noted)

STAGE	DESCRIPTION	1996	1997	1998	1999
1	Previous Net Cultivation (ha)	214,800	209,700	194,100	190,800
2	Net Cultivation (ha)	209,700	194,100	190,800	183,000
3	Dry Coca leaf (mt)	306,782	267,663	239,435	203,305
4	Cocaine base (mt)	887	803	759	687
5	HCl at labs (mt)	841	774	702	666
5+	HCl at labs, less South American seizures (mt)	795	715	628	613

South American departure to world markets

An estimate of cocaine availability at departure (Stage 6) was determined by the STAR Model, based on the domestic consumption estimate, discussed earlier. Table 11 shows the figures which were determined from beginning with the estimate of cocaine consumption at the domestic retail level and working backwards in flow, by adding estimates for seizure and consumption in transit.

Table 11: Net cocaine produced for domestic retail market (units as noted)

STAGE	DESCRIPTION	1996	1997	1998	1999
6	HCl at SOAM departure (mt)	532	596	564	574
7a	HCl at non-US/Latin America market (mt)	78	99	88	105
7b	HCl at transshipment area (mt)	382	385	375	347
8	HCl at U.S. border area (mt)	333	337	337	313
9	HCl at U.S. retail markets (mt)	288	312	291	276

The difference between estimated cocaine available for world markets (shown as Stage 5+ in table 10), and the estimate of cocaine available for departure from South America (shown as Stage 6 in table 11) is due to South American consumption and uncertainties in the various input estimates. These differences vary between 40 and 260 metric tons. To understand the accuracy of these estimates, another series of estimates will be shown: estimates of cocaine departing South America based on an intelligence assessment of cocaine movement events.

The Interagency Assessment of Cocaine Movement (IACM)[ii] uses an event-based, interagency consensus methodology to quantify intelligence reports about cocaine movement through the transit zone. Table 12 shows the annual estimates for cocaine flow through each transshipment corridor. The annual total is decreased, assuming 85% purity, to result in an independent estimate of cocaine departing South America.

Table 12
Event-Based Cocaine Amounts Departing South America
By Transit Corridor, 1996-1999 (bulk metric tons) [iii]

	1996	1997	1998	1999
Caribbean	174.5	138.4	160.3	220
Mexico/Central America	341.7	250.7	318.6	277
Direct to U.S.	91.2	43.9	51.4	15
Non U.S. Destinations	42.8	62.6	64.5	75
Unknown	2.5	-	1.0	-
Total	**652.7**	**495.6**	**595.8**	**587.0**
Pure (assume 85% purity)	***554.8***	***421.3***	***506.4***	***499.0***

Figure 3 compares the three annual estimates of cocaine from the different approaches:

1) estimate of cocaine available for world consumption , from the STAR Model, based on the cultivation estimates,

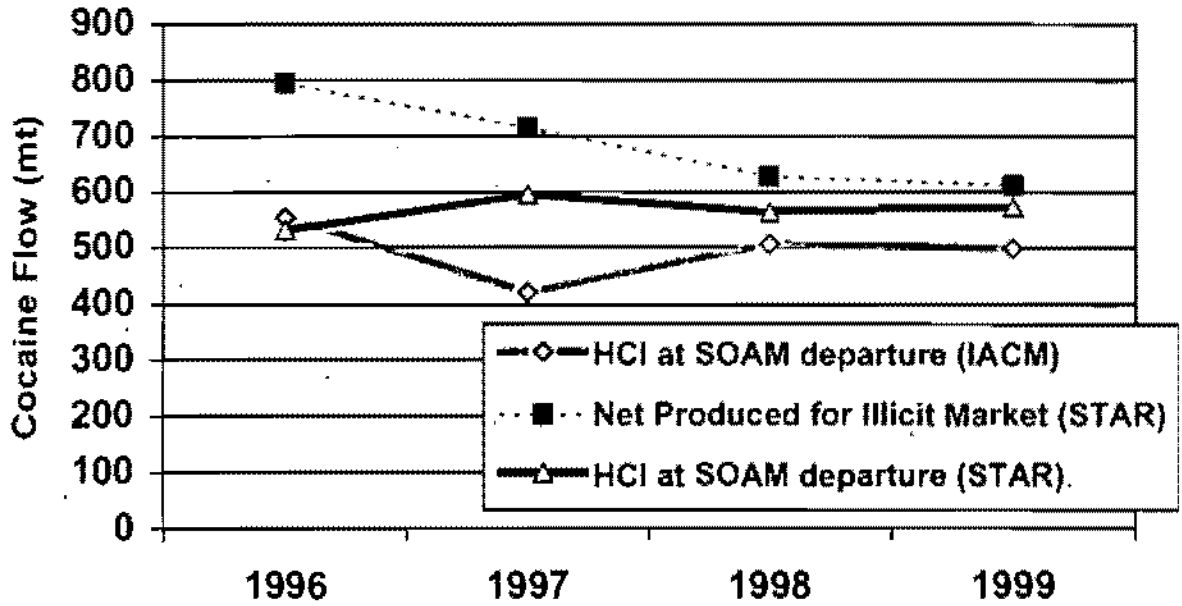
2) estimate of cocaine departing South America, from the STAR Model, based on the domestic consumption estimates, and

3) estimate of cocaine departing South America, from the IACM, based on an assessment of movement events.

The figure shows that all of the estimates are within 200 metric tons of one another. Both the IACM and the STAR estimates of cocaine availability show similar stable trends over the past four years. The STAR estimate of cocaine available for world markets shows a decreasing trend over the four years, which is not consistent with other trends. Worldwide seizures and domestic consumption have been stable over the past four years; Latin American and European consumption is believed to be increasing; therefore, cocaine availability for world consumption should be stable or increasing. But without better cocaine cultivation and production data, these uncertainties will remain.

Figure 3

Comparison of cocaine availability estimates, metric tons



Heroin

The modeling approach used for heroin differs from that for cocaine. While the bulk of cocaine production is destined for the United States, less than five percent of worldwide heroin/opiate production is sent to the United States, so modeling the flow from production to consumption is impractical. Also, dissimilar data are collected for heroin and cocaine. For example, heroin has no counterpart to the Interagency Assessment of Cocaine Movement (IACM), so we know less about the dynamics of heroin movement than about cocaine movement. On the other hand, cocaine has no counterpart to the DEA's Domestic Monitor Program (DMP) and Heroin Signature Program (HSP). A heroin availability model must differ from a cocaine availability model, because it is constructed from a different empirical base.

This section presents a model of the movement of heroin into the United States. Details appear in a companion report.[47] We do not consider the model as final, because data about heroin trafficking continues to grow, and modeling improvements will follow from better data. Nevertheless, the model is an important

step toward structuring what is currently known about the ways that heroin suppliers provide drugs to the United States. Like its cocaine counterpart model, the heroin flow model seeks to weave together and reconcile various estimation systems into one comprehensive model.

Model of Heroin Availability

Figure 4 depicts an overview of the heroin model. The rest of this report elaborates, and the companion report provides details. Whereas the cocaine movement model takes potential production estimates as its starting point, the heroin model begins at the other end - with the U.S. consumption estimates that were developed earlier in this report.

The source of heroin consumed in the U.S. is partitioned into four production areas: South America, Mexico, Southeast Asia and Southwest Asia. That partitioning is based on an analysis of data from the Heroin Signature and Domestic Monitor Programs, first done by Abt Associates for the Drug Enforcement Administration [48] and later extended for the Office of National Drug Control Policy.

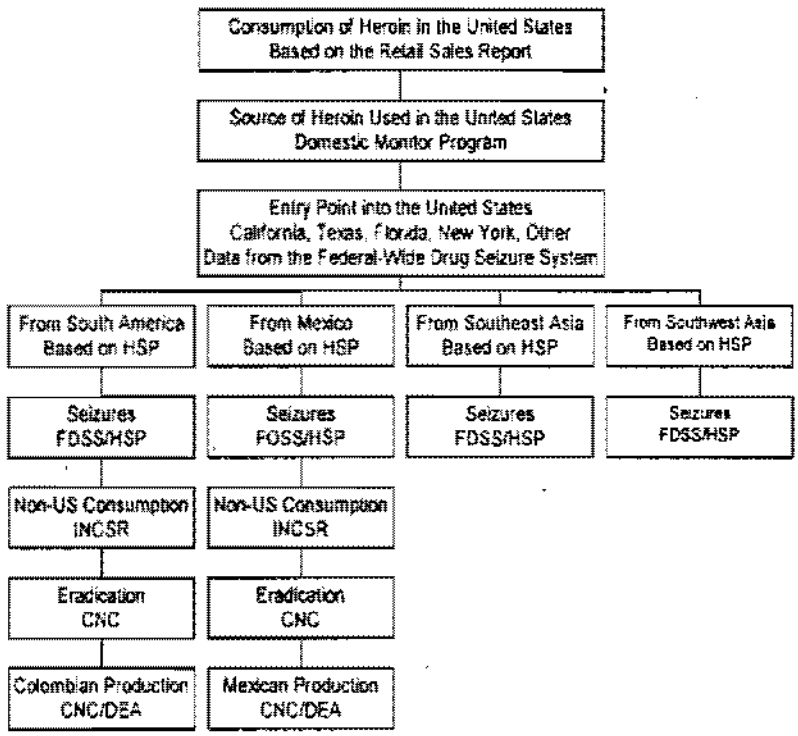
The Federal-Wide Drug Seizure system provides the best estimates of where heroin enters the United States. As shown subsequently, most seizures were in California, Texas (and Arizona), Florida (and Puerto Rico), and New York (including New Jersey) so the figure identifies those four principal entry points. The source country of those seizures is estimated from the Heroin Signature Program (HSP).

The model takes into account seizures and non-U.S. consumption of South American and Mexican heroin. However, according to reports by the Community Epidemiological Working Group (CEWG) and the U.N. World Drug Report, consumption seems minimal within Colombia and Mexico, so most South American and Mexican heroin is probably destined for the United States. Because non-U.S. consumption accounts for so much of the Southeast and Southwest Asian heroin, the model accounts for heroin movement from Southeast and Southwest Asia at the U.S. border, but not earlier.

The model provides a consumption-based estimate of the amount of heroin produced in South America and Mexico. CNC provides a production-based estimate of the heroin production potential in the same areas. After accounting for seizures and other leakage, the supply-based estimates should agree with the consumption-based estimate at least roughly - if not, something is wrong with the consumption model, with

CNC's production estimates, or both. CNC also estimates potential production for Southeast and Southwest Asia, but there is no apparent way to tie a consumption-based model into those estimates.

Figure 4
Overview of a Heroin Flow Model



Determination of Source Area

The Drug Enforcement Administration supports two programs – the Heroin Signature Program and the Domestic Monitor Program – to determine the source area (South America, Mexico, Southeast Asia and Southwest Asia) of heroin sampled at three points: seizures at ports of entry, a random sample of other seizures and purchases, and DMP purchases. We included all samples weighing less than one gram in a retail-level sample, comprising all the DMP data and several purchases from the random sample. We used that retail-level sample to estimate the sources of heroin used in the United States.

Our inferences are based on the retail-level sample, rather than an importation-level sample, because the retail-level sample comes closest to representing heroin actually consumed in the United States. Still, raw data tabulations are not very useful, for two reasons. First, some of the retail level samples have too little drug to afford a signature, so the source area is unknown. This creates some problems, because Mexican

heroin is easily identified and therefore is rarely classified as unknown. To prevent Mexican heroin from being over-represented in the data, we developed imputation routines for assigning a signature to every sample in the retail level data where an imputation seemed justified. Second, the Domestic Monitor Program oversamples in places where heroin use is relatively rare. (For example, St. Louis has a quarterly sample size of 10 purchases, while Baltimore has the same sample size but many more heroin users and purchases.) We developed a weighting procedure so that the signature program would represent a national estimate.

We have been unable to classify about 10% of the heroin seized and purchased since 1995. These unclassified samples are reported as unknown (UNK) in Table 13, which details estimates for the percentage of heroin from each source area. Because data were not available for 1998 and later, the 1998 and 1999 estimates are projections – that is, they are the averages for 1995 through 1997.

If we are correct about these percentages, and if we are correct that between 1995 and 1998 about 12 to 13 metric tons of heroin is used per year in the United States, then we can derive estimates of the amount of heroin that come from each area (Table 14). We do not provide estimates before 1995, because the unknown signature category is comparatively large before 1995.

Table 13
Source of Heroin Used in the United States (Projected for 1998 and 1999) (Percentages)

Year	Mexico	South America	Southeast Asia	Southwest Asia	Unknown
1993	26.2	13.1	17.6	9.1	34.1
1994	25.6	27.6	21.4	3.8	21.6
1995	26.4	46.6	11.6	2.6	12.7
1996	26.1	51.2	11.6	4.0	7.1
1997	22.8	52.5	10.0	5.6	9.1
1998	25.1	50.1	11.0	4.1	9.6
1999	25.1	50.1	11.0	4.1	9.6

Sources: Data from the Heroin Signature Program and Domestic Monitor Program

Table 14

Estimated Amount of Heroin from Each Source Area (metric tons)				
	1995	1996	1997	1998
Mexico	3.0	3.2	3.0	3.1
South America	5.3	6.3	6.9	6.2
Southeast Asia	1.3	1.4	1.3	1.4
Southwest Asia	0.3	0.5	0.7	0.5
Unknown	1.4	0.9	1.2	1.2
Total	11.4	12.4	13.1	12.5

Source: See Table 5.

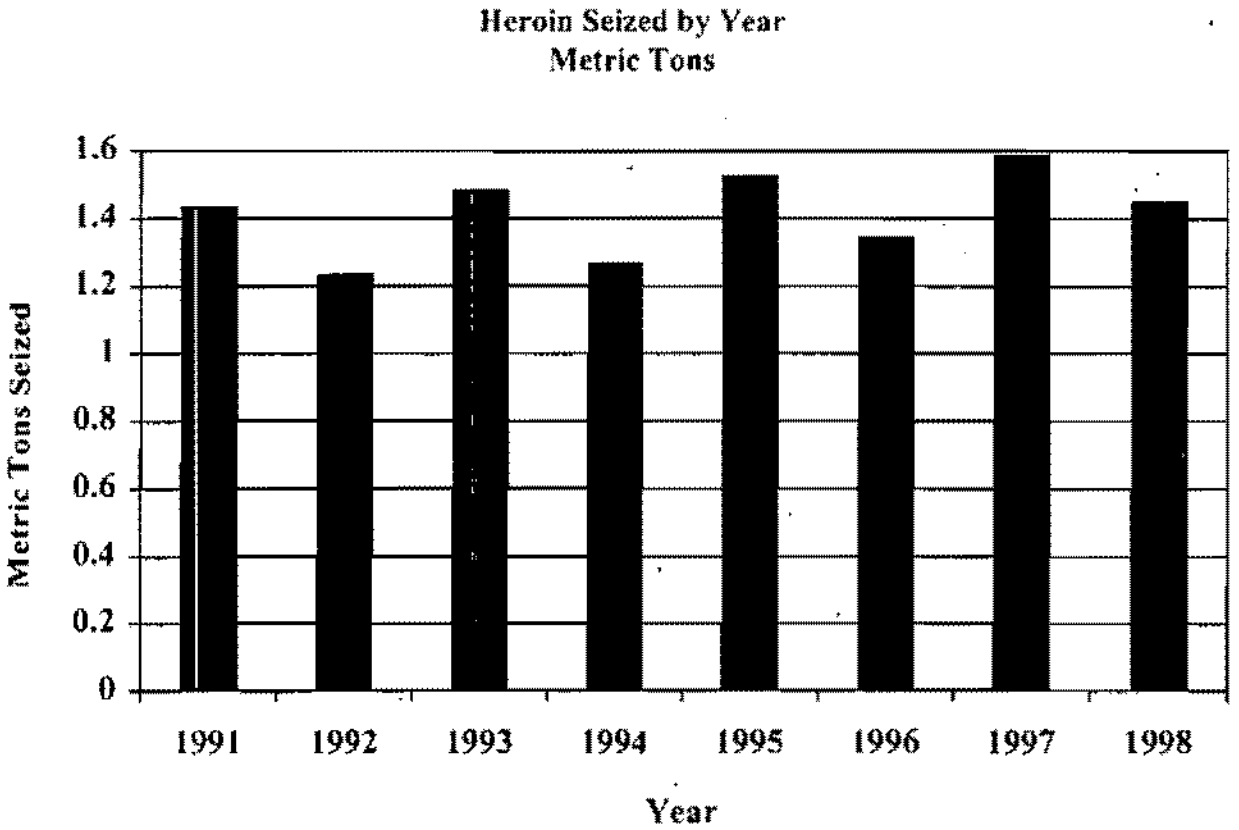
According to these calculations, U.S. consumers use somewhat less than 7 metric tons of South American heroin and somewhat more than 3 metric tons of Mexican heroin. However, the South American and the Southeast and Southwest Asian numbers might be somewhat higher depending on how the unknown signatures are partitioned across the data.

Seizure Levels

Some foreign production gets seized as it enters the United States. We tabulated heroin seizures reported in the FDSS from 1991 through the first half of 1998. To provide greater comparability between 1998 and earlier years, we interpolated seizures for the entire year by doubling seizures from the first half of 1998. The figure seems to show that seizures have varied between about 1.2 and 1.6 metric tons from 1991 through 1998. There is no apparent trend.

There is a second useful way to look at these data. Between 1991 and 1998, 99.2 percent of all seizures were less than 10 kilograms. Likewise, 99.7 percent of all seizures were less than 20 kilograms and 99.9 percent of all seizures were less than 50 kilograms. If we exclude all seizures larger than 50 kilograms from the tabulation, seizures have remained fairly constant at about 1.2 metric tons. Apparently, exceptionally large seizures can occasionally lead to spikes in the seizures observed during any year, distorting the trend. When large seizures are included in the estimates, an annual seizure rate of 1.3 metric tons seems representative of law enforcement success at preventing heroin from entering the United States.

Figure 5



In fact, when imported into the United States, heroin is typically about 80 percent pure.[49] Thus the 1.3 metric tons of bulk heroin probably translate into somewhat more than 1 metric ton of pure heroin being seized as it enters the United States. According to the 1999 INCSR, Mexican authorities have seized between 0.14 and 0.38 metric tons of heroin (or opium equivalent) every year since 1995. Given what U.S. authorities seize, Mexican traffickers seem to lose on average about 0.34 metric tons per year. Colombian authorities never seized more than about 0.15 metric tons per year, so seizures probably account for an average of about 0.75 metric tons of Colombia's production per year.

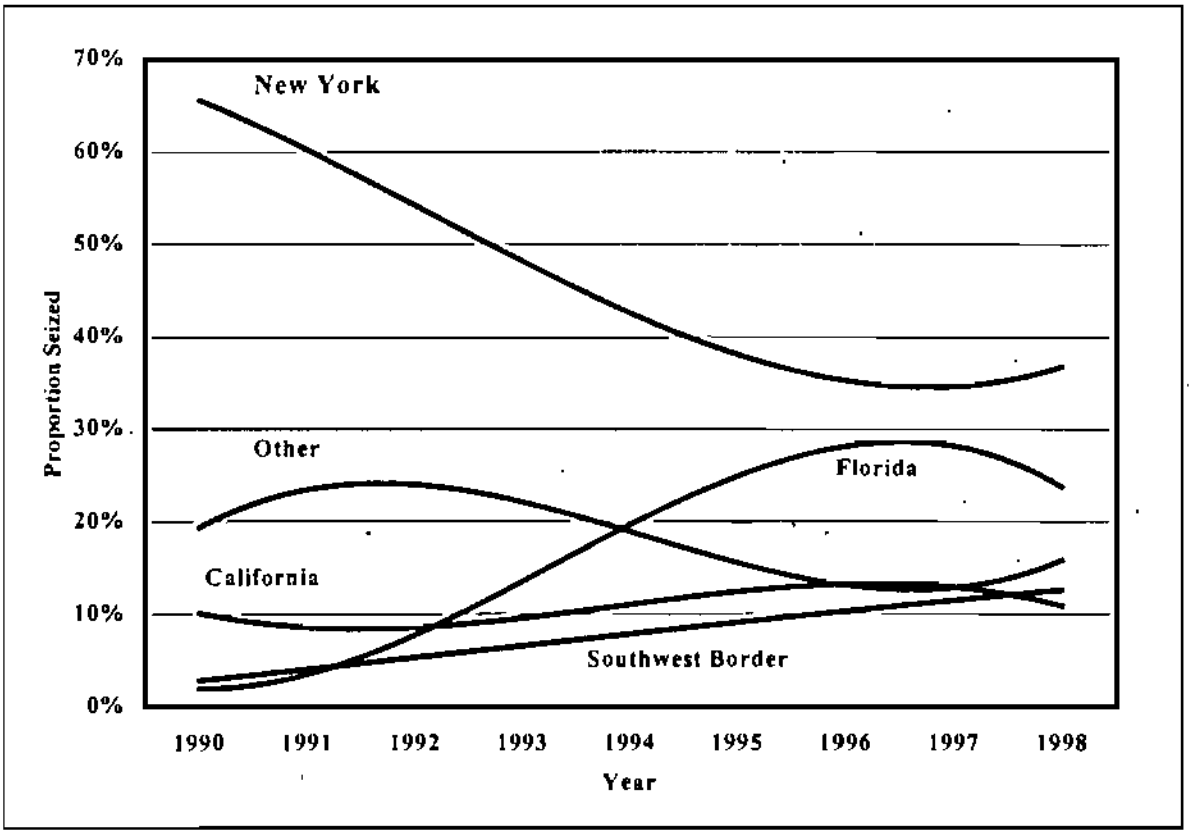
Importation Points

Where do these seizures occur? Most seizures happen in one of four importation areas, defined:

- New York (includes New Jersey)
- Florida (includes Puerto Rico)
- California
- Texas (includes Arizona)

The rest of the seizures occur throughout the United States.

Figure 6
Proportion of Heroin Seized by State (Region)
Weighted by Seizure Size



The curves shown in Figure 6 are a smoothed representation of how the location of seizures changed over time. Seizures have been weighted to reflect the amount of heroin involved in the shipment. A companion report explains the methodology used to develop these curves.[50]

The figure shows that the proportion of seizures made in New York, represented by the highest line in this figure, decreased precipitously from 1991 through 1995 and then stabilized. Most of that reduction was balanced by a dramatic increase and then stabilization of seizures made in Florida. The figure suggests that more heroin was being shipped to New York during 1998 than was the case in 1996 and 1997. This may be true, or it may be that a few especially large shipments have distorted the trend. Also, the smoothing procedure can distort trends at the end of the period. It would be prudent, therefore, to discount the apparent increase in New York seizures and decrease in Florida seizures observed in 1998.

One point is clear: By 1995, seizures had decreased markedly in New York, and they had increased correspondingly in Florida. There was little change in seizures in the rest of the nation. Using the geography

of seizures as an indication, after 1995 the geographic movement of heroin into the United States has been relatively stable.

Movement of Heroin from Source Areas into the United States

Table 15 reports the source of heroin that was seized in the five areas identified in the previous figure. This table is based on seizures made at airports, at the borders, and through the mail. The probability that a shipment is seized likely varies across conveyance mode and geographic location, so a simple tabulation of seizure data would be a biased representation of where heroin enters the United States. To make the tabulations more representative of heroin imports, we weighted the data so that the source area of heroin *seized* was the same percentage as the source area of heroin *used* in the United States.[51] Estimates of the source areas of heroin in the United States have been reported already in Table 14.

Table 15 should be read down its columns. For example, an estimated 82 percent of the heroin that entered the U.S. through California came from Mexico. Almost 86 percent of the heroin that entered through Florida came from South America.

Table 15

Estimated Percentage of Heroin Entering the United States by Importation Point for Each Source Area

Source Area	Importation Point				
	California	Florida	New York	Texas	Other
Mexico	82.4	0.0	0.0	69.2	53.2
South America	7.1	85.9	60.3	13.0	7.6
Southeast Asia	5.5	0.3	22.9	7.0	17.3
Southwest Asia	0.0	0.4	8.9	0.0	9.7
Unknown	4.9	13.5	7.9	10.8	12.2
Total	100.0	100.0	100.0	100.0	100.0

Table 16 reports the estimated percentage of heroin from each source region that entered the United States through each of the five importation areas. This table should be read across its rows.

Table 16

Estimated Percentage of Heroin Entering the United States by Source Area for Each Importation Point

Source Area	Importation Point					
	California	Florida	New York	Texas	Other	Total
Mexico	64.3	0.0	0.0	16.3	19.4	100.0
South America	2.8	52.9	41.3	1.5	1.4	100.0
Southeast Asia	9.9	1.0	71.2	3.8	14.4	100.0
Southwest Asia	0.0	3.1	75.0	0.0	21.9	100.0
Unknown	10.0	43.3	28.3	6.7	11.7	100.0

If weighted seizures are a good reflection of where heroin enters the United States, then 64.3 percent of Mexican heroin enters through California and 16.3 percent enters through Texas. That is, more than 80 percent of Mexican heroin probably comes across the Southwest border, and the rest of Mexican heroin enters the United States through other diverse locations. More than half of South American heroin enters the United States through Florida, and most of the rest comes through New York. Almost three-quarters of Southeast Asian heroin enters through New York and the rest goes through diverse places. Three-quarters of the Southwest Asian heroin also seems to enter through New York City, and the rest goes through various places. The increased role of South America as a supplier of heroin explains why Florida has become an increasingly important heroin importation point.

Table 16 provides another useful way to summarize these data. Multiplying the percentages by source area and importation point (Table 16) by the amounts per source area (Table 14) provides an estimate of metric tons moved through each importation point by source area. To develop this estimate, we average across the five years reported in Table 14.

If we are correct that Americans used about 12.3 metric tons of heroin per year between 1995 and 1998, then Table 17 gives some idea of how much heroin from each source moves into the country through each region

of the United States. Of course, there exists considerable uncertainty in estimates that provide this much detail.

Table 17
Estimated Amount of Heroin (Metric Tons) Entering the United States by Souree Area and Importation Point, 1995-1998

Source Area	Importation Point					
	California	Florida	New York	Texas	Other	Total
Mexico	2.0	0.0	0.0	0:5	0.6	3.1
South America	0.2	3.3	2.6	0.1	0.1	6.2
Southeast Asia	0.1	0.0	1.0	0.1	0.2	1.4
Southwest Asia	0.0	0.0	0.4	0.0	0.1	0.5
Unknown	0.1	0.5	0.3	0.1	0.1	1.2
Total	2.4	3.8	4.2	0.7	1.1	12.3

Almost 10 percent of the heroin was classified as unknown – that is, DEA chemists could not assign a source area to that heroin. Note that, excluding the unknown category, virtually all heroin seized in Florida came from South America. It seems reasonable to suppose that most of the 13.5 percent of the heroin seized in Florida and identified as "unknown" also came from South America. This same reasoning cannot be applied to other places where South America is not the dominant supplier, but it does suggest that South America's share of the U.S. market may be greater than is indicated by Tables 14 and 17.

CNC Potential Production Estimates

How do our estimates of the amount of heroin from the producer nations compare with CNC's reports of production potential? Since 1995, CNC has consistently estimated the production potential of South America at about 6.1 to 7.5 metric tons. (These estimates are after subtracting eradication losses from total hectares. The 7.5 metric ton figure is for 1999; it was never previously larger than 6.6 metric tons.) Unfortunately, estimates are of uncertain accuracy because the assumed conversion ratios from poppy to opium is based on intelligence fieldwork in Southeast and Southwest Asia. We cannot know for sure whether or not those

conversions apply to South America. Nevertheless, we must take those conversion estimates as the best currently available.

According to our consumption estimates, Americans consume somewhat more than 6 metric tons of heroin from South America, and United States authorities seize about 0.75 metric tons. Our consumption/seizure estimates exceed South America's production capacity, but the difference is not great. This suggests that the estimated 12 to 13 metric tons of total domestic heroin consumption is about right if somewhat high.

Since 1995, CNC's estimates of the production potential for Mexico vary over time between 4.3 and 6.0 metric tons. According to our estimates, Americans consume somewhat more than 3 metric tons of Mexican heroin and another 0.34 metric tons are seized by U.S. or Mexican authorities. The consumption-based estimates are less than the production-based estimates. The Mexican production estimates suggest that the estimated 12 metric tons of domestic heroin consumption is too low.

CNC's production estimates for Mexieo are inconsistent with our consumption estimates. There seems to be no ready reconciliation, but speculation may be helpful. CNC emphasizes that its estimates are for *potential production*, and actual production may differ. Perhaps Mexieo's produetion is well below its potential, but it is difficult to reason why potential production would be consistently less than realized production. A better explanation comes from CNC's warning that:

> The wide variation in processing efficiency achieved by traffickers complicates the task of estimating the quantity of coeaine or heroin that could be refined from a crop. These variations occur because of differences in the origin and quality of the raw material used, the technical processing method employed, the size and sophistication of laboratories, the experience of local workers and chemists, and decisions made in response to enforcement pressures. (INCSR, 1999)

CNC's assumptions may overstate Mexico's produetion efficiency. This is speculation, of course, but we observe that heroin imports are about 44 percent pure when from Mexico, 80 percent pure when from Colombia, and 70 to 75 percent pure when from Southeast and Southwest Asia. Because CNC makes the same assumptions about production efficiency for Mexieo as it does for Southeast and Southwest Asia, the potential production may overstate Mexico's actual production.

Suppose that Mexican production were 0.59 as efficient as is assumed by CNC. (The 0.59 comes from dividing 0.44 purity by 0.75 purity.) Then an estimate of Mexico's actual production would be between 2.5 and 3.5 metric tons, numbers that agree with the consumption estimates. Using this same argument, we might assert that Colombian production is 1.07 times more efficient than is assumed by CNC. This would lead to a higher estimate of Colombia's production, which would be more consistent with the eonsumption estimates. This reasoning is speculative, but not unreasonable in the face of having no reliable data about the actual production efficiency in Mexico and Colombia.

Non-U.S. Consumption

How much heroin is consumed within Mexico and within South America? What other reductions occur in the production and distribution systems? Unfortunately the answers to these questions are all but unknown.

Perhaps the most useful published information about consumption comes from reports of the Community Epidemiological Working Group (CEWG). The CEWG is focused on the United States, of course, but most of its reports include sections on consumption in other nations. These reports are seldom quantitative, because nations outside the United States rarely have data collection systems affording estimates of domestic consumption. Based on CEWG assessments, we assume that the consumption of heroin within South and Central America is negligible. Most heroin produced in South and Central America is probably destined for North American markets.

Canada is a bigger problem. According to CEWG reports, heroin is seen as a major drug problem, at least in Vancouver and Toronto. But we do not know the amount of heroin used in Canada; nor do we know the source.[52] It seems reasonable to assume that some South American and Mexican heroin is shipped to Canada, but we do not yet have an estimate of the amount.

Heroin B the Supply-Side Assessment

Our best estimate is that roughly 12 to 13 metric tons of heroin is used in the United States during a given year. The level of use could be lower, of course, but if it were much lower than 12 metric tons, then we could not account for production potential in Colombia and Mexico, most of which is presumably exported to the United States. Likewise, the level could be higher, and while Mexico could be providing more than 4 metric

tons, estimates of more than 12-13 metric tons would be difficult to reconcile with Colombia's apparent production capacity.

Modeling the Flow of Methamphetamines

In 1990, Mexican organized crime groups began large-scale production of methamphetamine and rapidly expanded distribution into California and other parts of the Southwest. In addition to combating large-scale production, United States government efforts to control the distribution of methamphetamines have become increasingly difficult due to the proliferation of small clandestine labs, each of which produces small quantities of the drug. Methamphetamines can be produced easily and inexpensively using chemicals bought at local drug stores or chemical supply companies. A person with little technical training can easily learn how to make methamphetamines. This has become increasingly possible due to several Internet sites that include detailed step-by-step "cooking" directions.[53]

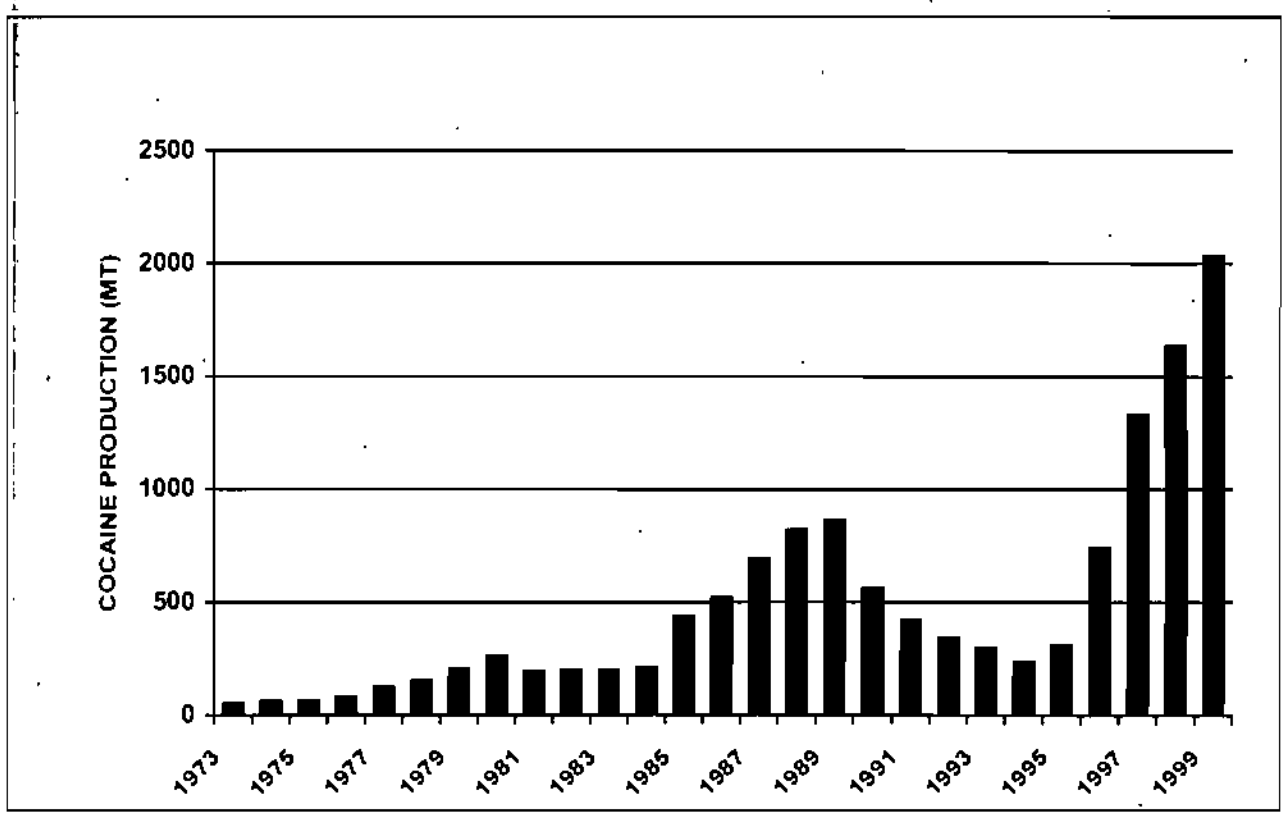
Prior to 1989, methamphetamines were produced primarily by outlaw motorcycle gangs using a technique called "Phenyl-2-Propnanone (P2P) synthesis." During this time, P2P was a controlled substance; however, the precursors required to make P2P were not controlled, which enabled the motorcycle gangs to "legally" produce methamphetamines. The precursors of P2P were subsequently controlled by the first US chemical control act, the 1989 Chemical Diversion Trafficking Act (CDTA).[54] After 1989, the primary methamphetamines precursor shifted from P2P to ephedrine. The ephedrine reduction method became the primary method of synthesis due to a CDTA loophole: The CDTA restricted the importation of bulk ephedrine but made no restrictions on the tablet form of the chemical.[55]

From 1990 to 1994, ephedrine-based production, based in Mexico and California, was the predominant production method. During this time, methamphetamine production rapidly expanded from Mexico and the Southwest corner of the United States into the Midwest and the South.[56] The Mexican drug cartels used existing marijuana and heroin distribution networks to distribute the methamphetamines. Passage of the Domestic Chemical Diversion Control Act (DCDCA) in 1994 made ephedrine tablets a List 1 chemical, restricting their sale. This Act did not stop the Mexicans, who in 1994 began the illegal smuggling of ephedrine. Mexican drug rings purchased large amounts of ephedrine indirectly from rouge companies outside of Mexico that, in turn, purchased the chemicals and then delivered them to Mexico.[57]

The DCDCA also caused a shift in methamphetamine's mode of production. Although the DCDCA controlled the sale of ephedrine, it did not control the sale of pseudoephedrine, which became the precursor of choice.[58] Pseudoephedrine is found in Sudafed and other similar over-the-counter cold medicines. This made it much easier for average criminals to get access, leading to a rapid increase in the number of small clandestine labs, especially in the Midwest. From 1994 to 1996 the number of pseudoephedrine imports into the United States (in metric tons) increased by almost 50 percent Clandestine labs in the Midwest primarily use a method of synthesis called the "Nazi method," because it was first used in Germany during World War II. The Nazi method has become the dominant production procedure in the Midwest because it requires ammonia, which is used throughout the Midwest in fertilizers. Stolen ammonia is the primary source of ammonia for the clandestine labs. The Nazi method is popular because it can produce a highly pure methamphetamine product very quickly: in about 3 hours, compared with the ephedrine reduction method, which can take several days. Small clandestine labs are often mobile and typically produce between 1 and 4 ounces of methamphetamine at a time.[59] From 1995 to 1996, the DEA reported a 169 percent increase in the number of DEA clandestine lab seizures (327 and 879 respectively). This trend continued in both 1997 and 1998.[60]

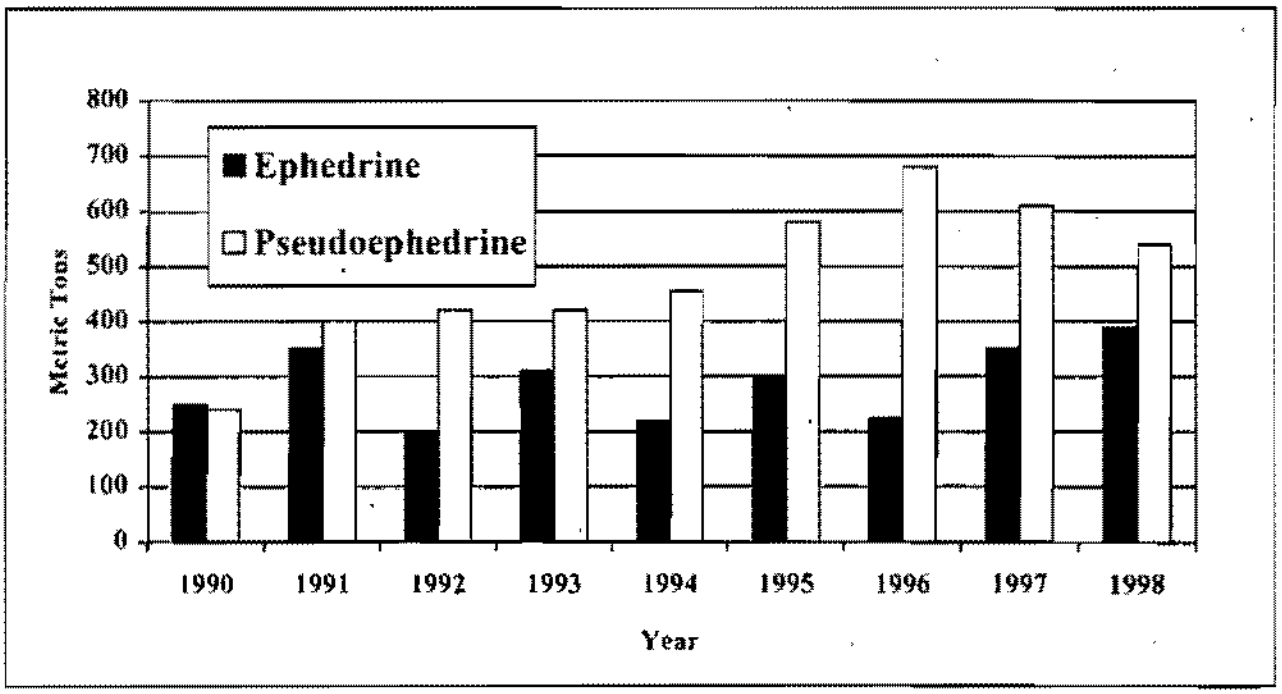
Although the number of small clandestine labs have grown rapidly, the methamphetamine seized from them only accounts for a small portion of the methamphetamine seized by the DEA from labs. In 1998 small clandestine labs accounted for 95 percent of the lab seizures, but only 22 percent of the lab-seized methamphetamine; a majority of the seized methamphetamine (78 percent) came from seizures of the super labs.[61]

Figure 7
Cocaine Production



Source: U.S. Department of Justice, Drug Enforcement Administration, Offiee of Diversion Control, Chemical Investigations Seetion

Figure 8
Ephedrine & Pseudoephedrine Imports into the United States



Source: U.S. Department of Justice, Drug Enforcement Administration, Office of Diversion Control, Chemical Investigations Section

Modeling the flow of methamphetamines poses unique challenges. A cocaine model can begin with estimated production in known growing areas, but methamphetamine production has no comparable geographic boundaries. A heroin model can begin with consumption-by-production region estimates, but developing signatures has proved to be much more difficult with methamphetamine, primarily because of the large number of clandestine labs that have spread all over the United States. In order to develop a signature for a drug, there must be large geographic variability between different drug sites. Clandestine labs are now in almost every state in the United States, making it much more difficult to decipher between different drug sources. In addition, methamphetamine is completely synthetic. Using the Nazi method, clandestine labs can make a highly pure drug product, mitigating the levels of impurities that are necessary to accurately determine the signature of a drug. Unlike heroin or cocaine, which are grown in specific geographic locations (Columbia, Thailand, etc.), anyone can manufacture methamphetamines with the proper ingredients and

cooking instructions. This adds a dimension of difficulty to finding an accurate model of methamphetamine production and distribution in the United States.

An alternate way to model the production and distribution of methamphetamine is to monitor the production and distribution of precursor chemicals. This approach has serious limitations, including the need to make allowance for the legitimate use of those precursors. For example, methamphetamine production requires a large quantity of pseudoephedrine. In order to produce 1 ounce of methamphetamine, a small lab requires 680 60 mg tables (roughly 1.44 ounces) of pseudoephedrine (based on a 70 percent conversion rate). Figure 10 shows that pseudoephedrine imports increased by roughly 200 metric tons after 1994, although this increase was only about 100 metric tons by the late 1990s. If we assume this 100 metric ton increase reflects methamphetamine production, then it represents 70 metric tons of methamphetamine. Given a typical street purity of about 40 percent, this represents just under 30 metric tons of pure methamphetamine– considerably more than the consumption-based calculations, and this does not account for production imported into the United States.

According to the DEA,[62] between June 1993 and December 1994, an estimated 170 metric tons of ephedrine were supplied to Mexican traffickers. Also according to the DEA, this could have yielded 170 tons of methamphetamine. Again assuming 40 percent purity, this represents almost 70 metric tons of pure methamphetamine, far in excess of the consumption-based estimates.

The above arguments are not untended to argue that the consumption-based estimates are correct while these supply-based estimates are wrong. Rather, the point is that supply-based estimates, which are based on precursor chemicals, provide estimates that are difficult to reconcile with reasonable inferences about the use of methamphetamine. According to the DEA, the 170 tons of methamphetamine were "...enough to supply 12.4 million abusers with three 10-milligram doses a day for 365 days per year." Even assuming this eighteen-month estimate implies just over 8 million hardcore methamphetamine users, DEA's estimate seems much too high. The consumption-based estimate is about 400,000 hardcore users. The NHSDA estimates about 800,000 past month users of any amphetamine during this same period, and not all these used methamphetamine. Furthermore, TEDS reports 53,000 treatment admissions in 1997, a figure than has grown from only 15,000 in 1992. It is difficult to see how 8 million daily methamphetamine users could generate only 53,000 treatment admissions, when an estimated 3.5 million weekly cocaine users generate 255,000 treatment admissions. Modeling based on precursor chemicals does not seem to provide a suitable way of estimating the supply of methamphetamine to the United States.

Marijuana

It is also difficult to develop an estimate of the size of the U.S. retail market for marijuana from estimates of available supply. First, the amount of marijuana that Americans cultivate for personal use is impossible to estimate. Second, even though a large amount of the domestic marijuana market is grown in the United States, countries in South and Central America, the Caribbean, Asia, North Africa, and the Middle East also supply cannabis to the domestic market.[63] Unfortunately, the data needed to develop better estimates are not available, and, therefore, we cannot develop a plausible supply-based estimate of the retail value of the marijuana market in the United States.

Legitimately Manufactured Controlled Substances and Illicitly Manufactured Dangerous Drugs

It is impossible to know the amount of controlled substances, such as inhalants and hallucinogens, that are produced legally but diverted for illicit consumption. It is also impossible to know the amount of drugs that are manufactured illicitly in domestic or foreign laboratories. We do know that these substances are readily available.[64]

Price and Purity of Illicit Drugs

Drug prices and purity offer some information about the availability of drugs in the United States. By themselves, trends in illicit drug prices are not a convincing indication of whether the demand or the supply for illicit drugs is either increasing or decreasing. For example, price might remain about the same if both the supply and the demand for drugs were increasing, but then again, a decrease in both the supply and the demand could also result in stable prices. Nevertheless, prices provide some confirmation of patterns reported in this study.

Because illicit drugs can be bought and sold in different amounts, degrees of purity, and levels of distribution, prices can vary greatly from sale to sale. Using the Drug Enforcement Administration's System To Retrieve Information from Drug Evidence (STRIDE) data from January 1981 through June 1998,[65] we have developed statistical models to estimate typical prices for standardized purchases of cocaine, heroin, methamphetamine, and marijuana. A standardized purchase involves a set quantity and quality of drugs exchanged at a specified distribution level. A useful application of these estimates is to examine price trends for these standardized purchases over time.

- Figure 9 shows the estimated retail level[66] and importation level[67] prices per pure gram of cocaine over time. The average price per pure gram at the retail level has decreased considerably from just over $400 per pure gram in 1981 to about $170 per pure gram in 1998. The average price at the importation level has also decreased from roughly $750,000 per pure metric ton in the early 1980s to about $25,000 per metric ton in the late 1990s.

- Figure 10 compares the estimated retail-level purchase price with the estimated importation[68] purchase price of heroin. The figure shows two retail prices because the retail heroin market appears to be bifurcated into a sector selling relatively low purity heroin to injection drug users[69] and a sector selling comparatively high purity heroin to those who either inject or sniff the drug.[70] At the lowest retail level, heroin prices have fallen from about $3.00 per pure milligram in 1981 to about $2.00 per pure milligram in 1998. At the second retail distribution level, prices have fallen from about $2.00 per pure milligram in 1981 to about 40 cents per pure milligram in 1998. In 1998, a weighted average of the two lowest distribution levels suggests a price of roughly $1.00 per pure milligram. Prices at the importation level have also fallen- from $400,000 to $500,000 per metric ton in the early 1980s to under $200,000 per pure metric ton in the late 1990s. In fact, border prices are probably lower, but these trends are descriptive.

- The street price[71] of methamphetamine has fallen over the last twenty years (see Figure 11). In the early 1980s, prices were close to $300 per pure gram. By the late 1990s, methamphetamine was selling for under $200 per pure gram. Importation[72] level prices changed by less than retail-level prices. In the early 1980s, prices seemed to range between $40 and $50 per pure gram, but there were so few high-level purchases that estimates are suspect. By the late 1990s, prices seemed to be closer to $20 to $30 per pure gram.

- Figure 12 shows trends in the predicted prices per bulk gram of marijuana.[73] The average price per bulk gram has risen steadily from just under $5 per bulk gram in 1981 to its peak of about $15 in 1991. Prices returned close to their 1981 levels by 1998.

Figure 9

Predicted Price per Gram of Cocaine at the Retail and Importation Distribution Levels

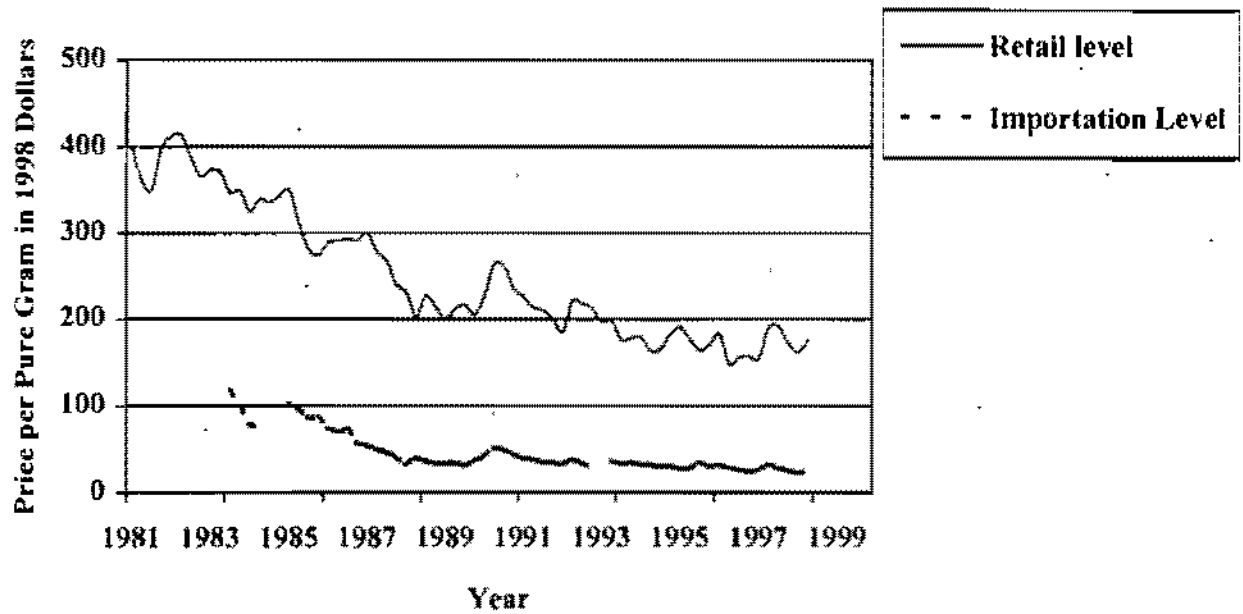


Figure 10
Predicted Price per Pure Gram of Heroin at the Retail and Importation Distribution Levels

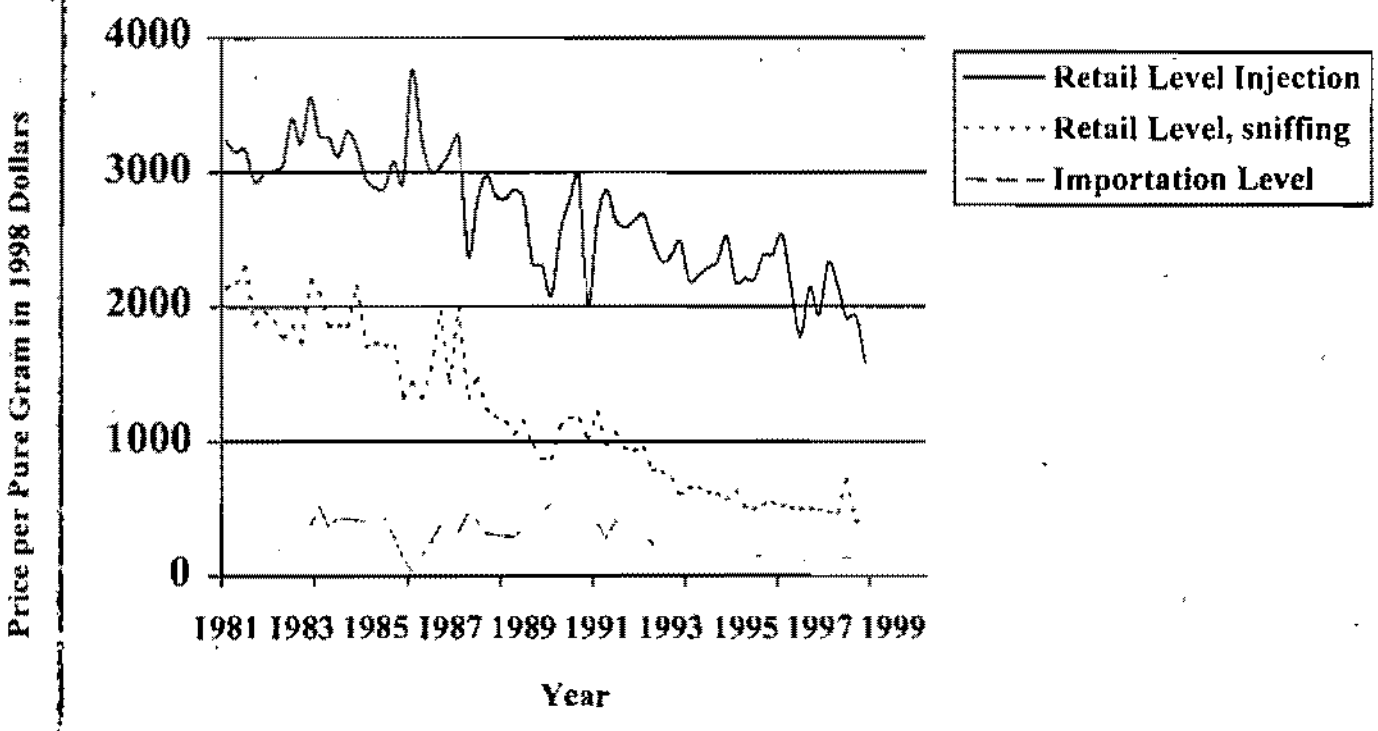


Figure 11

Predicted Price per Pure Gram of Methamphetamine at the Retail and Importation Distribution Levels

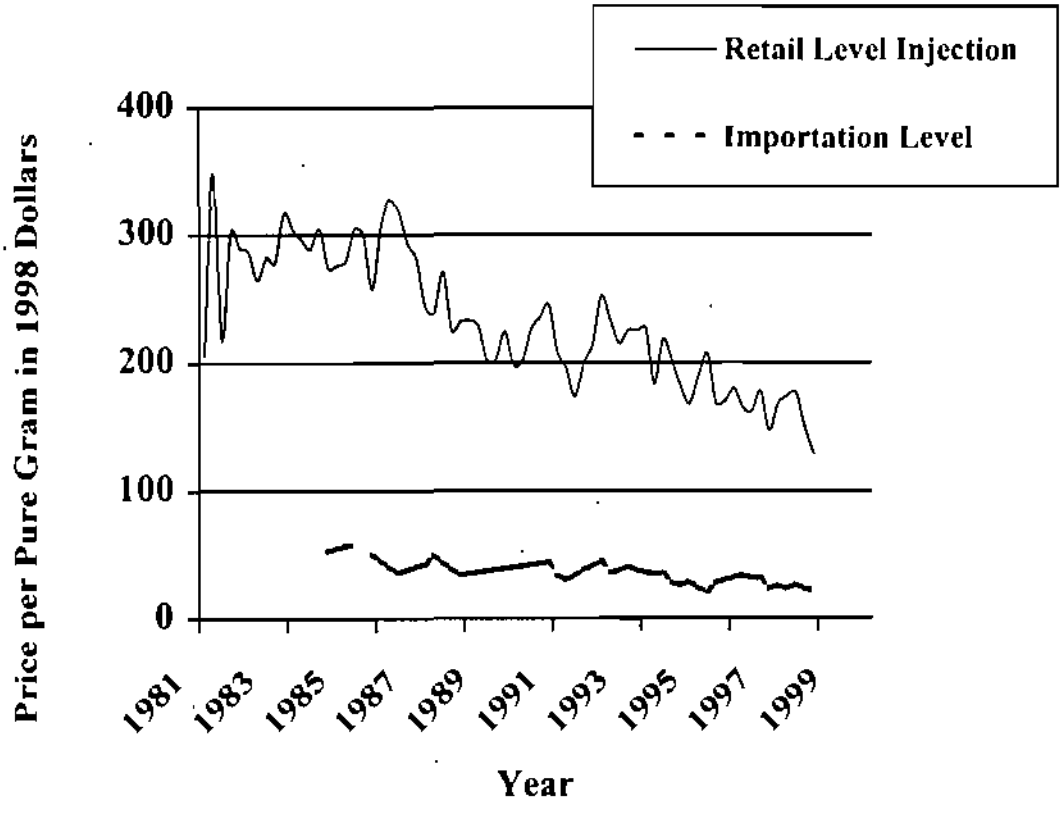
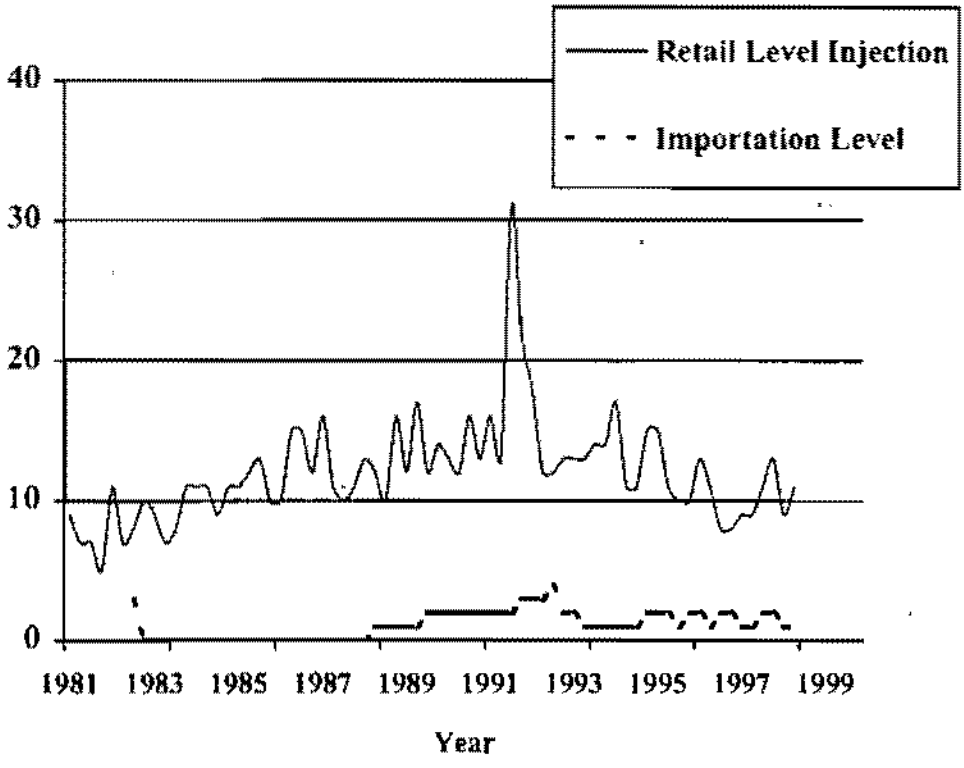


Figure 12

Predicted Price per Bulk Gram of Marijuana at the Retail and Importation Distribution Levels



Summary

Because of the quality of available data, there is considerable imprecision in estimates of the number of hardcore and occasional users of drugs, the amount of drugs they consume, and the retail sales value of those drugs. The best estimates (all for 1998) follow:

- In 1998, about 3.3 million Americans were hardcore cocaine users, and about 980,000 were hardcore heroin users. The number of hardcore cocaine users has remained fairly stable over the last six years (the figure was 3.9 million in 1988). The number of hardcore heroin users has decreased and then increased. The initial decrease in the number of hardcore heroin users (1990-1992) is probably attributable to the impact of the AIDS epidemic on injection drug users and increasing rates of incarceration, while the rebound in 1993-1995 may be the result of new users progressing to hardcore use.

- About 3.2 million Americans were occasional cocaine users, and about 500,000 were occasional heroin users. (The estimate is 253,000 for 1998, but this is anomalous given the three preceding years.) The number of occasional cocaine users dropped from 6.0 million in 1988, and the number of occasional heroin users increased from 170,000 in 1988.

- More Americans use marijuana than either cocaine or heroin. In 1998, about 11 million Americans had used marijuana at least once in the month prior to being surveyed. The number of marijuana users has remained fairly constant over time, with some dip in use during the early 1990s when prices were relatively high.

- Methamphetamine abuse is now recognized as a major problem, but estimates of the size of the problem are imprecise. Perhaps 300,000 to 400,000 Americans are hardcore methamphetamine users, but trends are difficult to detect.

- Many Americans use illicit drugs other than cocaine, heroin, methamphetamine and marijuana, or they may use licit drugs illegally. About 12 million Americans admitted using these other drugs in 1998. These numbers include some overlap of polydrug users.

Deriving estimates of the total expenditure on illicit drugs and licit drugs consumed illegally is more difficult and uncertain because those estimates require more data about amounts used and prices paid. Nevertheless, the best estimates indicate the following:

- In 1998, Americans spent about $39 billion on cocaine, $12 billion on heroin, $1.5 billion on methamphetamine, $11 billion on marijuana, and $2.3 billion on other substances.

- Again, estimating trends is risky, but it appears that expenditures on cocaine, heroin, and marijuana have fallen some over the last decade. However, almost all the reduction can be attributed to a fall in prices.

Estimates of the total amount of cocaine consumed are broadly consistent with estimates of the total amount of cocaine available for consumption in 1998:

- From the supply-side perspective, the cultivation estimates imply that fewer than 406 metric tons of pure cocaine were available for consumption in the United States (1998). The event-based estimates imply that more than 267 metric tons were available for consumption.

- From the consumption perspective, Americans consumed roughly 290 metric tons of cocaine (1998).

The cultivation estimates are surely overstated. First, they do not account for domestic seizures by State and local officials, and second, they do not account for other leakages from the distribution system. In contrast, the event-based estimates are surely understated, because authorities cannot identify all shipments. Although the supply-based and the consumption-based estimates are remarkably close, they cannot be completely reconciled.

This report provides, for the first time, a model of the supply of heroin to the United States. The model cannot fully resolve the problem that Colombia's heroin production potential is somewhat less than estimates of the amount of South American heroin used in the United States. Nor can it fully resolve the observation that Mexico's production potential is more than what is consumed in the United States. Nevertheless, consumption and production estimates are remarkably close.

Although these estimates paint a picture of drug consumption with an extremely broad brush, and although not all estimates can be reconciled, the approach we use provides an important perspective on what is *not known* about drug production and consumption and what *needs to be known* to better understand the policy choices available to the Nation.

We make no pretense here that the model and estimates we present in this report are fully adequate to the larger task of informing public policy decisions. They are, at best, a start, but they offer important possibilities of integrating what are otherwise seen as disparate pieces of information about the consumption and supply of drugs.

We expect incremental improvements to the estimates and methods offered here, particularly as better data become available. We also expect improvement in the models. In fact, the Office of National Drug Control Policy has started a project to improve and integrate drug use and supply indicator data, and these future data are bound to improve retail sales calculations. Thus, it is probably best to consider this an interim report. The estimates we present might be seen as an improvement over those reported in 1997 and as a prelude to improved estimates for 2001 and later.

Moreover, the estimates by themselves have only modest importance – they tell us nothing more than that the drug trade is large, a conclusion that requires no special study. The real utility of these numbers is the development of a systematic methodology for integrating the various indicators – crops in foreign countries, drugs seized at the borders, arrests made in American cities, etc. – that can help policymakers to better understand the dynamics of the drug trade and to fashion appropriate policy responses.

Endnotes

1. Money is not the only form of payment for illicit drugs. Dealers often keep drugs for personal use, users help dealers in exchange for drugs, and users perform sex for drugs (especially crack cocaine). When such "income in kind" is valued at current retail prices, an additional $4 billion to $7 billion must be added to the total for cocaine and an additional $2 billion to $4 billion to the total for heroin. In this report, all expenditures are in 1998 dollar equivalents. These expenditure estimates do not include income in kind.

2. By comparison, Americans spent about $43 billion on tobacco in 1993. *The Tax Burden on Tobacco* (Washington, D.C.: The Tobacco Institute, 1993).

3. The NHSDA excludes military personnel, those incarcerated in jails and prisons, and those who are residents of treatment facilities. Military personnel, whose consumption of illicit substances is monitored through urinalysis, do not have the opportunity to be heavy drug users. Those incarcerated in jails and lockups may use drugs, but that consumption must necessarily be limited by restricted availability. A Bureau of Justice Statistics study reports "In State correctional facilities, 3.6 percent of the tests for cocaine, 1.3 percent for heroin, 2.0 percent for methamphetamine, and 6.3 percent for marijuana found evidence of drug use. In Federal prisons, 0.4 percent of the tests for cocaine, 0.4 percent for heroin, 0.1 percent for methamphetamine, and 1.1 percent for marijuana were positive." C. Harlow, *Drug Enforcement and Treatment in Prison, 1990* (NCJ-134724, July 1992). These percentages are probably high because tests are most likely to be conducted when drug use is suspected. In any case, drug use in prisons cannot account for much of the drug use that occurs in America. Sources at the National Institute on Drug Abuse consider drug use by those in residential treatment facilities to be minimal.

4. Evidence that a large segment of the drug-using population is excluded from the NHSDA comes from a number of sources. According to the 1991 NHSDA, drug use is twice as high among respondents who lived in households considered unstable than it is among those who lived in more stable environments, indicating that the NHSDA's bias toward reporting on stable households is likely to miss many heavy drug users. Additional evidence also comes from interviews with nearly 35,000 intravenous drug users who were contacted by National Institute on Drug Abuse-sponsored researchers as part of an AIDS outreach project. Abt Associates' tabulations show that of these drug users, an estimated 40 percent lived in unstable households and about 10 percent could be considered homeless.

   Available evidence indicates that NHSDA's respondents understate heavy drug use.. A. Harrell, K. Kapsak, I. Caisson, and P. Wirtz, "The Validity of Self-Reported Drug Use Data: The Accuracy of Responses on Confidential Self-Administered Answer Sheets," paper prepared for the National Institute on Drug Abuse, Contract Number 271-85-8305, December 1986. M. Fendrich, T. Johnson, S. Sudman, J. Wislar and V. Spiehler, "Validity of Drug Use Reporting in a High-Risk Community Sample: A Comparison of Cocaine and Heroin Survey Reports with Hair Tests," *American Journal of Epidemiology* 149(10): 955:62, 1999. Consistent with these observations, the Substance Abuse

Mental Health Services Administration reports that virtually no heroin addicts answer the National Household Survey on Drug Abuse. Substance Abuse Mental Health Services Administration, *Preliminary Estimates from the 1993 National Household Survey on Drug Abuse* (June 1994).

A comparison of the demographic characteristics of the heavy cocaine users in the NHSDA with those of heavy cocaine users based on other sources (the Drug Use Forecasting program, the Drug Abuse Warning Network, and the National AIDS Demonstration Research project) shows a marked difference between those populations and the one represented in the NHSDA. Incomes are greater, unemployment is lower, and there are fewer respondents using more than one drug in the NHSDA. D. Hunt and W. Rhodes, —haracteristics of Heavy Cocaine Users Including Polydrug Use, Criminal Behavior, and Health Risks," paper prepared for Office of National Drug Control Policy (ONDCP), December 14, 1992.

Finally, estimates of heavy drug use reported in the NHSDA are difficult to reconcile with other data sources maintained by the Substance Abuse Mental Health Services Administration, especially with reports of the treatment for cocaine or heroin. These incompatibilities are discussed later in this report.

5. A large percentage of heavy drug users are arrested at some time in their drug-using "careers," so the criminal justice system provides valuable supplemental data when counting heavy drug users. For example, in the 1993 Household Survey, about 58 percent of weekly cocaine users surveyed had been arrested and booked at some time, 39 percent during the year prior to the survey. In the National AIDS Demonstration Research data, 81 percent of heavy cocaine users had been arrested at some time in their lives, and one-third had been in jail or prison during the six months prior to the interview.

6. The population of hardcore users is not identical to the population of users who need substance abuse treatment. Still, using the 10 days per month threshold, the DUF data show that 57 percent of hardcore cocaine users and 77 percent of hardcore heroin users deemed themselves to be in need of treatment. These self-reports probably understate the need for treatment, because denial of the need for treatment is high among hardcore users.

7. Because urinalysis will detect cocaine and heroin use within two to three days of its consumption, it is unlikely that urinalysis will fail to identify an individual who uses cocaine on at least a weekly basis. (Most weekly users use it more frequently than once a week.) However, an occasional user is likely not to have used cocaine or heroin within two to three days of his or her arrest. Consequently, DUF would frequently fail to identify occasional users. Arguably, the EMIT test used by DUF understates drugs in the urine of arrestees. C. Visher and K. McFadden, *A Comparison of Urinalysis Technologies for Drug Testing in Criminal Justice*, NCJ-129292, June 1991. However, it seems reasonable that occasional users are more likely than hardcore users to have an erroneous negative urine test, so we have not adjusted the DUF urine test results to reflect the EMIT test's false negative rate of about 20 percent. For evidence supporting this decision, see T. Mieczkowski, "Immunochemical Hair Assays, Urinalysis, Self Reported Use and the Measurement of Arrestee Cocaine and Marijuana Exposure in a Large Sample," paper presented at the Annual Meetings, American Society of Criminology, New Orleans, November 7-22, 1992.

8. S. Everingham, C. Rydell and J. Caulkins, "Cocaine Consumption in the United States: Estimating Past Trends and Future Scenarios," *Socio-Economic Planning Sciences*, Vol. 29 (4) December 1995: 305-314. The authors report that heavy users of cocaine use 70 percent of all cocaine. Estimates based on retail sales expenditure, reported later, are consistent, but also show that hardcore heroin users account for a larger fraction of heroin sales than hardcore cocaine users account for cocaine sales.

9. Drugs are sometimes received as income-in-kind, especially by drug-using dealers who keep part of what they otherwise would deal, and also those who exchange drugs for sex. Income-in-kind is not included in the retail sales dollar amounts, but it is factored into the measures of metric tons of drugs consumed.

10. To project hardcore user estimates from the DUF data, we estimated the number of hardcore users in 1998 as a linear projection of estimates from 1995, 1996 and 1997. We set estimates for 1999 and 2000 equal to the 1998 projection. Finally, we applied a three-year moving average to all the estimates from 1989 through 2000. The three-year moving average is reported in the text. Statistics for 1998 had already been reported for the NHSDA, so we used a linear projection (using data from 1988 through 1998) to estimate comparable figures for 1999 and 2000. The final hardcore users estimates equal the smoothed estimates from DUF data plus one-half the estimate of hardcore use from the NHSDA.

11. A large number of drug users use both heroin and cocaine. For example, of the hardcore drug users in the 1995 DUF sample: 70 percent are hardcore users of cocaine only, 16 percent are hardcore users of heroin only, and the other 14 percent are hardcore users of both.

12. W. Rhodes, S. Langenbahn, R. Kling, and P. Scheiman. *What America's Users Spend on Illegal Drugs: 1988-1995* (Washington, D.C.: Office of National Drug Control Policy, Fall 1997). See Appendix A.

13. D. Hamill and P. Cooley, *National Estimates of Heroin Prevalence 1980-1987: Results from Analyses of DAWN Emergency Room Data*, RTI Technical Report, (Triangle Park, N.C.: Research Triangle Institute, 1990).

14. R. Simeone, W. Rhodes, and D. Hunt, *Methodology for Estimating the Number of Hardcore Drug Users*, report submitted to the Office of National Drug Control Policy, March 1997.

15. SAMHSA estimates that 7.1 million people needed treatment in 1994. Persons needing treatment are divided into two categories, Level 1 and Level 2. The Level 2 category is a more severe category of need and contains about 3.6 million people. We have used this 3.6 million figure in our calculations under the assumption that Level 2 users are similar to the hardcore drug users described in our report. See: Substance Abuse and Mental Health Services Administration,"The Need for and Delivery of Drug Abuse Services: Recent Estimates," February 22, 1996.

16. SAMHSA defines those who are severely in need of drug treatment using four criteria. NHSDA respondents were classified as in need of treatment if they reported any of the following in the past 12 months:

- Been dependent on any drug other than marijuana;
- Reported injecting cocaine, heroin or stimulants;
- Received drug abuse treatment at a specialty facility; and
- Used drugs frequently.

To account for the underestimation of hard-core drug use in the NHSDA, SAMHSA adjusted the number of people needing treatment using a ratio estimation technique that links NHSDA data to data from the Uniform Crime Reports and the National Drug and Alcohol Treatment Unit Survey. This ratio estimation technique inflated estimates of treatment need by 20% in 1991 and 1992 and 30% in 1993. Although we did not have figures for the ratio estimation in 1994, we assumed a similar adjustment of 20 to 30%. See: Substance Abuse and Mental Health Services Administration,"The Need for and Delivery of Drug Abuse Services: Recent Estimates," February 22, 1996 and "Estimating Substance Abuse Treatment Need for a National Household Survey," by Joan Epstein and Joseph Gfoerer, OAS Working Paper, presented at the 37th International Congress on Alcohol and Drug Dependence, August 20-25, 1995, UCSD Campus, La Jolla, California.

17. Using SAMHSA's description of their technique for estimating the number of persons needing treatment, we developed the following algorithm using the NHSDA. Persons were classified as severely needing treatment if they met at least one of the following criteria:

- Dependence on any drug other than marijuana in the past 12 months. Six question types from the 1994 revised NHSDA were used to approximate the DSM-III-R criteria for drug dependence. Respondents were classified as dependent if they answered at least three of these six questions positively for any drug except marijuana. We originally defined dependence using positive answers to at least two of the six questions, since the DSM-III-R uses three of nine questions to determine dependence. However, this procedure yielded estimates that were too high.

- Reported using needles to inject cocaine, heroin or stimulants at least once during the last year.

- Reported receiving drug treatment at a hospital (as an inpatient), a drug treatment facility (as an inpatient), or at a mental health facility over the past year.

- In the past year, reported using marijuana daily and met the criteria for marijuana dependence described above, reported any heroin use, reported using cocaine at least weekly, or reported daily use of other drugs, including inhalants, hallucinogens, stimulants, sedatives, analgesics, and tranquilizers.

We inflated the estimate obtained through this method by 25% to approximate the ratio estimation technique used by SAMHSA.

18. National Institute on Drug Abuse, *Epidemiological Trends in Drug Abuse, Volume I: Highlights and Executive Summary*, Community Epidemiological Work Group, December 1996: Exhibit 5, page 18. We excluded Minneapolis/St. Paul from this summary, because that site did not exclude alcohol – only from its treatment statistics.

19. Treatment Episode Data Set (TEDS): 1992-1997. SAMHSA, August 26, 1999. Downloaded from the Internet 11/18/1999: www. samhsa.gov/teds9297.htm

20. Center for Disease Control and Prevention, *HIV/AIDS Surveillance Report* 1998, Vol. 10 (No. 2).

21. Trends in lifetime prevalence of heroin use among 12th graders rose from 1993 to 1997, but leveled or dropped from 1997 to 1998. Table 5-1, *National Survey Results on Drug Use from the Monitoring the Future Study, 1975-1998* (Bethesda, Maryland: National Institute on Drug Abuse, 1999).

22. Treatment data are difficult to interpret. From the Treatment Episode Data, we observe that treatment admissions for heroin increased from 167,000 in 1992 to 218,000 in 1997; furthermore, while 77 percent of heroin users injected in 1992, only 68 percent injected in 1997. Perhaps these trends imply more heroin users in the late 1990s. It certainly implies a larger prevalence on non-injection drug use. Substance Abuse Mental Health Services Administration, Treatment Episode Data Set (TEDS): 1992-1997.

23. Table 2.10 Downloaded from the Internet on 11/15/99: www.samsha.gov/oas/p0000018.htm

24. R. Simeone, W. Rhodes, and D. Hunt. *Methodology for Estimating the Number of Hardcore Drug Users*. Report submitted to the Office of National Drug Control Policy by Abt Associates Inc., March 1997.

25. Weekly expenditures on cocaine and heroin have decreased over time, but this change results from using the CPI to convert expenditures to 1998 dollar equivalents. Many hardcore users spend two-thirds of their incomes on drugs, but they probably do not see themselves as spending less over time because the price of cocaine and heroin has fallen in real terms since 1988. The CPI is not a good reflection of a hardcore drug users' market basket.

26. K.J. Riley, *Crack, Powder Cocaine, and Heroin: Drug Purchase and Use Patterns in Six U.S. Cities*, joint report of the National Institute of Justice and the Office of National Drug Control Policy (Washington, D.C., December 1997).

27. We are indebted to Linda Truitt for these calculations.

28. On this point, see J. Caulkins, B. Johnson, A. Taylor and L. Taylor, "What Drug Dealers Tell Us About Their Costs of Doing Business," *Journal of Drug Issues* 29(2), Spring 1999. This study was about the distribution of crack, but a similar marketing scheme is likely to pertain to heroin.

29. Two factors make the assumption of higher spending questionable. First, incomes of most drug users cannot support a higher level of drug use. Second, heavy drug users have a high level of unemployment and underemployment. D. Hunt and W. Rhodes, "Characteristics of Heavy Cocaine Users, Including Polydrug Use, Criminal Activity and Health Risks," paper prepared for ONDCP, December 14, 1992. As discussed in Appendix B, illegal income from property crimes and prostitution accounts for much of the expenditure on drug use. However, illegal income cannot account for higher expenditures than are reported in this study. Drug dealing is often advanced as a way to support hardcore drug use, but in total, street-level dealing cannot generate the dollars that

ultimately must go to satisfy the cash demands of middle-level and upper-level dealers., If expenditures are much greater than reported here, the income source for supporting that level of consumption is suspect.

30. Reuter and Kleiman estimated that the market for cocaine was about $8 billion in 1982. This is about $14 billion in 1998 dollars. Because of the accelerating use of cocaine from that time until the mid-1980s, and after accounting for inflation, it is not surprising that their estimate is less than the figure reported here. Their $8 billion estimate for heroin expenditures equals about $14 billion in 1998 dollars. That is considerably less than our 1989 estimate. P. Reuter and M. Kleiman, "Risks and Prices: An Economic Analysis of Drug Enforcement," in *Crime and Justice: An Annual Review of Research*, volume 7, ed. M. Tonry and N. Morris (Chicago: University of Chicago Press, 1986), 194. Carlson, who conducted a study of the underground economy for the Internal Revenue Service, reported that an estimated $11 billion was spent on cocaine in 1982. K. Carlson et al., "Unreported Taxable Income for Selected Illegal Activities: Volume I: Consensual Crimes," paper prepared for the Internal Revenue Service under contract number TIR-81.57, September 1984. In an update of his study, Carlson estimated that cocaine expenditures increased from $5.8 to $6.6 billion between 1988 and 1991. K. Carlson, "Unreported Illegal Source Income 1983-1995," paper prepared for the Internal Revenue Service under order number 89-11565, May 15, 1990. Since he relied heavily on the NHSDA, and because his estimates are not adjusted for inflation, it is not surprising that his estimate is much lower than the one reported here. Carlson's estimate of heroin expenditures, based on the National Narcotics Intelligence Consumers Committee estimates for 1982, was in keeping with Reuter and Kleiman's $8 billion figure. His updated study, based on NHSDA data, put that figure at roughly $7 billion a year between 1988 and 1991.

31. Heroin distribution seemed to change toward the end of the 1980s and 1990s. As discussed later in this report, there was a marked decrease in the cost of heroin and an equally marked increase in the purity of heroin available to American consumers. At least as of 1995, Colombia had replaced Southeast and Southwest Asia as the principal source of heroin sold in the United States, and distribution practices changed as a consequence. As Appendix B argues, ethnographers increasingly reported that drugs were being distributed by profit dealers instead of users.

32. Using the CPI to inflate expenditure on drugs is arguable. The Federal government computes the CPI from a weighted average of prices paid by consumers for what is deemed to be a typical market basket. The problem when applying this CPI to hardcore users is that their market basket is grossly atypical—two-thirds to three-quarters of their income may be spent on illicit drugs. (See J. Fagan, "Drug Selling and Illicit Income in Distressed Neighborhoods: The Economic Lives of Street-Level Drug Users and Dealers," in *Drugs, Crime and Social Isolation*, edited by A. Harrell and G. Peterson, (Washington, D.C.: The Urban Institute Press, November 1994). Because the nominal prices of cocaine and heroin have fallen over much of the period examined through the retail sales calculations, hardcore users have seen a deflation, not an inflation, in how much they spend on their typical market basket, most of which may be for illicit drugs. Thus, when asked about drug expenditures, hardcore users may well say they spend about the same amount in 1998 as they spent in 1988.

33. Recent reports by the Community Epidemiological Work Group have told of increasing numbers of heroin users: "In the most recent reporting period (1997-1998), heroin indicators continued to

increase in 12 CEWG cities. In some cities, heroin use indicators have been trending upward for more than three years." December 1998 Advance Report. Downloaded from the Internet 11/15/99: www.cdmgroup.com/cewg/docs/1298-miami/1298adv.ntm#heroin

34. M. Childress, B. Dombey, and S. Resetor. *A Systems Description of the Cocaine Trade* (Santa Monica, CA: Rand, 1994).

35. M. Childress, et al. *A Systems Description of the Cocaine Trade* (Santa Monica, CA: Rand, 1994).

36. W. Rhodes, P. Johnson, S. Han, Q. McMullen, and Lynne Hozik. *Illicit Drugs: Price Elasticity of Demand and Supply*. Report submitted to the National Institute of Justice by Abt Associates Inc., February 17, 2000.

37. National Narcotics Intelligence Consumers Committee, *The NNICC Report 1993: The Supply of Illicit Drugs to the United States* (Washington, D.C., August 1994): 61.

38. The estimate of 0.0136 ounces is equivalent to 0.39 grams. The 1997 NNICC report says that a joint contains one-half gram on average, and that a ". . . blunt may contain as much as 6 times this amount." If the NNICC estimate is correct, our estimates would be about 25 percent too low, but the source of the NNICC estimate is unknown. *The NNICC Report 1997: The Supply of Illicit Drugs to the United States* (Washington, DC: DEA, November 1998).

39. Researchers disagree about trends in reporting practices, but they agree that self-reported tobacco use is only about three-quarters as large as reports based on foreign imports and tobacco sales resulting in state and federal excise taxes. K.E. Warner, "Possible Increases in the Under reporting of Cigarette Consumption," *Journal of the American Statistical Association*, 73 (1978):314-317. E.J. Hatziadreu, J.P. Pierce, M.C. Fiore, et. al, "The Reliability of Self-Reported Cigarette Consumption in the United States," *American Journal of Public Health*, 79, (1989): 1020-1023.

40. In 1993, about 74 percent of arrestees who tested positive for marijuana use at the time of booking reported some marijuana use during the month before the survey.

41. Using several self-report surveys, BOTEC Analysis Corporation estimated that marijuana costs $222 an ounce and that an ounce could be divided into 60 joints, yielding a unit price of $3.70 per joint. Based on these assumptions, BOTEC estimated that Americans spent $13.1 billion on 1,599 tons of marijuana in 1992. After adjusting for inflation, BOTEC's estimate is greater than the estimate presented in this report. The difference can be accounted for by three factors: methodological differences in estimating the number of users based on the NHSDA; BOTEC's inclusion of criminally active user estimates; and BOTEC's higher price estimates. A..L. Chalsma and D. Boyum, "Marijuana Situation Assessment," (Washington, D.C.: Office of National Drug Control Policy, September 1994).

42. We noted previously that heavy cocaine users and heavy heroin users frequently appear in the DUF data, but infrequently appear in the NHSDA data. The reverse occurs for other illicit substances. With few exceptions, which are specific to cities, other illicit substances have relatively low prevalence among arrestees.

43. Their answers, which were in ranges of days per year, were converted to a fixed number. For instance, the range three to five days became four days.

44. Estimates of frequency of use from the 1991 NHSDA were applied to earlier years.

45. Drug Enforcement Administration, *Illegal Drug Price/Purity Report United States: January 1990 - December 1993*, April 1994. Community Epidemiology Work Group, *Epidemiologic Trends in Drug Abuse*, (Rockville, MD: National Institute on Drug Abuse, June 1994).

46. M. Layne, P. Johnston, W. Rhodes, *Following the Flow of Cocaine: The Sequential Transition and Reduction (STAR) Model, 1996-1999*, May 2000.

ii. Defense Intelligence Agency, 1999. *Interagency Assessment of Cocaine Movement: August 1999* Eighteenth Edition, Mid-Year Review, p. 2

iii. We used movement events from the CCDB for our calculations, and they differ slightly from figures published in the IACM. See Cata, 1999.

47. W. Rhodes, M. Layne and P. Johnston, *Estimating Heroin Availability*. Report submitted to the Office of National Drug Control Policy by Abt Associates Inc., May 2000.

48. Rhodes, W., Truitt, L., Kling, R. and Nelson, A. *The Domestic Monitor Program and the Heroin Signature Program: Recommendations for Change* (Cambridge MA, Abt Associates Inc., June 30, 1998).

49. Coomber argues that this dilution of imported heroin is a product of the heroin production process. Thus it probably varies from source to source. South American heroin appears to be the most pure; Mexican is typically the least pure. R. Coomber, "The Cutting of Heroin," *Journal of Drug Issues, 29 (1), 1999: 17-35.*

50. W. Rhodes, M. Layne, and P. Johnston. *Estimating Heroin Availability*. Report submitted to the Office of National Drug Control Policy by Abt Associates Inc., May 2000.

51. Calculations began with all the seizure reports contained in the Heroin Signature Program data file. These reports are not comprehensive of all seizures at ports of entry. From this file we selected all reports where: (1) the seizure occurred at an airport, at the border, or through the mail; (2) the seizure happened in 1995 or later; and (3) the seizure involved less than ten kilograms. Each report was characterized by the amount of pure heroin seized, and then the sample was weighted so that the distribution by source country for the seizure data matched the distribution by source country for the consumption data. For example, if 10 percent of the seizures came from South America while 15 percent of consumption came from South America, we weighted the seizures from South America by 15/10 or 1.5. By source area, the weights were:

    0.73 for unknown
    2.67 for Mexico
    0.87 for Southeast Asia
    1.32 for Southwest Asia

1.67 for South America

As a practical matter, then, this weighting gives greater emphasis to Mexican and South American heroin.

52. The Canadian Center on Substance Abuse reports that 5.9 percent of Canadians tried heroin at some time; 1.1 percent of the population used heroin during 1994. Canadian Center on Substance Abuse, *Canadian Profile 1999 Illicit Drugs*, downloaded from the Internet www.ccsa.ca/cp99.11.htm, November 11, 1999.

53. Personal communication with Bill Wolf, Drug Enforcement Administration; November 12th, 1999.

54. Drug Enforcement Administration Memo: "International Chemical Conference on the Multilateral Chemical Reporting Initiative."

55. http://www.usdoj.gov/dea/programs/diversion/divpub/substanc/methamph.htm. G. Haislip, *Methamphetamine Precursor Chemical Control in the 1990s.*

56. http://www.usdoj.gov/dea/pubs/meth/threat.htm. *Methamphetamine: A Growing Domestic Threat – The Methamphetamine Problem.*

57. Personal communication with Bill Wolf, Drug Enforcement Administration; November 12th, 1999; Drug Enforcement Administration Memo: "Shifts in Predominance of Precursors."

58. http://www.usdoj.gov/dea/programs/diversion/divpub/substanc/methamph.htm. G. Haislip, *Methamphetamine Precursor Chemical Control in the 1990s.*

59. Personal communication with Bill Wolf, Drug Enforcement Administration; November 12th, 1999.

60. Drug Enforcement Administration Memo – April 9, 1997.

61. Drug Enforcement Administration Memo – W.J. Wolf Jr., July 27, 1999.

62. G. Haislip, *Methamphetamine Precursor Chemical Control in the 1990s*, Drug Enforcement Administration, January 1996, downloaded from the Internet www.usdoj.gov/dea/programs/diversion/divpub/substance/methamph.htm.

63. The DEA no longer estimates the amount of marijuana under cultivation outdoors in the United States. The DEA also notes that indoor cultivation continues and that there is no way to estimate the extent of this practice. *The NNICC Report, 1995: The Supply of Illicit Drugs to the United States* (Washington, D.C.: National Narcotics Intelligence Consumers Committee, August 1996).

64. Drug Enforcement Administration, Intelligence Division, *U.S. Drug Threat Assessment* (Washington, D.C.: U.S. Department of Justice, 1993).

65. Details of the statistical model can be found in P. Johnston, W. Rhodes, K. Carrigan and E. Moe, "The Price of Illicit Drugs: 1981 Through the Second Quarter of 1998." Paper prepared for the Office of National Drug Control Policy by Abt Associates Inc., February 1999.

66. A standardized retail cocaine purchase consists of 0.35 pure grams of cocaine at 67 percent purity. By assumption, retail cocaine purchases involve transactions of 0.01 to 1.0 pure grams.

67. A standardized middle level cocaine sale involves 30 pure grams (37.5 bulk grams) of cocaine at 80 percent purity. Middle level cocaine transactions are estimated to range from 15 to 140 grams, costing between $10 and $1000 per gram.

68. A standardized importation level purchase is 358 pure grams at 73 percent purity. Importation level purchases were 0.1 metric tons and larger.

69. A standardized purchase level for injection drug users is 40 milligrams at 13 percent purity. Purchases of 100 pure milligrams or less were considered to be purchases by injectors.

70. A standardized purchase level for those who sniff heroin is about one-third pure gram at 39 percent purity. Purchases between 0.1 and 1.0 pure grams fit this category.

71. A street-level purchase is 2.94 pure grams at 41% purity. This includes purchases of between 0.001 and 10 pure grams.

72. An importation-level purchase is 321 pure grams at 71 percent purity. A purchase was considered to be at the importation level if it exceeded 100 pure grams.

73. These estimates reflect retail level sales ranging from 0.001 to 10 grams; the retail price is evaluated at 3.1 grams. The importation level is for purchases of 1 metric ton and more. The prices are evaluated at 1.8 metric tons.