What America's Users Spend on Illegal Drugs, 1988-1995

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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

Table A

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

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	581-692	558-670	616-738
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	96	84	80	56	41
Cocaine shipped to the United States	547-660	509-624	539-664	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 INCSR, 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 yearsT and T-1. The estimate for 1989 is for year 1989 alone.

What America's Users Spend on Illegal Drugs

In 1995, the Office of National Drug Control Policy (ONDCP), working with Abt Associates Inc., reported that Americans spent an estimated $49 billion to $66 billion per year between 1988 and 1993 for illicit drugs and for licit drugs used illegally. New data and a revised methodology have enabled us to improve those estimates and to extend them through 1995.

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 or shipped through the United States to other countries. 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. Thus, estimates of retail expenditures must be based on incomplete, inaccurate, and often inconsistent data, as well as assumptions that occasionally lack strong justification.

Therefore, 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 also 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 three sections. Section I reports estimates derived using the consumption approach. Section II reports estimates for cocaine derived from a supply approach. Section III summarizes and reconciles the differences between the two approaches. Technical material appears in appendices.

1 Consumption Approach

Cocaine and Heroin

Between 1988 and 1995, American users spent $37 billion to $61 billion yearly on cocaine and $9 billion to $18 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 1996 dollar equivalents.

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.[5] The NHSDA misses a part of the population that may be a key to determining the extent of drug use: those who, although not homeless, are too unstable to be considered as part of a household, or who, if part of the household, are unlikely to answer surveys.[6]

This less-stable population is, however, well-represented in data collected by the Drug Use Forecasting (DUF) program, which questions a random sample of arrestees in 24 central city jails and lockups about their drug use.[7] DUF also asks arrestees to voluntarily produce samples for urinalysis. This helps to confirm whether the interviewees have used 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 frequency of drug use, it adds credence 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.[8] *Occasional users* are identified in the NHSDA as those whose drug use was less frequent than the hardcore drug use criteria described above. Occasional use cannot be estimated from DUF.[9]

Hardcore drug users seem to account for about three-quarters[10] of all cocaine and heroin used in the United States, so understanding hardcore consumption patterns is crucial to estimating expenditures on cocaine and heroin. The Office of National Drug Control Policy has sponsored recent studies to learn more about the number of hardcore users and their illicit drug expenditure habits. Findings from those studies, as well as from studies sponsored by other government agencies, have caused us to modify the procedures that underlie the retail sales calculations. Those procedures have always been conceptually simple, and for this year's retail sales report they have been simplified even more. 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 these users are unlikely to use heroin or cocaine heavily. The trick, of course, is to obtain reasonable estimates of both the number of hardcore users who are arrested during each year[11] and the average number of arrests that they generate during the year.[12]

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 is to ask the users, and ONDCP, the National Institute on Drug Abuse, and the National Institute of Justice have sponsored studies providing improved estimates of expenditures. (See Appendix B.) An estimate of the retail sales value of illicit drugs consumed by heavy users follows from multiplying estimated 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 useable 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.[13]

This explains the derivation of estimates of drugs used by hardcore users, but while hardcore users probably account for 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 with expenditures on these substances by more casual users based on the NHSDA. Estimates for marijuana use and for other illicit drugs (excluding cocaine, heroin, and marijuana) also 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. Between 1988 and 1995, about 3.0 million to 3.6 million Americans were hardcore users of cocaine and approximately 2.9 million to 6.0 million were occasional users. Another 690,000 to 880,000 Americans were hardcore users of heroin, and 140,000 to 320,000 were occasional users. Considering the overlap between hardcore cocaine users and hardcore heroin users, the estimates suggest that there were about 3.6 million hardcore users of heroin or cocaine in 1995.[14] Although imprecise, these estimates are consistent with reported estimates derived by others using different methodologies and data.

Table 1

Estimated Number of Hardcore and Occasional Users of Cocaine and Heroin (Thousands), 1988-1995

	1988	1989	1990	1991	1992	1993	1994	1995
NHSDA								
Cocaine Occasional	6,000	5,300	4,600	4,500	3,500	3,300	2,900	3,000
Heroin Occasional	170	150	140	170	210	200	210	320
DUF								
Cocaine Hardcore	3,600	3,400	3,200	3,000	3,100	3,300	3,200	3,300
Heroin Hardcore	875	880	780	730	690	790	800	810

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

Sources: NHSDA 1988, 1990 through 1995; DUF 1988 through 1995; Uniform Crime Reports (UCR) 1988 through 1995

For example, Appendix A presents estimates of hardcore heroin use that are based on a different methodology than the methodology described in this report. One calculation from Appendix A supports a national estimate of 508,000 hardcore heroin users; a second calculation supports a national estimate of 582,000 hardcore heroin users. The Appendix explains why both estimates probably understate the true number. We are aware of only one other national estimate of heroin addicts, by Hamill and Cooley,[15] who concluded there were 640,000 to 1.1 million heroin addicts in 1987. These estimates are roughly consistent with the estimated 690,000 to 880,000 hardcore heroin users assumed in the retail sales calculations.

Simeone, Rhodes and Hunt[16] estimate 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, 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 that are remarkably close to the 3.6 million estimate used in retail sales calculations.

The Substance Abuse Mental Health Services Administration estimates that about 3.6 million Americans have a severe need for substance abuse treatment exclusive of treatment for alcohol abuse.[17] SAMHSA derived this estimate by identifying someone as needing treatment if they met one of four criteria and then inflating the estimates to account for undercounting in the NHSDA.[18] 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.[19] 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 3.3 million weekly users 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 810 thousand weekly heroin users. Although conceivable, however, these differences are so large that they tax credulity. There are two 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 sites[20] 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. 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.

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 1995, estimates 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 modest decrease in the number of hardcore cocaine users from the 1988 to 1991. Thereafter, the estimated number of hardcore cocaine users has not changed much. Estimates of weekly use from the NHSDA show a much larger drop from 1988 to 1990. The estimated number of weekly cocaine users from the NHSDA did not change much between 1990 and 1992 (consistent with the trends from Table 1), but there appears to be a drop in prevalence when comparing the period 1990 through 1992 with the period 1993 to 1995 (inconsistent with the trends from Table 1). SAMHSA reports that these latter changes are not statistically significant, however, so the difference may not be meaningful.[21]

Table 1 shows a decrease and then an increase in hardcore heroin use. The apparent decrease in heroin use may be attributable to an increase in the number of heroin users being incarcerated as American prisons expanded during the late 1980s and early 1990s, and also to an increase in the level of morbidity and mortality attributable to HIV infection and AIDS.[22] The recent increase might be explained by high quality/low price heroin, as well as aggressive marketing by Colombian dealers, which has reportedly induced new entrants among heroin users.[23]

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.

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 1996 dollar equivalents based on the consumer price index.[24]

In 1995, hardcore cocaine users spent $187 a week on cocaine, and hardcore heroin users spent $208 a week on heroin (Table 2). These DUF estimates lack precision, but they are reasonable considering other data about expenditures on illicit drugs (see Appendix B).

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

Table 2

Weekly Median Cocaine and Heroin Expenditures Reported by Arrestee Hardcore Users, 1989-1995 (dollars, 1996 dollar equivalents)

	1989	1990	1991	1992	1993	1994	1995
Cocaine							
Median	$283	$267	$240	$219	$198	$189	$187
Heroin							
Median	$356	$340	$299	$267	$226	$211	$208

Sources: DUF 1989 through 1995.

Total Expenditures on Cocaine and Heroin

Between 1988 and 1995 American users spent $37 billion to $61 billion yearly on cocaine and $9 billion to $18 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, our 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.

Table 3

Total Expenditures on Cocaine and Heroin, 1988-1995
($ in billions, 1996 dollar equivalents)

	1988	1989	1990	1991	1992	1993	1994	1995
Cocaine								
heavy use	$55.0	$50.0	$45.0	$38.7	$35.4	$33.9	$31.9	$32.4
occasional	$6.2	$6.7	$6.5	$7.2	$6.4	$6.4	$5.5	$5.6
total	$61.2	$56.7	$51.5	$45.9	$41.7	$40.3	$37.4	$38.0
Heroin								
heavy use	$17.2	$16.3	$13.9	$11.4	$9.6	$9.3	$8.8	$8.7
occasional	$0.6	$0.5	$0.4	$0.5	$0.6	$0.6	$0.6	$0.9
total	$17.7	$16.8	$14.3	$11.9	$10.2	$9.8	$9.3	$9.6

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

First, we determined how the expenditure estimates would be affected if we used lower or higher estimates of the

number of users than we 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, but the value of the supply of the drugs as well.[25] (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.

In sum, it seems plausible that cocaine and heroin expenditures could be nearly twice as large or half as large as our estimates. But, for the reasons noted above, high- and low-end estimates should be discounted. In addition, other analysts have made clever use of available data to derive their own estimates of retail expenditures on cocaine and

heroin. After adjusting for the limitations of these other studies, our estimates are consistent with theirs.[26]

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 and that users of cocaine received half that amount.

If we monetize in-kind payments at street prices, then the 1995 dollar expenditure on cocaine would increase by about $2 billion, and the 1995 dollar expenditure on heroin would increase by about $2 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.

For purposes of estimating the prices, we assumed that a typical heroin purchase was of two to four bags, containing a total of 400 milligrams of bulk heroin, at a purity of 20 percent from 1988 to 1992, and at a purity of 25 percent from 1993 to 1995. These assumptions were used to estimate the average price paid for heroin, based on regression

predictions, for each year from 1988 through 1995. For cocaine, we assumed that the typical purchase was: two packages, containing 1.5 grams of bulk cocaine at 65 percent purity. Additional detail and justification for these assumptions is provided in Appendix C. Estimated prices are reported in Table 4.

The price of cocaine fell sharply throughout the early 1980s; increased during 1990; and then declined again in 1991 and into 1995. 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; increased slightly in 1990; and has continued to decline since 1991 (Table 4).

Table 5 shows estimates of the amount of cocaine and heroin that was consumed based on the expenditures reported in Table 3 (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 1995 period, cocaine users consumed somewhere between 290 and 390 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 10 and 14 metric tons of pure heroin each year during the same period. Consumption has stayed close to 10 metric tons during most of the 1990s, although there may have been an increase in 1995.

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.[27]

Table 4

Retail Prices Per Pure Gram for Cocaine and Heroin, 1988-1995
(dollars, 1996 dollar equivalents)

	1988	1989	1990	1991	1992	1993	1994	1995
Cocaine	$177	$163	$193	$165	$160	$155	$140	$139

Table 4

Retail Prices Per Pure Gram for Cocaine and Heroin, 1988-1995
(dollars, 1996 dollar equivalents)

Heroin	$1,655	$1,433	$1,476	$1,470	$1,315	$1,254	$1,099	$984

Sources: STRIDE 1981 through 1996

Table 5

Total Amount of Cocaine and Heroin Used, 1988-1995
(in metric tons)

	1988	1989	1990	1991	1992	1993	1994	1995
Cocaine	383	386	296	309	289	289	296	304
Heroin	13.1	14.3	11.8	9.8	9.5	9.6	10.3	11.9

Sources: See Tables 1 through 4.

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, but it is hard to be sure because of the unknown confidence intervals involved in these estimates. As already noted, there seem to be fewer heroin addicts in 1993 than there were in 1988. The HIV virus and AIDS have taken a toll. Yet, prices have fallen so much that remaining users may be able to purchase much more than they did in the past, and these lower prices may have attracted new users into the market.[28]

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.[29] This compares with our estimates of 386 metric tons. The Rand researchers estimate that 7.8 metric tons of heroin entered the States in 1991.[30] Our estimate is 9.8 metric tons.

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 6.

Number of Marijuana Users

More Americans use marijuana than either cocaine or heroin. During 1995, for example, about 9 million Americans used marijuana or hashish at least once in the month before the NHSDA. This number has decreased 26 percent since 1988, when it was almost 12 million.

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 1994 the NHSDA stopped asking respondents about the number of joints and amount of marijuana used in the last month. However, the average number of marijuana joints used in the past month has remained about the same (16.9 to 17.8 joints) from 1988 to 1993, so we projected past averages into 1994 and 1995.

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,[31] the average THC content of sinsemilla was at a 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 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. 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.

Table 6

Calculation of Total Marijuana Consumption, 1988-1995

	1988	1989	1990	1991	1992	1993	1994	1995
Number of Users (millions)	11.6	10.9	10.2	9.7	9.0	9.0	8.8	8.6
Joints used per month	16.9	17.3	17.6	16.6	17.2	17.8	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
Price per ounce, 1/3 ounce purchase	$287	$353	$369	$406	$460	$334	$305	$269
Total expenditure for the year ($ in billions, 1994 dollar equivalents)	$9.1	$10.9	$11.0	$10.7	$11.5	$8.8	$8.2	$7.0

Sources: NHSDA 1988, 1990 through 1995; STRIDE 1981 through 1996

Price

Price is the final factor in calculating the total value of marijuana consumption. (See Appendix D.) Marijuana prices

increased throughout most of this period, but fell in 1993 and thereafter.[32] Marijuana prices are currently lower than at any time during this eight-year period. These prices are for a one-third ounce purchase, which appears to be a typical purchase size by frequent users.

Total Consumption Estimates

The factors required to calculate total marijuana consumption are shown in Table 6. In 1995, average users consumed 18.7 joints a month. The average amount of marijuana used per joint equaled 0.0136 ounces. At a retail price of $269 an ounce, these users spent an average of $68 each month ($815 a year) on marijuana. This number, multiplied by the 8.6 million monthly users, yields a consumption estimate of $7.0 billion for the year.

These estimates are probably low. Users are likely to underreport socially disapproved behaviors, even when those behaviors are legal.[33] They would seem to have even more incentive to underreport illegal behaviors.[34] Given under reporting rates for tobacco and alcohol use, it might be reasonable to inflate marijuana estimates by about one-third. Such estimates of total spending are in line with estimates by others.[35]

Other Drugs

Most of the money spent on illicit drugs in America is spent on cocaine, heroin, and marijuana. However, expenditures on other illicit substances (inhalants and hallucinogens) and on licit substances consumed illegally (stimulants, sedatives, tranquilizers, and analgesics) is not small. Much of this drug use appears to be reported to the NHSDA.[36] 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 7 shows the number of respondents who, according to the NHSDA, used these other drugs between 1988 and 1995. Those respondents who admitted use during the year were asked how frequently they used the drug.[37] We then used these data to compute an average number of days a year that the respondents used a drug.[38] Since the survey

does not have 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 Administrations's (DEA) Illegal Drug Price/Purity Report and the National Institute on Drug Abuse's Community Epidemiological Working Group (CEWG) provided wide ranges.[39] 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 eight years (Table 7).

Table 7

Other Drugs: Total Yearly Users (thousands) and Expenditures
($ in billions, 1996 dollar equivalents), 1988-1995

Drug Used	1988	1989	1990	1991	1992	1993	1994	1995
Number of Users								
Inhalants	2,441	2,327	2,212	2,379	1,889	1,940	2,213	2,308
Hallucinogens	3,200	2,775	2,350	2,562	2,530	2,479	2,725	3,416
Stimulants	2,698	3,009	2,319	2,010	1,478	1,774	1,419	1,656
Sedatives	1,376	1,184	991	946	702	702	736	666
Tranquilizers	4,124	3,250	2,376	3,143	2,380	2,380	2,405	2,210
Analgesics	5,342	5,164	4,986	5,063	4,560	4,560	4,247	4,102
Expenditures	**$3.3**	**$2.8**	**$2.2**	**$2.3**	**$1.5**	**$1.5**	**$2.6**	**$2.7**

Sources: NHSDA 1988, 1990 through 1995

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, and marijuana must be a relatively small part of the total expenditure that Americans make on illicit substances and on legal substances consumed illegally.

Conclusion

According to the consumption-based procedure, Americans spent about $57 billion on heroin, cocaine, marijuana, and other illegal drugs in 1995: $38 billion on cocaine, $10 billion on heroin, $7 billion on marijuana, and $3 billion on other illegal drugs (Table 8). Table 8 appears to show a substantial decrease in expenditures on illicit drugs between 1988 and 1995. Most of this change is attributable to inflation as reflected in the consumer price index. For reasons explained in note 24, 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

Total 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	$1.5	$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 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 to the United States. For reasons discussed below, it is not practical to develop estimates for heroin, marijuana, and other illegal drugs.

Cocaine

This section focuses on the production and distribution of cocaine. Although the production and distribution data we use are the best available, we doubt they totally reflect the true processes by which coca leaves are converted into cocaine and distributed. Further, both the cocaine production and distribution processes are subject to numerous losses such as spoilage, seizures,[40] and consumption [41] in countries other than the United States. Rather than making highly speculative estimates of the amount of losses, we only estimate losses resulting from federal seizures, which are reported reliably, and source country seizures, which are more speculative.[42] The resulting estimates of the amount of cocaine supplied to domestic markets are higher than if we took into account the losses noted above.

Cocaine Production

The production and distribution of cocaine starts in South America, principally in the Andean nations, with the cultivation of coca plants by farmers and ends with retail-level drug dealers in the United States. Figure 1 depicts this production and distribution flow. Coca leaves are harvested and then chemically treated to produce coca paste. The paste is treated further to create base or another derivative, *agua rica* ("rich water," a suspension of cocaine base in solution). Another chemical process converts the base into cocaine hydrochloride (HCl), or pure cocaine.[43] The cocaine is then shipped directly to consumer countries or is transshipped through other countries.

We developed a computer model for each of the stages in this process (see Figure 2 for 1994 and Figure 3 for 1995) from cultivation through transportation to consumer markets.[44] The letter next to each box in Figure 2 corresponds to the letters in Figure 1.

Coca cultivation (Box A). Estimates of the amount of land under cultivation in the major coca producing countries (Peru, Bolivia, Colombia and Ecuador[45]) are published annually by the Department of State in the International Narcotics Control Strategy Report (INCSR).[46] According to the INCSR, about 194,968 to 219,858 hectares[47] were under cultivation for coca leaf during 1994, and about 215,301 to 242,785 were cultivated in 1995. If we take the midpoints of these ranges, we see a slight increase in 1994 and a larger increase in 1995 (particularly in Colombia) over the amount cultivated in 1993 (186,959 to 210,827 hectares).

Eradication efforts by the governments in producer countries, sometimes with the assistance of the United States, reduce harvestable coca leaves. In 1994, 6,013 hectares were eradicated (about 3 percent of the total area cultivated). When immature crops (coca bushes take two years to mature) are added to the amount eradicated, this leaves about 154,455 to 179,345 productive hectares under cultivation. In 1995, 14,243 hectares were eradicated (about 6 percent of the total area cultivated). Again, combining the hectares eradicated and the hectares containing immature crops, about 167,758 to 195,242 productive hectares were cultivated in 1995.[48] While these increases in eradication were laudable, and while they seemed to have some effect in 1994, the increase in production in 1995, especially in Colombia, more than compensated for the effects of eradication that year.

Coca plant yields (Box B). The State Department calculates coca leaf yields using the assumption that bushes can be harvested three or four times a year. We use these assumptions in our model.[49] In 1994, a total of 256,284 to 298,809 metric tons of leaves were harvested; in 1995, 273,013 to 319,330. As with production, this is a slight increase (1994) and a greater increase (1995) over the 1993 harvest of 250,758 to 292,563 metric tons.

Coca manufacturing (Boxes C through E). Converting the coca leaves into cocaine HCl requires laboratory equipment and large quantities of chemicals. Information about processing and the network of clandestine laboratories[50] is based on in-depth research on the production process that has been undertaken by the Drug Enforcement Administration.

Leaf to paste conversion (Box C). Two factors affect the amount of paste produced from treating coca leaves. First,

the species and variety of coca grown in different countries contain different levels of cocaine alkaloid. Because the conversion ratio varies with the leaves' alkaloid content, the conversion ratio varies from country to country. Second, the indigenous population in Bolivia and Peru consume coca leaves. Figure 2 shows modest consumption levels for both Peru and Bolivia.

Paste to base conversion (Box D). This stage, which may not be followed in all regions, is a relatively simple "washing" of the coca paste in acetone before the final purification process. This increases the purity of the final product.

Base to cocaine HCl (Box E). This stage requires acetone, ether, and hydrochloric acid, which are produced in many industrialized nations. One unit of base yields an equal unit of cocaine HCl.

As shown in Table 9 and 10, this cultivation and manufacturing process resulted in an estimated 558 to 670 metric tons of pure cocaine that were available for shipment to world markets in 1994 and 616 to 738 metric tons in 1995. The 1994 figures are lower than those reported for 1993 (581 to 692 metric tons) even though production was slightly higher in 1994, because of increases in leaf seizures in Peru and increases in base seizures in Colombia.

Cocaine Transshipment (Box G)

Cocaine is shipped from manufacturing countries (such as Colombia) to the primary consumer countries (principally the United States) by many modes and usually through a third country. Some cocaine is shipped directly to the consumer countries. To avoid detection, however, most of it is transshipped through other countries such as the Caribbean nations, South and Central American countries, Canada, and Mexico.[51] Some cocaine losses occur during these shipments.

Some of the cocaine is consumed in the transshipment countries, but it is difficult to determine how much for a number of reasons. For example, drug use surveys from these countries are usually limited in scope, and the

methodology changes from year to year. Accordingly, we have made no adjustments in our model for these losses.

The amount of cocaine available in consumer countries is further reduced by foreign seizures. According to the *INCSR*, authorities in producer, transshipment, and other consumer countries seized about 56 metric tons in 1994, and 41 metric tons in 1995, of cocaine that was destined for the United States market (Tables 9 and 10).[52]

Table 9

Estimates of Cocaine HCl Available in the United States in 1994 (in metric tons)

	Low	High
Cocaine HCl available for export	558	670
From producing countries[1]	428	514
Foreign seizures of cocaine destined for the United States[2]	-56	-56
Cocaine shipped to the United States	372	458
Federal seizures[3]	-120	-120
Cocaine available for consumption in the United States[4]	258	345

1   Estimates of cocaine HCl come from the 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   INCSR, 1995 and 1996.

3   Drug Enforcement Administration, Federal-wide Drug Seizure System.

4   Average for 1993 and 1994.

Note: Some numbers may not add due to rounding

Table 10

Estimates of Cocaine HCl Available in the United States in 1995 (in metric tons)

	Low	High
Cocaine HCl available for export	616	738
From producing countries[1]	462	554
Foreign seizures of cocaine destined for the United States[2]	<u>-41</u>	<u>-41</u>
Cocaine shipped to the United States	421	513
Federal seizures[3]	<u>-98</u>	<u>-98</u>
Cocaine available for consumption in the United States[4]	287	376

1   Estimates of cocaine HCl come from the 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   INCSR, 1995 and 1996. The category excludes seizures of cocaine not destined for the United States.

3   Drug Enforcement Administration, Federal-wide Drug Seizure System.

4   Average for 1994 and 1995.

Note: Some numbers may not add due to rounding

Estimates of the amount of cocaine shipped to countries other than the United States are uncertain. Western Europe would appear to be a significant market for cocaine, but there are no reliable prevalence numbers upon which to base European consumption estimates. It appears that cocaine use in Western Europe increased in the 1990s.[53] European cocaine prices also seem to have fallen from relatively high levels in the 1980s to relatively low levels in the 1990s,[54] suggesting that more cocaine was available in Western European markets and perhaps that those markets are better organized.[55] The International Narcotics Control Board reports that South American dealers are smuggling cocaine into Europe through Poland, the Russian Federation, Ukraine and other countries in Eastern Europe.[56] There appear to be no major diversions of cocaine outside the Western Hemisphere, Europe, and North Africa.

Lacking prevalence estimates, we estimated cocaine consumption for Europe from cocaine seizures during the past

decade. The United Nations International Drug Control Program (UNIDCP) estimates show that total cocaine seizures in Europe rose from 14.3 metric tons in 1990 to 28 metric tons in 1994. It decreased to about 18 metric tons in 1995 (according to the 1995 NNICC report) but increased back to 1994 levels in 1996 (according to INTERPOL). For comparison, the U.S. Government has seized about 100-120 metric tons per year since 1989. Based on this limited information, we assume that the European share of the South American cocaine market has grown linearly from 15 percent in 1989 to 25 percent in 1995, and our calculations reflect that assumption. These estimates are rough approximations. Although the Europeans do not seize as much as 25 percent of world seizures, given U.S. expenditures on interdiction, we expect that Europeans are less effective than U.S. authorities at identifying shipments. Of course, we cannot be sure that the volume of seizures is proportional to the amount of cocaine imported into Europe, but some country-specific studies are supportive of the assumption that European consumption has increased.[57]

Based on these admittedly imperfect assumptions, we estimate that about 372 to 458 metric tons of cocaine were shipped to the United States in 1994 (Table 9) and 421 to 513 metric tons of cocaine were shipped to this country in 1995 (Table 10).

The U.S. Cocaine Market (Box H)

Each of the steps involved in manufacturing and transporting cocaine requires time to complete. For example, not all the leaf crop harvested during the 1995 growing season will be turned into cocaine sold on American streets during the same year. There is an inherent delay between growing coca leaves, turning those leaves into paste, base and cocaine, shipping that cocaine through intermediary destinations, and finally smuggling it into the U.S. Furthermore, cartel members may stockpile cocaine when harvests and production yield cocaine in excess of the supply that would maximize cartel profits, a consequence that further separates the timing of cocaine production and cocaine distribution in the States. We are unsure of the delay between production and distribution, so for purposes of making retail sales calculations, we first estimate the U.S. cocaine supply as if all the production was distributed in the States the same year that leaves were harvested in the Andean nations, and then compute the average for year T and year T-1 and treat

this as the year T estimate. This is the same as saying that half the cocaine arrives in the States the same year the leaves were harvested, and the other half arrives in the States during the next year.

Of the amount of cocaine shipped to the United States, Federal authorities seized about 120 metric tons in 1994, leaving 258 to 345 metric tons of pure cocaine for domestic consumption during 1994 (Table 9). In 1995, Federal authorities seized about 98 metric tons, leaving 287 to 376 metric tons available for domestic distribution.[58] Supply in the United States decreased slightly from 1993 (when we estimated 364 to 463 metric tons were available) to 1994, probably due to the increase in seizures by producer countries Peru and Columbia. However, in 1995, the increase in production and the decrease in foreign and domestic seizures led to a slight increase in the supply available to U.S. markets.[59]

The broad picture painted by Table 11 is that the supply of cocaine has fallen from roughly 420 metric tons per year before 1993 to about 270 metric tons per year after 1993. Although this may reflect an aspect of reality, it is difficult to explain because the consumption-based estimates do not show such a large drop. Thus, although the general direction in the movement of the supply-based estimates seem reasonable, we doubt that year-to-year changes have much meaning.

Using the estimates of price per pure gram from Table 4, we calculated that the total retail value of cocaine available in the United States was between $36 and $48 billion in 1994 and between $40 and $52 billion in 1995.

Again, we consider this estimate to be high because we could not fully account for the many reductions in the supply noted previously. As emphasized throughout this section, the data upon which these estimates are based are not sufficiently precise to support a narrower range of estimates. Given our knowledge of cocaine use and price, it is unlikely that the retail sales expenditure on cocaine could be much greater than the upper end of these estimates.[60] When drug expenditures as income in kind are considered, however, the lower end of this range is consistent with estimates based on our analysis of drug consumption (Table 8).

The cocaine supply is lower in the 1993-1995 period than in the 1989-1992 period (Table 11). The initial reduction in cocaine available for export was caused by a fungus that attacked coca plants in Peru, creating a 30 percent reduction in crop available from that country in 1993. In 1994, the amount of cocaine available to the market was the lowest yet since 1989, even though production was slightly higher. The reduction in cocaine supply in 1994 was caused by increases in leaf seizures in Peru and base seizures in Colombia. In 1995, supply rebounded slightly due to an increase in cultivation in Colombia and to decreases in foreign and domestic seizures. Even though supply has fallen over the past three years while the number of consumers has remained constant, prices have not increased over this period.

In its publication *Seminannual Interagency Assessment of Cocaine Movement* (SIACM), the Office of National Drug Control Policy constructed a second, substantially different model to estimate the supply of cocaine to the United States. SIACM relies on reports of known shipments and intelligence of possible cocaine shipments, based on data from the Interagency Counterdrug Performance Assessment Working Group, the Joint Interagency Task Force East, the U.S. Coast Guard Intelligence Coordination Center, the El Paso Intelligence Center, HUMINT, and other seizure reports. This approach assumes that some intelligence exists for all cocaine movement, although not all that intelligence can be confirmed. Undoubtedly there are gaps in intelligence which preclude the knowledge of all cocaine shipments, and there is no way to estimate the amount of cocaine that goes completely undetected. Hence, SIACM is likely to underestimate cocaine flows.

Despite differences between the SIACM and the approach used to estimate retail sales, estimates of cocaine flow are similar. According to SIACM, the overall flow of cocaine was relatively constant from 1995 to 1996. During that period, SIACM estimates 648 metric tons (MT) as the total worldwide cocaine flow, which is within the range of our estimate of 616 to 738 MT available for export. Based on figures in SIACM, more than 432 MT of cocaine was shipped to the United States. This figure includes both cocaine shipments that were seized and those that were successfully smuggled to the United States. We estimate that between 421 and 513 MT were available in the U.S. before Federal seizures, and between 323 and 415 MT available after Federal seizures. Our figures and the SIACM figures are roughly consistent. One other source corroborates our estimates. Researchers from the Rand

Table 11

**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	581-692	558-670	616-738
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	96	84	80	56	41
Cocaine shipped to the United States	547-660	509-624	539-664	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   INCSR, 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 yearsT and T-1. The estimate for 1989 is for year 1989 alone.

Corporation, working with a very similar model, estimated that 451 metric tons of cocaine entered the United States in 1989.[61]

Heroin

Poppy plants, from which opium is extracted, are grown in Southeast Asia, Southwest Asia, and in the Western Hemisphere (Mexico, Guatemala, and Columbia). Opium is converted into heroin in laboratories in the countries where it is cultivated and in other countries, and then consumed locally or shipped to consumer countries.

There are two reasons why we cannot develop a supply model for Southwest and Southeast Asia heroin. First, it is difficult to estimate the total harvest in these areas. For example, estimates of areas under cultivation in Iran have been unavailable since the Islamic Republic broke off ties with the United States. The second problem is that Europe and North Africa are the primary export markets for heroin from these regions, and consumption figures are lacking for both areas. This makes it difficult to determine the residual amount of heroin shipped to the United States.

In contrast, the United States is the only major market for Mexican, Guatemalan, and probably Colombian heroin.[62] This fact should allow us to estimate the U.S. share of the worldwide market. The calculations are simple. The DEA's Heroin Signature Program (HSP) provides an estimate of the percentage of all heroin sold in the United States that comes from the Western Hemisphere. Call this X. If Y is the total amount of Western Hemisphere heroin that enters the United States, then $Z=Y/X$ estimates the total amount of heroin consumed in the United States. Finally, if W is the total amount of heroin (and heroin equivalents such as opium) in the world, then the U.S. share must be about Z/W.

According to the 1995 NNICC Report,[63] about 53 metric tons of opium were available for shipment to the U.S. from Mexico. According to the HSP,[64] 5 percent of the U.S. market came from Mexico in 1995. Given that roughly 10 tons of opium are required to produce 1 ton of heroin, this suggests that heroin users in the United States must be using about 106 metric tons of heroin. This estimate is about eight times as much heroin as was estimated using the

consumption-based approach, a discrepancy that illustrates the difficulty of developing a supply-based model for heroin.

Marijuana

It is 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,[65] countries in South and Central America, the Caribbean, Asia, North Africa, and the Middle East also supply cannabis to the domestic market. 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.[66]

Price and Purity of Illicit Drugs

In lieu of solid estimates of the amount of cocaine, heroin, marijuana, and other illicit drugs, 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 September 1996,[67] we have developed statistical models to estimate typical prices for standardized purchases of cocaine, heroin, 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 4 shows the estimated retail level[68] and middle level[69] prices per pure gram of cocaine over time. The average price per pure gram at the retail level has decreased considerably, from just under $400 per pure gram in 1981 to about $140 per pure gram in 1996. The average price per pure gram at the middle level has also decreased from just over $170 per pure gram in 1981 to about $50 per pure gram in 1996.

- Figure 5 compares the estimated retail level[70] and middle level [71] price per pure gram of heroin over time. The average price per pure gram at the retail level has decreased from about $2900 per pure gram in 1981 to just over $1000 per pure gram in 1996. The average price per pure gram at the middle level has also decreased from over $1600 per pure gram in 1981 to about $500 per pure gram in 1995.

- Figure 6 shows trends in the predicted prices per bulk gram of marijuana.[72] 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 to near their 1981 levels by the end of 1996.

Trends in cocaine prices are consistent with findings suggesting that the number of users has not changed much over the last eight years, nor has the supply of cocaine from South American sources. Cocaine prices have behaved the way we would expect under these conditions—they have remained relatively flat except for trends attributed to inflation.

Figure 4

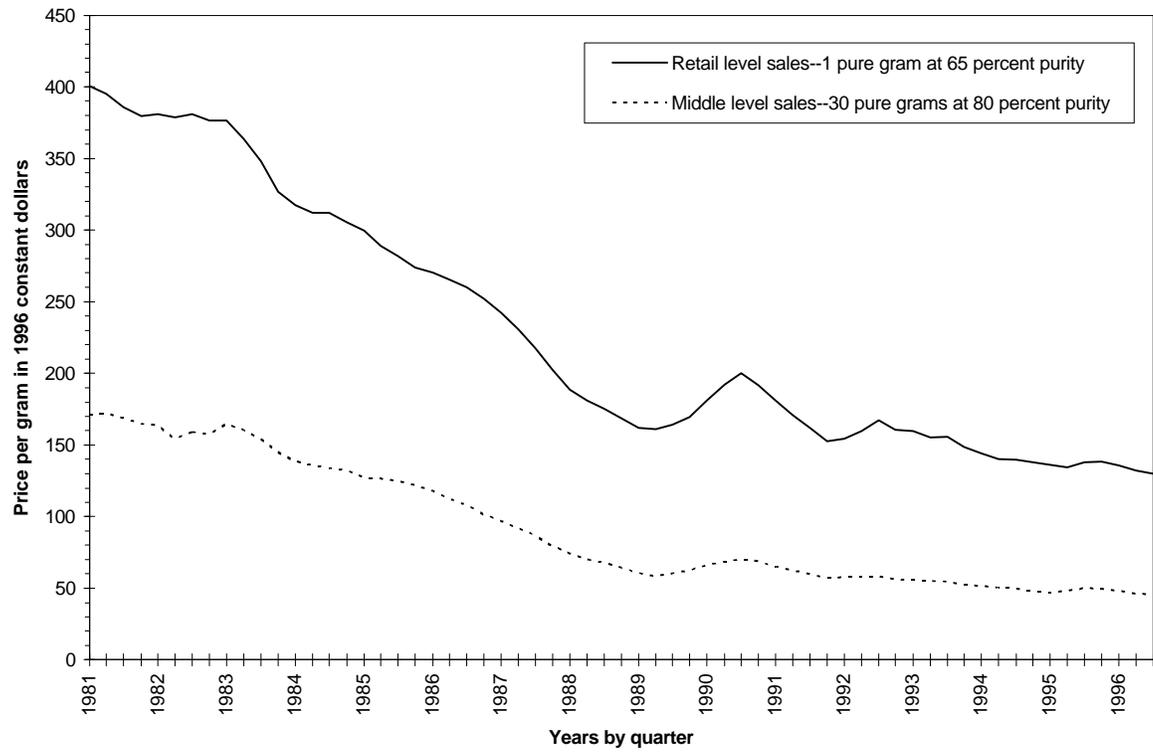### Predicted Price per Pure Gram of Cocaine at the Retail and Middle Distribution Levels

Figure 5

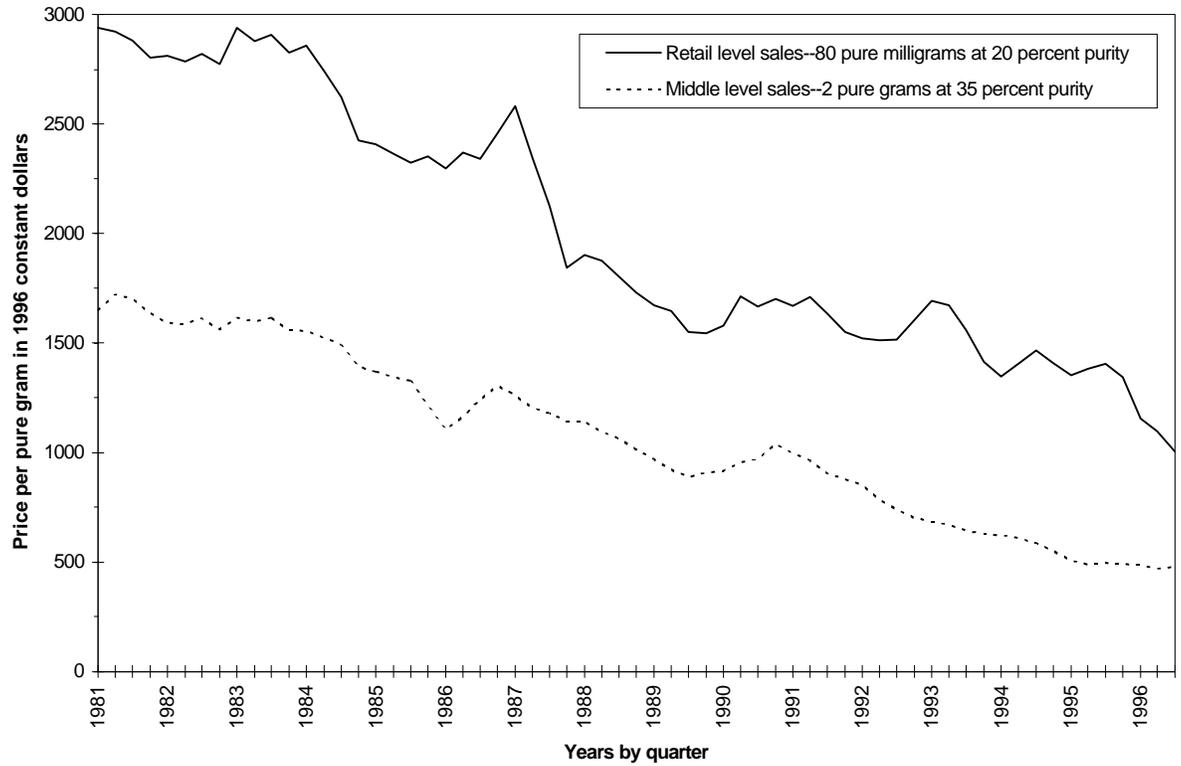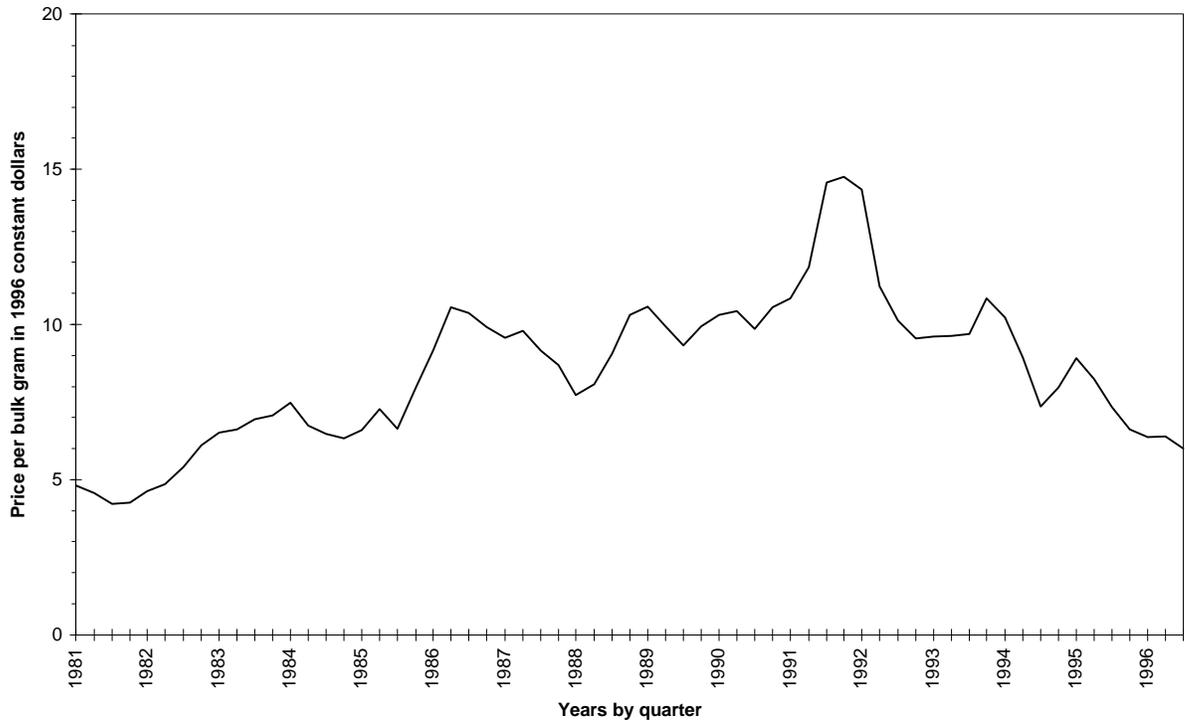**Predicted Price per Pure Gram of Heroin at the Retail and Middle Distribution Levels**

Figure 6

Predicted Price per Bulk Gram of Marijuana--10 Gram Purchase

We have no strong expectation about heroin prices. Our best estimates are that the number of heroin users has decreased slightly over the past eight years, perhaps because of increased incarceration of heroin users and perhaps because of deaths resulting from AIDS. We were unable to estimate the supply of heroin to U.S. markets, although anecdotal information indicates that it has increased markedly. Prices have behaved consistent with a hypothesis of increased supply, decreasing considerably more than can be accounted for by inflation over the last eight years.

Marijuana prices have increased from the early 1980s until the early 1990s, at which time they began to fall. We have no independent evidence about the availability of marijuana over this time, except for anecdotal evidence that it has become increasingly available. It is interesting that these changes in prices are the inverse of the changes in marijuana usage by minors enrolled in school, suggesting that minors' use of illicit drugs may be sensitive to price.

3   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 1995) follow:

- In 1995, about 3.3 million Americans were hardcore cocaine users, and about 810,000 were hardcore heroin users. The number of hardcore cocaine users has remained fairly stable over the last six years (the figure was 3.6 million in 1988). The number of hardcore heroin users has declined slightly, from 875,000 in 1988—although this trend is not a steady one. 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, while the rebound in 1993-1995 may be the result of new users progressing to hardcore use.

- About 3.0 million Americans were occasional cocaine users, and about 320,000 were occasional heroin users. 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 1995, about 8.6 million Americans had used marijuana at least once in the month prior to being surveyed. The number of marijuana users has fallen since 1988, when 11.6 million Americans admitted using marijuana.

- Many Americans use illicit drugs other than cocaine, heroin, and marijuana, or they may use licit drugs illegally. About 14.4 million Americans admitted using these other drugs in 1995. 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:

- Americans spent about $38 billion on cocaine, $10 billion on heroin, $7 billion on marijuana, and $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 eight years. 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 1995:

- From the supply-side perspective, 287 to 376 metric tons of cocaine were available for consumption in the United States.

- From the consumption perspective, Americans consumed roughly 304 metric tons of cocaine.

The supply-based estimates are surely overstated. First, they do not exclude some losses that occur within the source countries but that cannot be readily estimated, and, second, they do not account for domestic seizures by State and local officials. Although the supply-based and the consumption-based estimates are remarkably close, they cannot be completely reconciled. The consumption-based estimates are less than the lower range of the supply-based estimates for the early part of the eight-year period, but they are higher than the lower range of the supply-based estimates for more recent periods. We have no ready explanation, other than measurement error for both estimates, for these discrepancies.

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 model, which will include systematic and analytic links between government policy and drug use. 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 1993 and as a prelude to improved estimates for 1996 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 1996 dollar equivalents. These expenditure estimates do not include income in kind.

2. Between 616 and 738 metric tons of cocaine hydrochloride were available for export during 1995. To arrive at the total available for domestic consumption, we subtracted from this amount losses in shipment, shipments to other consumer countries, and Federal seizures.

3. Prevailing retail prices are used to convert drug supply to a dollar equivalent value when sold to final users.

4. By comparison, Americans spent about $43 billion on tobacco in 1993. The Tobacco Institute, *The Tax Burden on Tobacco* (Washington, D.C.; 1993).

5. 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.

6. 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 an estimated 40 percent of these drug users lived in unstable households and about 10 percent could be considered homeless.

Available evidence indicates that NHSDA's numbers understate heavy drug use. A. Harrell, K. Kapsak, I. Cisin, 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. Consistent with these observations, the Substance Abuse Mental Health and Services Administration reports that virtually no heroin addicts answer the National Household Survey on Drug Abuse. Substance Abuse Mental Health and Services Administration, *Preliminary Estimates from the 1993 National Household Survey on Drug Abuse* (June 1994).

Finally, 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 in populations. Incomes are greater, unemployment is lower, and there are fewer respondents using more than one drug in the NHSDA population. D. Hunt and W. Rhodes, "Characteristics 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.

7.   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.

8.   The population of hardcore users is not identical to the population of users who need substance abuse treatment. Still, according to DUF data, 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.

9. 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.

10. 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 reported in the NHSDA. 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.

11. The number of hardcore users who are arrested during a given year in the United States is difficult to know precisely, but this is not to say that the number cannot be estimated. From the Drug Use Forecasting data, we can learn the percentage of arrestees who test positive for cocaine or heroin, and then by asking the same respondents about the frequency of use, we can learn what percentage of those who test positive for recent drug use are really hardcore users—that is, they use on at least a weekly basis.

    There are complications to this approach. The DUF data suffer from many problems. (J. Chaiken and M. Chaiken, *Understanding the Drug Use Forecasting [DUF] Sample of Adult Arrestees*. Lincoln, MA: LINC, 1993.) Those problems undoubtedly affect the quality of our estimates despite efforts to deal with some of DUF's deficiencies. DUF is not a random sample of arrestees, so the sample is weighted to account for the

distribution of arrestees by charge and gender, using FBI arrests for the weighting. Also, DUF represents only about 24 cities, but by using a regression model the estimates can be extended to other cities based on population and arrest rates. A third problem is that DUF is only available for urban areas. To extend the estimates to suburbs and non-urban areas requires an assumption that drug use in urban, suburban and rural areas is proportional to the number of arrests for drug-specific charges in those areas. These assumption can only hold approximately, at best, so the estimates probably are subject to significant inaccuracy.

The accuracy of the assumptions is difficult to judge. In 1995, the Center for Substance Abuse Treatment funded the State to conduct one-time projects to test for drug use among arrestees. Abt Associates reviewed the results from those projects for 27 counties in nine States. On average, the regression model based on DUF data did a good job of predicting the rate of positive tests for cocaine and heroin in the CSAT studies. According to the regression-based imputations, 7.6 percent of arrestees would test positive for heroin based on a simple average of the 27 counties; the actual rate was 6.5 percent. Also, according to the regression-based imputations, 31.8 percent of arrestees would test positive for cocaine; the actual rate was 32.2 percent. Based on this comparison with CSAT data, we feel confident about projections in urban core areas, which account for about 48 percent of the hardcore users that enter the calculations. We are somewhat less confident about estimates for hardcore users in noncore areas, which account for about 35 percent of the hardcore users that enter the calculations. The other 16 percent come from areas outside of Metropolitan Statistical Areas, and confidence in the accuracy of these estimates is considerably lower, because we have no corroborating evidence. Findings from the 1994 Drug Abuse Warning Network (SAMHSA, Annual Emergency Department Data 1994, 1996) suggest that our estimates may overstate the percentage of hardcore users from areas outside the urban cores. According to DAWN, 79 percent of emergency room mentions for heroin and cocaine occur in the urban core areas, and the rest occur outside the urban cores. (From Table 3.23, which applies only to the 21 DAWN sites.) Because SAMHSA data do not include non-MSA areas, a comparable estimate from our data is 58 percent. There are several possible reasons for this difference. First, SAMHSA's estimates are for the 21 MSAs, not a national sample. Second, urban core hospitals, which may specialize in overdose, often have catchment areas that are wider than the urban core itself. Third, urban core hospitals are probably more frequently used for routine medical care than are suburban hospitals. In this regard, it is noteworthy that over 25 percent of ER mentions for cocaine and heroin are for detoxification, roughly the same percentage are attributed to chronic effects, and somewhat less than ten percent are for withdrawal symptoms. It is unlikely that suburban

emergency rooms would handle many of these types of cases.

12.   There are no national survey results to provide the average yearly arrest rate of hardcore users, but there are local studies. According to an ONDCP study, hardcore users in Cook County, Illinois, averaged 0.34 arrests per year. 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. This compares with figures of 0.39 and 0.37 for arrestees who tested positive for cocaine and heroin, respectively, and 0.36 for intravenous drug users, in Los Angeles, California. Y. Hser, "Population Estimation of Illicit Drug Users in Los Angeles County," *Journal of Drug Issues* 23(2), 1993: 323-334. Cohen reports yearly arrest rates of 0.36 for robbers and burglars who tested positive for drugs (exclusive of marijuana) in Washington, D.C. J. Cohen, "Incapacitation Effects of Incarcerating Drug Offenders," Final Report Submitted to the National Institute of Justice, May 4, 1992, figures interpolated from figure 4. According to Abt's tabulation of the 1993 National Household Survey on Drug Abuse, 39 percent of weekly cocaine users had been arrested during the year before the survey, so their arrest rate must have been greater than 0.39. These estimates are probably low, partly for study-specific methodological reasons (Cohen), partly because those who test positive for drugs are not necessarily hardcore users (some of the studies), and partly because the studies do not control for time spent in jail and prison (all the studies). On the latter point, Abt's analysis of responses from 12,000 male non-incarcerated intravenous drug users suggests they spent an average of 15 percent of the last five years in jail or prison, and 4,000 female IDUs spent an average of 10 percent of their time in jails and prisons. Analysis by Rhodes, Hyatt and Scheiman was used to estimate annual arrest rates of 0.44 for cocaine users across six cities and 0.51 for heroin users across five cities. Calculations based on W. Rhodes, R. Hyatt and P. Scheiman, "Predicting Pretrial Misconduct with Drug Tests of Arrestees: Evidence from Eight Settings," *Journal of Quantitative Criminology*, 12(3): 315-348. These estimates, too, are probably too low. Although they pertain to time on the street, they are for individuals who tested positive, not necessarily those who are hardcore, and evidence is that hardcore users have higher arrest rates than more casual users. E. Wish, M. Cuadrado, and J. Martorana, Drug Abuse as a Predictor of Pretrial Failure-to-Appear in Arrestees in Manhattan, unpublished paper prepared under Grant 83-IJ-CX-K048 to Narcotic and Drug Research Inc. Again, it is hard to be precise, but arrest rates of 0.50 arrests per year for hardcore cocaine users and 0.55 arrests per year for hardcore heroin users seem reasonable working assumptions and are adopted for the retail sales estimates.

13.   Drugs are sometimes received as income-in-kind, especially by drug-using dealers who keep part of what they otherwise would deal, and also in exchange 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.

14. 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 cocaine users, 16 percent are hardcore heroin users, and the other 14 percent are both.

15. 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).

16. 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.

17. 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 more 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.

18. 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.

19.   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.

20.   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.

21.   National Household Survey on Drug Abuse, Table 126A, taken from the Internet.

22.   As of June 1994, 105,335 cases of AIDS (78%) were attributed to injection drug use or to injection drug use plus some other mode of exposure. Centers for Disease Control and Prevention, HIV/AIDS Surveillance Report, 6, no.1 (1994): 16.

23. According to the CEWG: "The latest data measuring incidence of heroin consequences continue to confirm previous field reports of three types of heroin users: a small, but growing, number of younger users relatively new to the heroin scene; crack users who are starting to combine their crack with heroin; and a larger population of aging addicts who are switching to intranasal use (and sometimes to smoking.)" National Institute on Drug Abuse, Epidemiologic Trends in Drug Abuse, Volume 1: Highlights and Executive Summary (NIDA, Washington, D.C., June 1996): 5.

24. Weekly expenditures on cocaine and heroin have decreased over time, but this change results from using the CPI to convert expenditures to 1996 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.

25. 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 the Appendix, 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.

26. Reuter and Kleiman estimated that the market for cocaine was about $8 billion in 1982. 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 is more difficult to reconcile with what is reported here for two reasons. First, the number of heroin users has not fallen much over the last decade. Second, the price of heroin has dropped dramatically. We would expect their estimates to be greater than those reported here, but that is not the case. 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. Thus, his estimates are consistent with those reported here.

27. 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, (The Urban Institute Press, Washington, D.C., 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 1995 as they spent in 1988.

28. Recent reports by the Community Epidemiological Work Group have told of increasing numbers of heroin users who insufflate the drug. For example, see NIDA, Epidemiologic Trends in Drug Abuse: Volume 2 (NIDA, Washington, D.C., December 1995).

29. Childress, M.; Dombey, B. and Resetor, S. A Systems Description of the Cocaine Trade (Rand, Santa Monica, California, 1994).

30. Childress, M. A Systems Description of the Cocaine Trade (Rand, Santa Monica, California, 1994).

31. National Narcotics Intelligence Consumers Committee, *The NNICC Report 1993: The Supply of Illicit Drugs to the United States*, (Washington, D.C., August 1994): 61.

32. This recent decrease in marijuana prices is also described in the National Institute on Drug Abuse's Community Epidemiological Working Group (CEWG) bi-annual reports on drug abuse trends across the country. Community Epidemiology Work Group, *Epidemiologic Trends in Drug Abuse*, (Rockville, MD: National Institute on Drug Abuse, June 1994).

33. 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.

34. 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.

35. Using several self-report surveys, BOTEC Analysis Corporation, in an ONDCP report, 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. 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).

36. 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.

37. 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.

38. Estimates of frequency of use from the 1991 NHSDA were applied to earlier years. The raw data were not available for 1995, so we use 1994 estimates.

39. 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).

40.   Information about seizures is of questionable reliability. Besides providing an incentive for both over- and undercounting at various junctures, mislabeling of seizures can result in errors of calculation. Some estimates are quite speculative.

41.   Data are inadequate to derive estimates of drug use practices in Central and South American nations, but limited data indicate that consumption must be significant. For example, the Mexican government sampled 15,000 households in urban areas, interviewing individuals who were 12 to 65 years old. Roughly 0.5 percent of males (12-34 years old) in the northern part of the country used heroin in the year before the survey; cocaine was used by 3.4 percent in the northwest, 1.0 percent in the northeast, and 1.2 percent in the central north. M. Medina-Mova, "Drug Abuse in Northern Mexico: Results from a National Household Survey," in *Epidemiologic Trends in Drug Abuse, Proceedings June 1990* (NIDA, 1990). Although estimates are elusive, internal consumption of coca leaves and its derivatives is high in producing countries. For example, an estimated 1 million Peruvians across 20 cities chewed coca leaf, 200,000 smoked coca paste, and over 100,000 inhaled cocaine hydrochloride. F. Jeri, "Some Recent Facts about Drug Abuse in Peru," in *Epidemiologic Trends in Drug Abuse, Proceedings June 1990* (NIDA, 1990). In Colombia, the National Drug Agency estimates that 343,000 Colombians use cocaine derivatives and that 338,000 use cocaine hydrochloride. They believe that this totals 2 metric tons of cocaine or cocaine derivatives consumed domestically *(International Narcotics Control Strategy Report* (Washington, D.C.: Bureau of International Narcotics, Department of State, 1996). Bolivian law permits limited domestic cultivation (12,000 hectares [a hectare equals 2.47 acres]) of coca for domestic consumption *(INSCR*, 1996). In addition to consumption within producer countries, spoilage and in-kind payments for shipping must be a major loss to the cocaine industry.

42.   Losses include shipments that were left for a trafficker but never picked up. Losses also occur when a trafficker abandons cargo at sea when pursued by authorities.

43.   For a detailed discussion of cocaine processing, see Drug Enforcement Agency, Office of Intelligence, *Coca Cultivation and Processing: An Overview* (Washington, D.C.: U.S. Department of Justice, February 1991). The cocaine production process varies from one processor to another. Some processors store a suspension of cocaine base in solution. This derivative is called *agua rica* ("rich water"). Storing base in solution increases its shelf-life. It does not appear to increase the cocaine yield from coca leaves (K. Riley, "Snow Job? The Efficacy of Source Country Cocaine Policies" [Santa Monica, Calif.: RAND Corporation, 1993]).

44. The computer model is an adaptation of a version developed by RAND Corporation. Our model uses estimates of (1) land area under cultivation in known producer countries, (2) eradicated cultivation areas, (3) coca leaf crop yield, (4) differences in the alkaloid levels in coca leaves (this affects the resultant amount of cocaine hydrochloride which can be produced from leaf yields), (5) the efficiency of the process for converting leaf to intermediary products and then to cocaine, and (6) losses, consumption, and seizures within producer and transshipment countries.

45. Coca is reportedly cultivated in Brazil and Venezuela, but estimates of the amount of land under cultivation are not available.

46. *International Narcotics Control Strategy Report* (Washington, D.C.: Bureau of International Narcotics, Department of State Publications, 1996, and previous years). The Bureau bases its calculations of land under cultivation on "proven methods similar to those used to estimate the size of licit crops at home and abroad."

47. One hectare equals 2.47 acres.

48. *INCSR, 1996.* We assume for the purposes of the model that eradication is in the primary coca growing regions.

49. The conversion process can vary widely from one location to another in the processing countries. According to information now available from a variety of sources, the *INCSR* accurately reflects the conversion process in each of the producer countries (J. Inciardi, *The War on Drugs* [Palo Alto, CA: Mayfield Publishing Company, 1986], 71-89; and telephone interviews with E. Morales, West Chester University, PA).

50. Clandestine laboratories are located in the cultivating countries and in Argentina, Brazil, and Venezuela.

51. According to the United Nations, 70 percent of all cocaine destined for the United States is transshipped through Mexico (United Nations, International Narcotics Control Board [INCB], *Report of the International Control Board for 1991* [Vienna, 1990]). Although distribution routes change over time, most cocaine destined for the United States still passed through Mexico. Office of National Drug Control Policy, *Semiannual Interagency Assessment of Cocaine Movement*, February 1997.

52. *INCSR*, 1995 and 1996.

53. United Nations International Drug Control Programme, "Cocaine and Heroin Trafficking and Prices in Europe: 1983–93," Discussion Paper (New York: United Nations, August

1994). *United Nations International Drug Control Program World Drug Report* (Oxford University Press, Oxford, England, 1997).

54.   Commission on Narcotic Drugs, "Economic and Social Consequences of Drug Abuse and Illicit Trafficking: An Interim Report," Thirty-eighth session, Vienna, 14-23 March 1995, Item 3 of the provisional agenda, downloaded from the Internet, p. 23.

55.   This explanation is advanced for Nottingham by P. Bean and Y. Pearson, "Cocaine and Crack: Supply and Use" (Loughborough, Leicester, U.K.: Loughborough University, undated).

56.   "Cocaine seizures increased significantly in Europe. Central and Eastern European countries are increasingly being used by South American cartels as transit States for cocaine destined for illicit markets in western Europe. Increasing seizures indicate that Poland has become an important transit point for cocaine traffickers. Cocaine is smuggled into Europe through the Russian Federation and Ukraine and through several countries in south-eastern Europe. Despite the emergence of new trafficking routes, the Iberian peninsula continues to be the most important point of entry into Europe for cocaine from South America; however, France, the Netherlands and the United Kingdom are also making seizures of that drug in increasing amounts. Nationals of countries in western Africa continue to be used as couriers to smuggle cocaine out of South American and into Europe via airports in western Africa." International Narcotics Control Board, *Report of the International Narcotics Control Board for 1995*, (New York: United Nations), United Nations Publication Sales No. E.96.XI.1 ISBN 92-1-148096-5 ISSN 0257-3717, paragraph 368.

57.   A German study reporting an increase in first-time consumers of cocaine in 1994 supports the theory of increased European cocaine use. (United States Department of State, Bureau for International Narcotics and Law Enforcement Affairs. *International Narcotics Control Strategy Report, March 1995,* p. 337). If this trend in increased European consumption continued or accelerated through 1995, a greater amount of the cocaine supply could have been diverted to Europe. The 1995 INCSR report estimates between 300,000 and 500,000 cocaine users in Italy (p. 351). Heroin dominated treatment admissions (88%) and cocaine was negligible as a primary drug of abuse (2%) but was prevalent as a secondary drug of abuse (13%). (The United Nations International Drug Control Programme. *World Drug Report.* New York: Oxford University Press, 1997, p. 270-272.) Cocaine seizures reportedly doubled between 1991 and 1995. According to Bruno (Journal of Drug Issues, 1994) cocaine seizures increased from 577K in 1988 to 1366K in 1993. Assuming that between 5 and 20 percent of cocaine is seized, the UN report estimates that the Italian market for cocaine is $1 to $4 billion U.S.   The

June 1996 CEWG report shows the number of cocaine/crack addicts treated by the public sector rose from 1.6% of the population in 1991 to 3.1% in 1995. (CEWG, p. 388). According to the UNIDCP report, cocaine seizures in Sweden went from roughly 10,000,000 dosage units between 1990 and 1992 to about 15,00,000 dosage units in 1993 and 20,000,000 dosage units in 1994. If a dosage unit is $10, then this is about $200m—say the market is $100 to $200m based on a 10% seizure rate. (The United Nations International Drug Control Programme. *World Drug Report.* New York: Oxford University Press, 1997, p. 298.) Good trend data appear to be unavailable for the United Kingdom, but UNIDCP estimates (The United Nations International Drug Control Programme. *World Drug Report.* New York: Oxford University Press, 1997, p. 317-318) the market for cocaine at about $360 million. We can note that "persons found guilty, cautioned or dealt with by compounding for drug type and year" grew steadily from 860 for cocaine in 1990 to 1804 for cocaine in 1994—but all drugs also grew steadily from 45,000 to 87,000 over the same period. Also, P. Bean and Y. Pearson (undated) have reported that prices have fallen in the United Kingdom, suggesting that cocaine markets are better organized. In the December 1994 CEWG report, Francois-Rodolphe Ingold reports that "In Paris, we began witnessing the first signs of crack use in Paris... In 1992...an ethnographic study...revealed a small proportion of crack users among street drug users (18 percent) and that cocaine availability had significantly increased during the last few years.... During 1993, crack use increased dramatically." (CEWG, p. 330)

58. Federal seizure data come from the Drug Enforcement Administration's Federal-wide Drug Seizure System.

59. Data are sketchy, but the best evidence indicates that State and local authorities do not remove a large proportion of cocaine from street-level distributing. From various reports of the Community Epidemiological Working Group, we know that Illinois State and local authorities removed 3.1 metric tons of cocaine over a six-year period between 1989 and 1994. Assuming that this is about 8 percent of the cocaine seized by State and local authorities nationally (because Cook County accounts for about 8 percent of all emergency room mentions for cocaine according to DAWN), we might assume that nationally, State and local authorities seize about 7 metric tons of cocaine per year. The District of Columbia Metropolitan Police send drug samples to Drug Enforcement Administration laboratories for analysis. Assuming that all purchases and seizures by D.C. police are included in the DEA's STRIDE data, we find that D.C. police seized about 60 kilograms of cocaine on average each year since 1988. D.C. accounts for about 3 percent of all emergency room mentions nationally according to DAWN, so if we prorate the D.C. seizures, we might assume that State and local authorities remove about 2 metric tons of cocaine from domestic consumption. These relatively small amounts are not atypical. CEWG reports tell us that Wayne County (Detroit) authorities seized 160 pounds of crack in 1992 and 1993 combined. Hennepin County

(Minneapolis) authorities seized less than 1 kilogram of cocaine during 1994 and 1995 combined. It would be unreasonable to assert that the above data and calculations, especially the assumption that seizures are proportional to emergency room mentions, are very accurate. Nevertheless, even these crude estimates provide a strong impression that State and local authorities remove only a small amount of cocaine from the American market compared with the amount consumed and that taking these small amounts into account would have little bearing on our supply-based calculations.

There is another way to look at this problem. According to Abt imputations and tabulations of FBI Uniform Crime Report data, about 1.1 million adult arrests for drug law violations occurred in 1995. Not all were for cocaine, but the data do not distinguish arrests by type of drug. If we assume, nevertheless, that all were for cocaine, and that each arrest resulted in the police seizing 1 gram of pure cocaine, then these arrests would have accounted for 1.1 metric tons of cocaine being removed from American streets. Clearly this estimation procedure overstates the number of cocaine arrests, many of which are for possession, not sale, and also overestimates the amount of cocaine transacted in typical street deals—suggesting again that State and local authorities remove a relatively small amount of cocaine compared with consumption levels. Even accounting for a few large seizures made by State and local authorities, which may be understated by these estimates, it seems unlikely that the retail sales calculations are greatly affected by State and local seizures.

60.   A figure of $200 billion was reported by the Latin American Weekly report, with little substantiation. A similar figure has been cited by Webster and McCampell, attributed to Holmes, but the source of this estimate is obscure. *Latin American Weekly Report* (WR-91-12, March 28, 1991); B. Webster and M. McCampell, *International Money Laundering: Research and Investigation Join Forces* (NIJ Research in Brief, September 1992); C. Holmes, *Combating Money Laundering: An Arizona-Based Approach* (Police Executive Research Forum, March 1991). Such estimates seem impossibly large. If all $200 billion was attributable to cocaine, and if 3.4 million heavy cocaine users consume 75 percent of the available cocaine, then each user must be required to spend $44,000 per year on cocaine. Thus, $200 billion is certainly an excessively high estimate.

A report by the United Nations concluded that the international trade is roughly 400 billion dollars. This is a staggering amount, equal to about 8 percent of all international trade. The methodology upon which these estimates are based is promised in a forthcoming report from the United Nations. If the estimates are credible, they suggest that the U.S. market accounts for only 15 percent of the worldwide market for illicit drugs, based on revenue. Given that the U.S. market is likely to be the largest *cash* market for illicit drugs, how to reconcile the United Nations' number with those presented in this report is unclear. (United Nations International Drug Control Program, *World Drug Report*, Oxford University Press, 1997.)

61. Childress, M.; Dombey, B.; and Resetar, S. A Systems Description of the Cocaine Trade (Rand, Santa Monica, California, 1994).

62. The Royal Canadian Mounted Police report that Mexican and Central American heroin in Canada is under five percent (RCMP, *National Drug Intelligence Estimate 1994*). According to data on origins of seizures in Europe, no couriers originated in Mexico (International Criminal Police Organization, *The Heroin Situation in Europe in 1989* [Lyons, France: February 1990]).

63. National Narcotics Intelligence Consumers Committee, *The NNICC Report 1995* (Drug Enforcement Administration, August 1996), p. 29. The report says that 32 percent of all seizures were from South America and 5 percent were from Mexico.

64. The Heroin Signature Program (HSP), using a random sample from all seizures and purchases registered in STRIDE, tries to quantify the U.S. market shares of each of the three major heroin producing regions. The HSP analyzes 300 to 500 exhibits annually from a random sample of purchases and seizures made by Federal agents. This analysis probably does not reflect the U.S. heroin market as a whole. See *The NNICC Report, 1995: The Supply of Illicit Drugs to the United States* (Washington, D.C.: National Narcotics Intelligence Consumers Committee, August 1996).

65. 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).

66. Drug Enforcement Administration, Intelligence Division, *U.S. Drug Threat Assessment* (Washington, D.C.: U.S. Department of Justice, 1993).

67. STRIDE contains test results (amount and purity) for drug purchases made by undercover DEA agents, other Federal agents, and some State agents, including the District of Columbia police. Purchase prices are converted to September 1996 dollar equivalents based on the Consumer Price Index for Urban Wage Earners and Clerical Workers.

68. A standardized retail cocaine purchase consists of 1 pure gram (about 1.5 bulk grams) of cocaine at 65 percent purity. By assumption, retail cocaine purchases involve transactions of 0.01 to 15 grams, costing between $10 and $1000 per gram.

69. 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.

70.   A standardized retail heroin purchase is set at 80 pure milligrams (0.4 bulk grams) of heroin at 20 percent purity. Retail heroin transactions are estimated to range from 0.001 to 0.2 grams, costing between $50 and $20,000 per gram.

71.   A standardized middle level heroin sale consists of 2 pure grams of heroin at 35 percent purity. Middle level heroin estimates involve transactions of 0.2 to 100 grams, costing between $50 and $5000 per gram.

72.   These estimates reflect retail level sales ranging from 0.001 to 150 grams, with prices between $1 and $75 per bulk gram. Data are too sparse to estimate prices for higher distribution levels. Purity is unknown for marijuana, and upward trends in THC content may account for some of these price changes.