



# What America's Users Spend on Illegal Drugs

Executive Office of the President  
Office of National Drug Control Policy

D E C E M B E R 2 0 0 1



# **What America's Users Spend on Illegal Drugs 1988-2000**

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# Executive Summary

Since 1991, the Office of National Drug Control Policy has published a biennial report on expenditures by Americans on illegal drugs and on legal drugs used illegally. This current version of *What American's Users Spend on Illegal Drugs* provides comparable estimates of cocaine, heroin, methamphetamine and marijuana expenditures and consumption for 1988 through 1999 and projects estimates for 2000.<sup>1</sup> Previous versions of this report presented supply-based estimates of the flow of cocaine and heroin from producer nations, through transshipment zones, and into the United States. This version drops detailed discussion of supply-based estimates, which appear in two companion reports.<sup>2</sup> Similarly, previous versions explained how we estimate trends in the domestic prices of illicit drugs. This current version uses price estimates whose derivations are explained in a companion report.<sup>3</sup>

Because of the quality of available data, there is considerable imprecision in estimates of the number of chronic and occasional users of drugs, the retail sales value of their drug purchases, and the amount of drugs they consume. The best estimates reported in this paper follow:

- In 1999, about 2.8 million Americans were chronic cocaine users, and about 900,000 were chronic heroin users. The number of chronic cocaine users has declined over the last decade (the figure was 3.6 million in 1990). The number of chronic heroin users had decreased, perhaps due to the AIDS epidemic and increased incarceration, but that decrease had largely abated by the latter part of the decade, perhaps because new users were attracted by the availability of high-quality low-cost heroin.
- About 3.2 million Americans were occasional cocaine users, and about 250,000 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 1999, about 12 million Americans had used marijuana at least once in the month prior to being surveyed. The number of marijuana users has remained fairly constant over time, with some dip in use during the middle 1990s when prices were relatively high.
- Methamphetamine abuse is now recognized as a major problem, but estimates of the size of the problem are imprecise. Perhaps 600,000 Americans are chronic methamphetamine users. Consistent with other sources, we find increases in the number of methamphetamine users over the last decade.

- Many Americans use illicit drugs other than cocaine, heroin, methamphetamine and marijuana, or they may use licit drugs illegally. About 12 million Americans admitted using these other drugs in 1999. 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 projected for 2000 indicate the following:

- In 2000, Americans spent about \$36 billion on cocaine, \$10 billion on heroin, \$5.4 billion on methamphetamine, \$11 billion on marijuana, and \$2.4 billion on other substances (see Table 1).
- Again, estimating trends is risky, but it appears that expenditures on cocaine, heroin, and marijuana have fallen over the last decade. Much of the reduction is attributable to an increase in the consumer price index. Expenditures on methamphetamine have increased over the decade.
- During the latter part of the 1990s, Americans consumed about 270 metric tons of cocaine per year, down from over 300 metric tons earlier in the decade. (See Table 2.) Also during the latter part of the 1990s, Americans used close to 14 metric tons of heroin, which may represent an increase over the amount used during the middle of the decade. Although not shown in table 2, Americans used nearly 1000 metric tons of marijuana and 20 metric tons of methamphetamine toward the end of the decade.

Estimates of cocaine consumed in the United States were compared to estimates of cocaine availability based on coca cultivation estimates. As noted earlier, details about the supply-based estimates appear in companion reports. The STAR model affords an estimate of cocaine that leaves South America by beginning with the domestic consumption estimates reported in this document and augmenting those consumption estimates to include seizures, shipments to destinations other than the United States, and other reductions from the distribution system. The STAR Model provides a second estimate of cocaine that leaves South America by beginning with coca cultivation, transitioning to production potential, then subtracting seizures, indigenous consumption and other reductions from the system. The two estimates should agree, and broadly, they do. Between 1997 and 2000 the coca cultivation-based estimate is that from 537 to 616 metric tons departed from South America; during that same period, the domestic consumption-based estimate is that from 500 to 600 metric tons departed South America.

A different kind of comparison was used for the heroin flow model. Starting with the consumption estimates, and accounting for reductions from the distribution system, the model provides estimates of the amount of heroin that comes from South America and Mexico. Those estimates can be compared to potential production-based estimates for those two sources. The domestic consumption-based estimates for 1996 through 2000 are that 3.5 to 4.3 metric tons of heroin originated from Mexico and 7.0 to 9.5 metric tons originated from Colombia. The potential heroin production-based estimates for those same years are 4.0 to 6.0 metric tons for Mexico and 6.4 to 7.5 metric tons for Colombia. Colombia seems to produce somewhat less heroin, and Mexico seems to produce somewhat more heroin, than can be accounted for by the domestic consumption-based estimates. These differences might be explained by incorrect information about processing efficiencies, because estimates of processing efficiencies, which are based on Southwest and Southeast Asia studies, may not apply to Colombia and Mexico.

Although consumption-based estimates are imprecise, they are sufficiently reliable to conclude that the trade in illicit substances was somewhat less than \$70 billion per year during the latter part of the 1990s (Table 1).<sup>4</sup> The costs to society from drug consumption, however, exceed the amounts spent on drug abuse. Drug use fosters crime; facilitates the spread of catastrophic health problems, such as hepatitis, endocarditis, and AIDS; and disrupts personal, familial, and legitimate economic relationships. The public bears much of the burden of these indirect costs because it finances the criminal justice response to drug-related crime, a public drug-treatment system, and anti-drug prevention programs.

**Table 1 - Total U.S. Expenditures on Illicit Drugs, 1988-2000 (\$ in billions, 2000 dollar equivalents)**

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Cocaine	107.0	88.4	69.9	57.1	49.9	45.0	42.8	40.0	39.2	34.7	34.9	35.6	35.3
Heroin	26.1	24.3	22.5	20.3	17.2	13.8	13.2	13.2	12.8	11.4	11.1	10.1	10.0
Meth...	5.8	5.8	5.7	3.7	4.8	5.1	7.6	9.2	10.1	9.3	8.0	5.8	5.4
Marijuana	12.1	11.0	15.0	14.0	14.6	12.0	12.2	10.2	9.5	10.5	10.8	10.6	10.5
Other Drugs	3.3	2.8	2.2	2.3	1.5	1.5	2.6	2.7	2.7	2.5	2.3	2.6	2.4
Total	154	132	115	97	88	78	78	75	74	68	67	65	64

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

Sources: See Tables 3 through 10.

**Table 2 - Total Amount of Cocaine and Heroin Consumed, 1988-2000 (in metric tons)**

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

Estimates for 2000 are projections

*Sources:* See Tables 3 through 6

# Introduction

In 2000, the Office of National Drug Control Policy (ONDCP), working with Abt Associates Inc., reported that Americans spent an estimated \$65 billion to \$108 billion per year between 1989 and 1998 for illicit drugs and for licit drugs used illegally. New data and a revised methodology have enabled us to improve those estimates, extend them through 1999, and project them into the year 2000.

To estimate the retail sales value of illicit drugs consumed in the United States, we examined the number of drug users, how much they spend on drugs, and the amount of drugs they consume. For a number of reasons, this approach does not yield a precise estimate of the yearly retail value of the illegal drug trade. First, with some exceptions, drug dealers and their customers transact business away from public view. Second, drug users often misrepresent their drug use when interviewed. For these reasons, estimates of retail expenditures are based on the best available data, although those data are seldom as complete or accurate as desired. Also, the data lack a probability-sampling basis, so we cannot provide probabilistic confidence intervals.

Because of these complexities in drug use monitoring, we encourage an evaluation of our findings in three ways. The reader can first compare our estimates with those reported elsewhere. Second, the reader should consider whether or not two independent approaches (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.

Previous versions of *What America's Users Spend on Illicit Drugs* detailed both the consumption-based and supply-based estimation procedures. This version explains the consumption-based approach (technical material and details appear in an appendix) and summarizes results from the supply-based approach. Companion reports provide details about the supply-based approach.

# Discussion and Results

## Cocaine and Heroin

Between 1990 and 1999, American users spent \$35 billion to \$70 billion yearly on cocaine and \$10 billion to \$23 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 2000-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.<sup>5</sup> The NHSDA misses a part of the population that may be a key to determining the extent of drug use: those chronic drug users 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 truthfully answer surveys.<sup>6</sup>

This less-stable population of chronic drug users is, however, well-represented in data collected by the Drug Use Forecasting (DUF) program. (DUF is now the Arrestee Drug Abuse Monitoring (ADAM) program, but the data used here predate ADAM.) DUF questions a sample of arrestees in 24 central city jails and lockups about their drug use.<sup>7</sup> DUF also asks arrestees to voluntarily produce specimens for urinalysis. This helps to confirm whether the interviewees have used any of up to 10 types of drugs during the two to three days before the interview. Although urinalysis is subject to error and tells us nothing about the frequency of drug use, it adds credence to estimates of drug use when self-reports are unreliable.

The *chronic 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.<sup>8</sup> In this analysis, chronic 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.<sup>9</sup> *Occasional users* are identified in the NHSDA as those whose drug use was less frequent than the chronic drug use criteria described above. Occasional use cannot be estimated from DUF.<sup>10</sup>

An Appendix explains how we used data from the NHSDA and DUF, as well as other sources, to estimate the number of drug users in the United States. The rest of this section provides an overview and reports estimates. According to some researchers, chronic drug users seem to account for about three-quarters<sup>11</sup> of all cocaine used in the United States, so understanding chronic consumption patterns is crucial to estimating expenditures on cocaine. The concentration of heroin consumption is probably similar. Thus, reliable estimates of chronic drug use are especially important. The calculations start by estimating the number of chronic users who are arrested during the year. That number is then divided by the average number of arrests that chronic users generate during that year. For example, if chronic users account for 2 million arrests per year, and if chronic users are arrested an average of 0.5 times per year, then there must be 2 million divided by 0.5, or 4 million, chronic users in the nation. We then subtract estimates of chronic users in jails and prisons, because they are unlikely to use heroin or cocaine heavily while incarcerated. The trick, of course, is to obtain reasonable estimates of both the number of chronic users who are arrested during each year and the average number of arrests that they generate during the year (see Appendix).

Once estimates of the number of chronic users are available, the next step is to estimate how much they spend on cocaine and heroin. The best way to learn this information is to ask the users, and studies sponsored by ONDCP, the Substance Abuse and Mental Health Services Administration (SAMHSA), and the National Institute of Justice provided data (See Appendix). An estimate of the retail sales value of illicit drugs consumed by heavy users follows from multiplying estimates of typical expenditures by estimates of the number of chronic users.

Estimates of expenditures by chronic users are then converted to units measured in kilograms of heroin and cocaine, so that amount consumed can be compared with the amount of drugs trafficked into the country. This requires an estimate of the prevailing retail prices for illicit substances. Here, too, ONDCP and other agencies have sponsored research leading to estimates of what substance abusers pay for drugs on the streets (see Appendix). 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.<sup>12</sup>

This explains the derivation of estimates of drugs used by chronic users, but while chronic users probably account for about 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 chronic 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. This report complements expenditures by chronic users on

cocaine and heroin based on DUF data with expenditures on these substances by more casual users who report to the NHSDA.

Table 3 provides estimates of the number of chronic and occasional cocaine and heroin users derived from the NHSDA and the DUF data. (Users of other drugs will be discussed later. Chronic heroin users based on the NHSDA do not appear in this table, because virtually no chronic heroin users answer the NHSDA.) 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 in 1999, and trend statistics were adjusted by the Substance Abuse Mental Health Services Administration (SAMHSA) to take those changes into account. Estimates for 2000 are linear projections based on trends observed in the three preceding years.

Excluding persons in custody, between 1990 and 1999, about 2.7 million to 3.6 million Americans were chronic users of cocaine and approximately 3.0 million to 4.6 million were occasional users. Another 0.9 to 1.1 million Americans were chronic users of heroin, and 140,000 to 600,000 were occasional users. Considering the overlap between chronic cocaine users and chronic heroin users, the estimates suggest that there were about 3.2 million chronic users of heroin or cocaine in 1999.<sup>13</sup> Although imprecise, these estimates are consistent with reported estimates derived by others using different methodologies and data, as discussed below.

Later, we explain a preliminary methodology applied to the Treatment Episode Data Set (TEDS) to develop estimates of chronic methamphetamine users. Applying that methodology to cocaine users in treatment, we estimate there were about 2.0 to 2.5 million “chronic cocaine users” in 1998. (The range results from different assumptions about the inclusiveness of TEDS data.)<sup>14</sup> Here the definition of chronic means that a clinician would have identified cocaine as either the primary or the secondary substance of abuse had these chronic users actually presented for treatment. Despite differences in definitions, the TEDS-based 2.5 million estimate is remarkably close to the consumption-based 2.8 million estimate for 1998. Although this similarity increases our confidence in the consumption-based estimates, the TEDS-based estimation technique is preliminary, and in fact, TEDS-based estimates for heroin (1.3 to 1.6 million) are larger than our consumption-based estimates of 901,000 for 1998. Better understanding of the TEDS data, and increased refinement of the TEDS-based estimation methodology, might resolve these differences – or perhaps even demonstrate that the consumption-based estimates (especially for heroin) are in error. For now we can take some solace that the consumption-based estimates are or the same magnitude as the TEDS-based estimates.



Other policy analysts have reported their own estimates, and these can be compared with our estimates. For example, Rhodes, Langenbahn, Kling and Scheiman<sup>15</sup> provided one national estimate of 508,000 chronic heroin users, and a second national estimate of 582,000 chronic heroin users. The authors explain why both estimates probably understate the true number. We are aware of only one other national estimate of heroin addicts, by Hamill and Cooley,<sup>16</sup> who concluded there were 640,000 to 1.1 million heroin addicts in 1987. The higher estimate is consistent with our 1988 estimate of over one million chronic heroin users.

**Table 3 - Estimated Number of Chronic an Occasional Users of Cocaine and Heroin (Thousands), 1988-2000**

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
<b>NHSDA <sup>1</sup></b>													
Cocaine Chronic	1,100	980	850	806	829	615	734	582	608	682	595	595	537
Cocaine Occasional	6,000	5,300	4,600	4,478	3,503	3,332	2,930	3,082	3,425	3,487	3,216	3,216	3,035
Heroin Occasional	170	150	140	359	304	230	281	428	455	597	253	253	253
<b>DUF <sup>2</sup></b>													
Cocaine Chronic	3,434	3,334	3,133	2,976	2,854	2,773	2,665	2,575	2,524	2,506	2,502	2,457	2,436
Heroin Chronic	1,341	1,266	1,119	1,015	955	945	932	923	910	904	901	898	898
<b>Composite</b>													
Cocaine Occasional	6,000	5,300	4,600	4,478	3,503	3,332	2,930	3,082	3,425	3,487	3,216	3,216	3,035
Heroin Occasional	170	150	140	359	304	230	281	428	455	597	253	253	253
Cocaine Chronic <sup>2</sup>	3,984	3,824	3,558	3,379	3,269	3,081	3,032	2,866	2,828	2,847	2,800	2,755	2,707
Heroin Chronic	1,341	1,266	1,119	1,015	955	945	932	923	910	904	901	898	898

Columns may not add due to rounding. Estimates for 2000 are projections  
*Sources:* NHSDA 1988, 1990 through 1999; DUF 1988 through 1999; Uniform Crime Reports (UCR) 1988 through 1999.

<sup>1</sup> The NHSDA was not administered in 1989. Estimates are the averages for 1988 and 1990.

<sup>2</sup> Due to sample overlap, the estimated number of composite chronic cocaine users is derived from the sum of DUF chronic cocaine users and one half of NHSDA chronic cocaine users.

Simeone, Rhodes, Hunt and Truitt (SRHT)<sup>17</sup> estimated that there were about 300,000 chronic cocaine/heroin users in Cook County in 1995. Assuming a constant proportionality between the number of chronic users in a population and the number of emergency room admissions attributed to them, an extension of the SRHT estimates suggest there are about 3.75 to 4.25 million chronic users in the nation. Although such an

assumption of proportionality rests on shaky grounds, it nevertheless leads to estimates of a magnitude remarkably close to the 3.2 million estimate resulting from the consumption-based calculations.<sup>18</sup>

One other estimate sharply disagrees with those presented here. SAMHSA estimated that about 3.6 million Americans have a severe need for substance abuse treatment exclusive of treatment for alcohol abuse.<sup>19</sup> SAMHSA derived this estimate by identifying someone as needing treatment if he or she met one of four criteria and then inflating the estimates to account for undercounting in the NHSDA.<sup>20</sup> 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.<sup>21</sup> The result was that 920,000 cocaine users needed treatment, as did 130,000 heroin users and 59,000 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 2.8 million chronic users (1996) may conceivably be consistent with SAMHSA's estimate of 1.2 million who need treatment. Similarly, chronic 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 0.9 million chronic heroin users (1996). Although conceivable, these differences are so large that they tax credulity, and SAMHSA's estimate is inconsistent with our estimates of chronic use based on the TEDS data. There are three problems. The first is that, from the result of our calculations, a 20 to 30 percent inflation factor is insufficient to approximate the number of chronic users *not* represented by the NHSDA. A second problem is that the SAMHSA estimates suggest that at a maximum, about 25 percent of all people who need treatment for substance abuse are current users of heroin or cocaine. In fact, all 17 CEWG (Community Epidemiology Work Group) sites<sup>22</sup> report more than 25 percent of their treatment admissions are for cocaine or heroin, and 11 of 17 reported 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 persons who need treatment for cocaine and heroin, and persons who receive treatment for those substances. Third, according to the Treatment Episode Data Sets (TEDS), roughly 200,000 heroin users and another 250,000 cocaine users received treatment per year between 1993 and 1997.<sup>23</sup> SAMHSA's estimates are inconsistent with TEDS. Even after attempts to inflate estimates based on the NHSDA, the estimates seem to understate the number of chronic heroin and cocaine users, and consequently, the SAMHSA estimates cannot be reconciled with our estimates.

## Trends in Drug Use

If the prevalence estimates have some justification, what can be said about trends? Because the estimates presented in Table 3 are based on a consistent methodology from 1988 through 1999, they can be compared meaningfully over time. 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 gradual decrease in the number of chronic cocaine users throughout the period. Estimates of occasional use from the NHSDA show a consistent downward trend that agrees with the trend for chronic user.

The previous version of this report showed a decrease and then an increase in chronic heroin use. However, according to Table 3, the number of chronic heroin users has remained fairly constant since the mid-1990s. Not shown here, supporting calculations indicate a decrease and then an increase in heroin use for some places (New York and Philadelphia, for example) that historically have had high prevalence of chronic heroin use, but this is not universal. There are other places (mostly in the Southwest) that had a higher prevalence of heroin use at the end of the 1990s than at the beginning of the 1990s, and there exist still other places (Los Angeles, especially) where chronic heroin use seems to have declined sharply throughout the period. Note that the 1995 through 1997 NHSDA seemed to show an increase in occasional use, but those years appear to be inexplicable aberrations. Current estimates of occasional heroin use are at about the same levels as before the 1995-1997 peak.

Because trends in drug use are often disputed, it may be helpful to discuss whether or not other evidence is consistent with our findings. Chronic drug users are frequently in trouble with the law, so a temporal change in incarceration practices will necessarily have a large effect on them. Based on estimates explained in the Appendix, the increase in prison populations between 1988 and 1999 would have incapacitated 135,000 additional chronic cocaine users and 43,000 additional chronic heroin users. These are sizable yet conservative numbers, because they do not take into account inmates and detainees under the supervision of local correctional authorities.

The AIDS epidemic provides another reason for expecting a decrease in heavy drug use, especially by heroin users, but also for others who inject drugs. According to the Centers for Disease Control<sup>24</sup> 217,000 injection drug users had been diagnosed with AIDS as of 1998, and 87,000 had died of the disease. Having AIDS certainly does not preclude substance abuse, but advanced AIDS must make it all but impossible to support heavy use of heroin. Adding together chronic heroin users who are incarcerated and chronic heroin users who

have died equals about 127,000 fewer chronic heroin users at the end of the decade than at the beginning of the decade. The figure may be closer to 200,000 when we consider heroin users with advanced AIDS.

If no other factors affected chronic drug use, we would expect a decline in chronic cocaine users and, especially, chronic heroin users, from 1988 to 1999. Offsetting these trends toward less use, however, is an apparent recent increase in heroin use by people who do not inject. This increase might be a consequence of increased availability of higher purity heroin. Trends reported by SAMHSA in the 1998 Treatment Episode Data Set (Table 5.3) are consistent with trends based on our consumption estimates. Between 1993 and 1998, the proportion of admissions for heroin inhalation increased from 23 percent to 28 percent. Moreover, those admitted for heroin inhalation tend to be younger than those admitted for heroin injection; they are more likely to be experiencing a first treatment episode; and among heroin abusers experiencing a first treatment episode, those who inhale have typically used for a shorter time. Recent tabulations based on the National Household Survey on Drug Abuse and the Monitoring the Future Survey have suggested renewed drug use by youths.<sup>25</sup> Nevertheless, this increase is a relatively recent phenomenon, and it followed a decrease in earlier years. It is difficult to believe that these youth could have progressed to heavy use as of 1999, and certainly they could not account for much of the increase in treatment episodes for heroin where fewer than 5 percent of patients are less than twenty years old.<sup>26</sup> The DUF data provide additional evidence of increased use of heroin by inhalation. In the early 1990s across all DUF sites, roughly 87 percent of chronic heroin users said they used a needle during the last year; as of the late 1990s the percentage was 62 percent.

Another check on these trends comes from a comparison with reports from the Community Epidemiology Work Group (CEWG). Although the CEWG reports provide a somewhat inconsistent picture from one report to the next, the five reports between June 1999 and June 2001 suggest that cocaine use has been decreasing during the latter part of the decade. Thus, the trend in cocaine use reported by the CEWG is consistent with the trend reported in this version of What America's Users Spend on Illegal Drugs. The five CEWG reports suggest that heroin use has been increasing or remaining fairly stable across the Nation. Our estimates suggest that heroin use has remained fairly stable. The discrepancy, to the extent that it exists, may arise because the CEWG has identified increased use among young users who have not yet advanced to chronic use.

Finally, according to the Substance Abuse and Mental Health Services Administration, emergency room mentions for cocaine use have increased from about 110,000 in 1989 to about 169,000 in 1999. Emergency room mentions for heroin grew from about 42,000 in 1990 to 84,000 in 1999. A naïve observer might infer that heroin use doubled between 1989 and 1999, but this is almost certainly wrong. Little is known about the

dynamics of emergency room use by chronic cocaine and heroin users, but some speculation might be helpful. According to the 1997 DAWN (Drug Abuse Warning Network) report, dependence is the dominant drug use motive for heroin and cocaine users seeking emergency room assistance: 86 percent for heroin mentions and 68 percent for cocaine mentions. Chronic effects, withdrawal or seeking detoxification are the typical reasons for going to the emergency room: 62 percent for heroin mentions and 50 percent for cocaine mentions.<sup>27</sup> Addicts are more likely to seek treatment as they age, and treatment episodes seem to become more frequent over time.<sup>28</sup> For this reason alone, we would expect to see emergency room mentions increase even if the number of chronic heroin and cocaine users did not change. Furthermore, we suspect that chronic heroin and cocaine users will develop an increasing number of chronic health conditions as they age and as their addictions advance. This, too, can account for an increase in emergency room mentions. Our own calculation suggest that annual ER mentions have grown from about 4 per hundred chronic users in the late 1980s to about 7 per hundred chronic cocaine users in the late 1990s; for chronic heroin use, annual ER mentions have grown from about 4 per hundred to about 9 per hundred. While DAWN is valuable for detecting short-term changes in specific jurisdictions, such as a spike in overdose deaths, it would seem to have little or no value as a tool for monitoring long-term trends in the prevalence of substance abuse.

### **Average Amount Spent on Cocaine and Heroin**

DUF interviewers 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 the Appendix, we adjusted estimates to moderate the effect of extreme values. Because of a change in questionnaire design, DUF does not provide comparable estimates after 1995. The Appendix explains how we dealt with these problems. Table 4 provides estimates of the average expenditure on cocaine and heroin. All estimates were converted to 2000 dollar equivalents based on the consumer price index.<sup>29</sup>

In 1999, chronic cocaine users spent \$206 per week on cocaine, and chronic heroin users spent \$201 per week on heroin (Table 4). These DUF estimates lack precision, but they are reasonable considering other data about expenditures on illicit drugs.<sup>30</sup>

**Table 4 - Weekly Average Cocaine and Heroin Expenditures Reported by Arrestee Chronic Users, 1989-2000**

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Cocaine	\$440	\$377	\$318	\$266	\$247	\$236	\$232	\$226	\$220	\$188	\$197	\$206	\$212
Heroin	\$365	\$361	\$379	\$363	\$327	\$266	\$255	\$249	\$242	\$208	\$222	\$201	\$201

*Sources:* DUF 1989 through 1999

Of course, occasional users spend less per week than do chronic users. Based on NHSDA data, occasional cocaine users spent \$19 per week in 1988, \$23 in 1989, \$27 in 1990, \$30 in 1991, \$34 in 1992, and \$35 in 1993. More recent estimates are unavailable. We assumed that the \$35 figure applied to all years and adjusted for the consumer price index. No such estimates are available from the NHSDA for occasional heroin users. For the NHSDA, we assumed a weekly expenditure of \$50 per week. Again, we adjusted for the CPI.

### Total Expenditures on Cocaine and Heroin

Between 1990 and 1999 American users spent \$35 billion to \$70 billion yearly on cocaine and \$10 billion to \$23 billion yearly on heroin (Table 5). We derived these estimates by multiplying the number of chronic and occasional users in Table 3 by the average expenditures in Table 4 (and the figures cited earlier for occasional users) and adding the results.

**Table 5 - Total Expenditures on Cocaine and Heroin, 1988-2000 (\$ in billions, 2000 dollar equivalents)**

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
<b>Cocaine</b>													
Chronic Use	\$91.1	\$75.0	\$58.9	\$46.8	\$42.0	\$37.8	\$36.6	\$33.7	\$32.4	\$27.9	\$28.7	\$29.5	\$29.8
Occasional	\$15.9	\$13.4	\$11.1	\$10.3	\$7.8	\$7.2	\$6.2	\$6.3	\$6.9	\$6.8	\$6.2	\$6.0	\$5.5
Total	\$107.0	\$88.4	\$69.9	\$57.1	\$49.9	\$45.0	\$42.8	\$40.0	\$39.2	\$34.7	\$34.9	\$35.6	\$35.3
<b>Heroin</b>													
Chronic Use	\$25.4	\$23.8	\$22.0	\$19.2	\$16.2	\$13.1	\$12.4	\$11.9	\$11.5	\$9.8	\$10.4	\$9.4	\$9.4
Occasional	\$0.6	\$0.5	\$0.5	\$1.2	\$1.0	\$0.7	\$0.8	\$1.3	\$1.3	\$1.7	\$0.7	\$0.7	\$0.7
Total	\$26.1	\$24.3	\$22.5	\$20.3	\$17.2	\$13.8	\$13.2	\$13.2	\$12.8	\$11.4	\$11.1	\$10.1	\$10.0

Estimates for 2000 are projections

*Sources:* See Tables 3 and 4.

Other analysts have made clever use of available data to derive their own estimates of retail expenditures on cocaine and heroin. Even after adjusting for the limitations of these other studies, our estimates are higher than theirs, perhaps suggesting that – if anything – we might adjust our estimates downward.<sup>31</sup> But a large

downward adjustment seems unwarranted because domestic consumption based estimates would be much smaller than supply-based estimates.

### **How Varying the Assumptions Affects the Estimates**

In most regards, this version of *What America's Users Spend on Illicit Drugs* provides estimates of drug use and expenditures that are consistent with (but not identical to) estimates from the previous version. Nevertheless, there are important differences, which alert us to how varying assumptions and using different data alter the estimates. Therefore, comparing current estimates with previous estimates has some utility.

The new version has larger estimates for chronic drug use, especially for heroin, during 1988 and 1989. The major problem is that DUF was not administered in 1988 except at select sites, and our recent analysis of DUF data suggests that data quality was poor during DUF's 1989 start-up year. Under-reporting of drug use appeared to be especially high during that first year, and our attempt to adjust for that under-reporting caused the estimates to increase. (The 1988 estimate is a projection based on a three-year trend, so it is sensitive to the 1989 estimate.) Given problems with DUF in 1988 and 1989, coupled with the fact that the NHSDA was a relatively small sample in 1988 and not administered in 1989, we caution skepticism regarding the estimates for these early years. We are also cautious about 1990 estimates, because they are based on three-year moving averages, and therefore affected by problems with the 1988 and 1989 estimates.

Still, even if we disregard the years 1988 through 1990, the current estimates differ from the previous ones. (The appendix provides details; we summarize here.) We based current estimates on a refined analysis of trends in the DUF data and new estimates of truthful reporting that varied from year-to-year and from site-to-site. We also modified the algorithm for estimating the number of chronic drug users in places that lack DUF programs and, based on an analysis of new data, changed assumptions about the rate at which chronic users get arrested. Obviously the estimates are sensitive to those changes. One result is that we no longer estimate a significant mid-1990s dip in the number of chronic heroin users. That is encouraging because that mid-1990s dip was always difficult to explain.<sup>32</sup> With respect to chronic cocaine use, the previous estimates were about 20 percent higher than the current estimates from the middle to the end of the last decade. The recent estimates are closer to the TEDS-based estimates, which we might accept as suggesting that the new estimation procedure is better than the previous one. We note that in the last report, the 1999 estimate was a projection based on estimates for 1996 through 1998. In this report, the new 1999 estimate is based on the pre-1999 computing methodology, not a trend. Finally, the last estimate for 2000 and the current estimate for 2000 are

both projections, albeit from different bases. These changes account for the fact that current estimates for 1999 and 2000 differ from estimates of the same years from the previous version of this report.

We analyzed new data about expenditures by chronic drug users, and we employed a new computing algorithm to make estimates of weekly expenditures for 1988 through 2000. Details appear in an appendix. Estimates of weekly expenditures by chronic users on heroin changed very little from the previous version of *What America's Users Spend on Illicit Drugs*. The biggest changes are from the middle 1990s; the new heroin expenditures are almost 10 percent higher than previously. Our current estimates for cocaine expenditures are about 10 percent higher for the middle and later part of the decade. They are slightly lower for the middle part of the decade. We also made some modest changes, as described in the text, to our estimates of the weekly expenditures by occasional cocaine user. These assumptions caused expenditures to increase slightly during the early part of the period, but occasional users account for only a small proportion of cocaine use, so the changes have little impact on the "bottom line" of total expenditures.

Of course, the bottom line has changed somewhat from the earlier estimates. Compared with previous estimates, we now say there are somewhat fewer chronic cocaine users, but we also say they are spending somewhat more per week. (Some increase in expenditures results from using a more recent consumer price index, but inflation has been modest, so here we ignore inflation as an explanation.) These two changes are partly offsetting, and except for 1997 and 1998, the earlier estimate comports with the current estimates. For 1997 and 1998, the current estimates are 10 to 20 percent lower.

The bottom line changes for heroin. Because the new estimates fail to show the precipitous decrease in chronic heroin use during the early and middle part of the 1990s, we now say that heroin users spent up to 50 percent more than we had estimated previously for that period. This is especially true for 1991 through 1993. We have revised expenditure estimates downward for 1999 and 2000.

That these estimates change from one version of this report to another is frustrating both for the report's authors and for its readers. A consistent methodology would impose consistency but at a price. As better estimation techniques and improved data emerge, estimates of the number of drug users and their expenditures get better, so the price paid for consistency is inferior estimates. As mathematical modelers and statisticians, we now face a future where data are becoming suitable for supporting probability-based estimates of chronic drug use. The ADAM program provides, for the first time, detailed information about expenditure on illicit drugs. The next version of *What America's Users Spend on Illicit Drugs* surely portends major advances in



estimation technology at the price of yet one more round of revisions to estimates of chronic drug users and how much they contribute to a retail market for heroin and cocaine.

### **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 elsewhere,<sup>33</sup> we assume that chronic users of heroin received 22 percent of their drugs as in-kind payment in 1988, but that this percentage fell linearly to 11 percent as of 1995 because of changes in the way that heroin was distributed.<sup>34</sup> We assumed that users of cocaine received 11 percent of their cocaine as income in kind throughout the period.

If we convert in-kind payments into dollar equivalents at street prices, then the 1999 dollar expenditure on cocaine would increase by about \$4 billion, and the 1999 dollar expenditure on heroin would increase by about \$1.5 billion. These totals are not reflected in Table 5, 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. A companion report explains price derivations; the Appendix details how we modified the basic methodology for present purposes.

The price of cocaine fell sharply throughout the early 1980s (not reflected in the table) and continued to decline, but at a more modest rate) into the late 1990s (Table 6). Most of the decline after 1990 is caused by an increase in the consumer price index; these prices are smoothed, so the table masks year-to-year price

variations. Cocaine prices seem to have increased entering the new millennium. The price of heroin also fell throughout most of the period and that apparent price decrease was much steeper than its cocaine counterpart.

Table 7 shows estimates of the amount of cocaine and heroin that was consumed based on the expenditures reported in Table 5 (adjusted to account for drugs earned as income in kind) and the retail prices reported in Table 6. According to the data for the 1990 to 1999 period, cocaine users consumed somewhere between 270 and 450 metric tons of pure cocaine each year. The level of consumption has stayed close to 300 metric tons throughout the 1990s. It seems to have fallen below the 300 metric ton mark toward the end of the decade, but we note that the year 2000 estimate is a linear projection. Heroin users consumed roughly 14 metric tons at the beginning and end of the decade.

We note an apparent upward trend in the amount of heroin consumption beginning in 1995. If this trend is real, it might have resulted from an infusion of high-quality, low-cost Colombian heroin that competed with and eventually supplanted heroin from Southeast and Southwest Asia. However, for reasons explained in the Appendix, we are uncertain about estimates for the street price of heroin. We are especially concerned that the street prices may have been lower than shown in Table 6 especially for late in the 1990s. If that is so, then our estimates for heroin consumption would be too low, as those estimates comes from dividing expenditures by price.

Because estimates are not totally accurate, trends are uncertain. The amount of cocaine consumed in the United States appears to have decreased slightly over the last eight years. Total expenditures on cocaine have fallen over time, but this is attributable almost exclusively to using the consumer price index to inflate past expenditures.<sup>35</sup>

Trends in heroin use may be different. The amount of heroin used may have decreased from 1988 and 1989 into the middle 1990s. Thereafter, heroin consumption may have increased, and that increase may have continued into the end of the decade. As already noted, there seem to be fewer heroin addicts who inject in the middle 1990s than there were at the end of the 1980s. The HIV virus and AIDS have taken a toll, and many users have been incarcerated. Still, prices have fallen so much that remaining users have been able to purchase much more than they did in the past, and these lower prices may have attracted new users – many of whom snort the drug – into the market.<sup>36</sup>

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.<sup>37</sup> This compares with our estimates of 447 metric tons in 1990. The Rand researchers estimate that 7.8 metric tons of heroin entered the States in 1991,<sup>38</sup> our estimate is 12.5 metric tons.

We have made major changes to methods used to estimate retail-level prices for cocaine, and as a result, our new price series is lower than our previous price series. The largest differences occur during the earlier part of the time-series. As noted before, current expenditure estimates for cocaine are lower than previous estimates, but lower cocaine prices partly offset what otherwise would be a decrease in total cocaine use. We now estimate much higher cocaine use for 1988 through 1990, but for reasons already explained, we heavily discount the accuracy of estimates for 1988 and 1989 and distrust estimates for 1990.

We also made major changes to the method of estimating heroin prices but are skeptical that even these new estimates truly reflect retail-level market prices. The principal problem is that the retail market seems to be bifurcated between consumers who pay relatively low unit prices for high quality heroin suitable for inhalation and consumers who pay comparatively high unit prices for low quality heroin suitable only for injection. The larger the proportion of the market devoted to high quality heroin, the lower the average price; likewise, the larger the proportion devoted to low quality heroin, the higher the average price. We cannot tell the mix between high quality and low quality purchases; hence, we remain uncertain about how much users typically pay for their heroin. Table 6 reflects a working estimate.

**Table 6 - Retail Prices Per Pure Gram for Cocaine and Heroin, 1988-2000 (dollars, 2000 dollar equivalents)**

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Cocaine	\$180	\$170	\$174	\$178	\$160	\$151	\$147	\$139	\$144	\$140	\$145	\$146	\$152
Heroin	\$2,184	\$1,758	\$1,968	\$1,914	\$1,697	\$1,403	\$1,374	\$1,222	\$1,109	\$1,080	\$851	\$783	\$839

Estimates for 2000 are projections

Source: STRIDE 1981 through 2000

**Table 7 - Total Amount of Cocaine and Heroin Consumed, 1988-2000 (in metric tons)**

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

Estimates for 2000 are projections

Sources: See Tables 3 through 6.

## **Methamphetamine**

We applied the same computing algorithms used to derive estimates for cocaine and heroin to the problem of getting estimates for methamphetamine. When applied to methamphetamine, the approach does not work as well, for reasons that are discussed in this section. According to our calculations, there are probably between 200,000 and 300,000 chronic users of amphetamines. (As before, a chronic user is someone who uses a drug on more than ten days per month.) The estimate is technically about amphetamines, because that is the question posed in the DUF interview. Hereafter, however, amphetamine users are assumed to be methamphetamine users. This assumption is justified by the observation that in 1997, more than 96 percent of those who tested positive for amphetamines were confirmed by a second test to be positive for methamphetamine.

This estimate is problematic for two reasons. The first is that methamphetamine use is rare among arrestees in many cities, so the estimates are really based on the experiences of a few cities, and those experiences are then prorated across the nation. The fact that so few cities account for the estimates may impart additional uncertainty to the calculation. The second reason for skepticism is that the estimates vary markedly from year to year.

Therefore, we experimented with and ultimately adopted an entirely different method for estimating the number of chronic methamphetamine users. Applying an adaptation of an estimator developed for the National Institute of Justice,<sup>39</sup> we used the TEDS data to estimate the rate at which chronic methamphetamine users entered substance abuse treatment during 1998, the most recent year for which we have TEDS data. The logic is that if a chronic user enters treatment once every five years, then there must be five chronic users in the population for every chronic user who enters treatment. As a simple illustration, suppose that the typical chronic methamphetamine user generates 0.2 treatment admissions per year, or about one every five years. Suppose that we observe 200,000 treatment admissions during a given year. Then there must be  $200,000/0.2 = 1$  million chronic users of methamphetamine.

To get these estimates, we started with the total number of adults who entered treatment during 1998 and for whom methamphetamine was diagnosed as the primary or secondary drug of abuse. Because of this selection rule, in this context a chronic drug user is one who would be diagnosed as needing treatment for methamphetamine if he or she were examined by a clinician. We divided the data into Metropolitan statistical

areas, computed the number who entered treatment in each MSA, estimated the rate at which chronic users entered treatment in each MSA, and divided the former by the latter to estimate the number of chronic drug users in each MSA. The national estimate would be the sum of the estimates across the MSAs except for some problems.

The first problem is that some of those who were diagnosed as needing treatment for methamphetamine said they did not use methamphetamine in the last month. We did not see how such users could contribute to consumption estimates, so we excluded them from the calculations. The second problem arises when one substance abuse provider referred clients to another provider. If these referrals were for a continuum of care, they would amount to double counting, so we excluded such cases from the analysis. A third problem is that TEDS under-represents treatment admissions. According to TEDS documentation, in 1998 TEDS included about 83 percent of all TEDS-eligible admissions and about 67 percent of all treatment admissions. (A “TEDS eligible admission” is an admission to a program that receives public funding.) To adjust for under-counting, we might inflate the estimates by  $1/0.67$  or by  $1/0.83$  depending on whether methamphetamine users often pay for their own treatment (justifying the  $1/0.67$  adjustment) or rarely pay for their own treatment (and hence justifying the  $1/0.83$ ) adjustment. We actually used both adjustments and then averaged. A fourth problem is that the TEDS public release data combines treatment for methamphetamine with treatment for other stimulants. We assumed that methamphetamine accounted for about 79 percent of treatment admissions where stimulants were identified as the primary substance of abuse, so we adjust our estimates by multiplying them by 0.79.<sup>40</sup>

Following this logic, we estimate that about 670,000 Americans use methamphetamine at a level sufficient that a clinician would deem them to need treatment. This estimate is considerably larger than the alternative DUF-based estimate of 200,000 to 300,000. We can take comfort that this new estimation procedure produced a reasonable (if somewhat low) estimate for chronic cocaine and a reasonable (if somewhat high) estimate for chronic heroin use; hopefully it provides a reasonable estimate for methamphetamine. Last year we estimated almost 360,000 chronic methamphetamine users, so this new estimate represents a substantial increase over last year’s estimates.

Although we believe that 670,000 is a reasonable estimate of the number of chronic users of methamphetamine, we are uncomfortable about our understanding of the TEDS data, and we have very limited experience with the estimator used here. (Although it is derivative of an estimator developed for the National Institute of Justice, the extensions are non-trivial. We have been unable to thoroughly test sensitivity to

alternative assumptions.) Furthermore, a single point-estimate for 1998 does not provide any information about earlier and later years. To get that information we can overlay the 670,000 estimate on trend estimates based on the DUF data. As noted above, estimates upon which the trend is based were derived the same way as we developed the chronic estimates for heroin and for cocaine.<sup>41</sup> Table 8 reports the results from these calculations after subtracting for chronic users incarcerated in prisons and smoothing over three-year periods.

Estimates of weekly expenditure on methamphetamine are uncertain because the data are sparse. In the absence of hard data, we assumed that chronic users of methamphetamine spent about \$200 per week in 1995. Our reasoning was that expenditures by chronic methamphetamine users are probably comparable to expenditures by chronic cocaine and heroin users, and chronic heroin and cocaine users spend about \$200 per week. The Appendix explains why we selected 1995 as the base and how we used DUF data to estimate expenditures for other years.

The estimate of total revenue comes from multiplying the number of chronic users by their weekly expenditure, and then multiplying by 52 to determine a yearly expenditure. The result was multiplied by 4/3 (the reciprocal of 0.75) to account for occasional users. We estimate that in 1999 methamphetamine users spent somewhat less than \$6 billion per year on methamphetamine use. The next step was to estimate the price of methamphetamine. The Appendix explains the price derivation. Data are again sparse, so trends reported in Table 8 are uncertain. The final step is to divide total revenue by the price per pure gram. If casual users account for roughly 25 percent of consumption, the 1999 estimate is roughly 18 metric tons. As noted, seeking precision would be quixotic; these estimates are best treated as matters of scale with a wide (but unknowable) confidence interval. Trends are especially uncertain but the apparent increase in use and expenditures over the last decade agrees with reports by others.

There is scant evidence to support any secondary check on these calculations. According to the TEDS data, 15 to 18 percent of treatment admissions between 1993 and 1998 identified cocaine as the primary drug of abuse. Methamphetamine was the primary drug for between 1.3 percent (1993) and 3.6 percent (1998) of admissions. If we take the 1998 numbers to imply that there were 4.1 chronic cocaine users for every 1 chronic methamphetamine user, and if we accept the earlier estimates of the number of chronic cocaine users, then there would be about 680,000 chronic methamphetamine users during 1998. That agrees closely with the estimate reported in Table 8, but this assumption of proportionality is tenuous. If we take the 1993 numbers to imply that there were roughly 13.5 chronic cocaine users for every chronic methamphetamine user, and if we again use the earlier estimates of chronic cocaine users, we would say there are about 230,000 chronic

methamphetamine users in 1993, fewer than what we report in the table. Perhaps there is some comfort here that the scale is about right, but precision is elusive.

Assuming the scale is about right, what can be said about the trend? The TEDS data show an increase in admissions with methamphetamine named as the primary drug of abuse. Just 1.0 percent of admissions in 1992 and 1.3 percent of admissions in 1993 were for methamphetamine. This compares with 3.5 percent in 1997 and 3.6 percent in 1998. We see those trends reflected in Table 8.

As another check on trends, reports from the Community Epidemiology Work Group provide a somewhat inconsistent picture from one report to the next. During the last three years, the CEWG has reported that methamphetamine use has decrease and then increased. Our trend statistics show the opposite. However, our choice to smooth the estimates masks the fact that our estimates vary markedly from year-to-year. We doubt that we have captured the short-term trend during the late 1990s. On the other hand, we have no reasons to doubt the long-term trend during the decade, which is consistent with treatment admission data and other sources.

**Table 8 - Calculation of Total Methamphetamine Consumption, 1989-2000**

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Number of Chronic Users	274	269	259	270	302	381	474	584	664	707	669	617	595
Median weekly expenditure	\$327	\$311	\$319	\$196	\$229	\$194	\$232	\$226	\$220	\$189	\$173	\$136	\$132
Price per pure	273	307	358	369	352	271	223	169	187	262	294	316	276
Total expenditures (billions)	\$6.2	\$5.8	\$5.7	\$3.7	\$4.8	\$5.1	\$7.6	\$9.2	\$10.1	\$9.3	\$8.0	\$5.8	\$5.4
Metric tons	22.7	19.0	16.1	10.0	13.6	18.9	34.1	54.2	54.3	35.3	27.2	18.3	19.7

Estimates for 2000 are projections

Sources: NHSDA 1988, 1990 - 1999; STRIDE 1981 - 2000; DUF 1989-1999; Uniform Crime Reports 1988-1999; TEDS 1998

## 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 9.

## **Number of Marijuana Users**

More Americans use marijuana than either cocaine or heroin. During 1999, for example, about 11.9 million Americans used marijuana or hashish at least once in the month before the NHSDA. This number is somewhat greater than it was in 1988 (11.0 million). The trend was for decreasing use into the early 1990s and then increasing use into the late 1990s.

Reports from the Community Epidemiology Work Group provide confirmation for the trends presented here. The five reports between June 1999 and June 2001 suggest that marijuana use had been increasing until the end of the decade, at which point use stabilized and may have started to decrease. Our trend estimates, which are based entirely on the NHSDA, also suggest that marijuana use increased through much of the 1990s. Marijuana use may have stabilized toward the end of the decade, but the NHSDA does not show that marijuana use has begun to decrease.

## **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.<sup>42</sup> In 1995 the NHSDA stopped asking respondents about the number of joints and amount of marijuana used in the last month. Because marijuana users reported using an estimated 18.7 joints per month in 1994, we assumed the same was true for the years after 1994.

## **Average Amount of Marijuana Used**

The average amount of marijuana used in the past month was calculated from several questions in the survey.<sup>43</sup>

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 continuing study to monitor THC content conducted at the University of Mississippi,<sup>44</sup> during the 1990s the average THC content of commercial grade marijuana increased from about 4 percent to about 5.5 percent. The THC content of sinsemilla increased from about 8



percent to about 12 percent. Thus, the increase in drug use might be considered to be considerably greater than reflected in the Table 9.

## **Price**

Price is the final factor in calculating the total value of marijuana consumption.<sup>45</sup> Marijuana prices were roughly \$375 per ounce in the late 1980s. These prices are for a one-third ounce purchase, which appears to be a typical purchase size by frequent users. They jumped to closer to \$500 per ounce during the early 1990s. Throughout the rest of the decade, prices were considerably lower. The price trends appear to be roughly consistent with trends in THC content. That is, as the price of marijuana has fallen, its quality has improved.

Table 9 - Calculation of Total Marijuana Consumption, 1988-2000

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Number of Users (millions)	11.6	10.9	10.2	10.4	9.7	9.6	10.1	9.8	10.1	11.1	11.0	11.9	12.1
Joints used per month	16.9	17.3	17.6	16.6	17.2	17.8	18.7	18.7	18.7	18.7	18.7	18.7	18.7
Weight of a joint (ounces)	0.0134	0.0135	0.0137	0.0135	0.0134	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136
Price per ounce, 1/3 ounce purchase	\$385	\$361	\$508	\$499	\$545	\$432	\$397	\$340	\$309	\$311	\$322	\$292	\$284
Total expenditure for the year (\$ in billion dollar equivalents)	\$12.1	\$11.0	\$15.0	\$14.0	\$14.6	\$12.0	\$12.2	\$10.2	\$9.5	\$10.5	\$10.8	\$10.6	\$10.5
Metric Tons	894	866	837	793	761	791	874	848	874	960	952	1028	1047

Estimates for 2000 are projections

Sources: NHSDA 1988, 1990 through 1999; STRIDE 1981 through 2000.

## Total Consumption Estimates

The factors required to calculate total marijuana consumption are shown in Table 9. In 1999, we estimate that average users consumed 18.7 joints per month. The average amount of marijuana used per joint equaled 0.0136 ounces.<sup>46</sup> At a retail price of \$292 an ounce, these users spent an average of \$74 each month (\$891 a year) on marijuana. This number, multiplied by the 11.9 million monthly users, yields a consumption estimate of \$10.6 billion for the year. That translates into more than 1,000 metric tons for the year.

These estimates may be low. Users are likely to under report socially disapproved behaviors, even when those behaviors are legal.<sup>47</sup> They would seem to have even more incentive to under report illegal behaviors.<sup>48</sup> Given under reporting rates for tobacco and alcohol use, it might be reasonable to inflate marijuana estimates by about one-third. On the other hand these estimates could be too high. Joints are frequently shared, and it seems plausible that these calculations double count some consumption. At any rate, our estimates of total spending are in line with estimates by others.<sup>49</sup>

There is one disconcerting comparison, however. According to the DEA, nearly 830 metric tons of marijuana were seized during 1998, nearly 1,100 metric tons were seized in 1999, and more than 1,200 metric tons were seized in 2000. There may be a measurement problem. That is, the tonnage from seizures may include non-salable bulk, and thus, seizures may overstate the consumption-equivalent of marijuana seized at the border. Even taking that explanation into account, it seems unlikely that marijuana growers would continue to export into the United States when the probability of detection and seizure of product was as high as is implied by the combination of the consumption and seizure estimate.

## Other Drugs

Most of the money spent on illicit drugs in America is spent on cocaine, heroin, marijuana, and methamphetamine. However, expenditures on other illicit substances (inhalants and hallucinogens) and on licit substances consumed illegally (other stimulants, sedatives, tranquilizers, and analgesics) is considerable. Much of this drug use appears to be reported to the NHSDA.<sup>50</sup> 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 10 shows the number of respondents who, according to the NHSDA, used these other drugs between 1988 and 1999. To complete the table, estimates for 2000 were set to the 1999 estimate. Those respondents who admitted use during the year were asked how frequently they used the drug.<sup>51</sup> We then used these data to compute an average number of days a year that the respondents used a drug.<sup>52</sup> Since the survey lacks information about the number of doses taken on days that the drug was used, we assumed that each day of use resulted in a single dose. This is most certainly an underestimate.

It is difficult to determine prices per dose. Both the Drug Enforcement Administration's (DEA) Illegal Drug Price/Purity Report and the National Institute on Drug Abuse's Community Epidemiology Working Group (CEWG) provided wide ranges.<sup>53</sup> 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 \$2 billion and \$3 billion on other drugs each year during the last decade (Table 10).

These estimates are imprecise for the reasons noted above. However, even if we halve or double the estimates to reflect uncertainty, drugs other than cocaine, heroin, marijuana and methamphetamine must be a relatively small part of the total expenditure that Americans make on illicit substances and on legal substances consumed illegally.

## **Conclusion about Consumption**

According to estimates based on the prevalence-based procedure, Americans spent about \$67 billion on heroin, cocaine, methamphetamine, marijuana, and other illegal drugs in 1999: \$36 billion on cocaine, \$10 billion on heroin, \$11 billion on marijuana, \$6 billion on methamphetamine, and \$2.6 billion on other illegal drugs (Table 11). Table 11 appears to show a substantial decrease in expenditures on illicit drugs between 1990 and 2000. Most of this change is attributable to inflation as reflected in the consumer price index. This decrease may not be apparent to chronic 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.

**Table 10 - Other Drugs: Total Yearly Users (thousands) and Expenditures (\$ in billions, 2000 dollar equivalents), 1988-1999**

<b>Drug Used</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>
<b>Number of Users</b>													
Inhalants	2,441	2,327	2,212	2,379	1,889	1,940	2,213	2,308	2,427	2,329	2,009	2,009	2,009
Hallucinogens	3,200	2,775	2,350	2,562	2,530	2,479	2,725	3,416	3,602	4,063	3,565	3,565	3,565
Stimulants	2,698	3,009	2,319	2,010	1,478	1,774	1,419	1,656	1,896	1,687	1,489	1,489	1,489
Sedatives	1,376	1,184	991	946	702	702	736	666	678	638	522	522	522
Tranquilizers	4,124	3,250	2,376	3,143	2,380	2,380	2,405	2,210	2,430	2,122	522	522	522
Analgesics	5,342	5,164	4,986	5,063	4,560	4,560	4,247	4,102	4,510	4,210	4,070	4,070	4,070
<b>Expenditures</b>	<b>\$3.3</b>	<b>\$2.8</b>	<b>\$2.2</b>	<b>\$2.3</b>	<b>\$1.5</b>	<b>\$1.5</b>	<b>\$2.6</b>	<b>\$2.7</b>	<b>\$2.7</b>	<b>\$2.5</b>	<b>\$2.3</b>	<b>\$2.3</b>	<b>\$2.3</b>

Estimates for 2000 are projections

Source: NHSDA 1988, 1990 through 1999

**Table 11 - Total Expenditures on Illicit Drugs, 1989-2000 (\$ in billions, 2000 dollar equivalents)**

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Cocaine	107.0	88.4	69.9	57.1	49.9	45.0	42.8	40.0	39.2	34.7	34.9	35.6	35.3
Heroin	26.1	24.3	22.5	20.3	17.2	13.8	13.2	13.2	12.8	11.4	11.1	10.1	10.0
Methamp	5.9	5.8	5.7	3.7	4.8	5.1	7.6	9.2	10.1	9.3	8.0	5.8	5.4
Marijuana	12.1	11.0	15.0	14.0	14.6	12.0	12.2	10.2	9.5	10.5	10.8	10.6	10.5
Other Drugs	3.3	2.8	2.2	2.3	1.5	1.5	2.6	2.7	2.7	2.5	2.3	2.6	2.4
Total	154.3	132.3	115.4	97.3	88.0	77.5	78.4	75.2	74.3	68.4	67.2	64.6	63.7

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

Sources: Tables 3 through 9

## Summary and Comparison with Supply-Based Estimates of Availability

Due to the quality of available data, there is considerable imprecision in estimates of the number of chronic and occasional users of drugs, the amount of drugs they consume, and the retail sales value of those drugs.

The best estimates (all for 1999) follow:

- In 1999, about 2.8 million Americans were chronic cocaine users, and about 900,000 were chronic heroin users. The number of chronic cocaine users has declined over the last decade (the figure was 3.6 million in 1990). The number of chronic heroin users has decreased, perhaps due to the AIDS epidemic and increased incarceration, but that decrease has largely abated during the latter part of the decade, perhaps because of new users attracted by the availability of high-quality low-cost heroin.
- About 3.2 million Americans were occasional cocaine users, and about 250,000 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 1999, about 12 million Americans had used marijuana at least once in the month prior to being surveyed. The number of marijuana users has remained fairly constant over time, with some dip in use during the middle 1990s when prices were relatively high.
- Methamphetamine abuse is now recognized as a major problem, but estimates of the size of the problem are imprecise. Perhaps 670,000 Americans are chronic methamphetamine users. Consistent with other sources, we find increases in the number of methamphetamine users over the last decade.
- Many Americans use illicit drugs other than cocaine, heroin, methamphetamine and marijuana, or they may use licit drugs illegally. About 12 million Americans admitted using these other drugs in 1999. 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.

Nonetheless, the best estimates indicate the following:



- In 2000, Americans spent about \$36 billion on cocaine, \$10 billion on heroin, \$5.4 billion on methamphetamine, \$11 billion on marijuana, and \$2.4 billion on other substances.
- Again, estimating trends is risky, but it appears that expenditures on cocaine, heroin, and marijuana have fallen some over the last decade. However, almost all the reduction can be attributed to a fall in prices. Expenditures on methamphetamine have increased over the decade.

Figures of cocaine consumed in the United States were compared to estimates of cocaine availability based on coca cultivation estimates . As noted earlier, details about the supply-based estimates appear in companion reports. The STAR model affords an estimate of cocaine that leaves South America by beginning with the domestic consumption estimates reported in this document and augmenting those consumption estimates to include seizures, shipments to destinations other than the United States, and other reductions from the distribution system. The STAR Model provides a second estimate of cocaine that leaves South America by beginning with coca cultivation, transitioning to production potential, then subtracting seizures, indigenous consumption and other reductions from the system. The two estimates should agree, and broadly, they do. Between 1997 and 2000 the coca cultivation-based estimate is that from 537 to 616 metric tons departed from South America; during that same period, the domestic consumption-based estimate is that from 500 to 600 metric tons departed South America.

The heroin flow model requires a different kind of comparison. Starting with the consumption estimates, and accounting for reductions from the distribution system, the model provides estimates of the amount of heroin that comes from South America and Mexico. Those estimates can be compared to potential production-based estimates for those two sources. The domestic consumption-based estimates for 1996 through 2000 are 3.5 to 4.3 metric tons of heroin originated from Mexico and 7.0 to 9.5 metric tons originated from Colombia. The potential production-based estimates for those same years are 4.0 to 6.0 metric tons for Mexico and 6.4 to 7.5 metric tons for Colombia. Colombia seems to produce somewhat less heroin, and Mexico seems to produce somewhat more heroin, than can be accounted for by the consumption-based estimates. These differences might be explained by incorrect information about processing efficiencies, because estimates of processing efficiencies, which are based on Southwest and Southeast Asia studies, may not apply to Colombia and Mexico.

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. Indeed, a comparison of this report with its precursors for earlier years reveals the truth of this statement. Each new version of *What America's Users Spend on Illicit Drugs* has had access to better data and improved estimation methodology. In turn, each new version has provided revised estimates of the number of users, the amount they spend on illicit drugs, and the amount of drugs they use. Year-to-year changes in these estimates must be unsettling to this report's users, but we hope those readers can appreciate that the methodology has evolved over time, and the price of inconsistency has been year-to-year improvements.

We make no pretense here that the model and estimates we present in this report are fully adequate to the larger task of informing public policy decisions. They are, at best, a start, but they offer important possibilities of integrating what are otherwise seen as disparate pieces of information about the consumption and supply of drugs.

We expect incremental improvements to the estimates and methods offered here, particularly as better data become available. We also expect improvement in the models. In fact, the Office of National Drug Control Policy has started a project to improve and integrate drug use and supply indicator data. The National Institute of Justice, through its Arrestee Drug Abuse Monitoring program, has instituted projects to more accurately estimate the number of chronic drug users and to better describe illicit drug markets. Also, the Substance Abuse Mental Health Services Administrations, through the NHSDA, is implementing an important series of questions about marijuana purchasing practices. These emerging data will greatly improve future versions of these estimates.

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.

The current process for integrating this research into policymaker decisions is through the ONDCP Performance Measure of Effectiveness (PME) system. The PMEs set 97 performance targets and 127 associated measures. Many of these targets involve supply-side activity, such as reduction of heroin flow

into the United States. These targets are instrumental toward increasing the price of illicit drugs, reducing the supply of illicit drugs, or both. The results of this heroin model are inputs into the PME process, and will therefore be updated on an annual basis.



## Appendix

This appendix explains calculations performed to support estimation of the number of illegal drug users, the amount they spend on drugs and the amount of drugs they consume. Comments explain how and why this estimation procedure departed from the procedure used in earlier versions of What America's Users Spend on Illegal Drugs. It begins by itemizing steps taken to estimate consumption of cocaine and heroin. It then explains a different procedure used to estimate methamphetamine use, another procedure used to estimate marijuana use, and finally, still another approach used to estimate the consumption of other illegal drugs.

Documenting all assumptions and all calculation in an appendix is impractical. Except for supporting statistical analysis, spreadsheets document assumptions and calculations. Those spreadsheets are the source for details.

### 1.0 Cocaine and Heroin

With respect to cocaine and heroin, we used virtually the same procedure to estimate the number of users, how much they spent on drug use, and how much they used. We explain and illustrate that procedure.

#### 1.1 How Many Chronic Drug Users?

We categorize drug users into two use groups: chronic and occasional. Chronic users consume at least one of the drugs on more than ten days per months. Occasional users use less frequently. We discuss estimates for chronic drug use here and return to estimates for less frequent users later. Our approach to estimating the number of chronic users requires several steps, which are explained in turn. National estimates are a composite of local-area estimates. Because estimation does not vary by local area or by drug type, we use cocaine consumption in New York City to illustrate the derivation of local-area estimates.

##### 1.1.1 How many chronic users in selected counties?

For over a decade, the Drug Use Forecasting (DUF) program has questioned arrestees in twenty-three sites about recent drug use. (We exclude a twenty-fourth site, Kansas City, which participated for only a few years.) On a quarterly basis since 1989 interviewers selected a convenience sample of people booked into Manhattan's central jail facility. Interviewers questioned those arrestees about their drug use and requested a urine specimen, which was analyzed to learn whether or not the arrestee had used cocaine in the last two or three days. Our interest focused on the interview, and especially on the question about frequency of drug use (in days) during the last thirty days before being arrest. We classified anyone who reported more than ten days of powder or crack cocaine use as *chronic*.

Had DUF been a probability sample, we could have weighted these data to estimate the proportion of chronic drug users in the New York City arrestee population. Weighting is

required for several reasons, but the principal one is that drug use varies by offense category, while DUF provides disproportionate representation of offenses.<sup>1</sup> However, weights are unavailable for the DUF data, so we used a model-based approach to derive estimates. This required three steps.

Step one was to estimate a regression. In an ordered probit model, the dependent variable – self-reported level of drug use -- was coded 0 for none, 1 for 1 to 10 days, 2 for 11 to 20 days, and 3 for more than 20 days of cocaine use. Independent variables included nine charge categories: felonies (violent, property, drugs and other), misdemeanors (violent, property, drugs and other), and other.<sup>2</sup> These regressions provided estimates of the probability that an arrestee would be a chronic user conditional on the charged offense and year.<sup>3</sup>

The second step was to estimate the number of people who were arrested and booked for each of the nine charge categories for each of the eleven years. The Uniform Crime Report is the best data source, but for this purpose, the UCR has deficiencies. One problem is that some jurisdictions fail to report arrests for part or all of a designated year. We developed imputation routines to ameliorate this problem. A more serious problem is that a count of UCR arrests is not the same as a count of bookings into local jails. Arrests do not result in bookings when police release minor offenders on citation, so in this regard the UCR overstates the number of people booked into local jails. In contrast the UCR does not include bookings for warrants, revocations and some other reasons for being booked, so in that regard the UCR understates bookings. Using available booking data, we developed procedures for adjusting the UCR counts so they reflected bookings.<sup>4</sup> Finally, with respect to problems with the UCR data, we needed counts of the number of bookings by felony, misdemeanor and other categories. The UCR does not specify

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1 Offenders charged with the most serious crimes are the least likely to be released from jail prior to the DUF interview. Thus, the DUF sample has a disproportionate number of felony offenses compared with the population of arrestees. This problem is especially acute in places like Manhattan, where arrestees booked for the least serious crimes are released at precincts before being transferred to the central facility. Thus, misdemeanor offenders who appear at the central facility typically are those for whom there was an outstanding warrant at the time they were booked for that misdemeanor. Without weighting, those misdemeanants would be under-represented. Another problem is more difficult to solve. The Manhattan central facility received arrestees from the Manhattan Boroughs, but not from the other New York City boroughs. We are forced to assume that Manhattan represents the other New York boroughs. This same problem exists in other sites, such as Los Angeles. The new Arrestee Drug Abuse Monitoring survey, which has replaced the Drug Use Forecasting survey, overcomes this problem by including a probability sample of jails in its sampling design.

2 Besides the charged offense, the regressions included polynomial transformations of the time between arrest and booking, Fourier transformations of time, and dummy variables for years. The Fourier transformations captured cyclical patterns that happened on a weekly basis and on a yearly basis. The year dummy variables captured trends over the eleven years represented by the DUF data. This is the first year we used these regression results; estimates from previous years were based on offense-specific (six offenses) tabulations.

3 Estimates set all other variables to the means observed for the same year.

4 This was a global adjustment. We had booking data for several counties for 2000. We compared those booking data with UCR data from 1988. By inspection, we established rules for excluding some UCR reports (to account for arrests that did not result in bookings) and rules for inflating the UCR reports (to account for bookings that are not reported by the FBI). These global rules probably work better for some counties than for other counties. This approach improved on routines used for earlier reports, which simply assumed that half of the “other” arrest category would not result in bookings.

those categories, so we imputed the proportion of felonies and misdemeanors based on an analysis of actual booking data from several sites. Although approximate,<sup>5</sup> these modifications to the UCR data provided counts by offense type and year for New York City and other counties.

The third step was to multiply the proportion of chronic users conditional on the arrest category (estimated with the regression) by the number of arrests within that arrest category (estimated by adjusting the UCR data) for New York City.<sup>6</sup> This calculation was repeated for each year. Completing these three steps provides an estimate of the number of self-reported chronic drug users among New York City arrestees.<sup>7</sup> To deal with occasionally large year-to-year swings, we used three-year moving averages.

Because drug users frequently deny their drug use, we needed a means to inflate self-reports to account for underreporting. This required an estimate of the probability that a chronic user would tell the truth when asked about his drug use. To develop that estimate, we selected everyone in New York City who tested positive for cocaine, and we calculated the proportion that admitted to some illegal drug use (exclusive or marijuana) during the thirty days before being arrested. Calculations were done on a year-by-year basis. Truthful reporting rates differed from year-to-year and from site-to-site, but generally, about 65 percent of cocaine users were deemed truthful.<sup>8</sup> Call this the provisional rate of truthfulness.

As a measure of truthfulness, the provisional rate still seems to underestimate the rate at which chronic drug users tell the truth about their drug use during the last month. This inference is based on an analysis of truthful reporting about drug use during the three days before the interview. That is, examining the self-reports of everyone who tested positive for cocaine, we noted that self-admitted chronic users were more likely to be truthful about recent use than were other users. One reasonable inference is that the provisional measure of truthfulness, which mixes reporting by chronic and other users, understates truthful reporting by chronic users alone. Additional evidence that this measure understates truthfulness comes from Simeone, Rhodes, Hunt and Truitt (1997, hereafter SRHT) who reported (based on statistical analysis of hair bioassay) that three of four chronic users among arrestees in Cook County were truthful about their chronic drug use.

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5 We are uncomfortable with the accuracy of these estimates for individual sites. Nevertheless, accuracy of the chronic user estimates can tolerate measurement errors in individual sites provides the average measurement error across sites is small. The Arrestee Drug Abuse Monitoring survey, which has replaced DUF, will overcome this problem by collecting a census of booking information from every county that participates in the ADAM study. Those booking data will be available in most ADAM sites starting in the year 2000.

6 We repeated this estimation for each county represented by a DUF site. Typically the DUF site was a large city jail, and a sample drawn from that large city jail may not represent arrestees booked into other jails in that same county.

7 Two DUF sites – Los Angeles and Washington, D.C. – had estimated trends that were not credible. The problem appeared to be with the adjusted UCR data. For those two sites, we adjusted trends to be consistent with observed trends in Drug Abuse Warning Network emergency room mentions. We did this for all three drugs. For a few other sites, we sometimes replaced what appeared to be an errant estimate for a single year with the average for the two surrounding years. (Some of these occurred because data were missing for that single year.)

8 The probability of being truthful was closer to 75 percent for heroin and methamphetamine users.

We used the SRHT findings to adjust our estimates of truthfulness. Essentially, we figured that to achieve the 75 percent truthful reporting rate in Cook County, we would need to increase the above estimates of truthfulness by 1.167. (That is, if the above estimate was that X percent were truthful, we increased this to 1.167X.) We assumed this adjustment would hold for all sites and therefore adjusted the provisional rate, for each year and for every site, by 1.167. Then to account for underreporting, we divided the estimate of chronic drug users based on self-reports by the adjusted estimated proportion of arrestees who answered truthfully.<sup>9</sup>

Step four was a simple adjustment for the fact that the calculations to this point are for men. According to the FBI, men account for about 78 percent of all arrests, so we increased the estimates by  $1/0.78$  or by 1.28. In the past we separated estimates for men and women, but the DUF data are unavailable for women at several sites, and even when female data are available, we are skeptical of how well they represent female arrestees.

These four steps provided an estimate of the number of chronic cocaine users among arrestees in New York City. The next step was to divide this estimate by the rate at which chronic drug users get arrested. We are necessarily uncertain about this multiplier because researchers have seldom sought to estimate arrest rates that are suitable for our use, and furthermore, extant arrest rate estimates are for selected sites and specific periods.<sup>10</sup> Based primarily on available evidence from a 1995 addendum to the DUF survey, we assumed that chronic cocaine users generate an average of about 0.4 arrests per year, which implied that there are about 2.5 chronic cocaine users in the county for every chronic cocaine user in the arrestee population.<sup>11</sup>

In the sixth step, we sought to extend the estimates for New York City to the New York Metropolitan Statistical Area. To make this extension, we multiplied the estimated number of chronic cocaine users in New York City by the ratio of the number of arrests for drug law violations in the New York MSA to the number of arrests for drug law violations in New York City proper. For New York City, the adjustment was about 1.06; across all sites the average size

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9 The previous consumption report employed a similar logic to estimate a global truthfulness rate. For this current version of the consumption report, we allow the truthfulness rate to vary by year and by site.

10 The Arrestee Drug Abuse Monitoring program will overcome this problem starting in 2000. The ADAM instrument includes a calendar that captures an arrestee's booking profile over the year before the interview. Furthermore, the National Institute of Justice is sponsoring a methodology study for using those booking profiles to develop chronic drug user estimates. Essentially, results from that study will provide arrest rates for application to pre-2000 DUF data and chronic user estimates themselves for the year 2000 forward. Estimates from that chronic user estimation methodology could replace all the steps described to this point in this appendix.

11 Previous versions of *What America's Users Spend on Illegal Drugs* used a slightly smaller multiple. We increased the multiple this year because analysis of booking data from six sites in 1995 suggested that previous estimates were too low. We used the same rate for methamphetamine users. Consistent with past versions of this report, we assumed that chronic heroin users have a slightly larger arrest rate. We assigned them a multiple of 2.25. SRHT provided the only other estimate that used a methodology similar to the one that we used to estimate arrest rates from the six sites. SRHT provided a range from 0.27 to 0.38 arrests per year for chronic drug users in Cook County. Estimates used in our current study are consistent with the upper end of the SRHT range for arrest rates. We are conducting a rigorous analysis of arrest rates for the National Institute of Justice. While results are not yet available, provisional results reported at three national meetings suggest that multipliers between 2 and 3 are about right for most sites.



of this adjustment was 1.45.<sup>12</sup>

### 1.1.2 Chronic Drug Users Across the Nation

We repeated the process applied to New York City to each of the twenty-three DUF sites to provide estimates of the number of chronic drug users in each MSA represented by a DUF sites. Of course the DUF sites do not cover the entire country, so we needed a way to inflate the estimates from the DUF sites to account for the entire nation. Our approach was to assume proportionality between chronic drug users and DAWN emergency room mentions.<sup>13</sup> As a practical matter, this final adjustment increases the estimates by about 1.68 for cocaine; for heroin and methamphetamine, the estimates are about doubled. For cocaine, the adjustment increased over time, implying that cocaine had become a proportionately greater problem in non-DUF locations.<sup>14</sup> For heroin and methamphetamine, the adjustment was fairly constant over time.

This adjustment is problematic for several reasons. Although SAMHSA tabulates the DAWN data twice per year, there are few if any studies that seek to explain what DAWN actually represents. Because the majority of DAWN reports are for chronic users seeking substance abuse treatment, we have some justification for saying that DAWN reports are roughly proportional to the number of chronic drug users in a population. Comparing our estimates of chronic drug users in a MSA with DAWN estimates shows that this proportionality is inexact, however, because it varies across sites.

In fact, in Philadelphia the ratio between emergency room mentions for cocaine/heroin and our estimates of chronic cocaine and heroin user were too large (compared with other places) to be credible. We were forced to make an adjustment, discussed in the next subsection.

### 1.1.3 Adjustment

We made an adjustment to the calculations for Illinois. Data limitations undoubtedly affect our estimates in all sites. This problem may be especially serious in Cook County, because Illinois has had problems reporting UCR data during the last decade. We substituted estimates from SRHT for Cook County. The result in Cook County was to increase chronic estimates for cocaine by 50 percent and to decrease chronic estimates for heroin by about 60 percent.

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<sup>12</sup> We used 1999 UCR data to estimate this multiplier and then applied the same multiplier to the earlier years.

<sup>13</sup> Not all DUF sites are DAWN sites, and not all DAWN sites are DUF sites. For each year, we estimated the ratio between estimates of chronic drug use in the DUF MSA and emergency room mentions for cocaine in that same MSA. These estimates were weighted by the estimated number of chronic drug users in those MSAs. We used that estimated ratio to impute emergency room mentions for each of the DUF sites that lacked a DAWN counterpart. Finally we estimated the proportion of emergency room mentions across the nation that were represented by the twenty-three DUF sites and used the reciprocal of that estimate as the adjustment mentioned in the text.

<sup>14</sup> DAWN comprises reports from sentinel sites as well as a national panel. Over time, the national panel has represented an increasing proportion of emergency room mentions for cocaine. This is consistent with the increasing DAWN adjustment used in this report.

As noted, the ratio between our estimates of chronic drug use and emergency room mentions in Philadelphia were not credible when compared with emergency room mentions. This problem existed for certain years in other places, as well. Our approach was to adjust estimates for Philadelphia so that the resulting ratio between chronic users and emergency room mentions equaled the ratio for New York, Philadelphia's neighbor. This adjustment greatly increased our original estimates for Philadelphia. We did not attempt to adjust for other places.

#### 1.1.4 An Illustration

An illustration may be helpful. Across all cities, over all the years, steps 1 through 3 provided an average of 12,250 self-reported chronic cocaine users among all arrestees within a DUF county. After adjusting to account for women, the estimate increases to 15,705 chronic arrestees per DUF county. Adjusting that estimate to account for the entire MSA increases the number to 19,768 per county. After adjusting for the rate at which chronic users get arrested, we get 49,045 chronic drug users in each MSA. Then to account for counties that are outside the DUF sites, we use the ratio of ER mentions in the nation to ER mentions in DUF MSAs. This inflates the per site estimate to 95,415 chronic cocaine users. After accounting for underreporting, the estimate becomes 128,768 chronic cocaine users per DUF site per reporting year. Given the twenty-three DUF sites, this estimation process accounts for about 2,961,680 chronic cocaine users per year across the nation.

Consistent with past reports, we assumed that half of the chronic users who reported to the National Household Survey on Drug Abuse were not included in the DUF-based estimates. We added that missing half to form the DUF-NHSDA composite estimates. For this purpose, chronic drug use was defined as having used cocaine on a weekly basis.<sup>15</sup>

There is one final step. Because of the way that we estimated the arrest rate, our estimates should be inclusive of chronic users who are in prison.<sup>16</sup> We used data from the Bureau of Justice Statistics to estimate the number of chronic drug users among prisoners, and we subtracted that prisoner-based estimate from the DUF-NHSDA composite estimate. Results after that subtraction are reported in the main report.

Note that we estimated the number of chronic cocaine users separately from the number of chronic heroin users. In fact, the two groups overlap. Across all years and all cities, the DUF data have 344,000 chronic users of cocaine or heroin. The data have about 11,000 chronic users of heroin, but 43 percent (about 4,500) of them also use cocaine at the chronic level. Likewise,

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15 There was no 1989 NHSDA, so we averaged estimates from 1988 and 1990. The Substance Abuse Mental Health Services Administration made major changes to the NHSDA in 1999, so NHSDA estimates from 1999 are incomparable to earlier year estimates. SAMHSA collected a smaller 1999 sample using the extant methodology. That sample required some special adjustments, and after SAMHSA made those adjustments, they reported trends for last-month use. We used those trends to project the 1998 estimates into 1999.

16 The Bureau of Justice Statistics has sponsored prisoner surveys asking about drug use during 1991 and 1997. We estimated chronic use as the percentage of prisoners who said that were using cocaine at the time of their offense. Because the survey covered just these two years, we used linear interpolation to estimate the percentages for other years.

there are about 28,000 chronic users of cocaine, but 16 percent (the same 4,500) also use heroin at the chronic level.

## 1.2 How Many Occasional Drug Users

To estimate the number of occasional drug users, we started with NHSDA reports of the number of people who reported cocaine use in the last year and subtracted the number that reported using cocaine on a weekly basis. The National Household Survey on Drug Abuse was not administered in 1989, so our estimates are the average for 1988 and 1990. The Substance Abuse Mental Health Services Administration changed survey procedures in 1999, so 1999 data cannot be compared with earlier data to develop a trend. However, SAMHSA completed a smaller 1999 survey using the extant methodology, and after suitable adjustments (made by SAMHSA), those old-method data can support trend estimation. SAMHSA has reported adjusted trends for past-month use; we used those reported trends to project 1998 estimates of past-year and weekly use into 1999.

Year 2000 estimates are three-year linear projections for cocaine and heroin.

## 1.3 How Much Do They Spend

Having an estimate of the number of chronic cocaine users, we need an estimate of how much they spend on cocaine. Expenditure patterns are an under-researched aspect of drug consumption. The ADAM survey asks detailed questions about drug expenditure, but unfortunately, those data are not available for current purposes. Earlier versions of this report used a regression-based procedure to estimate yearly expenditure patterns. However, the DUF survey changed how it asked about expenditure so that pre-1995 estimates are not directly comparable to post-1995 estimates. Past reports made simple projections of the pre-1995 estimates, but given the accumulation of four more years of data, continuation of this practice seems problematic. We changed the methodology.

The new methodology requires three steps. First, from the DUF data we extracted data for all interviewees who used cocaine on more than ten days per month. Second, we tabulated those data for each of the twenty-three sites for each of the eleven years and computed the median expenditure on drugs. (The question is about expenditures on drugs per se, not about expenditures on a specific type of drug. We discarded data that reported over \$2000 per week expenditures.) Third, we weighted those averaged median amounts across the twenty-three sites to yield eleven estimates for the “weighted median”. The weights were the number of chronic drug users in each of those twenty-three sites. Fourth, using those weighted medians, we estimated the trend for 1989 through 1994 and the trend for 1996 through 1999. Fifth, we assumed that the expenditures were the same for 1994, 1995 and 1996. This assumption allowed us to join the trends despite the changes in DUF questioning. Finally, we assigned a typical expenditure to 1995, projected this typical expenditure based on the estimated trends, and adjusted by the consumer price index.

The remaining problem was to get an estimate of average expenditures on cocaine, heroin and

marijuana for 1995. For this purpose, we used data from a six-site study of drug buying practices, which was part of an addendum to the DUF instrument. That study was carefully done, but many of the answers about expenditures seemed incredibly large. Part of the problem is that some respondents seemed to be dealers who bought for resale. We did our best to eliminate dealers buying for resale from the study. (We retained dealers buying for personal consumption, however.) Another part of the problem is that respondents had trouble answering the questions, so while they might have been truthful, they provided inaccurate responses. To deal with this problem, we estimated expenditures based on the frequency of purchase and the amount paid for the last purchase, and we compared the estimated expenditure with the reported expenditure. When they departed by more than a factor of four, we deleted the case from the data. This deletion reduced the sample size from 1105 to 1000 for cocaine and from 705 to 649 for heroin. The resulting means were \$237 for cocaine and \$258 for heroin.

As estimates of typical expenditures, these are probably too high because they still include some purchases for resale. For example, we did our best to identify non-dealers and they only spent \$148 on cocaine and \$212 on heroin. Because of their income source, dealers surely spent more on drugs, so we could not base estimates on expenditures by non-dealers. Given that we had previously estimated weekly expenditures as \$186 and \$209 for cocaine and heroin, respectively, we “compromised” and set the average expenditure for cocaine at \$200 per week and the average for heroin at \$220 per week for 1995. We then projected these estimates forwards and backwards using the trends described earlier.

#### 1.4 What Price Do They Pay?

Last year, we used what seemed like a convoluted procedure to infer price paid based on the then extant price-series report. This year’s price-series report provides a more natural way of estimating prices paid at retail. It starts with the average amount of cocaine purchased as a function of the price paid. It then weights the amount purchased by the distribution of purchase prices paid by cocaine buyers across six DUF sites. (These data came from the 1995 DUF addendum referenced earlier.) Finally it inverts the grams per dollar estimate to provide a dollar per gram estimate. The resulting estimate is somewhat lower than prices estimates used in our last report.

Unfortunately, this procedure does not seem to work as well when estimating heroin prices. In fact, by the year 2000, the estimates approach \$400 per pure milligram. This is well below last year’s estimate of nearly \$1000 per pure gram. Both cannot be correct and the former estimate implies that heroin users are able to purchase 2½ as much heroin per dollar expenditure as the latter estimate.

The approach used for this report was to use the methodology applied to cocaine purchases after segmenting the market into two parts: low quality heroin (15 percent pure or less) and high quality heroin (more than 15 percent pure). We estimated the proportion of DUF respondents who said they had used needles during the last six months by year. (This percentage falls from 87 percent to 62 percent from 1989 to 1999.) We weighted the two prices by the percentage of

arrestees who said they used needles. That is, we assumed that heroin at less than 15 percent purity was used for injection and that other heroin was snorted. After adjusting for the consumer price index, we reported the resulting estimates in the text.

We are uncomfortable with this solution. Most of the decisions reported in this appendix could shift estimates by roughly 10 percent either way. This assumption about heroin prices would shift estimates of the amount of cocaine consumed by a factor of two. We have to entertain the possibility that Americans consume more heroin than is accounted for in this model.

This estimation problem happens because we lack a good understanding of how the DEA and other law enforcement makes purchases in heroin markets. Plausibly there are very low-level dealers who purchase quality heroin as small dollar purchases (\$100 or less), dilute that heroin, and resell it as heroin suitable for injection. Law enforcement may focus its purchasing attention on the quality-heroin buys, so that the STRIDE data under-represent the purchases of law quality heroin. We know of no data that help answer this question, although we are hopeful that ADAM will shed light on this issue. ADAM asked detailed question about market activity. Included are a series of questions that asked about the amount paid for a drug and what the respondent did with that drug – used it, sold it, gave it away, and so on. Until ADAM data are available and tabulated, we can do little but speculate.

## 1.5 How Much Do They Use

The final step is basically to divide the expenditure on cocaine by the price paid per pure gram of cocaine and then convert the resulting estimate into metric tons. There is one adjustment, however. Consistent with earlier version of this report, we increased cocaine consumption by 11 percent and we increase heroin consumption by 11 to 22 percent to account for income in kind. For both cocaine and heroin, the adjustment for income in kind has been 11 percent since 1995. For heroin, this adjustment for income-in-kind decreased linearly from its 22 percent peak in 1988.

## 2.0 Methamphetamine

We introduced an innovative but provisional procedures to estimate the number of chronic methamphetamine users. The methodology borrowed heavily on estimation procedures that we recently developed for the National Institute of Justice.<sup>17</sup> We refer the reader to that report for an explanation of methodology.

Data came from the Treatment Episode Data Set from the Substance Abuse Mental Health Services Administration, Office of Applied Studies. Those data report treatment admissions

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<sup>17</sup> W. Rhodes and R. Kling. Technical Notes on Estimating the Prevalence of Hardcore Drug Use. Report submitted to the National Institute of Justice by Abt Associates Inc. January 2002.

from TEDS-eligible treatment program. To be TEDS-eligible, a program had to receive public funding. Not all TEDS-eligible programs report to the TEDS program, and we made adjustments to account for coverage, as suggested by SAMHSA/OAS documentation.

Estimates used TEDS data for 1998. We then applied the 1998 estimates to trends based on DUF data. Trends from DUF data were produced in the same way as we estimated trends for cocaine and heroin. A three-year linear projection for 2000 provided a nonsensical result for methamphetamine because of the sharp drop in use from 1997 to 1998. We set the year 2000 estimate at the same value as the year 1999 estimate.

Data about expenditures by chronic methamphetamine users was sparse, so we computed the simple average expenditure by chronic amphetamine users across all DUF sites on a yearly basis. We assumed a \$200 expenditure for the 1995 anchor year but otherwise projected the expenditure the same way as for heroin and cocaine.

### 3.0 Marijuana

Marijuana calculations are unchanged from the earlier report. Our estimation procedures are described in the main text. We note here that SAMHSA is redesigning the marijuana module of the NHSDA to ask questions about expenditure and use patterns for marijuana. When available, answers to those questions will greatly improve estimates for marijuana consumption and expenditures.

### 4.0 Other Drugs

Calculations for other drugs are unchanged from earlier reports.

### 5.0 Other Adjustments

Typically we have reported three-year moving averages for most estimates provided in this report. That is, an estimate for period T is typically the simple average for periods T-1, T and T+1. For the first period, we used the simple average for period 1 and period 2. For the last period, we used the simple average for period T and T-1. Because of this averaging, trends say little about year-to-year changes in the reported measures.

We had no data for the year 2000. Estimates for year 2000 are almost always simple linear forecasts based on the previous three years. The exception was for amphetamines, for which a three-year forecast was unreasonable, so we set the 2000 estimate to the 1999 estimate. We used the same procedure to back-cast into 1998, which predated the usable DUF data.

### 6.0 Comments

We see this year's version of *What American's Users Spend on Illegal Drugs* as a bridge between

how estimates were computed in the past and how they should be computed in the future. Data are rapidly improving and future estimates will be able to take advantage of those data. As noted, the Arrestee Drug Abuse Monitoring system has replaced the Drug Use Forecasting system. DUF lacked a probability sampling basis, and it only collected data in one (or a few) urban jails. ADAM is a probability-based sample that collects data from a representative sample of jails in the county. Furthermore, ADAM's instrumentation is better designed to elicit valid and reliable responses about consumption and expenditure patterns. Finally, NIJ is sponsoring a methodology study of developing chronic users estimates for each county represented by the ADAM program. For 2000 forward, that chronic user estimation routine will replace the estimation routine used to date to estimate the number of chronic drug users in the ADAM counties.

The second especially noteworthy development on the data front is the NHSDA's new module for asking about marijuana use and expenditures. Past versions of *What America's Users Spend on Illegal Drugs* used questions from earlier NHSDA surveys to infer the amount of marijuana used conditional on the frequency of use. However accurate those inferences, we had no way to make inferences about sharing, which seems to be especially great for marijuana use. The new NHSDA will shed considerable light on that issue.

A third important development is a new method for estimating drug price series. We pioneered that method in the most recent version of the price series report and improved that methodology as reported here. In the future, ADAM will provides an improved means for weighting those price data, so we can expect improved prices series when ADAM data are fully available.

ADAM sill improve estimates in still another, more subtle way. ADAM will, for the first time, provides estimates of the number of people booked into local jails by offense charge. We will not need to estimate bookings based on UCR data.

Of course, we will still face the problem of estimating chronic drug use pre-2000 so we cannot totally replace the methodology described here. We can, however, greatly improve its component parts, and we changed the current methodology to anticipate those future improvements.





## Endnotes

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- 1 The calculations reported in this study used data from a variety of sources. Most sources were unavailable for 2000, and when that was the case, we projected estimates into 2000. Except where the text notes otherwise, we used linear projections based on data from 1997 through 1999. Some data were unavailable for 1998, in which case we projected backward using data from 1989 through 1991. Occasionally data were missing for a single year (e.g. 1989), and in that case we set the missing value equal to the average of the preceding and following years. To summarize available data for major sources:
  - National Household Survey on Drug Abuse – the Substance Abuse Mental Health Services Administration (SAMHSA) had published NHSDA tabulations that were current as of 1999.
  - Drug Use Forecasting system – the National Institute of Justice provided DUF data for 1988 through 1999.
  - Uniform Crime Reports – The FBI provided data from the UCR system for 1988 through 1999.
  - System to Retrieve Information from Drug Evidence – The Drug Enforcement Administration (DEA) provided STRIDE data from 1981 through the second quarter of 2000.
  - Drug Abuse Warning Network – DAWN reports, provided by SAMHSA, were current through 2000.
  - Treatment Episode Data Set – The TEDS data, also provided by SAMHSA, were limited (by this study) to reports from 1998, the most recently publicly available data.
  - Federal Drug Seizure System – FDSS data, from the DEA, were available for 1991 through 2000.Occasionally the survey designs changed so that a question asked on early surveys did not appear on later ones. For example, as of 1995 the NHSDA stopped asking respondents about the number of joints and the amount of marijuana used. We necessarily projected estimates for 1995 through 2000. These cases are noted in the text.
- 2 M.Layne, P. Johnston and W. Rhodes, *Following the Flow of Cocaine: The Sequential Transition and Reduction (STAR) Model, 1996-2000*, January 2002; A. Bruen, P. Johnston and W. Rhodes, *Estimation of Heroin Accountability in the United States*, January 2002.
- 3 W. Rhodes, P. Johnston and Ryan Kling. *The Price of Illicit Drugs: 1981 through the Second Quarter of 2000*. Office of National Drug Control Policy. October 2001.
4. By comparison, Americans spent about \$43 billion on tobacco in 1993. This figure is unadjusted for inflation. *The Tax Burden on Tobacco* (Washington, D.C.: The Tobacco Institute, 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

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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 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 Associate’s tabulations show that of these drug users, an estimated 40 percent lived in unstable households and about 10 percent could be considered homeless.

Available evidence indicates that NHSDA’s respondents understate heavy drug use. A. Harrell, K. Kapsak, I. Caisson, and P. Wirtz, “The Validity of Self-Reported Drug Use Data: The Accuracy of Responses on Confidential Self-Administered Answer Sheets,” paper prepared for the National Institute on Drug Abuse, Contract Number 271-85-8305, December 1986. M. Fendrich, T. Johnson, S. Sudman, J. Wislar and V. Spiehler, “Validity of Drug Use Reporting in a High-Risk Community Sample: A Comparison of Cocaine and Heroin Survey Reports with Hair Tests,” *American Journal of Epidemiology* 149(10): 955:62, 1999. Consistent with these observations, the Substance Abuse Mental Health Services Administration reports that virtually no heroin addicts answer the National Household Survey on Drug Abuse. Substance Abuse Mental Health Services Administration, *Preliminary Estimates from the 1993 National Household Survey on Drug Abuse* (June 1994).

A comparison of the demographic characteristics of the heavy cocaine users in the NHSDA with those of heavy cocaine users based on other sources (the Drug Use Forecasting program, the Drug Abuse Warning Network, and the National AIDS Demonstration Research project) shows a marked difference between those populations and the one represented in the NHSDA. Incomes are greater, unemployment is lower, and there are fewer respondents using more than one drug in the NHSDA.

D. Hunt and W. Rhodes, “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.

Finally, estimates of heavy drug use reported in the NHSDA are difficult to reconcile with other data sources maintained by the Substance Abuse Mental Health Services Administration, especially with reports of the treatment for cocaine or heroin. These incompatibilities are discussed later in this report.

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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.
  7. One change in nomenclature in this document, from previous reports, is the replacement of the word “hardcore” with “chronic”. The term “chronic” more accurately reflects the behavior and nature of frequent drug use.
  9. The population of chronic users is not identical to the population of users who need substance abuse treatment. Still, using the 10 days per month threshold, the DUF data show that 57 percent of chronic cocaine users and 77 percent of chronic 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 chronic users.
  10. 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.) An occasional user is however 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 chronic 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.
  11. S. Everingham, C. Rydell and J. Caulkins, “Cocaine Consumption in the United States: Estimating Past Trends and Future Scenarios,” *Socio-Economic Planning Sciences*, Vol. 29 (4) December 1995: 305-314. The authors report that heavy users of cocaine use 70 percent of all cocaine. Estimates based on retail sales expenditure, reported later, are consistent, but also show that chronic heroin users account for a larger fraction of heroin sales than chronic cocaine users account for cocaine sales.
  12. Drugs are sometimes received as income-in-kind, especially by drug-using dealers who keep part of what they otherwise would deal, and also those who exchange drugs for sex. Income-in-kind is not included in the retail sales dollar amounts, but it is factored into the measures of metric tons of drugs consumed.
  13. An appreciable number of drug users use both heroin and cocaine. According to the 1998 TEDS data, about 421,000 people were treated for cocaine as either the primary or secondary abused substance. Another 247,000 were treated for heroin as the primary or secondary abused substance. There were

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about 79,000 people for whom cocaine was the primary drug and heroin was the secondary drug or for whom heroin was the primary drug and cocaine was the secondary drug. This overlap in cocaine and heroin use suggests that about 88 percent of the total number of chronic heroin and chronic cocaine users are unique.

14. The Treatment Admission Data Set accounted for about 87 percent of treatment admission to publicly funded treatment programs during 1987. If all cocaine and heroin users receive treatment funded by the Government, then estimates based on the TEDS data should be inflated by  $1/0.87$ . This assumption gives the lower estimate. The TEDS data accounted for 67 percent of all treatment admissions during 1987. If cocaine and heroin users were as likely as other drug users to be treated in programs that receive Government funding, then the estimate based on the TEDS data should be inflated by  $1/0.67$ . This provides the upper estimate.
15. W. Rhodes, S. Langenbahn, R. Kling, and P. Scheiman. *What America's Users Spend on Illegal Drugs: 1988-1995* (Washington, D.C.: Office of National Drug Control Policy, Fall 1997). See Appendix A.
16. 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).
17. R. Simeone, W. Rhodes, D. Hunt and L. Truitt, *Methodology for Estimating the Number of Hardcore Drug Users*, report submitted to the Office of National Drug Control Policy, March 1997.
18. According to TEDS data for 1998, about 88 percent of people treated for cocaine or heroin abuse were treated for use of both drugs. The estimate reported in the text is the sum of chronic cocaine and heroin users for 1995 multiplied by 0.88.
19. SAMHSA estimated that 7.1 million people needed treatment in 1994. Persons needing treatment were divided into two categories, Level 1 and Level 2. The Level 2 category was the more severe category of need and contained about 3.6 million people. We have used this 3.6 million figure in our calculations under the assumption that Level 2 users are similar to the chronic 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.
20. 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

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number of people needing treatment using a ratio estimation technique that linked 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.

21. 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.

22. 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.
23. Treatment Episode Data Set (TEDS): 1992-1997. SAMHSA, August 26, 1999. Downloaded from the Internet 11/18/1999: [www.samhsa.gov/teds9297.htm](http://www.samhsa.gov/teds9297.htm)
24. Center for Disease Control and Prevention, *HIV/AIDS Surveillance Report 1998*, Vol. 10 (No. 2).

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25. Trends in lifetime prevalence of heroin use among 12th graders rose from 1993 to 1997. It remained fairly constant until a sharp increase in 2000. Johnston, L., O'Malley, P and Bachman, J. (2001) *Monitoring the Future National Results on Adolescent Drug Use., Overview of Key Findings* (NIH Publication No. 01-4923). Bethesda, Maryland: National Institute on Drug Abuse.
  26. Treatment data are difficult to interpret. From the Treatment Episode Data, we observe that treatment admissions for heroin increased from 167,000 in 1992 to 218,000 in 1997; furthermore, while 77 percent of heroin users injected in 1992, only 68 percent injected in 1997. Perhaps these trends imply more heroin users in the late 1990s. It certainly implies a larger prevalence on non-injection drug use. Substance Abuse Mental Health Services Administration, Treatment Episode Data Set (TEDS): 1992-1997.
  27. Table 2.10 Downloaded from the Internet on 11/15/99: [www.samsha.gov/oas/p0000018.htm](http://www.samsha.gov/oas/p0000018.htm)
  28. R. Simeone, W. Rhodes, Hunt, D. and L. Truitt. *Methodology for Estimating the Number of Hardcore Drug Users*. Report submitted to the Office of National Drug Control Policy by Abt Associates Inc., March 1997.
  29. Weekly expenditures on cocaine and heroin have decreased over time, but this change results from using the CPI to convert expenditures to 2000 dollar equivalents. Many chronic 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 chronic drug user's market basket.
  30. For a review, see W. Rhodes, M. Layne, P, Johnston and L. Hozik. *What America's Users Spend on Illegal Drugs 1988-1999*. (Washington, D.C. Office of National Drug Control Policy). Appendix B.
  31. Reuter and Kleiman estimated that the market for cocaine was about \$8 billion in 1982. This is about \$14 billion in 1998 dollars. Because of the accelerating use of cocaine from that time until the mid-1980s, and after accounting for inflation, it is not surprising that their estimate is less than the figure reported here. Their \$8 billion estimate for heroin expenditures equals about \$14 billion in 1998 dollars. That is considerably less than our 1989 estimate. P. Reuter and M. Kleiman, "Risks and Prices: An Economic Analysis of Drug Enforcement,": In *Crime and Justice: An Annual Review of Research*, volume 7, ed. M. Tonry and N. Morris (Chicago: University of Chicago Press, 1986), 194. Carlson, who conducted a study of the underground economy for the Internal Revenue Service, reported that an estimated \$11 billion was spent on cocaine in 1982. K. Carlson et al., "Unreported Taxable Income for Selected Illegal Activities: Volume I: Consensual Crimes," paper prepared for the Internal Revenue Service under contract number TIR-81.57, September 1984. In an update of his study, Carlson estimated that cocaine expenditures increased from \$5.8 to \$6.6 billion between 1988 and 1991. K. Carlson, "Unreported Illegal Source Income 1983-1995," paper prepared for the Internal Revenue Service under order number 89-11565, May 15, 1990. Since he relied heavily on the NHSDA, and because his estimates are not adjusted for inflation, it is not surprising that his estimate is much lower than the one reported here. Carlson's estimate of heroin expenditures, based on the National Narcotics Intelligence Consumers Committee estimates for 1982, was in keeping with Reuter

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- 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.
32. Elsewhere in this report we noted that heroin use could have fallen over time because of the AIDS epidemic and because heroin addicts were increasingly incarcerated during the decade. Nevertheless, we would expect any effect resulting from AIDS and incarceration to be gradual, while in the previous report the decrease in chronic drug users was inexplicably precipitous. Then the number of chronic heroin users abruptly increased. A possible explanation was that new users were drawn into heroin use by the advent of low-priced high-purity heroin. While this may in fact be true, the increase was almost as marked as the previous decrease. This was difficult to understand. Except for what appears to be a data blip, the NHSDA does not suggest a large increase in casual heroin use, and even if it did, a rapid onset of chronic use would be difficult to understand.
  33. W. Rhodes, M. Layne, P. Johnston and L. Hozik. *What America's Users Spend on Illegal Drugs 1988-1990*. (Washington, D.C.: Office of National Drug Control Policy). See Appendix B.
  34. Heroin distribution seemed to change toward the end of the 1980s and 1990s. There was a marked decrease in the cost of heroin and an equally marked increase in the purity of heroin available to American consumers. At least as of 1995, Colombia had replaced Southeast and Southwest Asia as the principal source of heroin sold in the United States, and distribution practices changed as a consequence. As Appendix B argues, ethnographers increasingly reported that heroin was being distributed by profit dealers instead of users.
  35. 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 chronic users is that their market basket is grossly atypical two-thirds to three-quarters of their income may be spent on illicit drugs. (See J. Fagan, "Drug Selling and Illicit Income in Distressed Neighborhoods: The Economic Lives of Street-Level Drug Users and Dealers," in *Drugs, Crime and Social Isolation*, edited by A. Harrell and G. Peterson, (Washington, D.C.: The Urban Institute Press, November 1994). Because the nominal prices of cocaine and heroin have fallen over much of the period examined through the retail sales calculations, chronic 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, chronic users may well say they spend about the same amount in 1998 as they spent in 1988.
  36. Recent reports by the Community Epidemiological Work Group have told of increasing numbers of heroin users: In the 1997-1998 reporting period, heroin indicators continued to increase in 12 CEWG cities. In some cities, heroin use indicators have been trending upward for more than three years. December 1998 Advance Report. Downloaded from the Internet 11/15/99: [www.cdmgroup.com/cewg/docs/1298-miami/1298adv.ntm#heroin](http://www.cdmgroup.com/cewg/docs/1298-miami/1298adv.ntm#heroin).
  37. M. Childress, B. Dombey, and S. Reseter. *A Systems Description of the Cocaine Trade* (Santa Monica, CA: Rand, 1994).
  38. M. Childress, et al. *A Systems Description of the Cocaine Trade* (Santa Monica, CA: Rand, 1994).

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- 39 W. Rhodes and R. Kling, Estimating the Prevalence of Hardcore Drug Use Using ADAM Data, report delivered to the National Institute of Justice by Abt Associates, January, 2002.
- 40 The assumption that 79 percent of treatment admissions for amphetamines are attributable to methamphetamine was based on early tabulations of data. Subsequent to our tabulations, SAMHSA has reported estimates that suggest that 94 percent of treatment admissions for amphetamines are attributable to methamphetamine. See Office of Applied Studies, Treatment Episode Data Set (TEDS) 1994-1999. , WWW.SAMHSA.GOV/OAS/teds/99teds/99teds.pdf. If we had used 94 percent to adjust our estimates, they would be about 18 percent larger than reported in the text.
- 41 We applied the same computing steps as were used to estimate the number of compulsive cocaine and heroin users to estimate the number of compulsive methamphetamine users. Call the resulting estimates  $N_{1988}$ ,  $N_{1999}$  ...  $N_{2000}$ . We used these estimates to compute a trend, defined as  $T_{1988} = N_{1988}/N_{1998}$ ,  $T_{1989} = N_{1989}/N_{1998}$  ...  $T_{2000} = N_{2000}/N_{1998}$ . As was true of the heroin and cocaine estimates, this trend was based principally on the DUF data. Then, using the 1998 TEDS data, we estimated the number of chronic drug users in 1998 as  $M_{1998}$ . Estimates for earlier and later years were defined as  $M_{1988} = M_{1998} * T_{1988}$ ,  $M_{1989} = M_{1998} * T_{1989}$ , ...  $M_{2000} = M_{1998} * T_{2000}$ .
- 42 W. Rhodes, M. Layne, P. Johnston and L. Hozik. What America's Users Spend on Illegal Drugs 1988-1991. (Washington, D.C.: Office of National Drug Control Policy). See Appendix B.
- 43 W. Rhodes, M. Layne, P. Johnston and L. Hozik. What America's Users Spend on Illegal Drugs 1988-1992. (Washington, D.C.: Office of National Drug Control Policy). See Appendix B.
44. The DEA reports: "According to University of Mississippi analyses, the THC content of commercial-grade marijuana has risen slowly over the years from an average of 3.71 percent in 1985 to an average of 5.57 percent in 1998. These analyses also show a corresponding rise in sinsemilla THC content from 7.28 percent in 1985 to 12.32 percent in 1998. Drug Intelligence Brief: The Cannabis Situation in the United States - December 1999. Downloaded from the Internet on December 10, 2001: <http://www.usdoj.gov/dea/pubs/intel/99028/99028.html>
- 45 W. Rhodes, M. Layne, P. Johnston and L. Hozik. What America's Users Spend on Illegal Drugs 1988-1993. (Washington, D.C.: Office of National Drug Control Policy). See Appendix B.
46. The estimate of 0.0136 ounces is equivalent to 0.39 grams. The 1997 NNICC report says that a joint contains one-half gram on average, and that a "...blunt may contain as much as 6 times this amount." If the NNICC estimate is correct, our estimates would be about 25 percent too low, but the source of the NNICC estimate is unknown. The NNICC Report 1997: The Supply of Illicit Drugs to the United States (Washington, DC: DEA, November 1998).
47. 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, "A 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.



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48. 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.
  49. Using several self-report surveys, BOTEC Analysis Corporation estimated that marijuana costs \$222 an ounce and that an ounce could be divided into 60 joints, yielding a unit price of \$3.70 per joint. Based on these assumptions, BOTEC estimated that Americans spent \$13.1 billion on 1,599 tons of marijuana in 1992. After adjusting for inflation, BOTEC's estimate is greater than the estimate presented in this report. The difference can be accounted for by three factors: methodological differences in estimating the number of users based on the NHSDA; BOTEC's inclusion of criminally active user estimates; and BOTEC's different price estimates. A..L. Chalsma and D. Boyum, "A Marijuana Situation Assessment," (Washington, D.C.: Office of National Drug Control Policy, September 1994).
  50. 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.
  51. 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.
  52. Estimates of frequency of use from the 1991 NHSDA were applied to earlier years.
  53. 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).