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**A SERIOUS DRUG ABUSER SCALE
BASED ON MANHATTAN ARRESTEES
(1987-1991)**

Andrew Golub, Bruce D. Johnson, and Mokerrom Hossain

September 1993

A REPORT from:

Expanding Applications of Drug Use Forecasting Data in New York

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ABSTRACT

The Serious Drug Abuser Scale provides a user-friendly, point-score system for estimating the probability that an arrestee's urine will test positive for recent use of cocaine, crack or heroin and has potential for use at various stages of criminal justice processing (see Johnson, Golub & Hossain, 1993 for particulars). Persons from the Drug Use Forecasting program in Manhattan (DUF-Manhattan) who are detected as cocaine-opiate users tended to also self-report using cocaine, crack or heroin daily, being dependent on drugs, and needing drug treatment. In contrast, few report being currently in drug treatment or having had treatment in the past. Providing drug treatment to arrestees who are also serious drug abusers could potentially reduce both their drug dependence and their criminal activity.

The Serious Drug Abuser Scale employs information typically available at the time of arrest: most serious arrest charge, misdemeanor/felony, race/ethnicity, gender, age, primary income source, and marital status to identify the likelihood of detecting recent cocaine-opiate use via urinalysis. Persons aged 26-40 arrested for drug possession exhibit the highest rates of detected cocaine-opiate use. Persons arrested for drug sales and burglary also exhibit particularly high rates. Validations with both the developmental sample (DUF-Manhattan 1987-1991) and a sample collected from the same jurisdiction subsequently (DUF-Manhattan 1992-1993) suggest that the scale is well-calibrated for use with serious arrestees in Manhattan. Ninety percent or more of the persons the scale identified as having at least a 90% likelihood actually were detected as cocaine-opiate users. An initial cross-validation with DUF samples from four other cities in the Northeast suggests that the scale may be useful in other jurisdictions although further analysis is clearly needed.

1. INTRODUCTION

This paper examines the potential for an easy-to-use prediction scale to assist in the referral of drug-abusing criminal offenders to drug-treatment programs by judges and by personnel in various criminal justice agencies. In particular, appropriate referral depends on knowledge of an individual's current substance abuse at arrest among other things. In practice, obtaining accurate information about an arrestee's drug use may be difficult. Official records are rarely available, even if an individual has been involved with a drug treatment program. Alternatively, self-reports of recent drug use could be used, however, many criminal offenders who abuse drugs may be reluctant or deceitful in providing such information, particularly if they suspect the information will have some bearing on the disposition of their case.

Another approach would be to use drug testing at the time of arrest to indicate recent use. This paper presents analyses based on arrestees from the Drug Use Forecasting (DUF) program for Manhattan suggesting that arrestees whose urine test indicates recent use of cocaine or opiates (*detected cocaine-opiate users*) tend to be abusers of either cocaine, crack or heroin. The substantial proportion of detected cocaine-opiate users who reported recent use of cocaine, crack or heroin (this subpopulation includes serious drug users who probably provided accurate self-report responses) were also likely to report that they were using at least one of these drugs on a daily basis, currently dependent on it, and in need of drug treatment. Hence, detected cocaine-opiate use at arrest appears to provide a good indicator of serious drug abuse.

Judges and criminal justice personnel, however, may not even need to perform actual urine tests at arrest to establish which arrestees would be highly likely to test positive. Serious drug abusers are more likely to be arrested for certain types of crimes (particularly drug possession, drug sales, and burglary) and serious drug abuse is correlated with a variety of demographic factors such as age, primary source of income, race/ethnicity, gender, marital status, and misdemeanor/felony.

This paper develops a Serious Drug Abuser Scale which provides the probability that an

individual arrestee would have been detected as a recent cocaine-opiates user--which strongly suggests a chronic problem of cocaine, crack or heroin abuse. This model is presented as a user-friendly point-score scale, is inexpensive to use, can be applied at any time subsequent to arrest (unlike a urine test which indicates use within the last 72 hours), does not require any chemical lab work, employs information readily available to and routinely collected by criminal justice personnel without reference to other prior records of arrest or drug treatment, does not require any self-admission of drug use, and can be used for all arrestees even when urine test results are not available. A companion report (Johnson, Golub and Hossain, 1993) provides further details of how this scale could be used by judges and other criminal justice personnel for individual referrals to drug treatment.

The Serious Drug Abuser Scale is derived from an analysis of variation in the *base rates* (defined below) of detected (by urinalysis) cocaine or opiate use among arrestees from the Drug Use Forecasting program in Manhattan (DUF-Manhattan). Hence, these findings are clearly valid for Manhattan. Base rates of drug use in the other boroughs of New York City are likely to be similar to those in Manhattan, but these base rates may be different at the twenty-three other DUF sites and in jurisdictions not included in the DUF program. A cross-validation analysis presented in this paper, however, suggests that similar patterns of variation in drug use occur among arrestees from four other Northeast DUF sites: Philadelphia, Chicago, Cleveland and Detroit.

A base rate is the proportion of individuals in a population who share a particular characteristic such as being female, or having brown hair. This study focuses on the proportion of arrestees interviewed by the DUF-Manhattan program between 1987 and 1991 whose urine specimen tests positive for recent use of serious drugs (either cocaine/crack or opiates such as heroin). The base rates from this sample can be employed to estimate a current arrestee's probability of serious drug use when such information is not available from other sources (such as a urine test), or even when an arrestee denies such use. In particular, 71% of all persons included in the DUF-Manhattan sample tested positive for cocaine or opiates. Consequently, there is a 71% chance that a urine test

would detect that any individual chosen at random from an arrest population similar to DUF-Manhattan is a cocaine-opiate user, and a 29% chance the individual would test negative. The statistical models developed in this report provide more accurate estimates for a given arrestee by considering variation in the base rate of serious drug abuse associated with additional information about the arrestee--particularly, arrest type and age.

1.1. Description of the Drug Use Forecasting Program

The Drug Use Forecasting (DUF) program was designed by the National Institute of Justice (NIJ) to measure trends in illicit drug use among booked arrestees in twenty-four major cities (Wish & Gropper, 1990; Johnson, Golub & Hossain, 1992; NIJ, 1992).¹ In each city, trained interviewers conduct voluntary, confidential, and anonymous interviews for 10-15 consecutive days at facilities where arrestees are booked (e.g., where the arresting officer completes documentation, the initial arrest charges are formally entered into criminal justice processing, the person is fingerprinted, and pretrial interviews are conducted). A standard interview schedule developed by NIJ is administered to arrestees by a trained interviewer in as private a location as possible. At the end of the interview, the interviewer requests and 90% or more of the subjects provide a urine specimen. Some sites provide an incentive such as cigarettes or candy, while others offer no such incentive to participate.

The DUF staff approach enough arrestees each quarter so that 225-250 males and 100 females complete the interview and provide a urine specimen. In order to have sufficient samples of female offenders for sex-specific analyses, NIJ completes 100 female interviews per quarter at most sites. Thus, females are overrepresented in DUF (about 25 percent of all subjects) when

¹Participating jurisdictions include New York City, Washington D.C., Portland (Oregon), San Diego, Indianapolis, Houston, Fort Lauderdale, Detroit, New Orleans, Phoenix, Chicago, Los Angeles, Dallas, Birmingham, Omaha, Philadelphia, Miami, Cleveland, San Antonio, St. Louis, Kansas City (Missouri), San Jose, Denver, and Atlanta.

compared with the general arrest population (about 10-15 percent of all arrestees are female). Consistently, 80-95 percent or more of all persons approached give their consent, complete the DUF interview, and provide sufficient urine for urinalysis. The DUF coordinator in each city carefully edits all of the completed interview schedules and sends them to the NIJ contractor which subsequently edits and enters all interview information into a database.

All urine specimens, labeled with the same code number as the interview schedule, are sent to Pharm Chem (the DUF urinalysis contractor). Pharm Chem completes an EMIT (Enzyme immunoassay test) test for 10 different drugs (cocaine, opiates (heroin), marijuana, PCP, amphetamines, barbiturates, benzodiazepines, propoxyphene, methadone, and methaqualone). The EMIT urine test is quite accurate in detecting illicit drug use (Visher, 1991), with near zero false positives, and about 20 percent false negatives (a function of the cutting point chosen by the manufacturer). The urinalysis results are merged with the interview data. Data from each quarter are forwarded to the program director at each site. About two years later, the data for all sites are cleaned to provide standard public release data set for all cities, and for selected cities. These data are subsequently deposited with the Inter-University Consortium for Political and Social Research (ICPSR), where they are made available to the general research community.

DUF data are very robust for conducting analysis of trends in illicit drug use within a site. Since its inception, DUF interview procedures have been standard every quarter. The same sample sizes (about 350 subjects) have been obtained in each city, the same organizations have conducted the interviews, the instructions for selection of subjects have remained similar, and high participation rates are the rule. The DUF data provides comparable samples of arrestees quarterly and is, therefore, well suited for studies of time trends in drug use, both via urinalysis and self-reports.

At its inception DUF was explicitly designed to address trends with a given site; a "statistically representative" or random sample of arrestees was not planned. Rather, the twenty-four DUF cities participating in 1992 were selected so as to include most large cities with population of at least one million, as well as many smaller cities representing all regions of the United States.

These cities were not selected as part of a representative sample of cities or the United States as a whole.

Chaiken, Chaiken & Poulin (1993) provide extensive documentation about how closely the DUF samples approximate a representative sample of arrestees in selected sites (although this has not been documented for every participating site). Three general findings seem clear:

- 1) The characteristics of DUF samples are very similar to all booked arrestees during that same time period. When small differences emerge, police procedures which keep arrestees away from the facility where DUF interviewers are located--rather than the selection procedures by DUF interviewers at the facility--account for many discrepancies.
- 2) DUF selection procedures recommend undersampling persons arrested on drug charges, but selection of all felony and many misdemeanor charges; these selection rules probably result in drug use rates which are somewhat lower than might be the case in a true random sample of all arrestees.
- 3) Sites may exhibit some variation in interpretation and compliance with DUF procedures. Such variations generally involve police/court decisions about the inclusion or exclusion of persons arrested on common misdemeanor charges (e.g., prostitution, vagrancy, DWI), not felonies and drug sale crimes. Despite such inconsistencies, DUF samples appear to be quite representative of booked arrestees coming to the specific booking centers where DUF interviewing takes place.

Chaiken et al. (1993) present complex statistical and other adjustments for geographic coverage of booking facilities, distribution of arrest charges, offense characteristics, booking procedures, and other factors.

This report is a secondary analysis of the DUF data for Manhattan only. Bruce D. Johnson is the director of the DUF-Manhattan program and receives quarterly DUF data about 2 months after data collection. DUF-Manhattan data begin in the second quarter of 1987 (abbreviated 2Q87) through 4Q91. This provides nearly a five year period, 1987-91, for Manhattan only. Additional and more recently received data through 1Q93 are used as a validation sample. Due to the absence of a contract, no data were available for 3Q88. Women were not interviewed in the initial waves in 2Q87 & 3Q87. In 4Q90, the booking of female offenders was changed from the Police Department to Corrections; staff were unable to gain access and conduct interviews for this quarter. Across the

remaining 17 quarters of data, over 5,600 booked arrestees were interviewed for DUF-Manhattan and their urine specimens analyzed for 10 different drugs.

1.2. Characteristics of the DUF-Manhattan Sample (1987-1991)

Arrestees interviewed by the DUF-Manhattan program from 1987-1991 comprise the developmental sample for the Serious Drug Abuser Scale. This sample includes a disproportionately serious group of offenders. Table I reports that almost two-thirds (66.1%) of the arrestees were charged with a felony. Table I also reports most serious offense charged at arrest. This report uses the same offense categories as Chaiken et al. (1993) with a few minor enhancements. Table II describes the DUF offense charges included in each offense categories. These categories identify drug offenses, and distinguish the UCR index offenses from other offense categories (except for the few arson cases which are included with other serious crimes. Unlike Chaiken et al., this report distinguishes drug possession from drug sales, and burglary from other property index offenses.

[Table I about here]

Nearly half of the arrests were for a property offense--robbery, burglary or larceny/auto theft accounted for 14.3%, 7.5%, and 21.3%, respectively. More modest percentages were for drug possession (10.3%), drug sales (4.8%) and the violent index crimes which include assault, homicide and rape (12.5%). The remaining arrestees for non-index and non-drug offenses comprise over one-quarter of the sample. These charges are classified as either other income generating offenses such as forgery or pickpocketing (8.8%), other serious crimes against person/property such as arson, weapons, and family offenses (9.4%) and simply other offenses including bribery and prostitution (11.1%).

[Table II about here]

Table I also reports demographic characteristics of the DUF-Manhattan sample. The DUF program purposefully oversamples female offenders to constitute about one-quarter of arrestees interviewed. The majority of arrestees report being Black (54%),² close to a third Hispanic (30.3%), and a smaller proportion White (11.6%). The remaining 4.1% either reported being of another Race/Ethnicity or did not respond to the question. Table I presents both arrestee ages at arrest and the year in which they were born since both are used in this analysis. Most arrestees (a combined 85.5%) are between 18 and 40 years old and almost half are aged 21 to 30. Consistent with the sampling having occurred between 1987 and 1991, the peak birth years for the sample are between 1955 and 1969.

The DUF-Manhattan arrestees tended to self-report low levels of educational attainment, marital status, and primary source of income. Many report not having completed high school (43.2%) although some report having gone to college (15.0% attended but did not graduate, and 5.8% received a college degree). The majority of the arrestees report being currently single (66.5% never married and 11.9% previously married); less than one-quarter (21.6%) report being involved in a legal or common-law marriage. The majority of arrestees report earning their income primarily through legal means (81.4%), most of these by legal income (46.2%) a category which includes full-time, part-time and occasional work along with being primarily in school or maintaining a home. Among those supporting themselves by illegal means (18.6% of the total sample), 4.4% report dealing drugs and 4.4% report prostitution, a substantial proportion (9.8% of the total sample) report other illegal means of support, perhaps property crimes such as robbery, burglary and larceny. Of course, self-reports of these attributes are subject to misrepresentation.

²This analysis uses the older racial designation of black to include individuals identified as African-American and those identified as black such as those from the Caribbean and Africa.

2. DRUG USE PATTERNS AMONG DUF-MANHATTAN ARRESTEES

A urine test provides a highly accurate indication of recent drug use--unlike self-reports of drug use which are always subject to problems of recall and deceit. With regard to the DUF program, a urine test at the time of booking specifically indicates those individuals who were using serious drugs (particularly, cocaine or opiates such as heroin) in the past 48-72 hours leading to the current arrest; marijuana and PCP tend to remain in the bloodstream for much longer (Wish & Gropper, 1990). Furthermore, this section presents analyses which combine self-reported drug-use information and urine test results both provided by the DUF-Manhattan program which strongly suggest that arrestees who test positive for recent use of cocaine or opiates (such as heroin) tend to be regular abusers of these drugs.

Among DUF-Manhattan arrestees from 1987 to 1991, cocaine appears to be the most prevalent and perhaps most important drug detected with urinalysis. Table III indicates that the majority of DUF arrestees (68%) tested positive for cocaine which is substantially more than tested positive for opiates (20%) or marijuana (20%), the two next most prevalent drugs. No more than 5% of the DUF-Manhattan arrestees tested positive for any one of the other drugs included in the DUF urine tests including PCP, amphetamines, barbiturates, benzodiazepines, propoxyphene, and methaqualone;³ collectively, only 10% of the sample tested positive for at least one of these six less-prevalent drugs. Nearly all of the arrestees (88%) who tested positive for any of the ten drugs, also tested positive for cocaine, further suggesting the importance of cocaine among arrestees who abuse serious drugs.

[Table III about here]

³The DUF program also tests for use of methadone. However, since methadone is primarily used by heroin users, it is not included in this analysis of other drugs used.

This paper examines the potential for classifying arrestees as to six types of current drug users (see Table IV) distinguished by the drugs detected--but not their frequency of use nor the level of personal problems resulting from drug use/abuse. This classification first distinguishes between arrestees who test positive for serious drug use. The classification scheme further identifies, from among those detected as cocaine-opiate users, those who self-report ever having injected heroin or ever having used crack. Those arrestees who report both heroin injection and crack use are classified as heroin injectors. These two types of users--heroin injectors and crack users--are of particular concern to the criminal justice system because many such users exist and these drugs have been linked with serious crime (Chaiken & Chaiken, 1987 and 1990; Johnson et al., 1985; Johnson, Williams, Dei & Sanabria, 1990). Many of the DUF-Manhattan arrestees aged 21 and above are heroin injectors (14%), and a substantial proportion are crack users (36%). The remaining 26% of the sample detected as cocaine-opiate users self-report never using intravenous drugs nor crack cocaine. Based on their detected cocaine use these arrestees are classified as cocaine snorters. However, this category surely includes a substantial number of heroin injectors and crack users who deny having ever used either. Among arrestees aged 21 and above whose urines test negative for cocaine-opiates, the classification scheme distinguishes three groups: marijuana users who test positive for marijuana but not cocaine or opiates (4%), those who report having used drugs at some time during their lifetime but were not urine positive (10%), and those who were urine negative and self-report having never used drugs at any time (11%).

[Table IV about here]

2.1. Drug Use Among Youthful Arrestees

Drug use among youths and young adults differs from that among adults in general.

Typically, individuals follow a pathway from no drug use in youth, through less serious drugs such as alcohol, cigarettes, and marijuana in adolescence, which potentially culminates in the use of serious drugs like cocaine and heroin as adults (Kandel & Yamaguchi, 1985; Golub & Johnson, 1994). Serious drug abusers tend to have established the use of more serious drugs by their mid-twenties; those persons who have not tried serious drugs by their twenties probably never will (Kandel & Yamaguchi, 1985; Johnston et al., 1992). Drug use among the DUF-Manhattan sample also appear to have followed this pattern of onset. Among DUF-Manhattan arrestees aged 21 and above who report currently using either cocaine or heroin on a daily basis, 79% report having first tried cocaine or heroin by age twenty-one and 97% by age thirty. The percentage who onset by age thirty is biased by the fact that many of the arrestees were under age thirty at the time of the interview.

This report focuses on drug abuse among adult arrestees. To approximate the age by which arrestees tend to have established whether they will be serious drug users or not, the distribution of drug use types across arrestee ages is presented in Table V. The DUF program samples individuals arrested and booked as adults (the DUF program for juvenile offenders is not included in this study). The age of adult jurisdiction in New York is 16 years, but some arrestees aged 16-18 may be treated under youthful offender statutes. Table V suggests that 21 years is a convenient age for distinguishing youthful and adult arrestees. Those arrestees less than age 21 were less likely to be detected as cocaine-opiate users than those aged 21 and above.⁴ Among arrestees aged 21 and above, a more stable distribution across the six types of current drug use prevails; at each age, at least two-thirds of all arrestees were detected as cocaine-opiate users, around 5 to 10% are current heroin injectors, and close to 40% are crack users. All subsequent analyses presented in this report are restricted to the 5,052 DUF-Manhattan arrestees aged 21 years and older. Golub & Johnson (1993) examines trends in drug use among DUF-Manhattan arrestees aged 20 and below.

⁴Golub & Johnson (1993) also document major declines in cocaine and crack use among arrestees under age 21; the statistical models developed below would be less accurate in predicting high levels of cocaine-opiate use among these arrestees.

[Table V about here]

2.2. Drug Use Among Adult Arrestees

Obtaining accurate reports of frequency of drug use presents a major obstacle to establishing the correspondence between detected drug use at arrest and regular drug use. This analysis uses self-reported frequency of drug use. Although subjects were assured in advance that their responses would be kept confidential and would have no bearing on the disposition of their cases, arrestees are likely to have misrepresented the extent of their drug use, since they were recruited at time of arrest and faced the possibilities of prosecution and criminal sanctions.

To control for possible misrepresentation, the analysis of extent of drug use emphasizes the responses of the 1,654 arrestees who both tested positive for cocaine or opiates and who self-reported use of cocaine, crack or heroin in the last 72 hours. This subsample represents nearly two-thirds (64%) of the 2603 DUF-Manhattan arrestees from 1989-1991 whose urine tested positive for cocaine or opiates. Subjects recruited in 1987-1988 were not asked about their use of crack in the last 72 hours or past 30 days and are, therefore, excluded from this analysis.

Table VI compares the results of self-reports and urine test results for recent use of cocaine, crack or heroin.⁵ An extremely small proportion (6%) of those whose urine tested negative reported having recently used cocaine, crack or heroin. On the other hand, a substantial proportion (36%) of those who tested positive failed to report recent use.

[Table VI about here]

⁵Smoking crack cocaine and snorting cocaine powder are reported as separate drug use activities in the DUF program, despite the fact that both involve the use of cocaine. Urine tests detect cocaine, but cannot distinguish between cocaine and crack use.

The urine test for cocaine and opiates provides an objective test of an individual's self-reported use of cocaine, crack or heroin within 48-72 hours prior to arrest. By extension, those arrestees who both test positive and report recent drug use are assumed to provide reasonably honest and accurate responses to other questions regarding drug use.

The findings clearly suggest that detected cocaine-opiate use at arrest is associated with frequent use of cocaine, crack, or heroin. Among the 1652 DUF-Manhattan arrestees both detected as and reporting recent use of such drugs, 62% report using either cocaine, crack or heroin on a daily basis and nearly all (90%) report at least weekly use (see Table VII). Crack is the drug most widely used on a daily basis (37%), followed by heroin (24%), and cocaine powder (21%). Additionally, these arrestees were most likely to report current dependence on crack and most likely to need treatment for crack; again, crack was followed by heroin and cocaine powder. The correspondence between detected cocaine-opiate use and frequency of use estimated with these cases could be biased to the extent that the regularity of use among the 949 detected users who denied recent use differs from those who both self-report and are detected as recent users. In particular, this analysis could over-estimate the regularity of drug use among detected users, if those arrestees detected users who do not self-report recent drug use tend to use serious drugs less frequently.

[Table VII about here]

The prevalence of need for drug treatment reported by DUF-Manhattan arrestees suggests a wider need for drug treatment services than are currently provided (Table VII). Perhaps all the detected users--75% of the DUF-Manhattan sample age 21 and older, which is slightly higher than the overall rate of 71% including younger arrestees--are in need of treatment, whether they admit it or not. Indeed, 69% of detected users who self-reported recent use of cocaine, crack or heroin within the last 72 hours also report that they currently need drug treatment. Furthermore, 71%

report that they are currently dependent on cocaine, crack or heroin. These two questions did not elicit consistent responses across all arrestees. Some arrestees (11%) reported they were currently dependent on cocaine, crack or heroin but not in need of drug treatment. These responses may be consistent with the arrestee's opinion of their drug abuse habit. However, a practitioner might argue that any criminal offender who reports a need for treatment or a dependence on serious drugs could be referred to drug treatment. This population includes 80% of all detected users who self-report use within the last 72 hours, yet only 35% of these arrestees report having ever been involved with any type of drug treatment and only 8% report being currently in drug treatment.

These results are for arrestees who acknowledge their recent drug use. The 994 detected users who do not report recent use are much less likely to admit a need for treatment of a cocaine, crack or heroin problem (only 5%). These arrestees are also less likely to report dependence on cocaine, crack or heroin (16%), having received drug treatment previously (7%), or currently receiving drug treatment (6%). These arrestees may indeed be less likely to need drug treatment as they report. Alternatively, they may be the most recalcitrant drug abusers who deny their need for drug treatment. These data do not provide a basis for distinguishing between these possibilities.

2.3. Covariates of Type of Drug User

The base rates of detected serious drug use among arrestees can provide judges and other criminal justice personnel with important information useful for case referral. The particularly high, overall prevalence (or base rate) of detected cocaine-opiate use among all DUF-Manhattan arrestees age 21 and older of 75% suggests that most arrestees could use treatment--assuming detected serious drug use indicates a drug abuse problem. If a judge were to refer all Manhattan arrestees age 21 and above to drug treatment, then at least 75% of the time such referrals would be appropriate. This 75% likely represents an underestimate since some individuals not detected as

cocaine-opiate users at arrest may actually be serious drug abusers who had not used these drugs within the prior 48-72 hour period which can be detected by the EMIT test used by the DUF program . However, if serious drug users tend to use on a daily basis, the proportion of undetected serious drug abusers is likely to be small. At most 25% of the DUF-Manhattan arrestees were not regularly using either cocaine, crack or heroin at the time of arrest. This error rate (and the possibility of sending individuals to drug treatment who might not be serious drug users), can be reduced by using information at the time of arrest to selectively determine which arrestees have higher and lower probabilities (than the overall base rate) of being positive for cocaine or opiates.

The remainder of this paper examines sources of systematic variation in the rate of detected serious drug use associated with individual attributes easily identified at the time of arrest: most serious arrest charge, misdemeanor or felony, race/ethnicity, gender, age or birth year, primary source of income, education, and marital status (offenders's self-reports of drug use are not included in these analyses). This section identifies those attributes which are differentially associated with the various types of drug users identified in Table IV, including covariates of heroin injection and crack use.

The substantial proportions of adult arrestees classifiable as current crack users (36%) and heroin injectors (14%) suggest considerable needs for particular services appropriate to these addictions. However, since most arrestees are classified as neither crack users nor heroin injectors, remanding all arrestees to drug treatment would result in a substantial proportion of type II errors--sending arrestees to treatment they may not need. This section examines the potential for using individual demographic and arrest characteristics to help identify type of drug use--especially, crack users and heroin injectors, two groups that are of particular interest to the criminal justice system.

Table VIII presents a cross-tabulation of DUF-Manhattan arrestees aged 21 years and older by type of drug user with individual demographic and arrest characteristics. The first column presents the percent of adult arrestees classified into each of the levels for the following attributes: most serious arrest charge, misdemeanor or felony, gender, race/ethnicity, birth year, education,

marital status and primary source of income. The six subsequent columns present the distributions across levels for each attribute for the members of each of the mutually-exclusive types of drug users.

[Table VIII about here]

This analysis focuses on birth year as opposed to age since the types of drugs a serious drug abuser consumes depends greatly upon which drugs were popular when the individual first started using serious drugs, typically around age 18 (Johnson et al., 1990; Johnson & Manwar, 1991; Golub & Johnson, 1992b, 1993 and 1994). For example, a substantial proportion of current serious drug abusers who inject heroin came of age (reached 18) during the Heroin Injection Era prevailing in New York City during the 1960s and early 1970s. Persons reaching age 18 after the early 1970s are much less likely to report ever having injected heroin (Hunt & Chambers, 1976; Boyle & Brunswick, 1980; Clayton & Voss, 1981; Golub & Johnson, 1992b). Furthermore, many drug abusers who inject heroin today first onset to its use in the 1960s and 1970s (Johnson, Golub & Hossain, 1992). Some of these long-term heroin abusers have subsequently added crack cocaine to their habit and some former heroin injectors may have reduced or terminated its use in preference to crack (Dunlap & Johnson, 1992; Golub & Johnson, 1992b; Johnson, Lewis & Golub, 1992).

The profiles of drug user types by birth year presented in Table VIII are congruent with these prior findings. Current heroin injectors are likely to have been born in the 1950s, whereas crack users (who do not report injecting heroin) and cocaine snorters were more typically born in the 1960s. Table VIII also reports that heroin injectors are disproportionately likely to sustain an arrest for larceny or burglary; to be arrested for a misdemeanor; to be White or Hispanic; to have been born in the late 1940s and 1950s; to be formerly married (although this may be because they are older); and to obtain their income by illegal means such as dealing drugs or prostitution, but even more so by other illegal sources, possibly larceny and burglary (the crimes for which they are most

likely to sustain an arrest).

Crack users (who report never having injected heroin) present a distinctly different profile. They tend to be disproportionately arrested for robbery and drug possession; to be Black; to have been born in the 1950s and 1960s; to be single (perhaps related to their youthfulness); and to be unemployed, deal drugs, or have other illegal means of income. Cocaine snorters are disproportionately likely to be male; Hispanic; married; and have a legal job, be unemployed or on welfare/SSI.

Drug user types not detected as cocaine-opiate users at arrest exhibit patterns of attributes distinct from those detected as serious drug users. Detected marijuana (only) users tend to be disproportionately likely to sustain an arrest for assault/homicide, robbery or other crimes; be male; White; born in the late 1960s; and have legal income. Those arrestees with no detected cocaine-opiate use who self-report prior use of cocaine, crack, heroin or marijuana are disproportionately likely to have sustained an arrest for assault/homicide and other crimes; be White; born in the late 1960s; and have a college degree. Those arrestees with no detected or self-reported lifetime use of cocaine, opiates, or marijuana are disproportionately likely to have sustained an arrest for assault/homicide or other crimes; have committed a felony; be White or Hispanic; born prior to 1950; have a college degree; be married; and have legal income.

The variation in these profiles are not sufficient for accurate classification of individual arrestee's as to user type, in spite of the variation identified in Table VIII. In order to predict an arrestee's likelihood for each type of drug user, six logistic regression models were developed (logistic regression is described in further detail in Section 3.2). The dependent variables were each type of drug user and the independent variables were the characteristics presented in Table VIII.

The ability of each model to accurately identify a particular type of drug user was ascertained using a method for validating models referred to as *postdiction*. The logistic regression coefficients for the heroin injector model can be used to identify the likelihood that an individual drawn from a population similar to the DUF-Manhattan 1987-1991 sample is a heroin injector

based on that person's demographic and arrest characteristics. Similarly, the other five logistic regression models can identify the likelihood for each of the other types of drug users. Using a mathematical model for classification of members of a new sample is commonly referred to as prediction. The heroin injection model can also be used to identify the likelihood that a member of the DUF-Manhattan sample would be classified as a heroin injector, despite the fact that each subject's classification is already known. This procedure is called postdiction.

Postdiction was used to determine how useful each logistic regression model for the six drug user types would have been had it been available. The likelihood that each member of the sample belonged to each of the six types of drug users was calculated. Ideally, arrest and demographic information would prove sufficient for identifying each arrestee as extremely likely to belong to one of the types of drug users and unlikely to belong to the others. In which case, subsequent evaluations such as urine tests or self-reported drug use inventories would be redundant. This was not case.

Table IX reports the proportion of all arrestees that each scale identified as extremely likely (defined as a probability of 90% or more) and at least highly likely (defined as 67% or more) to be a member of each of the six types of drug users. The results indicate that the postdiction scales do not identify any arrestees as extremely likely to be classified as any of the six drug user types, although they do identify a small proportion as highly likely to be heroin injectors (.2%), crack users (6.9%) and as having no detected or reported drug use (.4%).

[Table IX about here]

The logistic regression models based on individual arrest and demographic characteristics failed to accurately classify individuals into each of the six types of drug users for two inter-related reasons:

- 1) Demographic and arrest information provide limited information that is correlated

with drug use patterns,

2) Each type of drug use is relatively rare and is, consequently, difficult to identify with high accuracy by actuarial models.

Crack users were predicted more accurately primarily due to relatively higher prevalence (36% of adult arrestees). Heroin injectors were predicted more accurately than most other types of users in spite of their relatively low prevalence (14% of DUF-Manhattan arrestees aged 21 and above) since heroin injectors tend to have several distinguishing characteristics such as having been born earlier and being arrested for burglary (see Table VIII).

3. MODELING DETECTED COCAINE-OPIATE USE

This section develops three models designed to classify arrestees from DUF-Manhattan aged 21 and older according to their likelihood of detected cocaine-opiate use.

A) FULL MODEL: a logistic regression model of the association of detected cocaine-opiate use with a variety of independent variables including most serious arrest charge for the instant offense, misdemeanor/felony, race/ethnicity, gender, age, primary source of income, and marital status. This model provides the foundation for the two subsequent models.

B) ARREST CHARGE-AGE MODEL: a two-way table with arrest charge and age--the two strongest covariates of detected cocaine-opiate use--along the vertical and horizontal axes, respectively, and the base-rate of detected cocaine-opiate use presented for arrestees in each cell.

C) SERIOUS DRUG ABUSER SCALE: a user-friendly point-score system wherein an arrestee accumulates points according to their individual attributes of most serious arrest charge for the instant offense, misdemeanor/felony, race/ethnicity, gender, age, primary source of income, and marital status. Higher scores on this Serious Drug Abuser Scale are associated with higher base rates of detected cocaine-opiate use.

These models can be characterized according to their relative precision and their ease of use.

The ability of these models to accurately identify many adult arrestees as serious drug abusers derives partially from the high overall base rate of detected cocaine-opiate use (75%). In particular, a referral rule which remanded all DUF-Manhattan arrestees to drug treatment would be right in three out of four cases due to this underlying base rate. By including other covariates of detected cocaine-opiate use, a model can further distinguish those arrestees whose urine is even more likely to test cocaine-opiate positive. Specifically, the following categories are defined to describe relative probability of testing cocaine-opiate positive at arrest:

- 1) **Extremely high likelihood** of being detected as a cocaine-opiate user at arrest: having a probability of detected cocaine-opiate use of 90% or more. These arrestees could be correctly remanded to drug treatment at least 9 out of 10 times based on their estimated base rate alone. Conversely, less than 1 out of 10 such remandees would be incorrectly placed under such a referral system (a rate of Type II errors of 10% or less).

2) **Very high likelihood** of being detected as a cocaine-opiate user at arrest: having a probability of detected cocaine-opiate use between 80 and 89%, which is higher than the overall base rate of 75% but not as high as in the previous category. These arrestees could be correctly remanded to drug treatment at least 4 out of 5 times based on their estimated base rate alone.

3) **High likelihood** of being detected as a cocaine-opiate user at arrest: having a probability of detected cocaine-opiate use between 67 and 79%--similar to the overall base rate. These arrestees could be correctly remanded to drug treatment at least 2 out of 3 times based on their estimated base rate alone.

4) **Intermediate likelihood** of being detected as a cocaine-opiate user at arrest: having a probability of detected cocaine-opiate use near one-half (45 to 66%). The probability of incorrectly referring these arrestees to drug treatment ranges from 1 in 3 up to more than 1 in 2 (half the time).

5) **Low likelihood** of being detected as a cocaine-opiate user at arrest: having a probability of detected cocaine-opiate use of less than 45%. Less than half these arrestees should be referred to drug treatment.

The Full Model provides the most accurate classification of arrestees based on postdiction; it identifies 16.3% of the DUF-Manhattan arrestees (1989-1991) as extremely likely to test cocaine-opiate positive (Section 4.1 provides details of these postdiction calculations). The Serious Drug Abuser Scale, which is less precise than the Full Model (but apparently not much), identifies 15.8% as extremely likely. The Arrest Charge-Age Model identifies 6.8% which suggests that the additional variables included in the Serious Drug Abuser Scale provides appreciably more information regarding which arrestees are at least 90% likely to be detected as cocaine-opiate users.

In terms of ease of use, both the Serious Drug Abuser Scale and the Arrest Charge-Age Model are straightforward to use and could be taught to and subsequently employed by judges and other criminal justice personnel. Calculating a person's base rate with the Full Model requires more complex arithmetic (taking logarithms and working with four-decimal-place precision). Whereas, the Full Model is not as user friendly it could be programmed quite straightforwardly on a computer. Such implementation would mask the mechanics of the calculation and provide practitioners with only the desired probability estimate of detected cocaine-opiate use.

Another consideration in choosing between these models is that models with many

independent variables and high levels of precision often *overfit* the data (Copas & Tarling, 1986; Gottfredson & Gottfredson, 1986). Consequently, the Full Model can be expected to perform less accurately on a new data set of arrestees similar to the DUF-Manhattan, 1987-1991 sample used for development. In particular, the percent detected as cocaine-opiate users among those classified in the extremely high likelihood category may be fewer than 90% predicted. However, the predictive accuracy of the less precise Arrest Charge-Age Model and Serious Drug Abuser Scale may be better, since these models are less specific. In other words, the Full Model may have greater precision than it does accuracy.

Two validation analyses with new data samples test this hypothesis. Section 4.2 presents results from a predictive validation with DUF-Manhattan data from 1992 and first quarter of 1993--abbreviated 1992+1Q93. This predictive validation tests the extent to which drug use patterns among adult arrestees have remained stable through 1993 (particularly among arrestees who tend to use cocaine powder, crack and heroin). Additionally, Section 4.3 presents results from a cross-validation with DUF data from four other major cities in the Northeast for 1988-1989: Chicago, Cleveland, Detroit and Philadelphia. To the extent that drug use patterns similar to DUF-Manhattan prevail among arrestees in these other Northeast cities, the models should accurately predict which arrestees are more likely to test cocaine-opiate positive. The remainder of this chapter examines time-variation in detected cocaine-opiate use among DUF-Manhattan arrestees from 1989 to 1991 and, subsequently, presents the development of each of the models of detected cocaine-opiate use in detail.

The use of ascribed attributes, particularly race/ethnicity, in criminal justice processing is a source of much controversy. In some situations, the Arrest Charge-Age Model may be preferred on the basis that it does not include race/ethnicity as a predictor or current drug use even though it provides less accurate predication. Alternatively, a scale similar to the Serious Drug Abuser Scale but excluding race/ethnicity as a predictor might be used. A scale, excluding race, was developed; Section 4.1.3 summarizes the predictive utility of this model.

3.1. Time Variation in Detected Cocaine-Opiate Use

To test whether the rate of detected cocaine-opiate use varies substantially from 1987-1991, the year of the DUF interview can be included in the model as an independent variable. Ideally, a single logistic model would have been estimated including all the independent variables, simultaneously. Such an analysis, however, was precluded by missing data which caused colinearity among the independent variables. Arrestees recruited in 1987-1988 were not asked about education and primary source of income. To include these variables in the logistic regression analysis, the education and primary source of income variables were coded as a dummy level indicating missing data. In this manner, data for arrestees from 1987-1988 can be used to estimate variation in detected cocaine-opiate use associated with other variables such as arrest charge and age. However, the inclusion of these missing-value levels for all subjects arrested in 1987-1988 results in colinearity of education and primary source of income with interview year.

A preliminary logistic regression analyses was performed including interview year as an independent variable but excluding the education level or primary source of income variables to examine the nature of any variation in detected cocaine-opiate use attributable to interview year, controlling for other independent variables. This model found a modest decline in detected cocaine-opiate use from 1987 to 1991 amounting to a total drop in odds of 38% (the relationship between odds and base rate of detected use is discussed in Section 3.2). This variation accounted for substantially less variation in detected cocaine-opiate use than that associated with other attributes such as arrest charge and age.

This model also tested for seasonality, whether detected cocaine-opiate use varied according to quarter in which the interview occurred. The model found only marginal variation (statistically significant at the $\alpha=.05$ but not the $\alpha=.01$ level) associated with quarter after controlling for all other variables. This preliminary analysis suggests that the variation in detected cocaine-opiate use across

years and quarters, controlling for all other variables, is moderately small and justifies using a model which excludes these two variables--thereby allowing for the inclusion of education and primary source of income.

3.2. Covariates of Detected Cocaine-Opiate Use

The logistic regression results reported in Table X indicate the base rate of detected serious drug use as a function of individual attributes at the time of arrest. The procedure for calculating the base rate for any individual involves two steps:

1) Calculate the log-odds of detected cocaine-opiate use as the sum of estimated coefficients for the level of each attribute pertaining to the arrestee. In this regard, logistic regression provides a linear additive model similar to that obtained with ordinary least-squares regression. In logistic regression, however, the dependent variable is the log-odds as opposed to the attribute value as provided by linear regression.

$$\text{log-odds} = .84 + \left[\begin{array}{l} \text{estimated coefficient} \\ \text{for arrest charge} \end{array} \right] + \left[\begin{array}{l} \text{estimated coefficient} \\ \text{for age} \end{array} \right] + \dots$$

2) Convert log-odds to a percentage. The log-odds is simply another form for expressing the base rate, although, one that is probably unfamiliar to many criminal justice practitioners. Other more familiar forms include the odds and the base rate. The following formulas describe how to convert from log-odds to odds and to base rates, respectively.

$$\text{Odds} = e^{(\text{log-odds})}$$

$$\text{Base Rate} = \frac{1}{1 + e^{(-\text{log-odds})}}$$

The constant for the logistic regression reported in Table X indicates the estimated log-odds

of detected serious drug use (opiates or cocaine) of 1.46 for the reference population (those persons whose profile matches the reference level are identified by "@" and have a .00 value in Table X for each attribute). These log-odds for the reference population corresponds to odds of detected serious drug use of 4.3 ($e^{1.46}$) indicating that a member of the reference population is more than four-times as likely to test cocaine-opiate positive than not. The log-odds for the reference rate corresponds to a 81% base rate [$1/(1+e^{-1.46})$] of detected cocaine-opiate use. This estimated rate of detected cocaine-opiate use of 81% for Black, single, males, aged 21-25, with legal income, arrested for felony larceny/auto theft, is slightly higher than the, mean rate of 75% for DUF-Manhattan arrestees aged 21 and above.

[Table X about here]

Table X presents the results of estimating the variation in detected cocaine-opiate use across a variety of demographic and arrest attributes. The Wald statistics reported in Table X indicate whether each attribute is associated with statistically significant variation in serious drug use based on a X^2 -test with degrees of freedom equal to one less than the number of levels for the attribute. This statistic also provides a loose basis for ranking the importance of each attribute with respect to identifying variation in detected serious drug use. According to the Wald statistics, most serious arrest charge and age are by far the most important attributes of serious drug use. The other attributes associated with significant variation in detected cocaine-opiate use include primary source of income, race/ethnicity, gender, marital status, and misdemeanor/felony, in decreasing order of importance. Education was not associated with significant variation ($\alpha=.05$) in detected cocaine-opiate use, after controlling for the other attributes.

The estimated coefficients suggest that persons whose most serious arrest charge is for drug possession are much more likely to test cocaine-opiate positive than those arrested for murder/aggravated assault or for those charges included in the other category. All else being equal,

an individual arrested for drug possession has the highest odds of detected cocaine-opiate use--over twice those for someone arrested for the reference category of larceny/auto theft, $e^{.82}=2.27$ --and an individual arrested for other income generating crimes has the lowest odds--less than one-half the rate for larceny, $e^{-.77}=.46$. Thus, there is close to a five-fold range ($2.27/.46=4.9$) in odds of detected cocaine-opiate use associated with most serious arrest charge. The variation in detected cocaine-opiate use with top charge of misdemeanor or felony was statistically significant but rather small, after controlling for variation with arrest charge; felony offenders were 33% ($1-e^{-.39}$) less likely to test positive than misdemeanants.

In terms of variation with age, the odds of detected cocaine-opiate use reaches a peak among persons in their early thirties (estimated coefficient of .49) and subsequently declines to its lowest level among those sixty-one years of age and older (coefficient of -1.78). This represents close to a ten-fold range of variation in odds of detected cocaine-opiate use associated with age ($e^{.49-(-1.78)}=9.7$), all else being equal.

The variation associated with gender is moderate; female arrestees exhibit odds of detected cocaine-opiate use about 41% lower than male arrestees ($e^{-.52}=.59$), all else being equal. The range associated with race/ethnicity is also quite modest. Black arrestees exhibit higher rates than White arrestees which exhibit a similar rate as Hispanic arrestees. This difference between Black and White arrestees amounts to a 45% difference in odds ($e^{-.59}=.55$), all else being equal.

The variation associated with primary source of income is substantial. Arrestees who report making their living primarily through drug sales exhibit the highest rates of detected cocaine-opiate use (estimated coefficient of 1.79) which represents a six-fold range of variation in odds of detected cocaine-opiate use associated with income source ($e^{1.79-(0)}=6.0$), all else being equal.

The variation associated with marital status, is small although statistically significant. Married arrestees exhibit the lowest odds of detected cocaine-opiate use. Interestingly, arrestees who were formerly married exhibit higher odds than those who report never having been married.

3.3. Variation With Arrest Charge and Age

Table XI presents empirically-estimated rates of detected cocaine-opiate use for each category of age at arrest and top arrest charge (the two largest sources of estimated variation in detected cocaine-opiate use). The count (number of cases) upon which each percentage and standard errors are based show that many cells contain too few cases for accurate estimates of base rates. Thus, these rates were smoothed by estimating coefficients for a logistic regression model with two main-effects terms: age and arrest charge--the results are reported in Table XII.

[Table XI about here]

Table XII indicates that detected cocaine-opiate use is highest among arrestees aged 31-35 (an overall rate averaged across crime types of 82%) which is slightly higher than among ages 26-30 (79%) and 36-40 (78%). The arrest charge most associated with detected cocaine-opiate use is, not surprisingly, drug possession (89% overall), although detected use among arrestees for drug sales was substantially lower (83%). The rates of detected use for persons arrested for property index offenses are nearly as high: 84% for burglary, 81% for larceny/auto theft, and 79% for robbery. Persons arrested for non-drug and non-property index offenses exhibit substantially lower rates of detected use: 63% for violent offenses, 66% for other income generating offenses, 68% for other serious crimes, and 68% for other offenses.

[Table XII about here]

This analysis reports the strong and central variation in detected cocaine-opiate use associated with arrest charge and age and could be used as a "quick screen" for detected cocaine-opiate use (Johnson, Golub & Hossain, 1993). These two attributes alone are only

moderately useful for identifying many arrestees whose urine is extremely likely to be detected as cocaine-opiate users. Table XII identifies only persons aged 26 to 40 arrested for drug possession as extremely likely; a sub-population comprising 6.8% of the DUF-Manhattan sample. However, other arrestees--such as those arrested for robbery who support themselves primarily from drug sales--may also be extremely likely to be detected. The Serious Drug Abuse Scale includes additional information provided by several arrestee attributes other than age and arrest charge and, thereby, increases the variation in the types of arrestees classified as having an extremely high likelihood of detected cocaine-opiate use at arrest.

3.4. Serious Drug Abuser Scale

The logistic regression results presented in Table X could be used as a guide to determine which Manhattan arrestees are likely to be recent users of serious drugs (even when actual urine test results are not available). However, this model is not particularly user-friendly, thereby, limiting its potential usefulness among judges and other criminal justice practitioners. These results can be transformed straightforwardly into a Serious Drug Abuser Scale (Table XIII) which provides a more user-friendly tool for applying these findings about variation in detected cocaine-opiate use.

To use this scale, a judge (or other practitioner) first identifies an arrestee's most serious arrest charge, misdemeanor or felony, race/ethnicity, gender, age, primary source of income, and marital status. Based on this profile, an arrestee's Serious Drug Abuser Scale score can be calculated using Table XIII to assign points for each attribute and tallying the arrestee's score. This score can then be compared with the chart at the bottom of Table XIII to identify a given offender likelihood of detected cocaine-opiate use at arrest. For example, a score of 18 or above indicates the arrestee is extremely likely (90% or better) to be detected as a cocaine-opiate user.

[Table XIII about here]

The Serious Drug Abuser Scale is composed of whole, non-negative numbers designed to be simpler to calculate than the logistic regression model. This simplification involves reducing the precision of the estimated base rates slightly, in order to improve user-friendliness, by ignoring difference of .15 or less in the log-odds of detected cocaine-opiate use. This level of precision is of the same order of magnitude as the standard errors for estimated coefficients of the model (see Table X) which range from .05 to .31. Hence, this reduction in precision of the model of detected cocaine-opiate use is consistent with the overall accuracy of the model.

This overall decrease in precision is relatively modest. A difference in log-odds of .15 corresponds to a difference of about 16% in the odds ($e^{.15}=1.16$). In terms of the base rate, for someone with 4:1 odds of detected cocaine-opiate use, an increase of 16% raises the odds to 4.64:1 which corresponds to a base rate of 82% as opposed to the original 80%, an overall difference in estimated likelihood of detected cocaine-opiate use amounting to 2%.

To derive an integer scale from the decimal results in Table X, each coefficient estimate was divided by a scaling factor of .30 and subsequently rounded to the nearest whole number (see Table XIV); remainders of less than .15 are rounded down and those .15 and above are rounded up. Next, to obtain non-negative scores, the most negative value associated with each attribute is identified and a positive amount equal in magnitude is added to the score value associated with each level of each attribute.

[Table XIV about here]

The conversion chart presented in Table XIII, is consistent with both theoretical consideration and empirical findings with the 1989-1991 DUF-Manhattan data. Table XVII presents both the empirical rates of detected cocaine-opiate use and those implied by the logistic

regression model. The logistic regression rates derive from two basic relationships resulting from the procedure for developing the scale:

- 1) A score of 15 is associated with log-odds of detected cocaine-opiate use of 1.46 the same log-odds as the reference population, and
- 2) Each one-point deviation in the scale score corresponds to a deviation (in the same direction) in the log-odds of .30, the scaling factor.

Hence, the log-odds of detected cocaine-opiate use associated with each score on the Serious Drug Abuser Scale can be conveniently determined and the base rate associated with each score derived from that.

The size of the scaling factor simultaneously determines the precision of the scale and the range of scale values observed. The scaling factor of .30 employed in the Serious Drug Abuser Scale resulted in a range of possible scores from 0 to 27. The logistic regression estimates provide the most precise estimates of the base rates obtainable from the profile at the time of arrest, however, they are cumbersome to employ in practice unless programmed into a computer. Alternatively, a larger scaling factor would decrease the range of scores, perhaps reduce the number of factors that go into the scale and, thereby, improve the ease of use of the scale but simultaneously decrease its overall precision.

The Serious Drug Abuser Scale presented in Table XIII was developed from profiles of individuals arrested in Manhattan. The scale should not be used in other jurisdictions without empirically verifying that a patterns of drug use among arrestees similar to Manhattan's prevails. This scale has been validated with data from four other Northeast cities (see Section 4.3); the results suggest the scale may be appropriate for use in Philadelphia, Chicago, Cleveland and Detroit.

Furthermore, the Serious Drug Abuser Scale is based on drug use patterns prevailing from 1987 to 1991. A previous analysis suggested the variation in the rate of detected cocaine-opiate use attributable to differences in interview year from 1987 to 1991 was only moderate, controlling for other factors in the arrest profile (Section 3.1). Therefore, drug use patterns among arrestees are

likely to have remained stable in 1992 and 1Q93 and to be similar to those prevailing from 1987 to 1991 (Section 4.2 provides an empirical test of this stability). However, the more time elapsing between scale development and use, the more likely a shift in drug use patterns may occur and render the scale out of date. To this end, the Serious Drug Abuser Scale should be periodically reestimated with DUF data, perhaps annually. This practice entails performing a logistic regression with data from recent arrestees to ascertain whether the coefficient estimates are similar enough to those presented in Table X to warrant using the same scale or whether significant modifications may be indicated.

4. VALIDATION

The utility of any model of detected cocaine-opiate use is its ability to differentiate arrestees who are almost certainly serious drug abusers from those who are not so likely--especially arrestees who are extremely likely to be detected as cocaine-opiate users. To ascertain how frequently each model--Full Model, Arrest Charge-Age Model, and Serious Drug Abuser Scale--classifies offenders into each category--extremely high, very high, high, intermediate, and low--requires a validation sample that includes all the attributes included in the model along with an indication of whether each arrestee was indeed cocaine-positive at arrest.

This section provides the results of a several validations involving different samples of DUF arrestee data. Section 4.1 presents results of a postdiction validation using the DUF-Manhattan sample from 1989-1991, the data used to develop the models (the 1987-1988 data are excluded from this analysis). Section 4.2 present predictive validation using the Serious Drug Abuser Scale with more recent data from the DUF-Manhattan program (1992+1Q93). This section also presents replications in which the parameters for the Full Model and the Arrest Charge-Age Model are estimated using the new data set (DUF-Manhattan 1992+1Q93) and compared with the estimates obtained with the developmental sample (DUF-Manhattan 1987-1991). These replications discern the extent to which the variation in detected drug use across the various attributes included in each model has remained constant over time and identifies any specific changes. Section 4.3 presents cross-validation results of the Serious Drug Abuser Scale and replications of the other two models with DUF data from four other Northeast cities. These cities were chosen from the remaining 23 DUF sites as being the most likely to have patterns of serious drug abuse among arrestee populations similar to Manhattan.

Each analysis presented in this chapter tests the *calibration* of the models in addition to examining the distribution of scores. This involves comparing the proportion of arrestees in each of the likelihood categories who actually test cocaine-opiate positive. If a model is well-calibrated

then at least nine out of ten arrestees identified as extremely likely to test cocaine-opiate positive will have done so, on average. Similarly, between eight and nine out of ten of those arrestees identified as very highly likely will test positive, and so forth as dependent on the definitions of the likelihood categories. If fewer than 90% of the arrestees identified as extremely likely test positive, then the model is not well calibrated to the sample.

In the case of postdictive validation, miscalibration is not expected since the models were developed from this sample. Miscalibration in the case of the predictive validation with DUF-Manhattan data from 1992+1Q93 could suggest that drug use patterns among Manhattan arrestees have changed over time. The nature of any such change could then be further identified from the replication of the Full Model. Miscalibration in the case of cross-validation could indicate that drug use patterns differ between Manhattan and other DUF locations in the Northeast.

4.1. Postdictive Validation with DUF-Manhattan 1989-1991

This section presents postdictive validation results for each of the models of detected cocaine-opiate use developed from the DUF-Manhattan 1987-1991 sample. The analysis includes the 3315 arrestees aged 21 and above in the DUF-Manhattan sample from 1989-1991 (the *developmental sample*) who have complete arrest and demographic records. The remaining 1571 arrestees (mainly those interviewed in 1987 and 1988) who can be classified by the Arrest Charge-Age Model, but not the Full Model, are excluded from these analyses so that the models are compared on identical samples.

4.1.1. Full Model

The distribution of scores presented in Table XV strongly suggests that straightforward arrest and demographic attributes of arrestees used judiciously can often clearly identify persons whose urine would test cocaine-opiate positive. Because of the large variation in detected cocaine-opiate use across attributes, the high precision of this model and the particularly high base rate of detected cocaine-opiate use (75% among adult arrestees), the Full Model was able to identify many persons (16.3% of the sample) who were extremely likely to be detected as cocaine-opiate users. An additional 28.1% were identified as very highly likely and nearly three-quarters (74.2%) were identified as at least highly likely. Only about one-fifth (20.7%) of the sample were identified as intermediately likely; 5.1% were identified as having low likelihood of a positive test.

[Table XV about here]

4.1.2. Arrest Charge-Age Model

The Two-Factor Model including arrest charge and age can be expected to classify more arrestees as having a probability of detected cocaine-opiate use close to the overall mean of 75%, since it includes so many fewer covariates than the full model. This lack of differentiation results in appreciably fewer arrestees (only 6.8%) classified as extremely likely to test cocaine-opiate positive (Table XVI). The model identifies an additional 37.2% as very highly likely to test positive. Hence, the Arrest-Charge Age Model identifies a similar proportion as at least very highly likely (44.0%) as does the Full Model (44.4%). The Arrest Charge-Age Model identifies 38.4% as highly likely and 17.6% as intermediately likely. The model identifies only 2.0% as having a low likelihood of a positive test which is substantially smaller than the 5.1% identified by the Full Model. Overall, the

model provides a distribution of likelihoods almost as broad as achieved with the Full Model since arrest charge and age are the two strongest covariates of detected cocaine-opiate use.

[Table XVI about here]

4.1.3. Serious Drug Abuser Scale

The Serious Drug Abuser Scale has less precision than the Full Model and may, therefore, be expected to classify more arrestees as having a probability of detected cocaine-opiate use close to the overall mean of 75%. The Serious Drug Abuser Scale classifies 15.8% of the sample as having a score of 18 or more which is associated with an extremely high likelihood of detected cocaine-opiate use. This percentage is nearly equal to the 16.3% achieved with the precision of the Full Model and substantially better than the 6.8% achieved with the Arrest Charge-Age Model.

The Serious Drug Abuser scale identified an additional 31.9% as very highly likely, resulting in only 47.7% identified as having an 80% chance of detected cocaine-opiate use or better which is slightly higher than observed with either the Full Model or the Two-Factor Model based on arrest charge and age. The Serious Drug Abuser Scale identified 36.3% as highly likely, and 13.6% as intermediately likely. Lastly, the scale identified 2.4% as having a low likelihood of detected cocaine-opiate use at arrest which is better than achieved with the two-factor model.

[Table XVII about here]

Table XVII also indicates that the Serious Drug Abuser Scale is well-calibrated to the DUF-Manhattan 1989-1991 data, as expected since this is the developmental sample. The second column in Table XVII reports the percentage of the arrestees with a given score *actually* detected as

cocaine-opiate users. The third column presents the percent *theoretically* expected based on the logistic regression model underlying the Serious Drug Abuser Scale (see Section 3.4). The two percentages show strong correspondence. For example, fifteen is both the most common and median score on the scale. Theoretically, 81% of persons receiving such a score should be detected as cocaine-opiate users. In actuality, 82% were detected, which is quite accurate especially considering that the standard errors associated with the actual estimate of detected cocaine-opiate use is between two and five percent.

To test the importance of race to the Serious Drug Abuser Scale, another scale excluding this ascribed attribute was developed. A logistic regression analysis with all the independent variables except race/ethnicity provided very similar coefficient estimates for the variation associated with instant offense, misdemeanor/felony, gender, age, primary source of income, and marital status. So much so, that the scale would look identical to the Serious Drug Abuser Scale with the section on scoring points for the various levels of race/ethnicity removed. Arrestees with a score of 17 would be classified as having an extremely high likelihood (>90%) of detected cocaine-opiate use and those with scores of 14-16 as very high likelihood (80-89%). Fewer individuals would be classified into each of these categories as compared with the Serious Drug Abuser Scale. The revised scale (excluding race/ethnicity) categorized 12.4% of the sample into the extremely high category as opposed to the 15.8% identified by the Serious Drug Abuser Scale--a 22% decline. This percentage is substantially larger than the 6.8% identified as having an extremely high likelihood by the Arrest Charge-Age Model. A sizable proportion, 40.2%, are categorized in the very high category and above as opposed to 47.7% with the Serious Drug Abuser Scale--a 16% decline. Hence, the inclusion of race/ethnicity in the Serious Drug Abuser Scale substantially increases its ability to predict those most likely to be detected as cocaine-opiate users, although the scale excluding race/ethnicity is still quite powerful for identifying cocaine-opiate users and is more powerful than the Two-Factor Model including only arrest charge and age.

4.2. Predictive Validation with DUF-Manhattan 1992+1Q93

The Serious Drug Abuser Scale was developed with data collected from the DUF-Manhattan program from 1987-1991. This section examines the extent to which this model would have been appropriate for use with a *validation sample* of arrestees recruited by DUF-Manhattan during the first three quarters of 1992 and the first quarter of 1993 (DUF-Manhattan did not collect data in the fourth quarter of 1992) and, thus, provides a test of the predictive validity of the Model. This section also presents results of replicating the Full and Arrest Charge-Age Models.

4.2.1. Full Model

Table XVIII presents results of a logistic regression analysis of the nature of the variation in detected cocaine-opiate use as a function of various arrest and demographic attributes with the DUF-Manhattan 1992+1Q93 sample. A comparison with the rightmost columns indicates the extent to which similar patterns in variation occur within the validation period (1992 and 1Q93) as during the period used for developing the model (1987 through 1991). The constant of .90 represents the log-odds of detected cocaine-opiate use for arrestees 1992+1Q93 whose attribute levels are the reference level and corresponds to a 71% probability of detected use. This reference rate is somewhat smaller than the 1.46 estimated with the development sample. However, this difference is not statistically significant.⁶ Furthermore, the coefficients associated with age are substantially

⁶Estimates were compared using the standard t-test:

$$\frac{\beta_1 - \beta_2}{\sqrt{\sigma_1^2 + \sigma_2^2}}$$

For large samples, the difference between the estimates divided by the standard deviation of the

higher among this validation sample than estimated with the developmental sample: in particular, at the peak age for detected cocaine-opiate use (age 31-35) the estimated coefficient is sufficiently larger than the .49 for the developmental sample which effectively compensates for the difference in the constant between these two models.

[Table XVIII about here]

Overall, the logistic regression model estimated with this validation sample suggests that the pattern of variation in detected cocaine-opiate use across arrestees is quite similar to that observed with the developmental sample. The differences between coefficient estimates across the two estimated models are not statistically significant for each attribute level, except for those associated with age, which tends to compensate for the lower constant term estimated with the validation sample. This analysis strongly suggests that similar patterns of variation in detected cocaine-opiate use across arrestees prevailed in 1992 and 1993 as in previous years.

4.2.2. Arrest Charge-Age Model

Table XIX presents smoothed estimates of the base rate of detected cocaine-opiate use by arrest charge and age (the same procedure used to generate Table XII was employed). The overall rate of detected cocaine-opiate use for the DUF-Manhattan 1992+1Q93 sample of 75% matches the rate observed from 1987-1991. The variation across arrest charge and age are also quite similar. Persons arrested for drug possession exhibit the highest rates of detected cocaine-opiate use (91%

difference follows a standard normal distribution. The standard deviation equals the square root of the variance which is given by the standard error of the first estimate squared plus the standard error of the second estimate squared. A value outside the range (-1.96,1.96) indicates a difference which is significant at the $\alpha=.05$ level. Based on this statistic, the difference in estimates for the constant terms between the two samples is not significantly different ($\alpha=.05$ level).

for the more recent sample and 89% for the 1987-1991 sample). Persons arrested for drug sales exhibited only slightly lower rates of detected use (89%) compared to 83% among the 1987-1991 sample, suggesting that this distinction in detected use between those arrested for possession versus sales of drugs may not be persisting into the 1990s. Persons arrested for property index offenses (robbery, burglary, larceny/auto theft) exhibited rates around 80% just as they did in the 1987-1991 sample, and those arrested for the remaining offense categories exhibited rates in the high 50s or 60s.

[Table XIX about here]

The variation in detected cocaine-opiate use with age among the 1992+1Q93 sample also strongly resembled the variation observed among the 1987-1991 sample. A high of 84% was observed among arrestees aged 31-35, rates nearly as high were observed among other arrestees aged 26-40. Moving further from the peak, the correspondence between the two samples is not as strong. Arrestees aged 21-25 exhibited an overall rate of 63% which is somewhat less than the 73% observed from 1987-1991 and arrestees aged 41-45 exhibited a rate of 80% which is higher than the previous rate of 68%. The difference in rates for the two oldest categories 56-60 and 61+ may be attributable to the relatively small proportion of arrestees in these categories within the 1992+1Q93 sample (7 and 8 in each).

4.2.3. Serious Drug Abuser Scale

The Serious Drug Abuser Scale performed well with this predictive validation sample. Table XX indicates that a particularly large proportion of the validation sample (24.0%) had a scale score in the extremely high range (18-27) and that as a group arrestees with each such score

exhibited rates of detected cocaine-opiate use of close to 90% or above, as predicted for extremely high scale scores. In fact, a comparison of the actual and predicted percentages of detected cocaine-opiate use in Table XX indicate that the Serious Drug Abuser Scale is well calibrated for this prediction sample. Those in the very highly likely range also exhibited scores close to or in the 80-89% range. The proportion of arrestees testing positive shows a consistent decline among arrestees with a scale score of 14 or less. Those in the highly likely range tested positive from 60 to 80%. Those in the intermediate range tested positive very close to 50% of the time which is consistent with the rates around 50% expected in this range. Those in the low range exhibited rates of less than 45%, as expected, however these estimates have low accuracy due to the limited number of arrestees with such scores.

[Table XX about here]

Table XXI presents the variation in scale scores associated with the DUF-Manhattan sample from 1989-1Q93. The table suggests that the usefulness of the scale for identifying those with at least a 90% chance of detected cocaine-opiate use (the extremely high category) has increased. From 1989-1991, the percentage of the sample classified as having an extremely high likelihood of detected use was in the teens (12.8 to 18.1%). However in 1992 and 1993, this percentage increased by roughly one-half to 23.1 and 26.1%. The usefulness of the scale for identifying arrestees who have at least a high probability (67% chance or better) of detected cocaine-opiate use remained relatively stable from 1989 to 1991 at about 85%.

[Table XXI about here]

4.3. Cross-Validation with Four Additional Northeast DUF Sites

This section analyzes the extent to which the Serious Drug Abuser Scale developed with the DUF-Manhattan data (1987-1991) is appropriate for use with a *cross-validation sample* of arrestees from four other Northeast cities. Additionally, the section presents replication results of the Full and Arrest Charge-Age Models estimated with this sample. The DUF data for arrestees aged 21 and older from Philadelphia, Chicago, Cleveland and Detroit (1988-1989) were combined since the available data for each city were too few by themselves. Table XXII presents the overall base rates of detected cocaine-opiate use by city. The overall base rate in Philadelphia is the same as for Manhattan, the other three cities exhibit base rates of detected cocaine-opiate use in the 60 to 69% range. The lower overall base rate for the four city sample (68% as opposed to 75%) could possibly lead the model developed with the DUF-Manhattan sample to overpredict the proportion of arrestees who are extremely likely to test positive. Unless the lower overall rate in these other cities is due to a difference in the type of arrestees included in the sample. For example, a lower overall rate of detected cocaine-opiate use would be expected if the four city sample included fewer persons arrested on drug possession.

[Table XXII about here]

4.3.1. Full Model

Table XXIII presents results of a logistic regression analysis of the nature of the variation in detected cocaine-opiate use as a function of various arrest and demographic attributes. A comparison with the Full Model estimated with the developmental sample (DUF-Manhattan 1987-1991) indicates the extent to which similar patterns in variation occur across the jurisdictions

and the nature of the differences. This model includes an additional variable, site, to identify the nature of variation in detected cocaine-opiate use across jurisdictions after controlling for other factors. The constant of 1.28 represents the log-odds of detected cocaine-opiate use for arrestees from Philadelphia whose attribute levels are the reference level and corresponds to a 78% probability of testing detected cocaine-opiate use. A comparison of this constant with that estimated for the DUF-Manhattan sample (from Table X) indicates that the reference population in Philadelphia exhibits a similar base rate of detected cocaine-opiate use. However, the variation across the four Northeast cities is statistically different. Arrestees from Chicago exhibit odds of detected cocaine-opiate use 37% ($1-e^{-.46}$) lower than from the reference site (Philadelphia); arrestees from Cleveland and Detroit exhibit odds similar to each other and 53% ($1-e^{-.76}$) lower than in Philadelphia.

[Table XXIII about here]

Overall, the logistic regression model for these four cities suggests that the pattern of variation in detected cocaine-opiate use across arrestees is quite similar to that observed with the DUF-Manhattan data. However, the differences between the two logistic regressions are substantial enough to discourage using a model as precise as the Full Model calibrated with a DUF-Manhattan (1987-1991) sample in these other four cities. Just as with DUF-Manhattan, Table XXIII indicates that arrest charge and age are the most significant covariates of detected cocaine-opiate use. The order subsequent to these two variables differs substantially. The covariates for the four Northeast cities are, in decreasing order of importance, race/ethnicity followed by primary source of income. The variation associated with education and marital status is only marginally significant ($\alpha=.05$ but not $\alpha=.01$ level) and that associated with gender and misdemeanor/felony are not statistically significant; unlike the DUF-Manhattan analysis where all variables except education are associated with significant variation.

The nature of the variation in detected cocaine-opiate use across the various arrest charges

are similar between the models. The difference between estimated parameters on a coefficient-by-coefficient basis are not statistically significant based on t-test comparisons using the standard errors for the estimates. The variation associated with age, race/ethnicity and primary source of income are also similar in this same respect. Although, the peak age of detected cocaine-opiate use in the four other Northeast cities may occur in the late 20s as opposed to the early thirties as in Manhattan.

4.3.2. Arrest Charge-Age Model

Table XXIV presents smoothed estimates of the base rate of detected cocaine-opiate use by arrest charge and age (the same procedure used to generate Table XII was employed). A comparison of Table XII with Table XXIV indicates that the nature of the variation in detected cocaine-opiate use across arrest charges and age are similar between the two models. The highest base rates of detected cocaine-opiate use prevail among persons arrested for drug possession and drug sales, respectively. Slightly lower rates are observed among persons arrested for robbery, burglary and larceny/auto theft. The lowest rates are observed among persons arrested for assault/homicide and other crimes. The peak rates of detected cocaine-opiate use prevail from ages 26-40. This suggests that the same types of arrestees--those charged with drug possession and sales, aged 26-40--are most likely to test cocaine-opiate positive whether they are arrested in Manhattan, Philadelphia, Chicago, Cleveland or Detroit.

[Table XXIV about here]

However, the overall base rate of detected cocaine-opiate use is lower among arrestees from the four Northeast cities (68%) than from Manhattan (75%). This difference is reflected in the

marginal rates by both crime type and age (the column totals and row totals, respectively) which are consistently on the order of 7% lower. Moreover, this difference is reflected cell-by-cell suggesting that even after controlling for most serious arrest charge and for age that the base rate of detected cocaine-opiate use is lower on average across the four Northeast cities than in Manhattan.

4.3.3. Serious Drug Abuser Scale

Table XXV presents the results of classifying arrestees in the DUF four Northeast cities sample according to the Serious Drug Abuser Scale developed for DUF-Manhattan. Overall, the results suggest that the Serious Drug Abuser Scale could be employed in other jurisdictions in the Northeast in spite of the fact that the scale was developed with DUF-Manhattan data and that some of the covariates of detected cocaine-opiate use vary somewhat across locations as suggested in Table XXIII. This utility results from the reduction in overall precision between the Full Model and the Serious Drug Abuser Scale. As a consequence, the patterns of variation in detected cocaine-opiate use in the four other Northeast cities is reasonably well characterized by the Serious Drug Abuse Scale.

[Table XXV about here]

As with the DUF-Manhattan sample, a moderate proportion of the sample (16.1%) were classified as extremely likely to be detected as cocaine-opiate users. Arrestees with scores of 18 and above were detected as users close to 90% of the time or more, suggesting that in terms of identifying arrestees in this particularly important category that the Serious Drug Abuser Scale is well calibrated. An additional 34.5% are classified as highly likely to test positive and the range of percentages testing cocaine-opiate positive for these scores was from 74-79 which is substantially

lower than the 80-89 percent predicted from the DUF-Manhattan sample. Many arrestees (34.0%) are classified as highly likely and the proportion actually testing positive within this category ranges from 49 to 67% which is somewhat lower than the 67-79% range suggested by the DUF-Manhattan sample. Arrestees classified in the intermediate and low categories exhibited rates of detected cocaine-opiate use close to 50% and less.

This cross-validation suggests that the Serious Drug Abuser Scale can be used for identifying those arrestees with a 90% or higher chance of being detected as cocaine-opiate users in other jurisdictions in the Northeast. The scale can also provide a relative ranking of the likelihood of detected use, in these four jurisdictions. However, arrestees in other jurisdictions in the Northeast exhibit slightly lower rates of detected cocaine-opiate use, overall. Consequently, the observed rate of detected cocaine-opiate use among persons classified in the very high and high categories by the Serious Drug Abuser Scale exhibit somewhat lower rates than observed with DUF-Manhattan. Therefore, the Serious Drug Abuser Scale should be recalibrated before being used outside of Manhattan. Furthermore, results of estimating the Full Model with this cross-validation sample suggest that several variables--misdemeanor/felony, gender, and marital status--could be dropped from the scale since they are not associated with significant variation in detected cocaine-opiate use (Section 4.3.1).

5. CONCLUSION

These analyses indicate that most DUF-Manhattan arrestees (a sample containing a high proportion of arrestees for more serious crimes) test positive for recent use of serious drugs (cocaine or opiates such as heroin). Moreover, detected cocaine-opiate use at arrest is highly associated with daily use of either cocaine, crack or heroin, drug dependence, and need for drug treatment. In contrast, few of these arrestees report being currently in drug treatment or having had treatment in the past. Providing drug treatment to arrestees who are also serious drug abusers could potentially reduce both their drug dependence and their criminal activity.

Logistic regression analyses with the DUF-Manhattan arrestee data (1987-1991) indicated that it is not possible to accurately identify specific types of drug abusers--especially those who use crack cocaine or inject heroin--due to two factors: 1) the moderate proportion of each specific type of drug abuser in the sample, and 2) a lack of information differentiating these persons provided by the basic arrest profile employed. However, this was not the case with general use of any serious drug as measured by detected use of cocaine or opiates, which is widespread among DUF-Manhattan arrestees.

The most important sources of variation in detected cocaine-opiate use include arrest charge and age. Arrestees for drug possession exhibited the highest rate of detected cocaine-opiate use; arrestees for drug sales and burglary also exhibited high rates. Arrestees aged 26-40 exhibited the highest rates of detected cocaine-opiate use with peak rates occurring among those aged 31-35. Significant variation was also associated with several other attributes: primary source of income, race/ethnicity, gender, marital status, and misdemeanor/felony. The highest rates were exhibited by arrestees for drug possession, aged 31-35, who support themselves through drug sales, are Black, male, are separated, widowed or divorced, and committed a misdemeanor. After controlling for the variation in other attributes, education did not further differentiate any variation in detected cocaine-opiate use.

The Serious Drug Abuser Scale is derived from this variation in detected cocaine-opiate use. It provides a user-friendly, point-score system for identifying which individuals are more likely to test positive for recent cocaine-opiate use based on a simple profile of demographic and current arrest characteristics including the following:

- 1) Most serious arrest charge,
- 2) Misdemeanor/felony,
- 3) Race/ethnicity,
- 4) Gender,
- 5) Age,
- 6) Primary source of income source, and
- 7) Marital status.

In a companion paper, Johnson, Golub & Hossain (1993) provide more complete guidelines for judges and other criminal justice personnel about the use of this scale for individual referrals.

This paper presented several important validation analyses. A postdiction validation using the developmental sample (DUF-Manhattan 1987-1991) indicated both that the scale can identify a large proportion of offenders as having an extremely high likelihood of being detected as cocaine-opiate users (at least 90% likely) and that the model is well-calibrated to the developmental sample. For example, of those arrestees whose score on the Serious Drug Abuser Scale suggests they have at least a 90% chance of detected cocaine-opiate use about 90% or more actually were detected. This result is not particularly unexpected in this case where the validation and developmental samples are the same.

The predictive validation with DUF-Manhattan data from 1992+1Q93 provides a truer test of whether the Serious Drug Abuser Scale is well-calibrated. Indeed, this test confirmed the usefulness of the scale and the correspondence, for each scale score, between the rate of cocaine-opiate use predicted by the scale and the proportion of arrestees with such a scale score actually detected. This calibration held in spite of a large increase, in 1992 and 1993, in the proportion of arrestees classified in the extremely high likelihood category and a slight increase in the overall rate of detected cocaine-opiate use.

A cross-validation analysis with DUF (1989) data from Philadelphia, Chicago, Cleveland and Detroit examined the usefulness of the Serious Drug Abuser Scale in other jurisdictions. These cities exhibited similar overall patterns of variation in detected cocaine-opiate use across individual attributes with two exceptions:

- 1) The overall rate of detected cocaine-opiate use was somewhat lower, and
- 2) The variation associated with several of the variables included in the scale were not statistically significant including misdemeanor/felony and gender. Furthermore, the variation associated with marital status was only marginally significant (significant at the $\alpha=.05$ but not the $\alpha=.01$ level).

Consequently, the Serious Drug Abuser Scale proved useful in ranking arrestees in these four cities with respect to their likelihood of detected cocaine-opiate use, arrestees with higher scale scores were indeed detected as cocaine-opiate users more frequently. Furthermore, arrestees identified as having an extremely high likelihood were detected as cocaine-opiate users close to 90% of the time or more. However, among arrestees with lower scale scores from these four Northeast cities, the proportion predicted by the scale was often substantially higher than the actual proportion detected as cocaine-opiate users. Depending on how the scale is going to be used, the Serious Drug Abuser Scale may need to be recalibrated for use in jurisdictions outside of Manhattan. Additional cross-validation analyses are required to establish the broader usefulness of the scale in other jurisdictions.

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Table I: Variation in Demographic and Arrest Attributes Among Developmental Sample of DUF-Manhattan 1987-1991 Arrestees (N=5988)

Attribute	% of Sample
MOST SERIOUS ARREST CHARGE	
Drug Possession	10.3
Drug Sale	4.8
Robbery	14.3
Burglary	7.5
Larceny/Auto Theft	21.3
Violent Index	12.5
Other Income Generating	8.8
Other Serious Crimes	9.4
Other	11.1
MISDEMEANOR/FELONY	
Misdemeanor	33.8
Felony	66.1
Citation	.1
GENDER	
Male	75.3
Female	24.7
RACE/ETHNICITY	
Other/Missing	4.1
Black	54.0
White	11.6
Hispanic	30.3
AGE CATEGORY^a	
1-17	5.0
18-21	10.5
21-25	23.8
26-30	23.7
31-35	17.0
36-40	10.5
41-45	4.6
46-50	2.3
51-55	1.2
56-60	.8
61+	.7
BIRTH COHORT^a	
Born 1900-44	5.5
Born 1945-49	5.5
Born 1950-54	11.3
Born 1955-59	18.6
Born 1960-64	25.1
Born 1965-69	22.1
Born 1970-74	11.3
Born 1975+	.7

Attribute	% of Sample
EDUCATION^b	
No HS Degree	43.2
HS Grad	22.1
Currently in HS	4.3
GED	9.5
Some College	15.0
College Degree	5.8
MARITAL STATUS^c	
Single	66.5
Married/Common Law	21.6
Sep/Wid/Div	11.9
PRIMARY SOURCE OF INCOME^d	
Legal Income	46.2
Welfare/SSI	13.6
Unemployed	21.6
Prostitute	4.4
Deal Drugs	4.4
Other Illegal	9.8

^aExcludes 7 missing cases.

^bNot collected in 1987-1988 and missing for 293 cases in 1989-1991.

^cExcludes 7 missing cases, distinct from those missing age.

^dNot collected in 1987-1988 and missing for 7 cases in 1989-1991.

Table II: Offense Categories for DUF-Manhattan

Offense Category	DUF Code	Offense Name
Drug possession	8	Drug Possession
Drug sales	9	Drug Sales
Robbery	29	Robbery
Burglary	4	Burglary
Larceny/auto	21	Larceny/theft
	33	Stolen vehicle
Violent index	2	Aggravated assault
	19	Homicide
	30	Sexual assault (rape)
Other income generating	5	Burglary tools
	10	Embezzlement
	16	Forgery
	17	Fraud
	18	Gambling
	28	Pickpocketing/jostling
	32	Stolen property
Other serious crimes against person/property	1	Arson
	7	Damage, destroy prop
	11	Extortion/threat
	12	Weapons
	13	Family offense
	20	Kidnapping
	23	Manslaughter
	25	Obstructing police, resist arrest
	27	Public peace/disturb/mischief/ trespass/reckless endangerment
	31	Sex offenses
Other	3	Bribery
	6	Prostitution/commercial sex
	14	Fare beating
	15	Flight/escape/bench warrant
	22	Liquor
	24	Obscenity/indecent exposure
	26	Probation/parole/ROR violation
	34	Influence of controlled substance
	50	Other
	51	D.W.I
	52	Driving (not D.W.I.)
	99	Data not obtained

Table III: Prevalence of Detected Drug Use within the Developmental Sample of DUF-Manhattan Arrestees (1987-1991)

	<u>Percent Detected as Users (Urine Test):</u>				
	Cocaine	Opiates	Cocaine or Opiates	Marijuana	Any Drugs ^a
Among all subjects	68	20	71	20	77
Among subjects who tested positive for any drug	88	25	91	24	--

^aThe DUF program tests for the following drugs: cocaine, opiates, marijuana, PCP, amphetamines, barbiturates, benzodiazepines, propoxyphene, methadone, and methaqualone.

Table IV: Hierarchy of Drug Use Types (DUF-Manhattan 1987-1991, 21 years and older)

Current Drug Use Type (percent each category)	Basis for Classification
Serious Drug Users (Detected cocaine and/or opiate users):	
1. Heroin Injector (14%)	Detected opiate user who self-reported lifetime injection of heroin. Most also report cocaine/crack use and are detected as cocaine users.
2. Crack User (36%)	Detected cocaine user who self-reported lifetime use of crack. This category excludes those classified as heroin injectors.
3. Cocaine Snorter (26%)	Detected cocaine or opiate users who are not categorized as heroin injectors or crack users. Thus, it includes crack users who deny lifetime crack use and heroin users who claim not to inject--in addition to arrestees whose most serious drug use involves snorting cocaine.
Not Positive for Cocaine or Opiates:	
4. Marijuana Smoker (4%)	Detected marijuana users.
5. No Detected Use (10%)	Not urine positive for marijuana, cocaine or opiates but self-report some lifetime use of either cocaine, opiates, or marijuana.
6. No Detected or Reported Use (11%)	Not urine positive and no self-reported lifetime use of either cocaine, opiates, or marijuana.

Table V: Type of Drug Use as a Function of Age at Arrest for the Developmental Sample (DUF-Manhattan 1987-1991)

Age at Arrest	Sample Size	Detected Cocaine or Opiate Use	Percent classified into each drug user type:				No detected use:	
			Heroin Injector	Crack User	Cocaine Snorter	MJ Only Smoker	Some Reported Use	No Reported Use
All Arrestees	5988	71	12	34	26	5	11	12
16	127	28	1	6	21	13	23	36
17	153	35	0	13	22	13	28	24
18	187	47	1	21	25	14	18	21
19	209	53	2	20	31	11	16	20
20	230	62	2	33	27	13	14	11
21	285	67	6	36	25	6	14	13
22	288	70	5	35	30	7	14	10
23	271	74	8	37	29	8	10	9
24	292	82	11	43	28	3	8	7
25	289	73	8	42	24	5	10	12

Table VI: A Comparison of Detected and Self-Reported Use of Cocaine, Crack or Heroin Use in the Developmental Sample (DUF-Manhattan 1989-1991)

Detected Cocaine- Opiate Use	Number (Row Percent) Who Self-Reported Use of Cocaine, Crack or Heroin in the last 72 hours:		
	No	Yes	Total
Negative	864 (94%)	56 (6%)	920 (26%)
Positive	949 (36%)	1654 (64%)	2603 (74%)
Total	1813 (52%)	1710 (48%)	3523 ^a

^aDUF-Manhattan arrestees recruited in 1987-1988 were not asked about recent use of crack and are consequently excluded from this analysis.

Table VII: Self-Reported Drug Use Characteristics for the Developmental Sample (DUF-Manhattan 1989-1991)

	Classification based on self-reported and detected cocaine-opiate use within 72 hours prior to arrest:			
	Reported and Detected	Not Reported but Detected	Detected	Complete Sample
Number of cases	1654	949	2603	3523
<u>Percent who:</u>				
Currently use cocaine/crack/heroin:				
Daily ^a	62	0	39	30
At least weekly ^b	90	8	60	46
Currently use daily:				
Cocaine	21	0	14	10
Crack	37	0	24	18
Heroin	24	0	15	12
Received drug treatment in the past ^c	35	7	25	20
Currently receiving drug treatment ^c	8	6	7	6
Currently need treatment for: ^c				
Cocaine	18	2	12	10
Crack	38	2	25	19
Heroin	26	1	17	13
Cocaine/crack/heroin	69	5	45	35
Currently dependent on: ^c				
Cocaine	23	6	17	13
Crack	43	9	31	23
Heroin	28	6	20	15
Cocaine/crack/heroin	71	16	51	39
Currently dependent on or need treatment for cocaine/crack/heroin	80	18	57	44

^aReport having used cocaine, crack or heroin 30 of the last 30 days.

^bReport having used cocaine, crack or heroin at least 4 of the last 30 days.

^cSelf-report.

Table VIII: Variation in Demographic and Arrest Attributes by Type of Drug User for the Developmental Sample (DUF-Manhattan 1987-1991, Aged 21+)

Attribute	Percent of Sample	Percent of drug user type at each level of the attribute: ^a					
		Heroin Injector	Crack User	Cocaine Snorter	Marij User	No Det. Use	No Det. or Rep. Use
Distribution of arrestees aged 21+	100.0	13.5	36.4	25.7	3.9	9.8	10.8
Most Serious Arrest Charge (N=5052)							
Drug Possession	10.4	11.9	14.2	10.0	7.6	4.7	3.3
Drug Sale	4.8	4.4	5.9	4.6	4.0	4.3	2.2
Robbery	11.6	6.6	14.6	11.3	13.6	10.9	8.2
Burglary	7.8	10.6	9.3	6.6	4.5	5.1	5.5
Larceny/Auto Theft	21.9	33.2	23.8	18.1	14.1	15.6	19.0
Violent Index	12.7	6.5	8.9	15.4	19.2	18.2	20.0
Other Income Generating	9.7	9.3	6.2	11.1	9.6	10.1	17.9
Other Serious Crime	9.3	7.0	8.4	9.2	11.6	12.1	12.1
Other	11.8	10.6	8.7	13.5	15.7	19.0	11.7
Misdemeanor or Felony (N=5024)							
Misdemeanor	36.1	46.3	36.5	33.3	34.0	36.6	28.7
Felony	63.8	53.5	63.5	66.6	65.5	63.4	71.2
Citation	.1	.1	.1	.1	.5	.0	.2
Gender (N=5052)							
Male	74.0	72.1	71.6	80.0	79.8	68.2	73.3
Female	26.0	27.9	28.4	20.0	20.2	31.8	26.7
Race/Ethnicity (N=4839)^b							
Black	55.8	39.0	70.3	53.5	49.7	56.0	33.7
White	13.0	20.7	8.3	10.9	16.4	20.5	16.8
Hispanic	31.2	40.3	21.4	35.6	33.9	23.5	49.5
Birth Cohort (N=5052)							
1900-44	6.5	4.7	2.9	6.4	6.6	8.1	19.0
1945-49	6.6	10.1	4.2	7.0	4.5	8.3	8.1
1950-54	13.3	25.6	11.7	11.6	9.1	10.3	12.1
1955-59	22.1	28.0	23.0	22.1	13.1	19.6	16.5
1960-64	29.7	20.6	35.0	31.7	28.8	26.7	21.1
1965-69	20.8	10.6	22.0	20.3	35.4	25.5	21.6
1970-74	1.1	.4	1.1	.8	2.5	1.4	1.6
Education (N=3257)^c							
No HS Degree	42.3	39.7	43.9	40.6	46.6	39.6	44.4
HS Grad	24.0	25.7	23.6	25.9	18.3	21.5	24.4
GED	10.0	12.2	11.0	10.0	9.2	10.4	4.4
Some College	16.9	16.5	16.2	16.9	22.9	18.8	15.8
College Degree	6.7	5.9	5.3	6.6	3.1	9.9	10.9
Marital Status (N=5045)^d							
Single	62.2	58.4	69.2	58.1	67.7	64.0	49.7
Married/cmn law	24.1	23.2	17.6	28.2	25.8	22.9	37.8
Sep/wid/div	13.7	18.4	13.2	13.7	6.6	13.2	12.5

Attribute	Percent of Sample	Percent of drug user type at each level of the attribute : ^a					
		Heroin Injector	Crack User	Cocaine Snorter	Marij User	No Det. Use	No Det. or Rep. Use
Distribution of arrestees aged 21+	100.0	13.5	36.4	25.7	3.9	9.8	10.8
Primary Source of Income (N=3483)^e							
Legal Income	45.0	27.3	36.0	56.0	59.8	46.0	65.8
Welfare/SSI	14.8	14.5	15.1	15.3	10.6	19.5	10.6
Unemployed	20.7	23.2	24.0	17.1	18.9	20.8	14.1
Prostitute	4.6	5.7	4.7	3.4	5.3	5.8	4.5
Deal Drugs	4.5	8.3	6.7	2.5	0.0	2.5	.2
Other Illegal	10.5	21.1	13.5	5.8	5.3	5.5	4.7

^aBased on the DUF-Manhattan sample aged 21 years and above.

^bExcludes 213 Asian, Native American, and missing cases.

^cNot collected in 1987-1988 and missing for some cases in 1989-1991.

^dExcludes 7 missing cases.

^eNot collected in 1987-1988 and missing for some cases in 1989-1991.

Table IX: Postdictive Accuracy of Models to Classify Arrestees According to Type of Drug User for the Developmental Sample (DUF-Manhattan 1987-1991)

Type of Drug User	Base Rate ^a (Percent)	Accuracy of the logistic regression model:	
		Highly Likely ^b Number (percent)	Extremely Likely ^c Number (percent)
Heroin Injector	13.5	6 (0.2)	0 (0.0)
Crack User	36.4	210 (6.9)	0 (0.0)
Cocaine Snorter	25.7	0 (0.0)	0 (0.0)
Marijuana User	3.9	0 (0.0)	0 (0.0)
No Detected Use	9.8	0 (0.0)	0 (0.0)
No Detected or Reported Use	10.8	13 (0.4)	0 (0.0)

^aPercent of DUF-Manhattan 1989-1991 arrestees classified as each type of drug user.

^bPercent identified as having a 67% or higher likelihood of detected use among the 3065 DUF-Manhattan 1989-1991 arrestees aged 21 and above whose record include all independent variables used for estimation (no missing values). The 1987-1988 data provide less extensive demographic information than collected in subsequent years.

^cPercent identified as having a 90% or higher likelihood of detected use.

Table X: Covariates of Detected Cocaine-Opiate Use for the Developmental Sample (Logistic Regression, DUF-Manhattan 1987-1991)

Attribute	Level	Estimated Coefficient	Standard Error
Arrest Charge Wald(8)=171.9**	Drug Possession	.82	.17
	Drug Sales	.30	.20
	Robbery	.01	.14
	Burglary	.29	.17
	@Larceny/Auto Theft	.00	
	Violent Index	-.67	.12
	Other Income Generating	-.77	.13
	Other Serious Crime	-.66	.13
	Other	-.75	.13
Misdemeanor/Felony Wald(1)=18.0**	@Misdemeanor	.00	
	Felony	-.39	.09
	Citation	-.37	.95
	Missing Data	-.23	.44
Gender Wald(1)=33.1**	@Male	.00	
	Female	-.52	.09
Race/Ethnicity Wald(3)=57.9**	@Black	.00	
	White	-.59	.11
	Hispanic	-.45	.08
	Missing Data/Other ^a	-.77	.16
Age Wald(8)=123.4**	@21-25	.00	
	26-30	.33	.09
	31-35	.49	.11
	36-40	.33	.12
	41-45	-.22	.16
	46-50	-.86	.20
	51-55	-.82	.27
	56-60	-1.02	.32
61+	-1.78	.35	
Primary Source of Income Wald(6)=83.2**	@Legal Income	.00	
	Welfare	.45	.13
	Unemployed	.37	.11
	Prostitute	.69	.21
	Drug Sales	1.79	.34
	Other Illegal	1.19	.18
Missing Data ^a	.58	.15	
Education Wald(5)=10.8	@No HS Degree	.00	
	HS Graduate	.08	.11
	GED	.29	.16
	Some College	-.18	.12
	College Degree	-.24	.17
Missing Data ^a	.10	.15	
Marital Status Wald(2)=20.4**	@Single	.00	
	Married	-.18	.08
	Sep/Wid/Div	.37	.12
CONSTANT		1.4637	.14

N=5045 (excludes 7 cases missing data for marital status)

-2×Log-Likelihood = 5033.5

@ reference level

* statistically significant $\alpha=.05$ level

** statistically significant $\alpha=.01$ level

^a attribute level included for estimation but not as part of postdiction model.

Table XI: Variation in Detected Cocaine-Opiate Use with Arrest Charge and Age for the Developmental Sample (DUF-Manhattan 1987-1991)

MOST SERIOUS ARREST CHARGE	AGE CATEGORY:									TOTAL
	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61+	
Drug Possession										
Mean	.84	.92	.93	.86	.92	***	***	***	***	.89
Standard Error of Mean	.03	.02	.03	.05	.05	***	***	***	***	.01
Count	148	166	107	58	26	14	4	3	1	527
Drug Sale										
Mean	.88	.83	.86	.68	.87	***	***	***	***	.83
Standard Error of Mean	.04	.05	.05	.10	.09	***	***	***	***	.02
Count	69	64	57	22	15	5	6	1	1	240
Robbery										
Mean	.76	.85	.89	.74	***	***	***	***	***	.79
Standard Error of Mean	.03	.03	.03	.06	***	***	***	***	***	.02
Count	224	162	99	54	20	17	5	3	3	587
Burglary										
Mean	.78	.89	.88	.88	***	***	***	***	***	.84
Standard Error of Mean	.04	.03	.03	.04	***	***	***	***	***	.02
Count	93	102	97	60	19	11	5	2	4	393
Larceny/Auto Theft										
Mean	.80	.81	.86	.84	.71	***	***	***	***	.81
Standard Error of Mean	.02	.02	.02	.03	.06	***	***	***	***	.01
Count	310	318	228	154	55	20	13	2	7	1107
Violent Index										
Mean	.57	.70	.69	.70	.58	***	***	***	***	.63
Standard Error of Mean	.04	.04	.04	.05	.07	***	***	***	***	.02
Count	157	165	130	86	45	26	14	13	8	644
Other Income Generating										
Mean	.62	.73	.76	.76	.58	***	***	***	***	.66
Standard Error of Mean	.05	.04	.04	.05	.08	***	***	***	***	.02
Count	100	117	103	75	38	19	11	15	10	488
Other Serious Crimes										
Mean	.68	.72	.76	.65	***	***	***	***	***	.68
Standard Error of Mean	.04	.04	.04	.07	***	***	***	***	***	.02
Count	137	134	94	51	25	13	8	4	5	471
Other										
Mean	.65	.66	.72	.82	.70	***	***	***	***	.68
Standard Error of Mean	.04	.03	.05	.05	.09	***	***	***	***	.02
Count	187	192	99	65	30	11	3	4	4	595
TOTAL										
Mean	.73	.79	.82	.78	.68	.55	.58	.45	.33	.75
Standard Error of Mean	.01	.01	.01	.02	.03	.04	.06	.07	.07	.01
Count	1425	1420	1014	625	273	136	69	47	43	5052

*** too few cases to reliably estimate the base rate (standard error > .10).

Table XII: Two-Factor Model for the Developmental Sample--Probability of Detected Cocaine-Opiate Use by Arrest Charge and Age (DUF-Manhattan 1987-1991)

MOST SERIOUS ARREST CHARGE	Estimated likelihood of detected cocaine-opiate use by age									TOTAL
	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61+	
Drug Possession	.88	.91	.92	.91	.86	.77	.80	.73	.59	.89
Drug Sale	.81	.85	.87	.85	.78	.66	.70	.62	.46	.83
Robbery	.76	.81	.84	.82	.73	.60	.64	.55	.39	.79
Burglary	.81	.86	.88	.86	.79	.67	.71	.63	.47	.84
Larceny/Auto Theft	.78	.83	.86	.83	.75	.63	.66	.58	.42	.81
Violent Index	.60	.68	.72	.68	.56	.42	.45	.37	.24	.63
Other Income Generating	.64	.71	.74	.71	.59	.45	.49	.40	.26	.66
Other Serious Crimes	.65	.72	.76	.72	.61	.47	.51	.42	.27	.68
Other	.65	.71	.75	.72	.60	.46	.50	.41	.27	.68
TOTAL	.73	.78	.82	.78	.68	.55	.58	.45	.33	.75

Table XIII: Serious Drug Abuser Scale (Detected Cocaine/Opiate Use at Arrest)

Attribute	Level	Points	Score
Arrest Charge	Drug Possession	6	_____
	Drug Sales	4	
	Robbery	3	
	Burglary	4	
	@Larceny/Auto Theft	3	
	Violent Index	1	
	Other Income Generating	0	
	Other Serious Crime	1	
	Other	0	
Misdemeanor/Felony	Misdemeanor	1	_____
	Felony	0	
	Citation	0	
Race/Ethnicity	Black	2	_____
	White	0	
	Hispanic	1	
Gender	Male	2	_____
	Female	0	
Age	21-25	6	_____
	26-30	7	
	31-35	8	
	36-40	7	
	41-45	5	
	46-50	3	
	51-55	3	
	56-60	3	
61+	0		
Primary Income Source	Legal Income	0	_____
	Welfare	2	
	Unemployed	1	
	Prostitute	2	
	Drug Sales	6	
	Other Illegal	4	
Marital Status	Single	1	_____
	Married	0	
	Sep/Wid/Div	2	
FINAL SCORE			_____

Score	0-8	9-11	12-14	15-17	18-27
Inference (likelihood of coc-op+)	Low (<45%)	Intermediate (~50%)	High (67-79%)	Very high (80-89%)	Extremely high (≥90%)

Table XIV: Steps to Converting Logistic Regression Results into the Serious Drug User Scale

Attribute	Level	Estimated Coefficient	Divide by Scaling Factor (.3)	Add most negative value to each level in an attribute	Amount Added
Arrest Charge	Drug Possession	.82	3	6	3
	Drug Sales	.30	1	4	
	Robbery	.01	0	3	
	Burglary	.29	1	4	
	@Larceny/Auto Theft	.00	0	3	
	Violent Index	-.67	-2	1	
	Other Income Generating	-.77	-3	0	
	Other Serious Crime	-.66	-2	1	
	Other	-.75	-3	0	
Misdemeanor /Felony	@Misdemeanor	.00	0	1	1
	Felony	-.39	-1	0	
	Citation	-.37	-1	0	
Race/Ethnicity	Black	.00	0	2	2
	White	-.59	-2	0	
	Hispanic	-.45	-1	1	
Gender	@Male	.00	0	2	2
	Female	-.52	-2	0	
Age	@21-25	.00	0	6	6
	26-30	.33	1	7	
	31-35	.49	2	8	
	36-40	.33	1	7	
	41-45	-.22	-1	5	
	46-50	-.86	-3	3	
	51-55	-.82	-3	3	
	56-60	-1.02	-3	3	
61+	-1.78	-6	0		
Primary Income Source	@Legal Income	.00	0	0	0
	Welfare/SSI	.45	2	2	
	Unemployed	.37	1	1	
	Prostitute	.69	2	2	
	Drug Sales	1.79	6	6	
	Other Illegal	1.19	4	4	
Marital Status	@Single	.00	0	1	1
	Married	-.18	-1	0	
	Sep/Wid/Div	.37	1	2	

Points associated with the reference population 15

Table XV: Postdiction Accuracy of the Full Model for Detected Cocaine-Opiate Use (DUF-Manhattan 1989-1991)

Postdicted Base Rate (percent)	Percent Detected ^a	Number of cases	Percent of sample	Cumulative percent of sample
Extremely High	95-99	182	5.5	5.5
	90-94	360	10.9	16.3
Very High	85-89	424	12.8	29.1
	80-85	507	15.3	44.4
High	75-79	422	12.7	57.2
	70-74	352	10.6	67.8
	67-69	214	6.5	74.2
Intermediate	65-66	113	3.4	77.6
	60-64	226	6.8	84.5
	55-59	158	4.8	89.2
	50-54	104	3.1	92.4
	45-49	84	2.5	94.9
Low	40-44	65	2.0	96.9
	35-39	49	1.5	98.3
	30-34	16	.5	98.8
	25-29	26	.8	99.6
	20-24	9	.3	99.9
	15-19	1	.0	99.9
	10-14	2	.1	100.0
	5-9	1	.0	100.0
TOTAL		3315	100.0	100.0

^aPercent of persons with postdicted base rates in first column actually detected as cocaine-opiate users.

^bStandard error greater than 5%.

Table XVI: Postdiction Accuracy of Arrest Charge-Age Model (Two-Factor Model) of Detected Cocaine-Opiate Use (DUF-Manhattan 1989-1991)

Postdicted Base Rate (percent)	Percent Detected ^a	Number of cases	Percent of sample	Cumulative percent
Extremely High	95-99	0	0.0	0.0
	90-94	225	6.8	6.8
Very High	85-89	570	17.2	24.0
	80-84	663	20.0	44.0
High	75-79	540	16.3	60.3
	70-74	535	16.1	76.4
	67-69	198	6.0	82.4
Intermediate	65-66	184	5.6	87.9
	60-65	234	7.1	95.0
	55-59	55 ^b	1.7	96.7
	50-54	60 ^b	.2	96.8
	45-49	43 ^b	1.2	98.0
Low	40-44	35 ^b	1.1	99.1
	35-39	42 ^b	.4	99.4
	30-34	0	0.0	99.4
	25-29	15 ^b	.4	99.8
	20-24	33 ^b	.2	100.0
TOTAL		3315	100.0	100.0

^aPercent of persons with postdicted base rates in first column actually detected as cocaine-opiate users.

^bStandard error greater than 5%.

Table XVII: Postdicted Distribution of Scores on the Serious Drug Abuser Scale
(DUF-Manhattan 1989-1991)

Serious Drug Abuser Scale Score		<u>Actual</u> Percent Detected	<u>Predicted</u> Based on Scale Score	Number of cases ^a	Percent of sample	Cumulative percent
Extremely High (≥90%)	27					
	26					
	25	100 ^b	99	3	.1	.1
	24	100 ^b	98	9	.3	.4
	23	100 ^b	98	15	.5	.8
	23	96	97	26	.8	1.6
	21	97	96	60	1.8	3.4
	20	92	95	87	2.6	6.0
	19	91	93	137	4.1	10.2
	18	90	91	186	5.6	15.8
Very High (80-89%)	17	89	89	258	7.8	23.6
	16	84	85	347	10.5	34.0
	15	82	81	453	13.7	47.7
High (67-79%)	14	75	76	444	13.4	61.1
	13	70	70	417	12.6	73.7
	12	58	64	344	10.4	84.0
Intermediate (45-66%)	11	66	57	232	7.0	91.0
	10	47	49	130	3.9	95.0
	9	42	42	86	2.6	97.6
Low (<45%)	8	44 ^b	35	45	1.4	98.9
	7	13 ^b	28	16	.5	99.4
	6	33 ^b	23	15	.5	99.8
	5	0 ^c	18	2	.1	99.9
	4	0 ^c	14	2	.1	100.0
	3	0 ^c	11	1	.0	100.0
	2					
	1					
0						

^aBased on the 3315 DUF-Manhattan arrestees from 1989-1991 whose records include all arrest and demographic information necessary to calculate a score.

^bToo few cases to accurately estimate the proportion detected as cocaine-opiate users. The standard error for other estimates ranges from 2 to 5 percent.

Table XVIII: Covariates of Serious Drug Use in for the Prediction Sample (DUF-Manhattan, 1992+1Q93)

DUF-Manhattan (1992+1Q93)				DUF-Manhattan (1987-1991)		
Attribute	Level	Estimated Coefficient	Standard Error	Wald	Coeff	S.E.
Arrest Charge Wald(8)=70.9**	Drug Possession	.94	.33	171.9**	.82	.17
	Drug Sales	.94	.37		.30	.20
	Robbery	.02	.31		.01	.14
	Burglary	.14	.35		.29	.17
	@Larceny	.00			.00	
	Violent Index	-1.01	.25		-.67	.02
	Other Inc. Gen.	-.98	.29		-.77	.13
	Other Ser. Crime	-.70	.28		-.66	.13
	Other	-.61	.31		-.75	.13
Misdemeanor/Felony Wald(3)=1.1	@Misdemeanor	.00		18.0**	.00	
	Felony	-.15	.21		-.39	.09
	Citation	-1.05	1.49		-.37	.95
	Missing	-.46	.97		.23	.44
Gender Wald(1)=.7	@Male	.00		33.1**	.00	
	Female	-.15	.19		-.52	.09
Race/Ethnicity Wald(3)=22.1**	@Black	.00		57.9**	.00	
	White	-.48	.21		-.59	.11
	Hispanic	-.76	.17		-.45	.08
	Missing Data/Other	-.96	.44		-.77	.16
Age Wald(8)=29.3**	@21-25	.00		123.4**	.00	
	26-30	.74	.20		.33	.09
	31-35	1.05	.22		.49	.11
	36-40	.66	.24		.33	.12
	41-45	.89	.31		-.22	.16
	46-50	.79	.48		-.86	.20
	51-55	.12	.50		-.82	.27
	56-60	.21	.84		-1.02	.32
	61+	-.30	.77		-1.78	.35
Primary Source of Income Wald(6)=35.1**	@Legal income	.00		83.2**	.00	
	Welfare	.49	.19		.45	.13
	Unemployed	.78	.35		.37	.11
	Prostitute	.14	.32		.69	.21
	Drug sales	1.55	.45		1.79	.34
	Other illegal	1.24	.27		1.19	.18
	Missing Data	-.03	.50		.58	.15
Education Wald(5)=11.7*	@No HS Degree	.00		10.8	.00	
	HS Graduate	.231	.201		.08	.11
	GED	.321	.260		.29	.16
	Some College	-.200	.207		-.18	.12
	College Degree	-.269	.271		-.24	.17
	Missing Data	-2.367	1.051		.10	.15
Marital Status Wald(2)=5.4	@Single	.00		20.4**	.00	
	Married	-.29	.17		-.18	.08
	Sep/wid/div	.22	.22		.37	.12
CONSTANT		.8957	.30		1.46	.14

N=1297

-2xLog-Likelihood = 1216.5

@ reference level

* statistically significant $\alpha=.05$ level

** statistically significant $\alpha=.01$ level

Table XIX: Two-Factor Model for the Prediction Sample--Probability of Detected Cocaine-Opiate Use by Arrest Charge and Age (DUF-Manhattan 1992+1Q93, N=1297)

Most Serious Arrest Charge	Estimated likelihood of detected cocaine-opiate use for age:									TOTAL
	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61+	
Drug Possession	.84	.92	.94	.92	.94	.90	.87	.88	.80	.91
Drug Sale	.82	.91	.93	.90	.92	.88	.84	.85	.78	.89
Robbery	.68	.83	.87	.82	.86	.79	.72	.74	.63	.80
Burglary	.69	.83	.88	.82	.86	.79	.73	.75	.64	.83
Larceny/Auto Theft	.69	.83	.87	.82	.86	.79	.73	.74	.63	.80
Violent Index	.41	.60	.69	.59	.66	.54	.46	.48	.35	.58
Other Income Generating	.43	.62	.70	.61	.67	.55	.47	.50	.37	.59
Other Serious Crime	.51	.69	.76	.68	.74	.63	.55	.57	.44	.66
Other	.53	.71	.78	.70	.75	.66	.58	.60	.46	.66
TOTAL	.63	.78	.84	.80	.80	.73	.59	.57	.50	.75

Table XX: Distribution of Scores on the Serious Drug Abuser Scale (DUF-Manhattan 1992+1Q93)

Serious Drug Abuser Scale Score	<u>Actual</u>		<u>Predicted</u>		Number of cases ^a	Percent of sample	Cumulative percent
	Percent Detected	Percent Detected	Based on Scale Score	Based on Scale Score			
Extremely High (≥90%)	27						
	26	100 ^b		99	1	.1	.1
	25	100 ^b		99	1	.1	.2
	24	67 ^b		98	3	.2	.4
	23	96		98	26	2.1	2.5
	23	94 ^b		97	18	1.4	3.9
	21	97		96	34	2.7	6.7
	20	96		95	46	3.7	10.4
	19	92		93	76	6.1	16.5
	18	89		91	94	7.6	24.0
Very High (80-89%)	17	89		89	114	9.2	33.2
	16	83		85	105	8.4	41.6
	15	77		81	137	11.0	52.6
High (67-79%)	14	80		76	138	11.1	63.7
	13	69		70	140	11.2	74.9
	12	60		64	118	9.5	84.4
Intermediate (45-66%)	11	55		57	89	7.1	91.6
	10	50 ^b		49	54	4.3	95.9
	9	50 ^b		42	22	1.8	97.7
Low (<45%)	8	38 ^b		35	16	1.3	99.0
	7	33 ^b		28	12	1.0	99.9
	6	0 ^b		23	1	.1	100.0
	5						
	4						
	3						
	2						
	1						
0							

^aBased on the 1245 DUF-Manhattan arrestees from 1992+1Q93 whose records include all arrest and demographic information necessary to calculate a score.

^bToo few cases to accurately estimate the proportion detected as cocaine-opiate users. The standard error for other estimates ranges from 2 to 5%.

Table XXI: Variation in Distribution of Scores on the Serious Drug Abuser Scale Across Interview Years and Locations

Serious Drug Abuser Scale Score		Cumulative Percent with Score by Year:					
		Manhattan					Four Cities ^a
		1989	1990	1991	1992	1993	1989
Extremely High (90-100%)	27						
	26					.3	
	25	.1		.2		.5	.1
	24	.2	.2	.7	.3	.5	.2
	23	.6	.5	1.3	2.4	2.6	.3
	22	1.3	1.1	2.3	4.2	3.4	.7
	21	3.0	2.8	4.3	6.6	6.9	2.0
	20	6.3	4.3	7.4	10.6	9.8	5.0
	19	10.8	7.9	11.6	17.1	15.0	9.6
	18	16.2	12.8	18.1	23.1	26.1	16.1
Very High (80-89%)	17	24.4	19.1	26.8	32.6	34.6	25.6
	16	34.3	31.2	36.3	40.8	43.5	37.1
	15	48.3	46.0	48.6	52.1	53.8	50.6
High (67-79%)	14	60.8	60.1	62.3	63.0	65.2	63.6
	13	73.3	72.6	75.0	75.2	74.4	74.0
	12	84.1	82.9	85.1	85.0	83.1	84.6
Intermediate (45-66%)	11	90.5	91.2	91.4	92.0	90.5	91.2
	10	94.8	95.3	94.8	96.1	95.5	95.6
	9	97.6	97.5	97.6	97.7	97.6	97.9
Low (0-44%)	8	98.8	98.9	99.0	99.0	98.9	99.1
	7	99.3	99.5	99.4	99.9	100.0	99.6
	6	99.8	99.9	99.8	100.0		99.8
	5	99.9	99.9	99.9			99.9
	4	99.9	100.0	100.0			100.0
	3	100.0					100.0
	2						
	1						
	0						
Mean Scale Score (Standard Error)		14.4 (.1)	14.2 (.1)	14.6 (.1)	15.0 (.1)	15.0 (.2)	14.5 (.1)
Percent Detected as Cocaine-Opiate Users		76.4	74.1	71.1	75.1	76.2	68.3
Number of Subjects		1119	1045	1151	866	379	2758

^aPhiladelphia, Chicago, Cleveland and Detroit.

Table XXII: Overall Base Rate of Detected Cocaine-Opiate Use among DUF Arrestees Aged 21+ from Philadelphia, Chicago, Cleveland and Detroit (1988-1989)

City	Sample Size ^a	Percent Detected as Cocaine-Opiate Users
Manhattan	5052	75
Philadelphia	1941	75
Chicago	1080	68
Cleveland	794	60
Detroit	1180	60
All Four Other Northeast Cities	4995	68

Table XXIII: Covariates of Detected Cocaine-Opiate Use in Cross-Validation Sample (Logistic Regression with DUF Philadelphia, Chicago, Cleveland and Detroit, 1988-1989)

DUF Philadelphia, Chicago, Cleveland and Detroit (1988-1989)				DUF-Manhattan (1987-1991)		
Attribute	Level	Estimated Coefficient	Standard Error	Wald	Coeff	S.E.
Arrest Charge Wald(8)=229.8**	Drug Possession	.83	.13	171.9**	.82	.17
	Drug Sales	.26	.18		.30	.20
	Robbery	-.06	.15		.01	.14
	Burglary	.07	.14		.29	.17
	@Larceny	.00			.00	
	Violent Index	-.86	.12		-.67	.02
	Other Inc. Gen.	-.82	.18		-.77	.13
	Other Ser. Crime	-.37	.13		-.66	.13
	Other	-.46	.13	-.75	.13	
Misdemeanor/Felony Wald(3)=2.8	@Misdemeanor	.00		18.0**	.00	
	Felony	-.02	.09		-.39	.09
	Citation	.02	.28		-.37	.95
	Missing	.55	.34		.23	.44
Gender Wald(1)=.7	@Male	.00		33.1**	.00	
	Female	.09	.11		-.52	.09
Race/Ethnicity Wald(3)=88.5**	@Black	.00		57.9**	.00	
	White	-.82	.09		-.59	.11
	Hispanic	.43	.14		.45	.08
	Missing Data/Other	-.49	.28		-.77	.16
Age Wald(8)=124.7**	@21-25	.00		123.4**	.00	
	26-30	.35	.09		.33	.09
	31-35	.32	.10		.49	.11
	36-40	.29	.12		.33	.12
	41-45	-.19	.16		-.22	.16
	46-50	-.82	.20		-.86	.20
	51-55	-.95	.27		-.82	.27
	56-60	-2.13	.41		-1.02	.32
	61+	-1.46	.33		-1.78	.35
Primary Source of Income Wald(6)=65.7**	@Legal income	.00		83.2**	.00	
	Welfare	.57	.11		.45	.13
	Unemployed	.80	.15		.37	.11
	Prostitute	1.12	.45		.69	.21
	Drug sales	1.03	.37		1.79	.34
	Other illegal	2.12	.60		1.19	.18
	Missing Data	.22	.12		.58	.15
Education Wald(5)=13.1*	@No HS Degree	.00		10.8	.00	
	HS Graduate	-.33	.12		.08	.11
	GED	.13	.17		.29	.16
	Some College	-.31	.14		-.18	.12
	College Degree	-.03	.23		-.24	.17
	Missing Data	-.12	.12		.10	.15
Marital Status Wald(2)=6.1*	@Single	.00		20.4**	.00	
	Married	-.19	.08		-.18	.08
	Sep/wid/div	-.02	.10		.37	.12

DUF Philadelphia, Chicago, Cleveland and Detroit (1988-1989)				DUF-Manhattan (1987-1991)		
Attribute	Level	Estimated Coefficient	Standard Error	Wald	Coeff	S.E.
Site Wald(3)=59.0**	@Philadelphia	.00				
	Chicago	-.46	.10			
	Cleveland	-.76	.11			
	@Detroit	-.72	.11			
CONSTANT		1.2784	.15		1.46	.14

N=4984

-2xLog-Likelihood = 5498.5

@ reference level

* statistically significant $\alpha=.05$ level

** statistically significant $\alpha=.01$ level

Table XXIV: Two-Factor Model with Cross-Validation Sample--Probability of Detected Cocaine-Opiate Use by Arrest Charge and Age (DUF Philadelphia, Chicago, Cleveland, Detroit 1988-1989, N=4995)

Most Serious Arrest Charge	Estimated likelihood of detected cocaine-opiate use by age:									TOTAL
	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61+	
Drug Possession	.82	.86	.85	.85	.77	.66	.64	.36	.52	.83
Drug Sale	.79	.84	.83	.83	.75	.63	.60	.32	.48	.80
Robbery	.72	.78	.77	.77	.67	.53	.58	.24	.38	.74
Burglary	.73	.78	.78	.77	.67	.54	.51	.25	.39	.75
Larceny/Auto Theft	.72	.78	.77	.77	.67	.53	.51	.24	.38	.74
Violent Index	.50	.57	.57	.56	.43	.30	.28	.11	.19	.51
Other Income Generating	.48	.55	.54	.54	.41	.28	.26	.10	.18	.48
Other Serious Crime	.57	.64	.63	.63	.50	.37	.34	.14	.24	.58
Other	.55	.62	.61	.61	.49	.35	.32	.13	.23	.58
TOTAL	.67	.73	.72	.71	.58	.45	.43	.17	.30	.68

Table XXV: Distribution of Scores on the Serious Drug Abuser Scale for the Cross-Validation Sample (DUF Philadelphia, Chicago, Cleveland, Detroit 1989)

Serious Drug Abuser Scale Score		<u>Actual</u> Percent Detected	<u>Predicted</u> Based on Scale Score	Number of cases ^a	Percent of sample	Cumulative percent
Extremely High (≥90%)	27					
	26					
	25	100 ^b	99	2	.1	.1
	24	33 ^b	98	3	.1	.2
	23	75 ^b	98	4	.1	.3
	23	100 ^b	97	9	.3	.7
	21	94	96	36	1.3	2.0
	20	96	95	84	3.0	5.0
	19	91	93	128	4.6	9.6
	18	86	91	177	6.4	16.1
Very High (80-89%)	17	78	89	264	9.6	25.6
	16	79	85	316	11.5	37.1
	15	74	81	373	13.5	50.6
High (67-79%)	14	67	76	358	13.0	63.6
	13	67	70	286	10.4	74.0
	12	49	64	293	10.6	84.6
Intermediate (45-66%)	11	51	57	183	6.6	91.2
	10	38	49	120	4.4	95.6
	9	36 ^b	42	64	2.3	97.9
Low (<45%)	8	25 ^b	35	32	1.2	99.1
	7	43 ^b	28	14	.5	99.6
	6	0 ^b	23	6	.2	99.8
	5	25 ^b	18	4	.1	99.9
	4	0 ^b	14	1	.0	100.0
	3	0 ^b	11	1	.0	100.0
	2					
	1					
0						

^aBased on the 2758 DUF arrestees from 1989 whose records include all arrest and demographic information necessary to calculate a score.

^bToo few cases to accurately estimate the proportion detected as cocaine-opiate users. The standard error for other estimates ranges from 2 to 5%.