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TRACKING THE CRACK EPIDEMIC IN NEW YORK CITY USING DATA FROM THE DRUG USE FORECASTING PROGRAM

Running Head: Tracking the Crack Epidemic

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ABSTRACT

This paper presents a hypothetical model for the crack epidemic as consisting of four phases: incubation, expansion, plateau and decline. Each successive phase can be distinguished by the quantity and type of persons first initiating crack use and continuing its use over time. Findings with data from arrestees interviewed in the Drug Use Forecasting program suggest that crack's popularity in New York City expanded rapidly from 1981 to 1985 among existing hard drug users. Crack was subsequently popular from 1984 to 1987 among youths first coming of age and experimenting with hard drugs (about age 18)--the plateau phase. Starting in 1988, many fewer high risk youths initiated crack use--a decline phase. These findings suggest that the crack problem facing New York City in the 1990s primarily results from existing crack users persisting in their habits.

BIOGRAPHICAL SKETCHES

Andrew Golub is an Assistant Professor of Public Administration at John Jay College of Criminal Justice and a Principal Research Associate at National Development and Research Institutes, Inc. His primary research focus is the use of analytical techniques for the evaluation and improvement of social policy. He is currently studying the potential for coordination of criminal justice and drug treatment programs to better serve their heavily overlapping clienteles and the community in general.

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The recent crack epidemic has provided a focal point for problems of public health, crime and economics dating back at least as far as November, 1985, when a front-page article in the New York Times (Brody, 1985) warned of this growing problem. Crack, however, was not the only drug use fad to have been of major concern in recent years. Johnson and Manwar (1991)--based on their long-term ethnographic experience in New York City, and their reading of mass media and scholarly literature--suggested that New York City experienced a succession of drug eras including periods of widespread marijuana use (1965-79), heroin injection (1963-73), cocaine snorting (1975-1984), cocaine freebasing (1980-84), and crack smoking (1985-1991+).

Musto (1987) suggested that widespread use and abuse of drugs followed by harsh public outrage and public policy reaction has been a continuous theme in American history. Reinarman and Levine (1989a, 1989b) and Belenko (1993) provided support for the idea that the recent response to the crack epidemic in the media and public policy had indeed been an overreaction. This included newspapers and magazine articles on such heinous characteristics of crack such as its instant addictiveness, the manic violence it induces, and problems faced by crack babies, characteristics which have since been shown to be largely unfounded (Johnson, Golub and Fagan, 1994). Belenko (1993) reported that the fight against this mythical scourge has lead to increased use of policing, and increased prison-terms especially for crack offenders.

Musto (1992) indicated that the U.S. experienced a previous epidemic of cocaine use around the turn of this century, 1885-1920s, when its use was legal and primarily unrestricted. The following quote illustrates its widespread availability:

> The neighborhood drugstore soda fountain of late-19th-century America came to serve as the poor man's Saratoga Springs. There, the weary citizen could choose from among dozens of soda pop pick-me-ups [containing cocaine], including Cola Coke, Rocco Cola, Koca Nola, Nerv Ola, Wise Ola, and one with the simple and direct name, Dope. (Musto, 1989; p. 61)

Musto (1987) further suggested that the public reaction to the widespread use and abuse of cocaine, alcohol, heroin and other opiates were central to the historic anti-drug legislation of the early Twentieth Century: the Pure Food and Drugs Act of 1906, the Harrison Act of 1914 and Alcohol Prohibition in 1919.

What was dramatically different about the recent epidemic of crack smoking in the 1980s was the extent to which the changes in the popularity of cocaine use was documented as it occurred. Changing preferences in drug use have been noted through ongoing drug use nationwide surveys such as Monitoring the Future [MTF] and the National Household Survey on Drug Abuse [NHSDA] as well as the Drug Use Forecasting [DUF] program (DOJ, 1992). In addition, several extended ethnographic studies corroborate the existence of a crack epidemic in New York City and provide insightful information into the context of cocaine use (Hamid, 1992; Johnson, Williams, Dei, Sanabria, 1990; Williams, 1989, 1992).

Several researchers have suggested that there is a specific pattern to the rising and ebbing of a particular drug's popularity (Becker, 1967; Hamid, 1992; Johnson, 1991; Johnson and Manwar, 1991; Johnston, 1991). This idea was operationalized in this study as a hypothetical model of the crack epidemic in New York City composed of four phases: incubation, expansion, plateau and decline. This model hypothesized that the crack epidemic started with an incubation period during which a limited group of existing drug users pioneered the idea of cocaine smoking. Hamid (1992) and Seigel (1982) suggested that the broader popularity of crack cocaine originated with the cocaine freebasing via the more technically challenging and dangerous method of heating cocaine powder with ether over an open flame, a practice limited to cocaine dealers, Rastafarians, and wealthier individuals at after-hours clubs in inner-city New York from 1979 to 1981. These users quite possibly were the pioneers of later crack epidemic. Johnson, Lewis and Golub (1992) further supported the idea of incubation period through analysis of data from the Careers in Crack project--a collection of 1003 drug and crime life histories obtained in 1988-89 from primarily frequent crack users; few of these current crack

users had initiated use of crack prior to 1983, although a modest portion (11%) had used cocaine freebase by this time.

The development and acceptance of crack cocaine--a prepackaged, ready-to-smoke form of cocaine freebase--in the mid-1980s allowed more individuals to engage in cocaine smoking due to crack's low price and ease of use (Hamid, 1992). Our model hypothesized that knowledge of the technique spread according to a diffusion of innovation process in which with the pioneers of cocaine smoking recruited or "turned on" other existing hard drug users. (Bartholomew, 1982, describes the mathematics of such word-of-mouth communication processes.) Johnson, Lewis and Golub (1992) found an increasing number of primarily adults with existing patterns of hard drug use--including snorting cocaine, freebasing cocaine or injecting heroin--reported initiation to crack use from about 1983 to 1985, suggesting these years comprised the expansion phase.

The hypothesized model of a diffusion of innovation process suggested that after most existing users of other hard drugs either initiated crack use or at least had the opportunity, the increase in the number of new crack users slowed substantially. During this plateau phase a relatively steady stream of youths first coming of age and starting hard drug use initiated use of the already popular drug. Johnson, Lewis and Golub (1992) found most of the crack users in 1988-89 who had not been hard drug users in 1982 had initiated use of crack from 1985 to 1987, subsequent to the rapid expansion of use among established hard drug users.

This model further hypothesized that crack use did or will persist during a decline phase as existing users continue its use even after youths first coming of age choose not to use crack. This hypothesis was drawn by analogy with the epidemic of heroin injection which prevailed in New York City during the 1960s and early 1970s (Boyle and Brunswick, 1980; Clayton and Voss, 1981; Hunt and Chambers, 1976; Johnson and Manwar, 1991). Currently, heroin injection is still a problem in New York City. However, heroin injection among arrestees coming in contact with the criminal justice system in the 1990s is dominated by persons in their forties and 50s who

initiated heroin injection during heroin injection's heyday, 1965-73 (Johnson, Golub and Hossain, 1992; Golub and Johnson, 1994b).

The use of crack may have stopped spreading, possibly signalling the start of the epidemic's decline around 1989. Hamid (1992) observed that youths began to disdain crack use, considered "crackhead" a dirty word, and even took to abusing crackheads. Whereas widespread use of cocaine and crack in New York City has persisted into the early 1990s (NIJ, 1993) this use might be the result of existing users continuing their practices and may not include many new users. If this is the case, then use of crack cocaine may gradually disappear over time eventually reaching insignificant levels many years in the future.

The data collected by the DUF program in Manhattan provided an excellent opportunity to investigate the reasonableness of the hypothesized four phases to the crack epidemic. In particular, this paper analyzes the date of first use of crack and the prevalence of detected cocaine use indicated by arrestees recruited by the DUF program in Manhattan as they vary over time. The DUF-Manhattan data are particularly well-suited for tracking the course of the crack epidemic for several reasons. First, the DUF program accurately detects recent drug use through urine tests. Obtaining accurate information about drug use can be difficult. A recent report by the U.S. General Accounting Office (1993) suggested that self-reported rates of drug use provided by MTF and NHSDA may be seriously understated due to subjects' unwillingness to report drug use.

Second, DUF oversamples serious drug abusers. Both the MTF and NHSDA programs tend to undersample particularly troubled drug abusers who tend to drop out of school and may not live in a stable household (Hser, 1991). In contrast, the DUF program recruits persons who are arrested for crimes, such arrestees often have many serious problems, and typically reside in low income, inner-city neighborhoods. Many such persons also have serious drug problems and prior research suggests that persons are most likely to sustain arrests during periods of persistent and frequent drug use (Chaiken and Chaiken, 1990). Typically, about one-half or more of the

DUF sample are detected as recent users of one or more illicit drugs (primarily cocaine), in each city in which the program is implemented (Mieczkowski et al., 1992; NIJ, 1992). MTF and NHSDA recruitment procedures, by contrast, typically identify few users of hard drugs such as cocaine, crack or heroin, and consequently provide limited information for identifying trends in their use.

Third, the DUF program collects information about trends in specific jurisdictions. In contrast, MTF and NHSDA provide nationally representative samples. Localized data is particularly important in tracking drug use trends, because these trends can start and finish at different times in different places.

Fourth, the DUF program collects information quarterly--MTF and NHSDA currently collect data annually. Consequently, the DUF program can potentially identify important changes in drug use earlier and with greater precision.

METHOD

DATA

The Drug Use Forecasting 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 including 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 (NIJ, 1992; Wish and Gropper, 1990). 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). In Manhattan,

this recruitment occurs at central booking and includes persons arrested as adults. A modest number of juvenile arrestees for particularly serious offenses aged less than 18 are brought to Manhattan central booking. A number of DUF locations also recruit arrestees at a juvenile facility, although Manhattan is not one of them.

The interviewers ask a standard set of questions in as private a location as possible. At the end, the interviewer requests a urine specimen. Some sites provide an incentive such as cigarettes or candy, while others offer no such incentive to participate. Consistently, 80-95 percent or more of all persons approached give their consent, complete the DUF interview, and provide sufficient urine for urinalysis (Chaiken, Chaiken and Poulin, 1993).

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 compared with the general arrest population (about 10-15 percent of all arrestees are female). The DUF coordinator in each city carefully edits all of the completed interview schedules and sends them to the NIJ contractor for further editing. About two years later, cleaned data from all sites are made available as a public release data set for all cities, and for selected cities.

All urine specimens are labeled with the same code number as the interview schedule to allow for subsequent matching and sent to Pharm Chem (the DUF urinalysis contractor). Pharm Chem completes an EMIT (enzyme immunoassay test) test for 10 different drugs (amphetamines, barbiturates, benzodiazepines, cannabis, cocaine, methadone, and methaqualone, opiates such as heroin, phencyclidine, propoxyphene). The EMIT screen for urine samples can accurately detect illicit drug use within the past 48 to 72 hours for cocaine and is thus a reliable and valid indicator (Wish and Gropper, 1990). The EMIT urine test is quite accurate in detecting illicit drug use. Visher (1991) compared EMIT results for 2,668 parolees and arrestees

with those from another extremely-accurate, more-expensive test, gas chromatography/mass spectrometry. The study indicated that the standard cutoff levels resulted in very few persons incorrectly classified as recent users (a false positive rate around 2%) for opiates, cocaine, marijuana, PCP, and amphetamines. The false negative rate--persons incorrectly classified as non-users--was somewhat higher (around 20%)--due primarily to the choice of cutting points chosen by the National Institute on Drug Abuse. Hence, the DUF program will tend to modestly underestimate the true prevalence of recent drug use within a sample.

Standardized procedures make DUF data very robust for analyzing trends in illicit drug use both via urinalysis and self-reports within each site. Since its inception, DUF interview procedures have been standardized. The same sample sizes (about 350 subjects) have been obtained quarterly 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.

At its inception the DUF program was explicitly designed to address trends within 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. DUF samples are typically not representative of the general communities where data collection occurs. GAO (1993) suggested that the prevalence of drug use detected with DUF is typically much higher.

Chaiken, Chaiken and Poulin (1993) examined how closely the DUF samples approximated a representative sample of arrestees within the selected sites and reached three general conclusions

> 1) The characteristics of DUF samples are very similar to all booked arrestees. 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--tend to account for any 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.

CHARACTERISTICS OF DUF-MANHATTAN ARRESTEES

The DUF-Manhattan program began in the second quarter of 1987 [2Q87], and at the time of this analysis, data were available through 1Q93, a period of six years. This sample includes a disproportionately serious group of offenders. Table 1 reports that most (66%) of the 7,465 arrestees were charged with a felony.[1] Table 1 also reports the nature of the most serious offense charged at arrest. Many arrests (41%) were for property, index offenses--robbery, burglary and larceny/auto theft accounted for 14%, 7%, and 20%, respectively. More modest percentages were for drug possession (11%), drug sales (6%) and the violent index crimes of assault, homicide and rape (13%). The remaining arrests for non-index and non-drug offenses comprised just over one-quarter of the sample (28%) and include other income generating offenses such as forgery and pickpocketing (8%), other serious crimes against person/property such as arson, weapons, and family offenses (9%), and other offenses including bribery and prostitution (11%).

[Table 1 about here]

Table 1 also reports demographic characteristics for DUF-Manhattan arrestees. The DUF program purposefully oversamples female offenders. In this sample they comprised about

one-quarter of the interviewees (26%). Most of the arrestees were minorities (54% Black and 30% Hispanic).[1] The modal birth year was 1960 corresponding to a modal age at interview in the late 20s or early 30s.

Prior drug use was quite high among DUF-Manhattan arrestees. Table 1 reports that nearly all (90%) subjects reported having used alcohol at some time in their life and most (74%) report having used marijuana. Among hard drug practices, the majority reported having snorted cocaine (56%), almost half reported having smoked crack (45%), and a sizeable minority report having injected drugs (21%).

Which drugs an individual had used prior to the crack epidemic was central to the analysis of variation in date of crack initiation. This construct was operationalized as a "pre-1980 drug-use hierarchy" with the following categories: non-use (35%), alcohol (13%), marijuana (24%), drug injection (primarily heroin, 12%), cocaine powder (13%), and crack (3%). The first three levels of drug use correspond to the widely-observed gateway model of drug use which identifies a typical succession of drugs used by those who became hard drug users (Golub and Johnson, 1994b, In Press; Kandel, 1978; Kandel, Yamaguchi and Chen, 1992). Tobacco, another important gateway drug, was excluded from this analysis, because information about its use was not collected in the DUF survey prior to 2Q92.

Arrestees who reported never engaging in any of the five drug practices included in the hierarchy prior to 1980 were classified as pre-1980 non-users. Those who reported only alcohol as alcohol users, and those who reported marijuana use and use of no other drugs except perhaps alcohol as marijuana users.

Arrestees who reported injecting drugs, snorting cocaine or smoking crack prior to 1980 were classified as various pre-1980 hard drug users. These persons with established habits of hard drug use prior to the crack epidemic were likely to have been among the early crack initiates. The order of the hierarchy was based upon the chronological order in which each drug held widespread popularity in New York City based on the periods suggested by Johnson and

Manwar (1991): drug injector, cocaine snorter, crack smoker. Golub and Johnson (In Press) examined the sequence of hard drugs used leading up to use of crack by subjects of the Careers in Crack project. They found that a drug user's pathway to crack tended to mirror the historical periods following a person's eighteenth birthday; nearly all of the more recently born crack abusers had not injected heroin and some had not even snorted cocaine. Similarly, among those DUF-Manhattan arrestees classified as pre-1980 drug injectors, 91% reported having snorted cocaine. In contrast, these drug-injecting cocaine snorters comprised only 16% of the pre-1980 cocaine snorters.

ANALYSIS

Variations in the dates of crack initiation and prevalence of detected cocaine use among DUF-Manhattan arrestees were examined to determine the reasonableness of the four-phased model hypothesized to explain the crack epidemic in New York City. These analyses also suggested when each phase occurred and the present state of the crack epidemic. To the extent that the model continues to hold, this analysis provides a trajectory for the remaining course of the crack epidemic.

The first step involved plotting both the year of crack initiation and the prevalence of detected cocaine use as a function of time. The EMIT screen employed by DUF detects use of cocaine within the past 48 to 72 hours but does not distinguish mode of use (i.e., snorting, smoking or injecting). Consequently, time variations in self-reported prevalence of crack smoking from 2Q89--when the crack use questions were first included in the DUF survey--were also examined. These self-reports were subjects to various potential errors of recall and misrepresentation and it was anticipated that these rates would be substantially lower than the rates identified through urinalysis.

Interpreting the plot of crack initiation by year was complicated by the extended period over which data was collected, 1987-1Q93. Arrestees interviewed in 1987 could not possibly

have reported initiation in 1988 or later, thus substantially biasing the relative rates of crack initiation in 1987 and after. Additionally, persons who initiated crack use early in the epidemic (i.e., around 1980) had more time to have stopped both their drug use and criminal behavior by 1993 than by 1987 and were thus probably underrepresented among subjects interviewed in later years.

Multiple regression was used to identify how the average year of crack initiation varied with the following attributes for those arrestees initiating use in 1980 or later: race/ethnicity, gender, birth year, pre-1980 drug use, arrest charge and interview year. Each variable was coded as a categorical variable. Interview year was included in this analysis to identify the extent to which the lengthy data collection period distorted the average crack initiation year. Interview year was coded as a sequence of inclusive dummy variables for each year subsequent to 1987 (i.e., 1988 and later, 1989 and later, etc.). Thus, an arrestee interviewed in 1990 would be coded with a positive value for the 1988, 1989 and 1990 dummy variables. By this means, the levels associated with interview year identified the incremental in mean year of crack initiation influence of each interview year over its preceding year. It was anticipated that increments would fall between 0 and 1. An increment of 0 would have indicated that most crack users initiated use during the same period of time predating 1987, suggesting that the crack epidemic was well into its decline phase by 1987. An increment of 1 would have indicated a steady-state situation in which roughly the same number of persons initiated and stopped using crack in each successive year since 1987, as hypothesized would have occurred during the plateau phase. An increment between 0 and 1 would have suggested a transition period.

This paper presents graphs of prevalence of detected cocaine use, over time for adult (age 21+) and youthful (age <20) arrestees. These findings were further substantiated by analyses of prevalence of self-reported crack use. Golub and Johnson (1994a) examined covariates of the change in prevalence of cocaine use among youthful (aged 18-20) arrestees by means of logistic regression, postdiction and age-period-birth cohort analysis. The

age-period-birth cohort analysis was reproduced from Golub and Johnson (1994a) to complete the presentation of DUF's ability to track the crack epidemic.

RESULTS

YEAR OF CRACK INITIATION

Few arrestees reported having initiated use of crack prior to 1980 as indicated in Figure 1. A rapidly increasing number report having initiated it in subsequent years, suggesting that the incubation period for the crack epidemic occurred in the very late 1970s or early 1980s consistent with Hamid's (1992) observation about the growing interest in cocaine freebase occurring at this time. The DUF questionnaire has never distinguished year of first use of crack from the smoking of cocaine freebase. Hence, much of the "crack initiation" reported by subjects around 1980 may actually have been initiation to smoking of cocaine freebase (and not crack).

[Figure 1 about here]

The size of the cocaine smoking population appears to have expanded rapidly during the early 1980s with the largest number of users beginning in 1986, suggesting that the plateau phase of the crack epidemic may have been reached by around this time. Some of the observed decline in crack initiation after 1986 may be attributable to the fact that DUF interviewing started in 1987.

Table 2 presents the multiple regression results identifying covariates of year of crack initiation. The estimated mean year of crack initiation reported at the bottom of Table 2 was for the *reference population*, persons whose attributes matched the reference levels identified in each attribute description in Table 2. Hence, male, black arrestees for a larceny, born since 1975,

interviewed in 1987, who reported no drug use prior to 1980 had an average year of crack initiation of 1987.8. Of course, substantial variation in year of crack initiation did occur. The covariates in this regression model only accounted for 11% of the overall sum of squares (R^2) and the model's standard error for estimated date of crack initiation was 2.4 years.

[Table 2 about here]

Table 2 also reports coefficient estimates associated with each attribute level differing from the reference level. The average year of crack initiation for non-members of the reference population equals the sum of the estimated coefficients associated with each attribute differing from the reference level, except interview year, added to 1987.8. For example, the analysis indicates that cocaine snorters whose other attribute values matched the reference levels had an average crack initiation time 1.3 years earlier or in 1986.5 (1987.8 - 1.3 = 1986.5).

The sum-of-squares [SS] reported for each attribute in Table 2 identified the partial variation in mean year of crack initiation accounted for by inclusion of each variable in the full model, controlling for the influence of all others. These statistics were the bases for partial F-tests with degrees of freedom as indicated in parentheses used to identify statistical significance. The SSs also provided a rough, rank ordering of the partial influence of each independent variable, controlling for all others. On this basis, the most important variable was interview year followed by pre-1980 drug use. The analysis found moderate variation associated with birth year. Arrestees born since 1975 initiated crack use on average two to three years later than otherwise comparable arrestees born earlier. Race/ethnicity was also moderately associated with year of crack initiation. Hispanic arrestees tended to have initiated crack use one-half a year later, all else being equal, than Black arrestees. White arrestees tended to have initiated use of crack on average in between Black and Hispanic arrestees. The variation in mean year of crack initiation associated with gender and arrest charge were not statistically significant (α=.05 level).

Arrestees interviewed in 1988 reported initiating use of crack on average .5 years later than those in 1987; increments associated with successive years were .2, .5, .3, .4 and .3 for 1989 through 1Q93, respectively. These increments were larger than zero but still for the most part closer to zero than one. These coefficient values reflect a continued initiation to crack subsequent to 1987, but probably at a rate much less than occurred at the peak prevailing in the mid-1980s. An additional regression analysis, not presented here, was performed including only those arrestees who reported initiating crack use from 1980-87. In this analysis, interview year was not statistically significant which suggested that the significance in interview year as reported in Table 2 reflects variation in year of crack initiation subsequent to 1987. Moreover, this additional regression analysis suggested that comparisons of the relative number of persons initiating use of crack from 1980 to 1987 as reported in Figure 1 was probably not substantially distorted by the extended sample-collection period.

As suggested by the model of the crack epidemic, pre-1980 drug use had a substantial effect on year of crack initiation. Persons who had snorted cocaine prior to 1980 tended to have initiated crack use, on average, over a full year earlier than persons who had been non-users, controlling for all other variables. Table 3 presents a demographic profile for each subpopulation by pre-1980 drug use. Each subpopulation of arrestees shows a similar race/ethnicity and gender composition. Substantial and statistically significant variation, however, does exist across year of crack initiation and birth year. Pre-1980 cocaine snorters where, on average, the first to initiate crack use with a mean year of crack initiation of 1985.0. These users tended to be some of the older arrestees with an average birth year of 1956.3. Arrestees who initiated crack use before 1980 tended to be even older, average birth year of 1954.3 and pre-1980 drug injectors older still, 1952.8. These older drug injectors initiated use of crack in 1986.0, on average, which was substantially later than pre-1980 cocaine snorters. Golub and Johnson's (1992) analysis with the Careers in Crack data also found that existing cocaine freebasers and snorters tended to be among the early users of crack and that existing drug injectors tended to have initiated crack use half a year later.

[Table 3 about here]

Several possible explanations exist as to why the younger (on the average) cocaine snorters tended to have initiated crack use before the older drug injectors. One possibility is that intravenous injection provides as effective a method for delivering cocaine as smoking and in New York City in the 1980s cocaine was frequently combined with heroin to form a speedball (Johnson et al., 1985). In contrast, cocaine snorters might have been were more immediately attracted to crack as a more effective method for delivering the cocaine high.

Alternatively, the later crack initiation by drug injectors may have represented a social phenomenon. Social networks tend to form among individuals with similar drug habits (Becker, 1967; Johnson and Manwar, 1991). These networks or extended communities develop informal norms regarding such practices as mixing drugs and dosage levels. The later crack initiation among drug injectors, who most likely heard and knew about crack earlier than others, suggests that these drug injectors may have had informal norms against the use of crack which were only gradually overcome, if at all. One final possibility, an early lack of interest in new drugs may have existed among IV-DRUG users because they were generally older and may have been more set in their ways.

The mean year of crack initiation for pre-1980 non-users and alcohol users were 1986.4 and 1986.2, respectively. The mean year of crack initiation for Pre-1980 marijuana users was 1985.6, more than half a year earlier. This earlier initiation by pre-1980 marijuana users was consistent with the gateway model. Pre-1980 non-users tended to have been relatively young in 1980 with an average birth year of 1967.3. Moreover, 91% of pre-1980 non-users were under age 18 in 1980 as compared with 6%, 15% and 19% for pre-1980 drug injectors, crack smokers and cocaine snorters, respectively. Pre-1980 marijuana users were substantially older, average birth year of 1959.7. Pre-1980 alcohol users were even older still, average birth year of 1955.6 which appears to be inconsistent with the gateway model. This variation could have been associated with the fact that

many people who get in trouble with the law never use or admit to the use of illegal drugs, but do admit to lifetime alcohol use. Consequently, the pre-1980 alcohol users included both these lifetime alcohol users who sustained an arrest and youthful arrestees who had not yet had the opportunity to progress to hard drug use by 1980. This explanation was supported by the fact that the average birth year of those pre-1980 alcohol users who initiated use of crack was 1961.9 which made them on average older than the pre-1980 non-users and younger than the marijuana users, which is consistent with the gateway model.

Figure 2 presents year of crack initiation for each pre-1980 drug use subpopulation and further suggests when each phase of the crack epidemic occurred in New York City. A substantial portion of early crack users were pre-1980 cocaine snorters and to a lesser degree drug injectors from 1980 until 1984. By 1986, crack initiation among pre-1980 cocaine snorters started to wane suggesting that most had either initiated use of crack or at least had the opportunity to do so. These findings suggested that the expansion phase of the crack epidemic in New York City lasted from 1981 to 1985. By 1983, pre-1980 marijuana, alcohol and non-users comprised a substantial and quickly growing proportion of the new crack initiates. This suggested that crack's popularity had spread to the younger drug users first experimenting with hard drug use by this time. By 1986, these more youthful arrestees dominated the new crack initiates indicating the start of the plateau phase. The decline in crack initiation which Figure 1 suggested started in 1987 may indicate the coming of the decline phase, although it was almost certainly affected by the right censoring resulting from a substantial portion of the sample having been interviewed in 1987 and soon after. Identification of a potential decline phase was more evident from analysis of data on prevalence of drug use.

[Figure 2 about here]

PREVALENCE OF DETECTED COCAINE USE

Figure 3 reports the rate of cocaine use detected by urinalysis among DUF-Manhattan arrestees from 1987--the inception date for the DUF-Manhattan program--through 1Q93. The previous analyses of year of crack initiation suggested that 1987-1Q93 falls after the expansion phase of the crack epidemic in New York City. Hence, these data do not indicate changes in prevalence of detected cocaine use during the early phases of the crack epidemic. Figure 3 indicates that the overall prevalence of detected cocaine use among arrestees was quite high (about 70%) and relatively stable from 1987 to 1Q93. This stability reflects continued high rates of detected cocaine use among arrestees aged 21 and above. However, there was a dramatic and constant decline in the proportion of youthful (aged less than 21) arrestees detected as recent cocaine users from 70% in 1987 to 17% in 1Q93.

[Figure 3 about here]

An analysis of self-reported use of crack within the last 72 hours indicated similar trends, however the rates were substantially lower, partly because urine tests identified any use of cocaine not just by means of crack smoking and partly because self-reports were subject to errors of misrepresentation and recall. Self-reported crack use among arrestees aged 21 and above remained constant at about 36% from 1989 through 1Q93; among arrestees under age 21 the rate had declined from 17% in 1989 to about 6% by 1992 where it remained in 1Q93.

Golub and Johnson (1994a) examined the decline in cocaine use detected among DUF-Manhattan youthful arrestees by means of three statistical procedures: logistic regression, postdiction, and age-period-cohort analysis. The results strongly suggested that the decline was primarily attributable to youths born more recently who got in trouble with both drugs and the law having not initiated regular use of crack cocaine. These findings are well illustrated by the age-period-cohort analysis reproduced in Table 4.

[Table 4 about here]

The column averages presented at the bottom of Table 4 report the overall decline over time in detected cocaine use among youthful arrests. Each row of the table presents the rate of detected cocaine use from 1987 to 1Q93 for each birth cohort from 1966 through 1978. The overall decline in detected cocaine use from 1987 to 1Q93 was not mirrored within each birth cohort as it aged over this same period suggesting that crack use persisted among members of earlier birth cohorts who initiated its use. It appears that a substantial proportion of persons born in the late 1960s who got in trouble with both drugs and the law became crack users and abusers and persisted into the early 1990s. In particular, 78% of arrestees born in 1968 were detected as recent cocaine users from 1987 through 1Q93. In contrast, only 10% of arrestees born in 1974 and 1975 were detected as recent cocaine users. Hence by 1988, the crack epidemic in New York City may have entered the decline phase as persons born in the early 1970s and reaching the age at which they might initiate hard drug use were unlikely to start using cocaine--even though they were arrested for crime and were otherwise demographically similar to their counterparts only 1-3 years older.

DISCUSSION

This study demonstrated several aspects of the DUF program's value for monitoring drug use trends. In particular, the results suggested that the Crack Epidemic in New York City passed through its expansion phase from about 1981 to 1985 during which time many existing hard drug users first initiated use of crack. The results also suggested that by 1986 the crack epidemic had entered a plateau phase. By this time, most hard drug users had either initiated crack use or at least had the opportunity to do so. Subsequent initiation of crack use during this plateau phase from about 1985 to 1987 was primarily by youths first reaching an age at which they might first initiate hard drug use. Persons born since 1970, and reaching age 18 in

1988 or later, appear to have missed the period of highest risk for crack use; these arrestees were not likely to be detected as crack users--suggesting that the crack epidemic had entered a decline phase perhaps as early as 1988. Continued sharp declines in detected cocaine use were also evident in 1989, 1990, and 1991 among youthful arrestees. However, the high (above 50%) levels of detected cocaine use and self-reported crack use among those born pre-1970 suggested that the continued use of crack in the 1990s and its associated social problems will be primarily among persons who initiated use of crack before 1988 persisting in their cocaine and crack use.

To the extent that future drug epidemics may follow a pattern similar to the crack epidemic in New York City, these analyses support the idea that the most important drug abuse prevention strategy at any time may likely depend on the phase of the prevailing drug epidemic or epidemics. Such a finding has potentially important implications for dealing with the recent crack epidemic and for any future drug epidemics to the extent that they follow a similar sequence of phases. During the incubation phase, an appropriate strategy might emphasize containment of the new drug's pioneering users to avoid a potential epidemic, to the extent that this is both legal and feasible. Early data from the DUF program could possibly help determine which drugs might be on the verge of more widespread popularity. However, given the limited subcultural nature of the hypothesized incubation phase, a drug epidemic would likely not become evident before the expansion phase is well under way.

DUF data may be useful in identifying the expansion phase as it occurs. This possibility was not tested for the Crack Epidemic in New York City since the expansion phase appears to have occurred in the early 1980s, prior to DUF data collection which did not start until 1987. During the expansion phase, emphasis might be placed on avoiding a damaging spread of the drug by informing existing hard drug users through outreach programs of the undesirable characteristics of a new drug and attempting to shift the street norms against its use.

DUF data can also help distinguish which types of persons are among the earliest users of a particular drug over time and help identify when the expansion phase gives way to the plateau phase. During the plateau phase, the policy emphasis might be placed on prevention programs to discourage youths from ever starting and stemming the flow of new users sustaining the epidemic. All of these strategies--containment, outreach, and prevention--might be less essential when a drug epidemic has entered the decline phase. DUF data can help identify the decline stage as both a period of dramatic decline in both prevalence of use by youthful arrestees and self-reported initiation of use.

To combat the crack epidemic in New York City which appears to be in the decline phase, the most effective policy strategy might be to focus primarily on the existing users of crack and encourage them to seek treatment or otherwise desist from use. Unless New York City deals with the existing population of crack users and abusers who began in the 1980s, the decline phase of the crack epidemic may be anticipated to last well into the 2010s and beyond.

DIRECTIONS FOR FURTHER STUDY

Clearly there is extensive opportunity for replication and extension of the ideas concerning drug epidemics and the methods for studying them presented in this paper. An obvious question involves the extent to which the timing of the crack epidemic was only a local phenomenon--as documented here for New York City--and the extent to which differences occurred across the United States. To address this question the authors would like to examine the nature of the crack epidemic with DUF data from the 23 other DUF locations. The authors are particularly interested in East Coast versus West Coast differences. In fact, regional differences in the type of drugs used may be quite strong. The extent and popularity of methamphetamine in the West may also have followed a pattern similar to that of the crack epidemic in New York City. The authors would also like to replicate the analyses presented here with data from other sources collected from non-criminal justice programs such as the MTF,

NHSDA programs. However, as discussed previously, there are many characteristics which commend the data from the DUF program for analyses such as these, but may not be available in other data sets.

The authors would also like to study the impact of the crack epidemic and other drug eras on individual careers in drug use. This would involve two separate analyses with the DUF data: pathways to hard drug use, and pathways through hard drug use. The pathways to hard drug use or gateway model will examine the sequence of drugs arrestees reported having used prior to the use of any hard drugs such as crack cocaine. This work would also replicate and extend findings from the Careers in Crack Study (Golub and Johnson, 1994b). Pathways through hard drug use will examine the sequence of drugs persons used prior to the initiation of crack use and beyond. This work will replicate and extend findings from the Careers in Crack project (Golub and Johnson, In Press). The discovery of substantial initiation to a new drug practice by existing crack users might result in the identification of the incubation phase of a new drug epidemic.

NOTES

1. The full DUF-Manhattan 1987–1Q93 sample includes 7495 arrestees. Thirty arrestees records were missing date of birth which figures centrally in this study. These cases were systematically excluded from all analyses. Due to the absence of a contract, no data were collected 3Q88 and 4Q92. Women were not interviewed in the initial waves in 2Q87 and 3Q87. Additionally, in 4Q90 the booking of female offenders was moved from the police department to corrections; staff were unable to gain access and conduct interviews for this quarter.

2. This study used the older race/ethnicity classification provided by the Drug Use Forecasting program of Black, White, Hispanic, and a much smaller group of other/missing composed of Native Americans, Asians and those whose response was missing.

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Fig 1

CRACK INITIATION YEAR FOR
DUF MANHATTAN 1987-1Q93

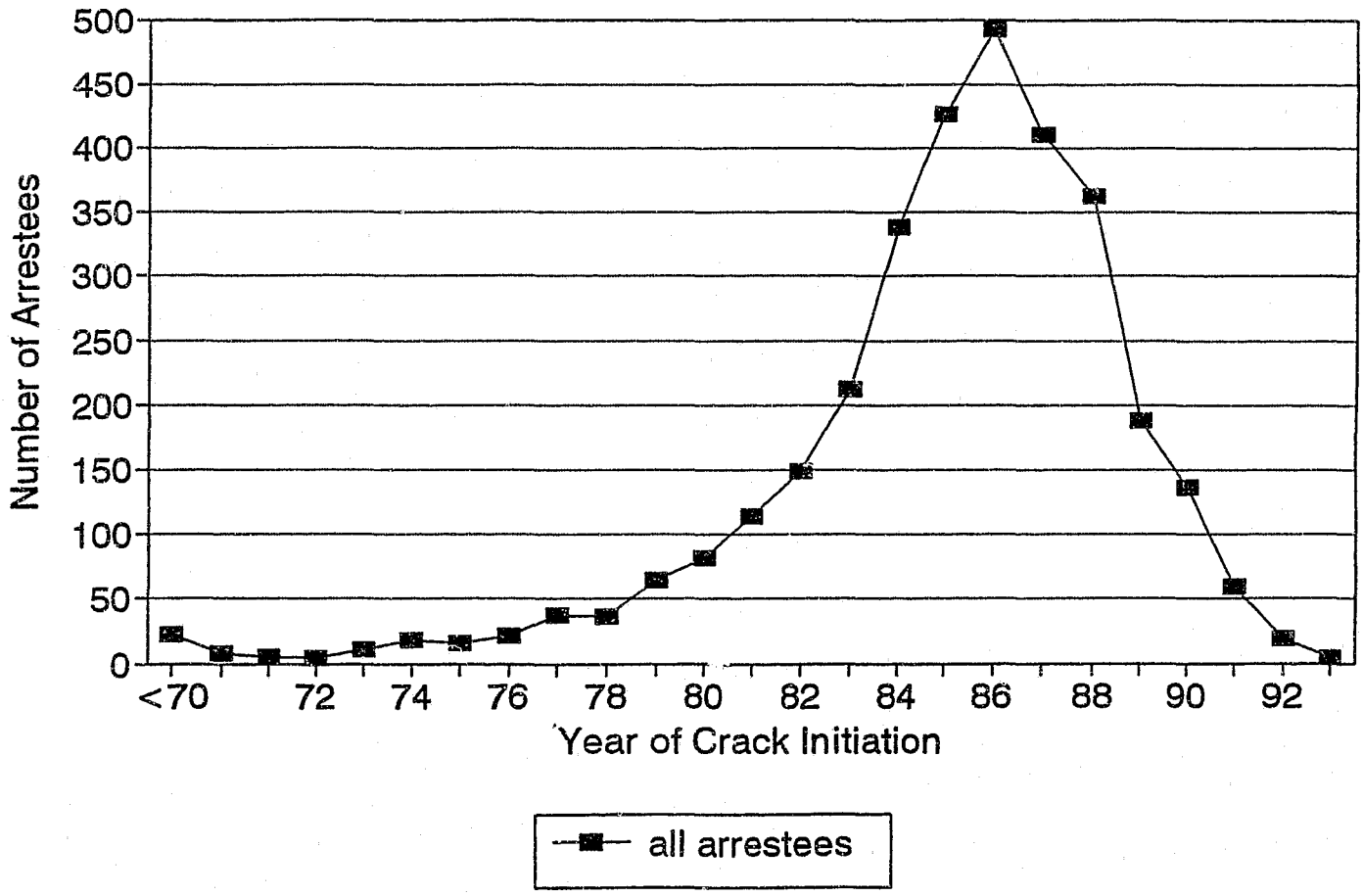

Fig 7

spellout two lines

CRACK INIT. YEAR/BY PRE-1980 DRUG US

DUF MANHATTAN 1987-1Q93

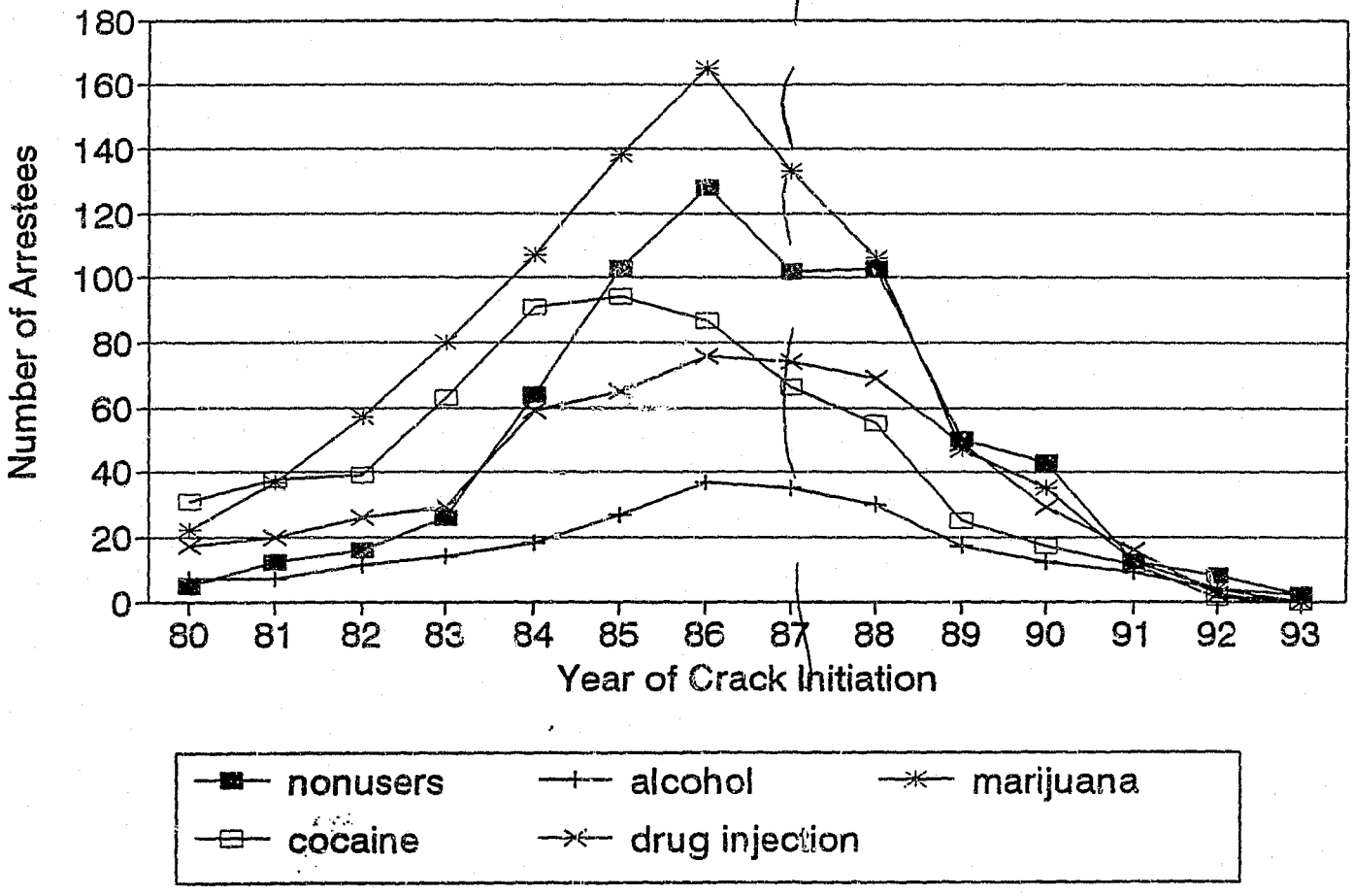

Fig 3

Detected Cocaine Use by Year

DUF-Manhattan 1987-1Q93

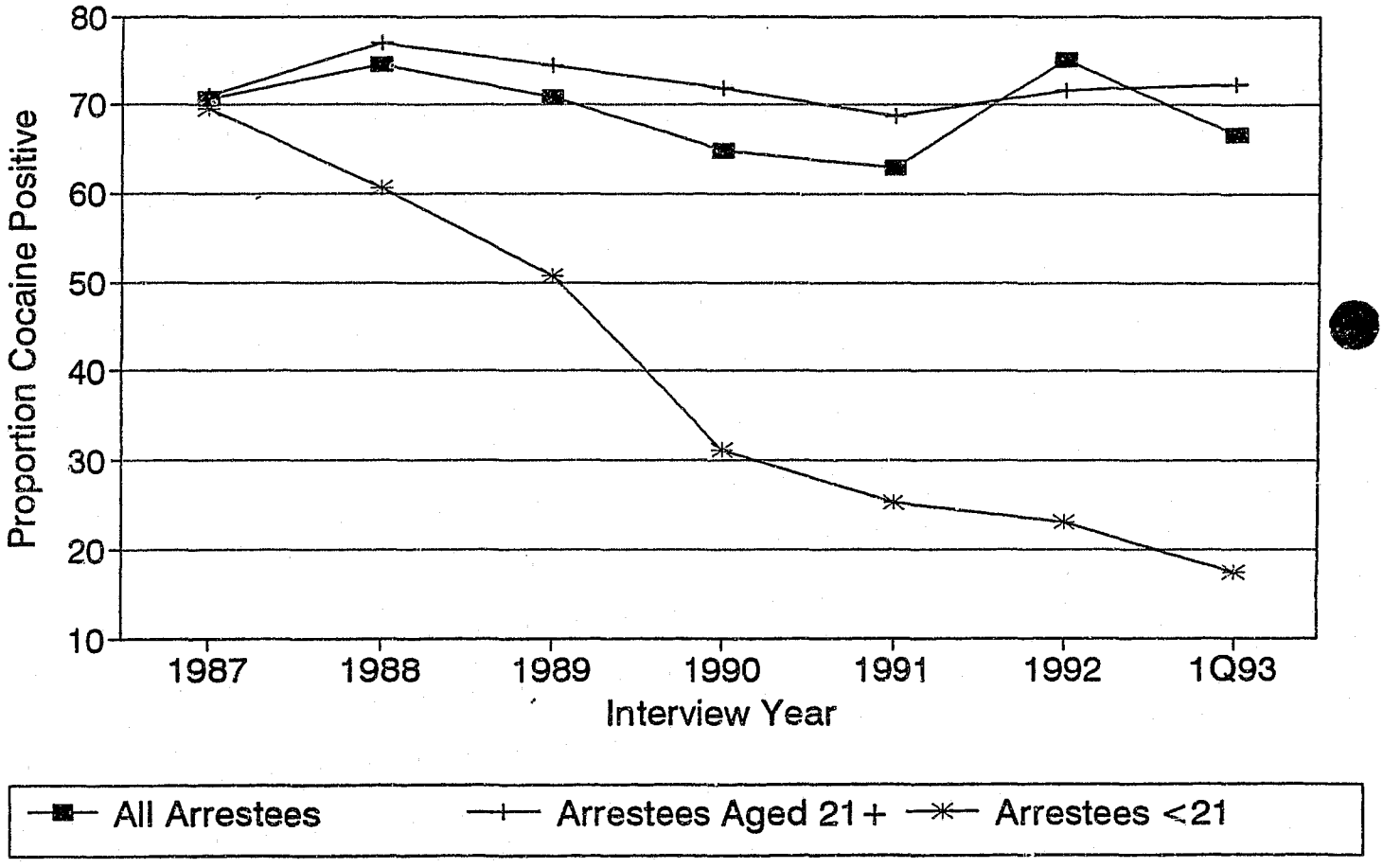

Table 1. Attributes of the DUF-Manhattan Sample of Arrestees 1987-1Q93 (N=7,465)

Attribute	% of sample
Misdemeanor/felony	
Misdemeanor	33
Felony	66
Citation/missing	1
Most serious arrest charge	
Drug possession	11
Drug sale	6
Robbery	14
Burglary	7
Larceny/auto theft	20
Violent index	13
Other income generating	8
Other serious crimes	9
Other	11
Gender	
Male	74
Female	26
Race/ethnicity	
Black	54
White	12
Hispanic	30
Other/missing	4
Birth year	
1900-44	5
1945-49	5
1950-54	11
1955-59	19
1960-64	25
1965-69	22
1970-74	12
1975+	1
Average year	1960
Interview year	
1987	10
1988	15
1989	19
1990	18
1991	19
1992	14
1Q93	6

Ever used---self-reported	
Alcohol	90
Marijuana	74
Drug injection	21
Cocaine	56
Crack	45
Pre-1980 drug use hierarchy	
Non-use	35
Alcohol	13
Marijuana	24
Drug injection	12
Cocaine	13
Crack	3

Table 2. Covariates of Year of Crack Initiation Among DUF Arrestees (Multiple Regression)

Attribute	Level	Coefficient
Interview year[a] SS(6)=1047.5**, SE[b]≈0.2	1988 v. 87	0.5
	1989 v. 88	0.2
	1990 v. 89	0.5
	1991 v. 90	0.3
	1992 v. 91	0.4
	1Q93 v. 92	0.3
Pre-1980 drug use v. non-use SS(4)=372.9**, SE≈0.2	Alcohol	-0.3
	Marijuana	-0.7
	Cocaine	-1.3
	Drug injection	-0.5
Birth year v. 1975+ SS(7)=189.8**, SE≈1.7	1900-44	-2.2
	1945-49	-2.4
	1950-54	-2.6
	1955-59	-2.7
	1960-64	-3.0
	1965-69	-3.0
	1970-74	-2.3
Race/ethnicity v. Black SS(3)=150.0**, SE≈0.2	White	0.3
	Hispanic	0.5
	Other/missing	0.1
Gender v. male SS(1)=13.0, SE≈0.1	Female	0.2
Arrest charge v. larceny SS(8)=44.1, SE≈0.2	Drug possession	-0.2
	Drug sales	-0.1
	Robbery	0.2
	Burglary	0.1
	Violent index	0.0
	Other income	0.2
	Generating	0.2
	Other serious crime	0.0
	Other	
Mean year of crack initiation for reference population		1987.8
R^2=.11		
Standard Error=2.4 years		

Note: This analyses was limited to the 2,996 arrestees who initiated crack use since 1980, excluding 4 which were missing information about drug injection.

* statistically significant α=.05 level

** statistically significant α=.01 level

[a] Attribute values for each interview year is contrasted with the previous year.

[b] Standard errors for each level were similar within each variable.

Table 3. Profile of Arrestees by Pre-1980 Drug Use (N=7,444)

	Pre-1980 drug use:					
	Non-use	Alcohol	Marijuana	Cocaine	Drug injector	Crack
Subsample size[a]	2553	980	1802	969	899	241
Crack use						
% ever used	28 (1)	24 (1)	54 (1)	64 (2)	60 (2)	100 ...[b]
Avg. year initiation	1986.4 (.1)	1986.2 (.2)	1985.6 (.1)	1985.0 (.1)	1986.0 (.1)	1975.5 (.3)
Race/ethnicity						
% black	52 (1)	39 (2)	61 (1)	59 (2)	52 (2)	68 (3)
% white	10 (1)	15 (1)	11 (1)	13 (1)	17 (1)	9 (2)
% hispanic	34 (1)	41 (2)	24 (1)	26 (1)	27 (1)	20 (3)
% other/missing	4 (1)	5 (1)	4 (1)	2 (1)	4 (1)	3 (1)
% female	26 (1)	23 (1)	27 (1)	30 (1)	28 (2)	27 (3)
Avg. birth year	1967.3 (.1)	1955.6 (.3)	1959.7 (.2)	1956.3 (.2)	1952.8 (.2)	1954.3 (.5)
% under Age 18 in 1980	91 (1)	34 (2)	46 (1)	19 (1)	6 (1)	15 (2)
Avg. interview year	1990.1 (.1)	1989.8 (.1)	1989.9 (.1)	1989.5 (.1)	1989.8 (.1)	1989.9 (.1)

Note: Standard errors provided in parentheses.
[a]This analysis excluded the 21 cases which were missing information about drug injection.
[b]Standard error is meaningless when prevalence is either 0 or 100%.

Table 4. Age-Period-Cohort Analysis of Detected Cocaine Use Among Youthful Arrestees (Age < 21)

Proportion detected as cocaine users [SE] and cell count (n) by DUF interview year[a]

Birth Year	1987	1988	1989	1990	1991	1992	1Q93	Avg[b]
1966		75 [6]	79 [6]	59 [7]	58 [6]	72 [7]	68 [11]	
	0	61	56	49	64	39	19	0
1967	62 [8]	**93 [7]**	70 [5]	63 [7]	78 [6]	61 [7]	71 [9]	71 [7]
	34	**14**	74	56	50	46	24	48
1968	88 [6]	67 [7]	**87 [9]**	53 [6]	57 [7]	79 [7]	68 [10]	78 [4]
	34	43	**15**	62	54	38	25	92
1969	64 [10]	63 [8]	57 [7]	**62 [4]**	65 [6]	58 [7]	50 [13]	60 [4]
	22	38	56	**13**	57	48	16	129
1970	72 [11]	64 [9]	60 [6]	47 [8]		47 [9]	45 [16]	58 [4]
	18	33	60	45	0	30	11	156
1971	40 [16]	46 [10]	45 [9]	37 [7]	49 [8]	**58 [15]**	15 [10]	45 [4]
	10	24	31	46	45	**12**	13	168
1972		28 [11]	29 [7]	18 [6]	20 [7]	27 [9]	**31 [13]**	24 [3]
		18	38	44	35	26	**13**	174
1973			32 [11]	30 [7]	20 [6]	20 [7]	44 [18]	26 [4]
			19	44	40	35	9	147
1974			0 ...[c]	10 [6]	22 [7]	17 [6]	0 ...[c]	16 [3]
			1	30	37	36	5	109
1975				0 ...[c]	11 [6]	16 [7]	0 ...[c]	10 [4]
				3	27	25	12	67
1976			0 ...[c]	33 [33]	0 ...[c]	13 [13]	0 ...[c]	10 [7]
			1	3	5	8	3	20
1977					0 ...[c]	100 ...[c]	0 ...[c]	20
					1	1	3	[20]
								5
1978							0 ...[c]	0 ...[c]
							1	1
Avg[b]	69 [4]	61 [4]	51 [3]	31 [3]	25 [3]	23 [4]	17 [6]	41 [1]
	118	170	221	228	190	143	46	1116

[a]The bold entries indicate when a birth cohort reached age 21.
[b]Averages include only those arrestees under age 21.
[c]Standard Error is meaningless when prevalence is either 0 or 100%.