

DIMINISHED LIFETIME SUBSTANCE USE OVER TIME AN INQUIRY INTO DIFFERENTIAL UNDERREPORTING

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Abstract This study investigates underreporting of lifetime marijuana and cocaine use in the National Longitudinal Survey of Youth. Comparing responses provided in 1988 with responses provided in 1984, this study evaluates the prevalence and correlates of two indicators of underreporting, including use denial and use reduction. At follow-up in 1988, a high rate of underreporting was evident for both marijuana and cocaine, with rates of use reduction observed for just under one-third of all 1984 marijuana users and just over one-third of all 1984 cocaine users. Outright denial of use in 1988 was almost twice as prevalent among cocaine users as it was among marijuana users; nearly 19 percent of all cocaine users denied use at follow-up, compared with nearly 12 percent of all marijuana users. Correlates of underreporting varied by substance and by measure of underreporting. The most consistent correlates of underreporting were interview mode, race/ethnicity, and educational status. Those interviewed by telephone, minority respondents, and those with lower levels of education were more likely to underreport. Race/ethnicity effects were particularly striking in our analyses. Black respondents had at least twice the odds of underreporting compared with white/other respondents for every indicator of underreporting. Findings are compared with other recent research on underreporting and are discussed in the context of recent substance use prevalence findings.

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Introduction

Denial of symptomatology upon reinterview among the previously symptomatic has been a consistent finding in psychiatric epidemiology. Researchers have concluded that a reinterview results in “retest artifact” or a decrease in the willingness of previously symptomatic individuals to disclose socially undesirable or sensitive information (Bromet et al. 1986; Henderson, Byrne, and Duncan-Jones 1981; Jorm, Duncan-Jones, and Scott 1989; Rubio-Stipec et al. 1992). Retest artifact calls into question the validity of inferences about socially undesirable information drawn from longitudinal research. Prior research suggests that the more sensitive the question being asked, the more pronounced the retest artifact will be (Jorm, Duncan-Jones, and Scott 1989). Such findings may have considerable implications for the validity of longitudinal survey research conducted on another sensitive topic—substance use.

The present analyses investigate retest artifact in responses to survey questions about lifetime use of marijuana and cocaine over two waves of interviews in the National Longitudinal Survey of Youth (NLSY), including both the 1984 and the 1988 surveys. We address the following questions: Among respondents identifying themselves initially as users in 1984, to what extent do respondents report reduced levels of lifetime use at follow-up? Among this same subsample of 1984 lifetime users, to what extent is use denied in 1988? What respondent and interview mode characteristics are associated with use reduction and denial? Do observed patterns and correlates of use reduction and denial differ for marijuana and cocaine?

Literature Review

At least four previous longitudinal analyses have evaluated reinterview effects in substance use surveys. Mensch and Kandel (1988) compared responses to questions about marijuana use over two waves (1980 and 1984) in the NLSY and found that 9 percent of those initially reporting use indicated that they never used marijuana at follow-up 4 years later. These authors found that blacks and Hispanics and those with less than a high school education were more likely to deny previously reported substance use. They also noted that “experimental” or low-level users were more likely to deny previous substance use. Fendrich et al. (1992) analyzed responses over 8 weeks to questions about quantity and frequency of drug use among self-identified drug users in an ethnographic sample. These authors found a general tendency toward reporting of reduced use over a series of eight prospective interviews. The pattern

held across substances, and was consistent across ethnic/racial groups. Anglin, Hser, and Chou (1993) investigated the long-term (10-year) consistency of retrospective drug use reports covering overlapping time periods in a sample of male opiate addicts committed to a compulsory drug treatment program by the California courts. The findings of the Anglin et al. study were not suggestive of a retest artifact; compared to the initial interview, the 10-year follow-up interview yielded higher levels of retrospective use for an overlapping period than did the initial interview. Collins et al. (1985) compared retrospective reports of substance use provided over two waves of interviews by high school youths who participated in a smoking prevention program. On the second wave of interviews, there was an overall tendency for youths to recall less use of cigarettes and alcohol than they reported at the initial interview. This study suggested that **recency** of use may be an important variable influencing the level of retrospective use at **follow-up**; higher levels of retrospectively reported marijuana use were associated with more recent use at follow-up.

It should be noted that most of the studies demonstrating retest artifact in general populations have focused on psychiatric symptomatology and illness and not substance use per se (although substance abuse diagnoses are considered). Three large psychiatric studies of adult samples demonstrated patterns of symptom reduction among the previously symptomatic (Bromet et al. 1986; Eaton et al. 1989; Rice et al. 1987). One recent study of children, adolescents, and young adults (Fendrich and Warner, in press) found that patterns of lifetime symptom report reduction were limited to internalizing disorders such as depression and were not in evidence for symptoms of conduct disorder and substance abuse.

Aquilino and LoSciuto (1990) argue that since questions about drug use are “threatening” to respondents they are affected by “socially desirable” response sets that bias toward underreporting. According to Sudman and Bradburn (1974), questions that evoke socially desirable response sets are sensitive to interview mode. Accordingly, interview modes favoring more privacy (the self-report) or more subject awareness of and control over the interview process (the face-to-face interview) should be conducive to honest reporting about substance use. In contrast, an interview mode that limits a respondent’s sense of privacy or control over the interview process—such as the telephone interview—should not be conducive to honest disclosure about substance use.

Several recent cross-sectional studies have shown that telephone administration of drug use questionnaires leads to considerable underreporting of drug use when compared with self-administered questionnaires or face-to-face interviews (Aquilino 1992; Aquilino and

LoSciuto 1990; Gfroerer and Hughes 1991, 1992; Johnson, Hougland, and Clayton 1989). Aquilino and LoSciuto (1990) argue that self-administered questionnaires minimize response effects due to social desirability. One recent study analyzing the National Household Survey suggested that respondents were less willing to disclose use of substances to interviewers than they were in self-administered questionnaires (Turner, Lessler, and Devore 1992). Analyzing the 1988 NLSY data, Schober et al. (1992) found lower rates of marijuana and cocaine use for private face-to-face interviews than for self-reports. They found that mode effects varied according to respondent race/ethnicity; in contrast to other respondents, black respondents reported similar prevalence rates of cocaine use across interview modes. Interestingly, they also found lower rates reported for marijuana and cocaine use in private face-to-face interviews than in nonprivate face-to-face interviews.

The above findings about ethnicity differences are at odds with studies comparing telephone interviews with face-to-face interviews. For example, Aquilino and LoSciuto (1990) compared substance use reporting in telephone interviews to self-administered questionnaires for blacks and whites and found significant underreporting in telephone interviews only for black respondents. Similarly, in a study comparing substance use reports given in face-to-face interviews with reports given in telephone interviews, Aquilino (1992) concluded that underreporting for the latter condition was significantly higher for black respondents. Note that this parallels the finding noted earlier by Mensch and Kandel (1988). It also parallels other research suggesting underreporting by black respondents on sensitive questions about abortion (Jones and Darroch-Forrest 1992). We found one study that investigated the interaction between gender and response mode effects; Johnson, Hougland, and Moore (1991) found that underreporting of substance use in telephone surveys was limited to male respondents. Additional findings reported by Mensch and Kandel (1988) suggest the possible importance of another interview mode variable in the study of underreporting in longitudinal drug use research: interviewer familiarity. Mensch and Kandel (1988) found that multiple contacts with the same interviewer depressed rates of reporting about cocaine.

Despite evidence that mode and subject characteristics may contribute to substance use underreporting, prior research has not simultaneously examined both types of variables. In previous cross-sectional research investigating interview mode effects, underreporting was evaluated in the aggregate for the group exposed to the specific interview condition. Rates of substance use reports were compared across groups defined by similar respondent characteristics. Since these prior studies were cross-sectional and used only a single assessment of sub-

stance use, individual-level indicators of underreporting could not be constructed. Without individual-level indicators of underreporting, respondent characteristics could not be examined as direct correlates of this behavior. In prior studies, sociodemographic variables were examined as interaction effects; investigators examined the variation in sensitivities to interview mode across demographic subgroups. Longitudinal studies assessing lifetime substance use over multiple waves facilitate the construction of individual level indicators of underreporting. In longitudinal studies, an index evaluating the difference between substance use frequency reports over two waves of interviews can be constructed for each individual respondent; since lifetime use is cumulative, diminished lifetime use over time can serve as an individual-level indicator of underreporting. Such individual-level estimates facilitate the direct examination of the association between underreporting and any subject characteristic of interest; they also facilitate the examination of the relative importance of different variables as predictors of underreporting in multivariate models.

Methods

SAMPLE

The NLSY is a nationally representative sample of 12,686 men and women who were ages 14–21 years when they were first interviewed in 1979 (Center for Human Resources Research 1991). The study was designed so as intentionally to oversample blacks and Hispanics as well as economically disadvantaged whites. A supplemental sample of young adults drawn from active military duty was also collected. Twelve waves of interviews were conducted on this sample between 1979 and 1990. Retention rates consistently approached or exceeded 90 percent in each of the survey years. Questions about illicit substance use were asked in three of the survey years—1980, 1984, and 1988. In 1988, half of the subjects were randomly assigned to drug use supplements that were administered by an interviewer and half of the subjects were randomly assigned to drug use supplements that were completed by self-report.

The focus of the current study is on the responses to surveys administered in 1984 and 1988, two surveys that included nearly identical questions about lifetime use for two illicit substances, cocaine and marijuana. Since the major emphasis of this report is on drug use recall (retest artifact) and its correlates, all analyses are based on unweighted samples. This study employs two subsamples of the NLSY for all analyses. The first subsample consists of all respondents who com-

pleted questions about marijuana use in 1984 and 1988 who also reported lifetime use of marijuana in 1984 ($N = 6,204$). The second subsample consists of all respondents who completed questions about cocaine use in 1984 and 1988 who also reported lifetime use of cocaine in 1984 ($N = 1,589$).

VARIABLES

Analyses investigated a number of sociodemographic and survey condition variables in association with retest artifact. We included a variable comparing three categories of race/ethnicity (blacks, Hispanics, and whites/other), a six-level indicator of 1988 income, an indicator of employment status, and an indicator of education (highest level of schooling completed).¹ Indicators of age and sex of respondent were also included in the analyses.

In order to address the influence of sociocultural norms on underreporting behavior we included two other sociodemographic variables, urban versus rural residence in 1988 and marital status in 1988. Prior research suggests that there have been consistently lower rates of reported substance use in rural areas as compared with urban areas (Johnston, O'Malley, and Bachman 1988). Prior research also suggests that marriage and the adoption of "conventional" lifestyles is associated with a reduction in reported levels of use (see Newcomb and Bentler 1988; Yamaguchi and Kandel 1984).

Interview condition variables included an indicator of interviewer familiarity (the number of times a subject had contact with the 1988 interviewer),* as well as a categorical indicator of interview condition reflecting the following four mutually exclusive possibilities: interviewed face-to-face alone, interviewed face-to-face in the presence of another person, interviewed over the telephone, and interviewed through self-administered questionnaire. We employed two indicators of drug use involvement in our analyses, including an assessment of initial levels of use in 1984 (using a four-category indicator that was identical across substances) and an indicator of the most recent time of use for each particular drug; recent users (those who used marijuana or cocaine within the past year in 1984) were contrasted with all other users (those who used marijuana or cocaine more than 1 year prior to the 1984 interview).

1. The income variable included five levels of income; we also included an additional category reflecting missing responses on this question.

2. Interviewer identification codes from the 1979 and 1980 surveys were not retrievable. This variable thus measures the number of contacts with the 1988 interviewer since 1980.

ANALYSES

Two dimensions of retest artifact were explored, including reports of reduced lifetime use at follow-up (use reduction) and reports of **nonuse** at follow-up (use denial). Because of the truncated and skewed distribution of the use frequency variables at each interview (see below), we treated use reduction as a categorical indicator with all respondents reporting a lifetime reduction at follow-up coded as 1 and all others coded as 0. Cross-tabulations and logistic regression models were constructed to evaluate correlates of use reduction and denial for both marijuana and cocaine. Within regression models, interaction terms were constructed in order to evaluate the consistency of mode effects within certain subgroups. Sex and age of respondent were included as control variables in all multivariate analyses.

Results

Table 1 describes the demographic characteristics of the two user subgroups included in the analyses. Each of the subgroups is compared with all other “nonusers” in 1984 for that substance. Statistically significant differences between users and nonusers of marijuana and cocaine were observed with respect to all of the demographic variables except highest level of education. Users of both substances were more concentrated in the older age groups (26-32 years old) than nonusers. A significantly lower percentage of users compared with nonusers of cocaine and marijuana were black, Hispanic, female, married, and from rural residences. Subgroup differences were more pronounced for cocaine use than they were for marijuana use reports. Nevertheless, the distributions on each of the demographic variables for the two subgroups of lifetime users were roughly parallel, with the same rank ordering for nearly every variable category within each subgroup. Table 1 suggests that there is somewhat limited power to detect differences within each of the main demographic variables; this is especially true for race, marital status, and residence.

Tables 2 and 3 compare substance use frequency reports across the two interview periods, 1984 and 1988. The bold areas in each table indicate underreporting in 1988 (i.e., they show frequencies for respondents whose lifetime use showed a reduction at follow-up). By summing up the total number of respondents that are bold and dividing this number by the total number of 1984 users for each substance, rates of underreporting can be generated. For marijuana (table 2), 31.2 percent (1,937/6,204) of the sample underreported their 1984 use upon reinterview. For cocaine, 39 percent (618/1,589) of the sample underre-

Table 1. Selected Sociodemographic Characteristics
by Drug Use Status in 1984

	1984 Marijuana User (%)		1984 Cocaine User (%)	
	No	Yes	No	Yes
1988 age (years):				
23-25	32.9	28.2	31.1	25.0
26-28	39.1	40.2	39.2	42.4
29-32	28.0	31.5	29.7	32.6
N	3,836	6,204	8,405	1,589
Race/ethnicity:				
Black	29.8	24.3	28.3	16.4
Hispanic	19.2	14.4	16.6	14.5
White/other	51.0	61.3	55.1	69.0
N	3,836	6,204	8,405	1,589
Sex:				
Female	58.5	46.4	53.1	40.0
Male	41.5	53.6	46.9	60.0
N	3,836	6,204	8,405	1,589
1988 marital status:				
Never married	38.3	39.1	37.9	43.2
Married	50.6	45.4	48.4	41.9
Other ^a	11.1	15.5	13.7	14.9
N	3,834	6,204	8,401	1,589
Residence:				
Rural	25.8	17.6	22.2	12.8
Urban	74.2	82.4	77.8	87.2
N	3,672	5,925	8,017	1,535
Highest education completed:				
< high school	17.7	17.7	17.9	16.3
High school graduate	43.7	45.3	45.0	43.4
Some college	20.6	20.8	20.4	22.0
College graduate	18.0	16.3	16.7	18.3
N	3,802	6,158	8,339	1,574

NOTE.-Since all data are unweighted, these percentages are not population estimates; these percentages relate only to respondent groups defined in the study. Differences between users and nonusers of marijuana and cocaine were significant at the .001 level for all demographic variables except highest education completed.

^a Divorced, widowed, or separated.

Table 2. 1984 and 1988 Lifetime Marijuana Use Frequency among 1984 Marijuana Users (*N* = 6,204)

1988 Marijuana Use Frequency (No. of Times Ever)	1984 Marijuana Use Frequency (No. of Times Ever) ^a							
	1-9 (<i>N</i> = 2,631)		10-39 (<i>N</i> = 1,107)		40-99 (<i>N</i> = 777)		100+ (<i>N</i> = 1,689)	
	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>
0	19.3	508	7.6	84	6.0	47	5.3	89
1-9	55.1	1,450	30.4	337	15.1	117	10.7	181
10-39	15.3	403	37.7	417	24.4	190	10.4	176
40-99	5.1	135	12.4	137	25.0	194	12.3	208
100+	5.1	135	11.9	132	29.5	229	61.3	1,035
Underreporting	19.3	508	38.0	421	45.6	354	38.7	654

NOTE.—Sample included all marijuana users from 1984 with 1988 completed interviews and with completed answers on 1984 use frequency question. Numbers in bold represent frequencies for respondents whose lifetime use showed a reduction at follow-up.

^a These categories were recoded to create consistent categories across the interview periods.

Table 3. 1984 and 1988 Lifetime Cocaine Use Frequency among 1984 Cocaine Users (*N* = 1,589)

1988 Cocaine Use Frequency (No. of Times Ever)	1984 Cocaine Use Frequency (No. of Times Ever) ^a							
	1-9		10-39		40-99		100+	
	<i>(N</i> = 792)		<i>(N</i> = 404)		<i>(N</i> = 194)		<i>(N</i> = 199)	
	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>
0	23.7	188	14.9	60	10.3	20	16.6	33
1-9	48.6	385	30.6	124	19.1	37	14.6	29
10-39	17.0	135	36.9	149	28.4	55	14.6	29
40-99	5.5	44	10.6	43	21.1	41	21.6	43
100+	5.1	40	6.9	28	21.1	41	32.7	65
Underreporting	23.7	188	45.5	184	57.7	112	67.3	134

NOTE.—Sample included all cocaine users from 1984 with 1988 completed interviews and with completed answers on 1984 use frequency question. Numbers in bold represent frequencies for respondents whose lifetime use showed a reduction at follow-up.

^a These categories were recoded to create consistent categories across the interview periods.

ported their 1984 use upon reinterview. Total denial of use was considerably higher for cocaine (18.9 percent) than for marijuana (11.7 percent). Although those in the lowest use (or experimental use) category were the modal group of deniers for both marijuana and cocaine, our findings are at odds with the suggestions of Mensch and Kandel (1988): underreporting is prevalent across use categories, with increasingly higher rates of underreporting observed for those at higher initial use levels; underreporting is not a phenomenon limited to experimental users. Indeed, for cocaine, the highest rate of underreporting is observed among the group of the heaviest 1984 users. Over two-thirds of those reporting 100 or more times of use in 1984 reported less use at follow-up. Even more striking, this same group showed the second highest rate of total denial of any use group (16.6 percent). Thus, denial appears to be a more serious problem for cocaine use than it is for marijuana use. Underreporting of use levels is consistently observed across substances and increases with increasing levels of initial use.

The differences between reports at each wave of interviews are underscored by statistical comparisons with respect to mean category levels among marijuana and cocaine users. Overall mean differences with respect to levels of use indicated slight but highly significant drops in reported marijuana and cocaine use between interviews (mean dif-

ference for marijuana, .21; mean difference for cocaine, .29; both paired *t*-tests are significant at the .001 level). Effect size estimates for the overall difference suggest only a very slight or small effect for both reductions (see Cohen 1988; effect sizes are both less than .3). An inspection of the correlation between use levels reported at each wave suggests that there is more consistency in reported use levels for marijuana than there is for cocaine. The correlation between use level reports for marijuana was .59, compared with .37 for cocaine.

Table 4 displays the results of bivariate comparisons across groups according to reductions in use level. All variables except for age and sex showed some level of association with use reduction or denial for at least one substance.

Race/ethnicity comparisons. Race/ethnicity showed consistent effects across outcome measures and across substances. Blacks showed the highest rate of use reduction and denial, followed by Hispanic respondents, and then by respondents in the white/other group. The largest differences for race were observed in the contrast between black respondents and white/other respondents on the denial outcomes: 33.2 percent of the black respondents denied cocaine use at follow-up compared with 15 percent of the white respondents.

Residence and marital status comparisons. Residence was associated with underreporting only for cocaine and not for marijuana. Residents of rural areas were more likely to report less use and more likely to deny use of cocaine than residents of urban areas (17.7 percent of the urban respondents denied cocaine use at follow-up compared with 25 percent of the rural respondents). Expectations about the role of marital status in underreporting were only confirmed for cocaine use. Married respondents denied cocaine use at a higher rate than those who were never married and than those who were divorced, widowed, or separated (rates of denial were 22.1 percent, 17.5 percent, and 14.3 percent, respectively, for those classified as married, never married, and other). Although the absolute magnitude of the difference in rates was relatively small, a significantly elevated percentage of use reduction for marijuana was reported by those who were divorced, widowed, or separated (rates of use reduction were 34.6, 30.9, and 30.3 percent, respectively, for those classified as other, never married, and married).

Employment, income, and education comparisons. Employment status was significantly associated with marijuana use denial; those who were out of the labor force or unemployed reported slightly elevated rates of use denial for marijuana compared with those who were employed or in the military (rates of denial were 14.6, 11.2, 12.3, and 10.5 percent, respectively, for those who were out of the labor force, employed, unemployed, and in the military). With respect to cocaine,

Table 4. 1988 Use Reduction and Denial among 1984 Users

	Substance Reported On					
	Marijuana			Cocaine		
	N	% Reporting Less Use	% Denying Use	N	% Reporting Less Use	% Denying Use
Interview mode:						
Self-report	2,964	31.3	10.4	742	36.5	16.7
Interview (alone)	2,606	31.0	12.5	657	39.1	18.6
Interview (someone present)	262	26.7	10.3	77	41.6	22.1
Interview (phone)	309	35.9	20.1	94	54.3	36.2
		n.s.	***		**	***
Interviewer familiarity (1988):						
Single contact	4,286	30.7	11.3	1,150	37.4	17.2
> 1 contact	1,904	32.4	12.8	435	42.8	23.7
		n.s.	n.s.		n.s.	**
Race/ethnicity:						
Black	1,508	40.9	19.3	261	48.3	33.2
Hispanic	891	36.5	14.9	231	39.4	20.8
White/other	3,805	26.1	8.0	1,097	36.6	15.0
		***	***		***	***
1988 age (years):						
23-25	1,752	29.9	11.7	397	38.8	21.4
26-27	1,667	33.4	12.4	451	40.8	19.7
28-29	1,567	30.2	11.4	404	35.9	17.6
30-32	1,218	31.6	11.3	337	40.1	16.6
		n.s.	n.s.		n.s.	n.s.

Table 4 (Continued)

	Substance Reported On					
	Marijuana			Cocaine		
	N	% Reporting Less Use	% Denying Use	N	% Reporting Less Use	% Denying Use
Sex:						
Male	3,327	31.1	11.3	954	40.4	19.4
Female	2,877	31.4	12.2	635	36.7	18.3
		n.s.	n.s.		n.s.	n.s.
1988 income:						
≤ 12,000	1,244	37.3	15.0	305	43.3	19.7
12,001–20,000	1,030	31.6	11.1	241	41.9	20.3
20,001–30,000	1,033	29.3	10.6	261	33.3	16.5
30,001–43,000	914	25.5	10.2	245	42.9	22.4
43,001 +	903	27.5	9.0	270	33.3	12.2
Missing	1,080	33.7	13.3	267	38.6	22.6
		***	***		*	*
1988 highest education:						
< high school	1,088	38.7	15.4	256	49.2	26.6
High school graduate	2,790	31.8	11.6	683	40.4	18.9
Some college	1,278	29.3	11.3	347	37.5	18.7
College graduate	1,002	24.0	8.3	288	28.1	12.8
		***	***		***	***

1988 employment:						
Employed	4,708	29.8	11.2	1,221	38.4	18.3
Unemployed	391	34.0	12.3	101	40.6	22.8
Out of the labor force	952	36.7	14.6	233	38.6	19.7
Military	153	32.7	10.5	34	52.9	26.5
		**	*		n.s.	n.s.
1988 marital status:						
Never married	2,422	30.9	11.7	687	35.8	17.5
Married	2,818	30.3	11.8	665	41.8	22.1
Other ^a	962	34.6	11.6	237	39.7	14.3
		*	n.s.		n.s.	*
Residence:						
Urban	4,882	31.4	11.7	1,339	37.6	17.9
Rural	1,043	29.5	11.7	196	44.9	25.0
		n.s.	n.s.		*	*
Most recent 1984 use:						
Use in last year	2,090	36.1	7.8	1,002	40.5	17.3
No use in last year	4,101	28.7	13.7	579	36.1	21.8
		***	***		n.s.	*
1984 lifetime use frequency (no. of times):						
1-9	2,631	19.3	19.3	792	23.7	23.7
10-39	1,107	38.0	7.6	404	45.5	14.9
40-99	777	45.6	6.0	194	57.7	10.3
100+	1,689	38.7	5.3	199	67.3	16.6
		***	***		***	***

^a Divorced, widowed, or separated.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

nonsignificant trends suggested elevated rates of use reduction and denial for those in the military and those who were unemployed compared with those who were employed or out of the labor force. Income was associated with use reduction and denial for both marijuana and cocaine. For marijuana, those earning under \$12,000 and those missing on the income question showed elevated rates of reported use reduction and denial compared with those in other income groups. The relationship between income and underreporting was more complicated for cocaine use reporting. Only two income groups had cocaine use reduction rates considerably under 40 percent—those in the middle income group and those in the highest income group. These same two groups also had the lowest rates of denial (with rates for other groups approaching or exceeding 20 percent). In contrast with income, the associations between education and underreporting for both marijuana and cocaine use were clearly monotonic. The higher the education level, the lower the rate of use reduction and denial for both marijuana and cocaine.

Interviewer familiarity and interview mode. Multiple contacts with the 1988 interviewer showed a significant association with underreporting only for cocaine use; 23.7 percent of the respondents with multiple contacts with the 1988 interviewer denied cocaine use compared with 17.2 percent of the respondents with one contact. Interview mode was significantly associated with denial of marijuana and cocaine use; it was associated with reports of use reduction for cocaine. Denial of marijuana and cocaine use was slightly lower for those who completed self-reports than for those who completed face-to-face interviews. The largest and most consistent differences in interview mode effects were observed for those who were interviewed over the telephone. Respondents interviewed over the telephone had twice the rate of denial for marijuana and cocaine compared with respondents who completed self-reports. Over half of the respondents interviewed over the telephone reported less cocaine use at follow-up (54.3 percent); over one-third of the respondents interviewed over the telephone denied cocaine use at follow-up (36.2 percent).

Use recency comparisons. The relationship between use recency in 1984 and underreporting varied according to outcome measure. Compared with other respondents, those reporting marijuana use during the past year in 1984 (recent users) were significantly more likely to report reduced lifetime use in 1988 (36.1 percent of the recent users reported reduced use, compared with 28.7 percent of all other respondents). On the other hand, those reporting recent use were significantly less likely to deny use of marijuana or cocaine in 1988. Those not reporting recent marijuana use in 1984 had nearly twice the rate of denial of recent marijuana users (rates of denial were 7.8 percent for

those with recent marijuana use, compared with 13.7 percent for those without recent use). Those not reporting recent cocaine use during 1984 had slightly higher rates of denial than recent cocaine users (rates of denial were 21.8 percent for those without recent cocaine use, compared with 17.3 percent for those with recent use). It should be pointed out that use recency in 1984 is significantly associated with use frequency for both marijuana and cocaine. Those who used more recently in 1984 were also more likely to report a higher level of lifetime use in 1984. The contrasting effects of recency on denial and use reduction parallel those found for the use frequency variable.

Tables 5 and 6 evaluate the impact of the covariates discussed above simultaneously in a set of logistic regressions. For each covariate, odds ratios provide an estimate of the effect of category membership (vs. nonmembership) on the relative odds of each outcome measure (see Hosmer and Lemeshow 1989). Findings are summarized for each substance below.³

Marijuana use reduction and denial. Significant effects for use reduction and denial in marijuana were detected for indicators of interview mode, race, income, educational status, marital status, and 1984 use frequency (see table 5). Compared with those who were interviewed face-to-face without anyone else present as the reference group, those who were interviewed by telephone were significantly more likely to deny and report reduced use of marijuana. Compared with white/other respondents, black and Hispanic respondents were significantly more likely to deny and report reduced use of marijuana. Compared with those with less than a high school level of education, those with higher levels of education were significantly less likely to deny and report reduced use of marijuana. Similarly, those in the higher income groups were significantly less likely to deny and report reduced use than those earning \$12,000 or less. Compared with those who were married, those who were never married were significantly less likely to deny and report reduced use of marijuana. Two additional indicators were significant predictors of marijuana use reduction: gender and use recency. Women were more likely to report reduced use of marijuana than were men. Those who reported marijuana use in 1984 were less likely to report reduced use compared with other respondents. Finally, note that the signs of the use frequency variables were reversed for use reduction and denial; frequency of use in 1984

3. Dummy variables for employment status were omitted from regression models for two reasons. Respondents with missing values on any variable were eliminated from regression analyses; these resulted in too few cases for two employment dummy variable categories (military and unemployed) to provide reliable parameter estimates. Additionally, these indicators were highly collinear with other indicators of social status that were already in the model (education and income).

Table 5. Logistic Regressions: Predicting Use Reduction and Denial of Marijuana Use (N = 5,846)

Variable	Use Reduction				Use Denial			
	b	Standard Error	Odds Ratio		b	Standard Error	Odds Ratio	
1988 interview mode:								
Face-to-face/alone	. . .	. . .	1.00		. . .	. . .	1.00	
Face-to-face/someone present	-.30	.16	.74		-.25	.24	.78	
Self-report	.06	.06	1.06		-.18	.09	.84	
Telephone	.34	.14	1.40*		.73	.17	2.08***	
1988 interviewer familiarity:								
One contact	. . .	. . .	1.00		. . .	. . .	1.00	
> 1 contact	.06	.06	1.06		.01	.09	1.02	
Race:								
White	. . .	. . .	1.00		. . .	. . .	1.00	
Black	.83	.07	2.29***		.96	.11	2.61***	
Hispanic	.60	.09	1.82***		.58	.12	1.78***	
Age (years):								
24-25	. . .	. . .	1.00		. . .	. . .	1.00	
26-27	.09	.08	1.09		.13	.11	1.14	
28-29	-.02	.08	.98		.07	.11	1.06	
30-32	.04	.09	1.04		.03	.13	1.02	
Sex:								
Male	. . .	. . .	1.00		. . .	. . .	1.00	
Female	.21	.06	1.24***		-.04	.09	.97	

Income:						
< 12,000	. . .	. . .	1.00	. . .	. . .	1.00
12,001–20,000	–.14	.10	.87	–.32	.14	.73*
20,001–30,000	–.22	.10	.80*	–.34	.15	.71*
30,001–43,000	–.43	.11	.65***	–.39	.16	.67*
43,000 +	–.24	.12	.79*	–.42	.17	.66*
Missing	–.11	.09	.89	–.19	.13	.83
Educational status:						
< high school	. . .	. . .	1.00	. . .	. . .	1.00
High school graduate	–.25	.08	.78**	–.38	.11	.69***
Some college	–.34	.10	.71***	–.42	.14	.66**
College graduate	–.38	.11	.68***	–.66	.17	.51***
Marital status:						
Married	. . .	. . .	1.00	. . .	. . .	1.00
Never married	–.28	.08	.76***	–.29	.11	.75**
Other ^a	–.12	.09	.89	–.23	.14	.80
1988 residence:						
Rural	. . .	. . .	1.00	. . .	. . .	1.00
Urban	–.03	.08	.97	–.02	.12	1.02
1984 use recency:						
Use in last year	–.20	.07	.81**	–.11	.11	.90
No use in last year	. . .	. . .	1.00	. . .	. . .	1.00
1984 lifetime use frequency	.40	.03	1.49***	–.54	.05	.58***

NOTE.—Model χ^2 ($df = 23$) for use reduction = 435.23***; model χ^2 ($df = 23$) for use denial = 405.11***.

^a Divorced, widowed, or separated.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

was positively associated with use reduction and negatively associated with use denial. This reflects the trends observed in table 2. It also reflects the possible operation of methodological artifacts such as ceiling and floor effects (e.g., see Cook and Campbell 1979). Those in the highest use categories had more opportunity for reduction in use because of the way in which the use response categories were structured. Those in the lowest use category had nowhere else to go but to the nonuse category to become use deniers.

Cocaine use reduction and denial. Significant effects for use reduction and denial were detected for interview mode, race, education, marital status, and interviewer familiarity (see table 6). Compared with respondents interviewed alone face-to-face, those interviewed by telephone were significantly more likely to report less use and to deny use in 1988. Compared with white/other respondents, black respondents were significantly more likely to deny and report less cocaine use at follow-up. Hispanic respondents were also more likely than white/other respondents to deny cocaine use. Those with higher education levels (i.e., with at least some college) were less likely to report reduced use or to deny use than those who failed to finish high school. Compared with married respondents, those who were divorced, widowed, or separated or those who were never married were less likely to deny and report less cocaine use. Respondents who were interviewed by the 1988 interviewer on more than one occasion were also more likely than others to deny and report less use of cocaine in 1988. Respondent residence was associated with reduced use of cocaine but not with use denial. Residents of urban locations were less likely to report reduced use than residents of rural locations. As with marijuana reports, higher cocaine use frequency in 1984 was associated with increased rates of reduced use and lower rates of use denial. Use recency, income, gender, and age were not associated with cocaine use reduction or denial.⁴

Some overall model similarities should be underscored. The most consistent overall correlate of use reduction and denial, regardless of substance, was race. In particular, black respondents consistently underreported marijuana and cocaine use compared with white/other respondents. This effect is reinforced by the finding that odds ratios

4. Upon completion of these analyses, we were informed by a staff member at the National Opinion Research Center that a small percentage of the interviewers were assigned new identification numbers over the course of the study. This has the obvious effect of decreasing the precision of our estimates of "interviewer familiarity" effects. We reestimated all of the regression models eliminating the potentially problematic indicator of interviewer familiarity. Irrespective of the dependent variable being predicted, none of the parameter estimates or standard errors for the effects of other variables were substantively affected by our elimination of the interviewer familiarity indicator.

were consistently highest for estimates pertaining to black versus white/other comparisons. Black respondents consistently had over twice the odds of underreporting compared with whites/others—even after controlling for a range of other important correlates of use reduction. The strongest risk differences were observed for cocaine use denial; blacks had over three times the odds of denial compared with whites/others. Other consistent differences were observed for interview conditions (respondents interviewed by telephone always had an increased risk for underreporting), education (respondents with higher levels of education always had a decreased risk for underreporting), and marital status (married respondents always had an increased risk for underreporting). Region of respondent residence and interviewer familiarity were only salient in models predicting cocaine use denial. Respondent income was only salient in models predicting marijuana underreporting.

Following up on the significant findings with respect to race and on previous research comparing mode effects (Aquilino 1992), we constructed a series of models evaluating interactions between race/ethnicity and interview mode. Out of four models, only one such interaction approached significance—the interaction between Hispanic ethnicity and responses on a self-administered questionnaire in the model predicting cocaine use denial. The coefficient for this interaction suggested that Hispanic respondents who were interviewed with a self-administered questionnaire were significantly more likely to deny cocaine use than Hispanic respondents who were interviewed face-to-face. The relative underreporting for black respondents persisted, irrespective of interview condition.

Discussion

A high rate of underreporting was evident for both marijuana and cocaine, with rates of use reduction observed for just under one-third of all marijuana users and just over one-third of all cocaine users. If denial is the criterion for evaluating underreporting, it appears that the harder substance, cocaine, is more affected by this phenomenon. Outright denial of use at follow-up was nearly twice as prevalent among cocaine users as it was among marijuana users.

We have used the term “underreporting” to describe logically inconsistent responses in 1988 observed in this study. One major limitation of this study is the lack of an external validating criterion for 1984 responses. Our review of prior research on reinterview effects suggests that initial responses are likely to have more validity than those provided at follow-up; it also suggests that reinterviews tend to result in

Table 6. Logistic Regressions: Predicting Use Reduction and Denial of Cocaine Use (N = 1,505)

Variable	Use Reduction			Use Denial		
	b	Standard Error	Odds Ratio	b	Standard Error	Odds Ratio
1988 interview mode:						
Face-to-face/alone	. . .	. . .	1.00	. . .	. . .	1.00
Face-to-face/someone present	-.23	.28	.79	.39	.15	1.48
Self-report	-.20	.12	.82	-.09	.15	.91
Telephone	.68	.24	1.98**	1.17	.26	3.24***
1988 interviewer familiarity:						
One contact	. . .	. . .	1.00	. . .	. . .	1.00
> 1 contact	.30	.13	1.35**	.36	.15	1.43*
Race:						
White	. . .	. . .	1.00	. . .	. . .	1.00
Black	.79	.16	2.20***	.70	.18	3.32***
Hispanic	.23	.17	1.25	.51	.20	1.67**
Age (years):						
24-25	. . .	. . .	1.00	. . .	. . .	1.00
26-27	-.06	.16	.94	-.07	.19	.93
28-29	-.30	.17	.74	-.19	.20	.83
30-32	-.12	.18	.89	-.22	.22	.80
Sex:						
Male	. . .	. . .	1.00	. . .	. . .	1.00
Female	.08	.12	1.08	.09	.14	1.09

Income:						
< 12,000	. . .	. . .	1.00	. . .	. . .	1.00
12,001–20,000	.12	.20	1.12	.16	.24	1.16
20,001–30,000	–.25	.20	.78	–.14	.25	.87
30,001–43,000	.01	.20	1.00	.13	.25	1.14
43,000 +	–.26	.21	.77	–.46	.28	.63
Missing	–.24	.19	.79	.04	.23	1.05
Educational status:						
< high school	. . .	. . .	1.00	. . .	. . .	1.00
High school graduate	–.32	.17	.73	–.33	.19	.72
Some college	–.39	.19	.68*	–.22	.22	.81
College graduate	–.62	.21	.54**	–.54	.26	.58*
Marital status:						
Married	. . .	. . .	1.00	. . .	. . .	1.00
Never married	–.49	.14	.61***	–.65	.17	.52***
Other ^a	–.39	.18	.67*	–.69	.23	.50***
1988 residence:						
Rural	. . .	. . .	1.00	. . .	. . .	1.00
Urban	–.34	.17	.71*	–.38	.20	.69
1984 use recency:						
Use in last year	–.18	.12	.83	–.16	.15	.85
No use in last year	. . .	. . .	1.00	. . .	. . .	1.00
1984 lifetime use frequency	.73	.06	2.08***	–.25	.07	.78**

NOTE.—Model χ^2 ($df = 23$) for use reduction = 131.41***; model χ^2 ($df = 23$) for use denial = 242.30***.

^a Divorced, widowed, or separated.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

reduced reports of behaviors (or symptoms) among those originally reporting them. There are, however, alternative explanations for logical inconsistencies observed in 1988 which may not reflect retest artifact. The validity of original reports may be threatened by errors in the data (erroneous coding, transcription, or data processing) or by respondent exaggeration. Deniers may reinterpret the question regarding use upon reinterview; experimental or low-level use may be honestly redefined as “nonuse” by certain respondents.⁵

Prior studies evaluating the effects of interview mode on underreporting in substance use surveys suffer from a similar problem. Researchers have assumed that within any given study, significantly lower rates of disclosure in one mode compared with another (usually telephone surveys compared with face-to-face interviews) reflect underreporting. Indeed, absent externally validating measures of substance use, an argument could be made that higher rates found in the face-to-face interviews reflect overreporting. Future research on underreporting in nationally representative samples needs to include externally validated measures of use (such as urine or hair samples, treatment records, or collateral reports by friends and relatives) against which respondent reports can be compared.

Another possible limitation of this study concerns its generalizability beyond the years covered by the two waves of interviews. Our analyses focus on reporting patterns observed during a period characterized by potent **antidrug** norms. Underreporting may be a reflection of the general **antidrug** sentiments held by society during the 1980s. To the extent that shifts away from such attitudes occur in other survey periods, the problem of underreporting may diminish in importance.

Rubio-Stipec et al. (1992) discuss three types of response errors in lifetime assessment of behavior using follow-up interviews. The present study focused on only one type of response error-failure to recall behavior reported earlier. Additional analyses suggest that one other type of error also occurs with relatively high prevalence within this survey: many subjects who initially denied substance use admit to use upon follow-up, with “onset” of use occurring before the 1984 interview. We are currently exploring the implications and correlates of this type of error. These additional analyses require reliance on the dating of behavior in a way that our present study of retest artifact does not; the precise dating of behaviors is notoriously inaccurate (see Jobe and Mingay 1991; Means and Loftus 1991).

These analyses suggested that there was differential underreporting by interview mode. An important limitation of the present study should be pointed out in connection with this finding. Although an attempt

5. These possibilities were suggested by an anonymous reviewer.

was made to randomly assign face-to-face and self-reported drug use interviews, our indicator of interview mode does not reflect a randomly assigned variable. In particular, telephone interviews and interviews in the presence of other people were not randomly assigned. Possible selection biases in mode assignment could have influenced our findings. Nevertheless, the influence of such biases were limited by our inclusion of demographic control variables (variables that should be associated with mode assignment) in multiple logistic regression models.

The validity of this quasi-experimental approach in the assessment of interview mode effects is supported by the consistency of our findings with previous studies. Consistent with previous studies cited above, this study suggests that telephone interviews lead to significant underreporting of substance use compared with face-to-face interviews or self-administered questionnaires. The lack of difference between underreporting for face-to-face interviews and self-administered questionnaires is not particularly surprising in light of the overall format for the NLSY interview. The drug use section of the survey was a separate section; all respondents had an interviewer with whom they interacted prior to the completion of this section. The presence of an interviewer and the repeated contact with study personnel over multiple interviews may have outweighed the additional sense of privacy gained through self-administration. Our interview mode comparisons provide evidence that telephone interviews are an ineffective method for ascertaining substance use history in longitudinal studies. The conclusions drawn by Johnson, Hougland, and Moore (1991) are relevant in this context. These researchers suggested that telephone interviews fail to provide respondents with "obvious cues to interviewer identity and the opportunities for nonverbal interaction routinely available in a face-to-face situation" (p 181). Such cues may be necessary to encourage self-revelation, especially under circumstances in which respondent anonymity is threatened (such as longitudinal surveys).

Analyses suggest that, irrespective of drug use survey mode, repeated contact with the same interviewer can have an impact on responses with respect to lifetime use of drugs. Consistent with the suggestions made by Mensch and Kandel (1988), interviewer familiarity does lead to underreporting. Note, however, that the extent of underreporting must be narrowly circumscribed. Interviewer familiarity was not associated with a decline in reports of marijuana use. Interviewer familiarity *was*, however, associated with higher rates of cocaine use underreporting.

In general, subgroup differences remained even after mode was controlled for in the multivariate logistic regression model. Consistent with prior literature suggesting differential sensitivities to interview

mode by race, it appeared that race was the single most consistent correlate of underreporting behavior. Hispanic respondents consistently had higher odds of underreporting compared with white respondents. Nevertheless, black versus white/other differences were striking in our analyses. Black respondents had at least twice the odds of underreporting compared with white/other respondents for every measure of underreporting.

Differences in rates of underreporting by race/ethnicity need to be examined further, especially in light of recent epidemiological studies showing lower rates of reported use among minority respondents. In the *Monitoring the Future* study of high school seniors, Johnston, Bachman, and O'Malley (1986) found that, compared with white respondents, black respondents were much more likely to leave responses about drug use blank. Additionally, in supplemental questions, black respondents indicated that if they used drugs, they would not have been willing to report it. Recent waves of the *Monitoring the Future* study summarizing the trends in prevalence across race/ethnic groups suggest relatively low levels of substance use prevalence (based on a 1-year reporting frame) for nonwhite youths compared with white youths (Bachman et al. 1991). These differences were more pronounced for cocaine than they were for marijuana. Similar race/ethnicity differences have been found in other school-based surveys of adolescents (see Oetting and Beauvais [1990] for a recent review). Research on samples of juvenile arrestees (Fendrich and Xu 1994) suggests that race/ethnicity differences in underreporting are not limited to school-based surveys. These prior results, when evaluated in the context of our findings with a longitudinally followed sample of adults, suggest that prevalence differences across race/ethnicity groups may be due in part to differences in underreporting and not entirely to differences in actual use.

In order to improve the validity of drug use reporting in survey research, the precise reasons for differential rates of underreporting among minority respondents need to be explored in greater detail. Our analyses suggest that these differences persist even after a number of possible confounding covariates are controlled for (income, education, residence, and use level at the initial interview). Thus, an explanation for persistent differences might focus on aspects of the interview process itself. A significant race-by-interview-condition interaction between Hispanic respondents and self-reports may indicate that some race/ethnicity differences are a function of language comprehension. Self-report measures written in English may prove challenging to some minority respondents whose native language is not English. Nevertheless, this explanation is of limited relevance to the persistent black versus white/other differences uncovered here.

One promising line of inquiry might investigate race/ethnicity differences between minority respondents and interviewers (Campbell 1981; Columbotos, Elinson, and Lowenstein 1968; Weeks and Moore 1981). Unfortunately, the data set did not facilitate our analysis of this issue. It should, however, be stressed that the underreporting found in this study characterizes data obtained from a number of interview settings. Furthermore, race differences between interviewer and subject are less salient in telephone interviews, the one setting found to show considerable race/ethnicity differences in underreporting in the past.

Previously, in their explanation of race differences in marijuana underreporting, Mensch and Kandel (1988) cited prior comments by Johnston, Bachman, and O'Malley (1984) with respect to black respondents' lack of trust in the research process. This lack of trust may be grounded in previous experience and knowledge about the consequences of disclosing information about sensitive behavior. The reasons associated with underreporting for race may be relevant to a discussion of underreporting for other respondents in which perceived inequalities or social status concerns may be salient. Status inequalities perceived by respondents with lower levels of education or income may result in an increased sense of vulnerability and a general reluctance to disclose information about illicit, socially unacceptable behavior.

Recent research has taken cognitive approaches to understand the validity of behavioral reports and to structure interviews to facilitate more valid reporting (see Jobe and Mingay 1991; Means and Loftus 1991). This work emphasizes the role of memory and comprehension in the validity of self-reports about behavior. The influence of low frequency use on underreporting and denial for both marijuana and cocaine may suggest that fading memory for rare, distant events may influence behavioral reports. If this were the case, however, one would expect use recency in 1984 to have a consistent negative association with underreporting; we did not find this to be the case. Additionally, the logistic regression models demonstrated that the influence of other variables on underreporting persisted even after use level at the initial interview was controlled for. These models suggest that underreporting may be more contingent on motivation than it is on memory.

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