INCREASE IN USE OF SELECTED DRUGS: MONITORING THE FUTURE STUDY OF 8TH-, 10TH-, AND 12TH-GRADERS

MEETING OF THE ANN ARBOR GROUP
APRIL 26-27, 1994

ANN ARBOR, MICHIGAN

PRELIMINARY REPORT
FINAL

Prepared for:

Executive Office of the President
Office of National Drug Control Policy
750 17th Street, N.W., Eighth Floor
Washington, DC 20500

Prepared by:

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and
The Ann Arbor Group

■ June 6, 1994 ■

MEETING OF THE ANN ARBOR GROUP

On April 26 and 27, 1994, the Office of National Drug Control Policy assembled a group of experts in Ann Arbor, Michigan, to examine the recent upswing in the use of some drugs by American adolescents and to explore alternative explanations for this phenomenon. Marijuana, inhalants, LSD (lysergic acid diethylamide), stimulants, and cigarettes were discussed at the meeting. Although cocaine has not shown a similar increase, the data on cocaine were discussed. Those in attendance were as follows:

- Investigators from the Monitoring the Future Study
  University of Michigan
  — Dr. Lloyd Johnston; and
  — Dr. Patrick O'Malley.

- Drug experts from around the country
  — Dr. Gilbert Botvin;
  — Dr. Deborah Ridley Brome;
  — Dr. Raul Caetano;
  — Dr. Richard Clayton;
  — Dr. Joy Dryfoos;
  — Dr. Phyllis Ellickson; and
  — Dr. William Hansen.

- Government officials
  — Dr. William Bukoski;
  — Mr. Fred Garcia;
  — Mr. Arthur Houghton;
  — Ms. Patricia McMahon; and
  — Mr. William Modzeleski.

- CSR staff members
  - Dr. Fe Caces;
  - Mr. Robert Cohen; and
  - Dr. Terry Zobeck.

The meeting lasted 1½ days and consisted of a thorough examination of the existing data from the Monitoring the Future (MTF) study and a thorough discussion of the causes of the phenomenon of increasing drug use and what can or should be done about it. The meeting began with a 2-hour presentation of results from the study by the principal investigator, Dr. Johnston. He covered the trends in use among the three grade levels overall (8th, 10th, and 12th grades—the study also includes samples of college students and young adults; however, the focus of the group was on the junior and high school student samples) and among key demographic subgroups. That presentation, which is summarized in Appendix A, also provided considerable information on the degree of covariance over time of perceived risk and personal disapproval with the use of each drug. Dr. Johnston pointed out that even if these attitudes and beliefs are key determinants of use, as the MTF researchers claim they are, one still needs to determine what factors lead to changes in these attitudes and beliefs.

As might be expected, the group had no definitive answers about what caused the rise, but a host of competing hypotheses emerged about what might be behind these changes in drug use rates.

There was consensus about one thing: These changes are real and constitute a wake-up call for the country. There was genuine concern that the reversal of the downward trend in drug use could signal the emergence of a new epidemic of drug use. On a number of occasions during the past 20 years, there have been assertions by highly placed officials that we have "turned the corner" on drug abuse. Each time, the assertion not only proved to be wrong but seemed to delay timely response to the changes. It would be tragic if nothing were learned from this history of bad guesses about where the trend line is going.

It also would be irresponsible not to ask why there has been a recent upswing in drug use among American adolescents. However, any interpretation must be cautious and made in

context. The context is that during the recent past there has been a dramatic decline in reported drug use among young people in the United States. Is the recent upswing in rates connected to a diminution of influence of the factors which caused the recent dramatic decline in drug use rates?

DISCUSSION

The Ann Arbor Group was asked to focus on five discussion questions.

1. What is the significance of the 1993 results from the MTF study?

2. Are the 1993 numbers the beginning of a long-term trend?

3. What hypotheses seem most promising to account for the observed changes?

4. How can these competing and alternative hypotheses be tested?

5. What other indicators are there from other data sources that either confirm or refute the 1993 MTF results?

Over the course of the 1½-day meeting, the group discussed each of these questions; responses for each question are presented below.

Question 1. What is the significance of the 1993 results from the MTF study? The MTF study has been tracking nationally representative samples of high school seniors annually since 1975. In 1991 nationally representative samples of 8th- and 10th-graders were added. The total sample size is now approximately 50,000. There are three distinctive features of the MTF study: (1) the students who complete the questionnaires are representative of all students in their class cohort; (2) the questions and questionnaires essentially have remained the same since 1975; and (3) the addition of the 8th- and 10th-graders provide earlier warning signs than were possible when the sample contained only 12th-graders.

The Ann Arbor Group noted that the study currently omits young people who have left school at each grade level. In 8th grade, this is probably a negligible proportion, but by 12th grade it can rise to 15 to 20 percent of a class cohort. (Among Hispanic youth, dropout rates may reach as high as 40 percent by the 12th grade.) However, census data suggest that there has been relatively little change in the overall dropout rate during the life of the MTF study.

Table 1 following this page presents past-year use of selected drugs (past-month use for cigarettes) for 8th-, 10th-, and 12th-graders for 1992 and 1993 (see Appendix B for more detailed data). Each drug and its use is discussed briefly below.

- *Marijuana use in past year.*—The Ann Arbor Group believes these increases are real. They are certainly statistically significant: For all three grades, the increases were significant at the 0.001 level. However, the primary concern is about the substantive significance of these results—marijuana is often the first illicit drug used. Any use of marijuana by young persons increases the probability that they will (1) become daily users of marijuana, (2) have opportunities to obtain other illicit drugs, and (3) use them. Slightly over one-quarter of high school seniors, almost one-fifth of 10th-graders, and almost one-tenth of 8th-graders reported use of marijuana in the past year. From a public policy perspective, these numbers and the increases from 1992 to 1993 deserve attention.

- *Inhalant use in past year.*—The group noted that although inhalants are the most widely available drug class, they have been historically ignored in drug prevention curricula and in public service messages. In all three grades (8th, 10th, and 12th), there was an increase in reported past-year use of inhalants, and this builds upon a longer term rise in use among high school seniors during the 1980's. However, the Ann Arbor Group was most alarmed about the statistically significant increase in use among eighth-graders (0.05 level). Part of the reason for the concern is that inhalant use, which is highest in the early teens, appears to function as a "gateway" to other illicit drug use, much like marijuana.

Table 1

Use of Selected Drugs Among 8th, 10th, And 12th Graders: 1992 And 1993[1]

	Year of Survey		
	1992	1993	Sign
Marijuana—Past Year Use			
Seniors	21.9	26.0	***
10th Graders	15.2	19.2	***
8th Graders	7.2	9.2	***
Inhalants—Past Year Use			
Seniors	6.4	7.4	ns
10th Graders	7.5	8.4	ns
8th Graders	9.5	11.0	*
LSD—Past Year Use			
Seniors	5.6	6.8	**
10th Graders	4.0	4.2	ns
8th Graders	2.1	2.3	ns
Stimulants—Past Year Use			
Seniors	7.1	8.4	**
10th Graders	8.2	9.6	*
8th Graders	6.5	7.2	ns
Cigarettes—Past 30 Day Use			
Seniors	17.2	19.0	**
10th Graders	12.3	14.2	**
8th Graders	7.0	8.3	*
Any Ellicit Drugs Other Than Marijuana—Past Year Use			
Seniors	14.9%	17.1%	**

[1]An increase can be statistically significant at three levels of probability. They are traditionally noted as .05, .01, and .001. These levels are noted in the table by an *, **, or ***. If * appears, it means that a difference between 1992 and 1993 this large or larger would occur by chance only 5 times in a 100 if this study were conducted 100 times. If ** appears, it means that a difference between 1992 and 1993 this large or larger would occur by chance only 1 time in a 100 if this study were conducted 100 times. If *** appears, it means that a difference between 1992 and 1993 this large or larger would occur by chance only 1 time in a 1,000 if this study were conducted 1,000 times. If "ns" appears, it means that the increase was not statistically significant.

- *LSD use in past year.*—The MTF researchers argue that the rise in LSD use, which had been occurring among college students and young adults for 3 years, may be due in part to the fact that it has been a long time since LSD was widely used, and young people became concerned about its consequences. "Generational forgetting" may have occurred. They also noted that self-reported availability has been rising for several years and, in the case of this drug, may have played a role in its increased use.

- *Stimulant use in past year.*—Stimulants constitute a class of illicit drugs which also were popular in the early years of the epidemic. There was a statistically significant increase in use for both 12th- and 10th-graders.

- *Use of any illicit drug other than marijuana in past year.*—This finding makes clear that the increase in drug use is not just confined to marijuana. While the increases in marijuana use in 1993 were clearly the sharpest, the proportion of seniors going beyond marijuana use to the use of other illicit drugs also rose significantly.

  Statistics for 8th- and 10th-graders' use of "other illicit drugs" are not calculated because their answers for inhalants and opiates other than heroin are not considered reliable by the MTF investigators. The "other illicit drugs" category for seniors does not include inhalants, alcohol, or cigarettes.

- *Cigarette use in past 30 days.*—There is evidence that cigarette use is a gateway drug for the use of other drugs, both in terms of time order of occurrence (i.e., simple age at onset) and conditional probability (e.g., use of cigarettes increases the likelihood of using marijuana), which may be related to learning how to smoke (e.g., route of administration) and learning to use a drug to alter mood. For these and other reasons, the data presented above are alarming to the members of the Ann Arbor Group. For example, the negative message about cigarette use is and has been consistent and constant in the mass media and through other channels as

well (i.e., school health curricula). This being so, why would statistically significant increases in past 30-day and daily use rates occur? It cannot be the inconsistency in, or the frequency with which, the message is being delivered. It also should be noted that, for most of these youth, purchasing any nicotine-containing product (e.g., cigarettes or smokeless tobacco) is illegal. The forthcoming increase in cigarette taxes should help, and perhaps the imposition of the Synar Amendment will have an effect on these rates. (The Synar Amendment to the 1992 Alcohol, Drug Abuse, and Mental Health Administration, (ADAMHA) Reorganization Act provides explicit performance guidelines to the States for limiting youth access to tobacco products). Certainly a careful examination of these rates over the next 3 to 5 years will be a way of naturalistically measuring the effect of legislation as a way of controlling access to such drugs.

The Ann Arbor Group reached consensus on the following points with respect to the significance of these findings:

- The observed upturn in drug use that has occurred among American adolescents is valid;
- The levels of use attained by 1992 were still high by historical and international standards;
- Despite substantial improvements in recent years, this turnaround suggests a need to critically examine prevention efforts;
- Things clearly can get worse;
- The interventions in the aggregate are proving insufficient to hold the ground that has been won;
- Drug use is a chronic, relapsing problem for society—one which requires sustained countermeasures; and

- It is important to inoculate new replacement generations of naive young people.

Question 2. Are the 1993 numbers the beginning of a long-term trend? There is no way to know for certain, of course, whether the increases in drug use will continue beyond 1993. Several ominous signs were noted, however. First, for a number of drugs the key attitudes of perceived risk and disapproval continued to erode in 1993, and they appear to have been leading indicators in this most recent turnaround. Further, there was erosion in these attitudes for cocaine and crack-cocaine, which could foretell an increase in their use in 1994, even though there was not a significant increase in 1993. Second, insofar as cigarettes, inhalants, and marijuana play roles as gateway drugs for the use of other illicit drugs, their increased use could have further consequences, particularly among eighth-graders. Finally, there has been no obvious shift in the historical situation related to drug use since the 1993 survey, which might be presumed to lead to some reversal of the increase. The major exceptions have been the widely publicized deaths of actor River Phoenix and rock star Kurt Cobain, which could have some deterrent value if students can learn vicariously from their experiences. Whether the trend is likely to continue, however, depends on what is driving it and whether those underlying factors are changing.

Question 3. What hypotheses seem most promising to account for the observed changes? The Ann Arbor Group spent a substantial amount of time discussing competing and alternative hypotheses, which might account for the observed changes of concern and the recent upswing in use of selected drugs. As an exercise, the group listed 20 such hypotheses and ranked them based on an average of individual ratings. Each participant was asked to rate what they judged to be the importance of each hypothesis in explaining the observed increase in drug use in 1993, taking into account the probability that the hypothesized change in the explanatory variables had occurred and the likely importance if it did occur. It is known that the rates of drug use are affected by a complex nexus of risk factors (e.g., at the individual biological, psychological, social, environmental, and cultural levels) and protective or resiliency factors (e.g., forces which might cancel out or buffer the influence of the risk factors). Therefore, multiple hypotheses (some of which are at least partially testable with existing data sets) may be true. Given this caveat, the hypotheses generated by the Ann Arbor Group are provided in Exhibit 1 on the following page.

Exhibit 1

Complete List of Hypotheses

1. Reduction in perceived risk and disapproval associated with drugs
   - A. More "proponents" and "reassurers" in the mass media
   - B. Less "informal learning" of risks, due to:
     1. Less news coverage
     2. Less Partnership coverage
     3. Less coverage in entertainment programs
     4. Fewer "unfortunate role models" (e.g., Len Bias)
2. Increased use of "gateway drugs"
   - A. Change in age at first use of gateway drugs
3. Diffusion down from college student population
4. Increased availability of LSD
5. Lower prices of cigarettes
6. Revival of interest in some attitudes, beliefs, and behavior from the 1960s
7. As drug use became rarer over the past 10 years, it may have become more "attractive" to youth as a form of rebellion
8. Fluctuations in economic cycles
9. Social and political alienation
10. Saturation/desensitization to prevention messages
11. Rise in deviance generally
12. Erosion in constraining factors (parents, teachers)
13. Improvement in school retention (i.e., decreasing expulsions and dropouts)
14. Rising school suspension rates
15. Parents are increasingly drug experienced
16. Reduced funding for prevention
17. Prevention in schools may be declining, less effective, or backfiring
18. Motivating force of executive leadership has declined
19. State and local efforts in prevention may be lagging
20. Increased influence of social stressors (racism, poverty, etc.)

The Ann Arbor Group discussed these hypotheses in some detail and ranked them in order of importance (i.e., from 1-highest to 20-lowest) for explaining the observed increase in drug use. The leading hypotheses are discussed below. The reader should be cautioned that these hypotheses are based on discussions by a selected group of experts; another selected group of experts might generate different or additional hypotheses for explaining the upturn in drug use.

A general rise in deviance generally has helped produce the observed rise in drug use among adolescents.

- The MTF study includes 14 items measuring delinquency (e.g., "gotten into a serious fight at school or work" and "damaged school property on purpose"). For 7 of the 14 items among high school seniors, the rates are at their highest levels since the study began in 1975.

- In most studies, delinquency and drug use are statistically correlated at the individual level though not necessarily at the aggregate level, and delinquency usually precedes drug use at the individual level.

- If aggregate levels of delinquency are increasing in this age group, an expected consequence might be increased drug use.

- It should be noted, however, that the trends in delinquency and drug use are not coincident at the aggregate level. While delinquency has risen gradually in recent years, drug use rose sharply in 1993.

An increased use of gateway drugs or a reduction in the average age at onset of use of gateway drugs has helped produce the observed rise in drug use among adolescents.

- The data show an increase in the daily use of cigarettes (all three grades).

- It is possible that the increases in cigarette use portends further increases in the use of marijuana and other drugs.

- The MTF study contains data that would allow a test of the hypothesis claiming the average age at onset of use of gateway drugs has declined.

- The use of two other drugs—marijuana and inhalants— which serve as gateway drugs to further illicit drug use increased in 1993.

The reduction in students' perceived risk of using specific drugs, and their perceived disapproval by friends for their using specific drugs, has helped produce the observed rise in drug use among adolescents.

- This hypothesis received considerable attention from the MTF investigators in regard to marijuana and cocaine. They found that increases in the perceived harmfulness of these two drugs and perceived disapproval of the use of these two drugs track exceedingly well with the trend lines in the use of these two drugs.

- The MTF researchers investigated whether changes in perceived availability, conservatism, and religiosity were plausible as alternative predictors in the earlier downturn of drug use; they were not.

- Given the strength of the existing evidence from the MTF study, drug use among high school students is most affected by the perceived harmfulness of using certain drugs.

- The following two subcomponents of this hypothesis were offered by the investigators to help explain the observed shifts in disapproval and perceived risk.

A. An increase in the number and visibility of drug use proponents and those who reassure young people that the use of drugs is safe and appropriate helped produce the observed rise in drug use among adolescents.

- It is assumed that youth are influenced by the mass culture.

- It is assumed that a distinct youth culture exists within the United States.

- The data underlying the hypothesis are a seeming increase in the number of popular songs which glorify drug use and the visibility of popular culture heroes who openly admit drug use and thus offer themselves as models.

B. An overall reduction in informal learning about the risks of drug use (e.g., less news coverage of drug issues, fewer numbers of and less appropriate time slots for Partnership for a Drug Free America PSAs (public service announcements), less focus on drug use in entertainment programming, fewer "unfortunate" role models for the dangers of drug use) has helped produce the observed rise in drug use among adolescents.

- There was an 83-percent reduction in the coverage of drug use issues in major television network news between 1989 and 1993.

- The major television networks reduced the dollar value of Partnership for a Drug Free America PSAs by 29 percent between 1990 and 1993.

- The data reflect the reduced priority of drug abuse on the public policy agenda, at least as that agenda is reflected in mass media coverage.

- The Persian Gulf War so dominated the mass media for so long that many important domestic issues, including drug use, were pushed off the public agenda and out of the consciousness of the American public.

- Violence in its many manifestations and health care emerged as top priority issues, replacing drug abuse as a topic of concern in the mass media. The degree to which drug use is integrally connected to these other problems has been substantially overlooked and ignored in the media.

- Young people watched, attended to, remembered, and reported that mass media PSAs had an influence on their intentions to use and the actual use

of drugs, according to data from the MTF study. In 1993 there was a decline in their recalled exposure to the adds, and to the judged impact of the ad campaign on their own drug-using behavior.

An erosion in the constraining influence of people in key social control roles (e.g., parents and teachers in particular) has helped produce the observed rise in drug use among adolescents.

- There is a widely held assumption that peer influences are so dominant during adolescence that the influence of significant adults (i.e., parents and teachers) is virtually nonexistent; this is not so.

- The group identified a steady erosion in the influence of parents and teachers as a possible predictive factor for the observed increase in use of selected drugs among adolescents.

- Possible mechanisms by which these factors might operate are:

  — Greater percentage of families with two working parents;

  — More single parents;

  — Less monitoring and supervision of children at all ages;

  — Increased level of discomfort among parents who themselves used drugs about telling their children not to use them; and

  — Increased loss of control within classrooms and the consequent loss of respect for teachers by students.

- In schools there is the impression that teachers have less authority and thus less influence.

- It should be noted that most of these social trends have been gradual and do not map well onto the change curves for drug use.

Increased availability (with specific regard to LSD) and lower price disincentives (with specific regard to cigarettes) helped produce the observed rise in the use of these drugs among adolescents.

- Data are available concerning the perceived availability of LSD. They show an increased perceived availability in recent years (see Appendix B). In addition, perceived risk and disapproval rates have been decreasing since 1991.

- If the previously published analyses are replicated, then increased availability would have less predictive power than decreases in perceived harmfulness in explaining the increase in LSD use.

- This hypothesis reflects a general principle about the price elasticity of a commodity like cigarettes. It generally is assumed that increases in price serve as a disincentive to new users, particularly adolescents, who presumably have less discretionary income. The question is whether, in this case, adjustments in price that occurred during a recent price war among tobacco companies increased use.

- It was not determined whether the annual time points used for measurement in MTF are ideal for capturing the effects of price wars. The effects of price changes more generally might be tested at the State level, however.

A decline in the motivating force of executive leadership (i.e., Federal, State, local, civic) helped produce the observed rise in drug use among adolescents.

- The assumptions behind this hypothesis are as follows:

— Leaders influence the priority rankings of social problems on the public policy agenda;

— Failure of leaders to identify drug use as a top priority causes it to drop from the agenda;

— There is a radiating effect of leadership out from the Federal level;

— The diminution of attention to drug use as a top priority at the Federal level has caused a diminution of concern about drug use at the State, local, and civic levels;

— The media take their cues in considerable part from the national leadership. The decline in media coverage already has been documented;

— There is some additional evidence to support this hypothesis at the State level. The National Association of State Alcohol and Drug Abuse Directors indicates that States have reduced their dollar commitments to deal with drug use in the past 2 to 3 years;

— This compounds the recent reduced Federal commitments of dollars targeted at drug use prevention and could be exacerbated by projected further decreases in such commitments from the Federal Government; and

- There was considerable agreement within the Ann Arbor Group that the societal wide problem of drug use was never really solved; the level of use simply declined appreciably. The reductions were used, at least implicitly, as a basis for shifting attention elsewhere.

- Two new foci of concern, particularly in the schools, have been HIV/AIDS (human immunodeficiency virus/acquired immune deficiency syndrome) and violence.

- There was also general agreement in the Ann Arbor Group that for any of the social problems (e.g., drug use, HIV/AIDS, violence in the schools and streets), there is need for a sustained and robust response—episodic and relatively weak commitments do not suffice.

It is always possible to generate more hypotheses than there are data available to test them, and the Ann Arbor Group has done that with its list of 20. However, data have been brought to bear on a number of them by the MTF research group; others could be tested to some degree with further analysis of the MTF data, and still others may be testable with the use of additional data sets.

It should be noted that most of these hypotheses are stated with the presumption that some condition in the society has changed, and that because of that change, drug use has gone up. The presumption itself should be tested first, and in a number of cases, it has been tested. Data of additional relevance come from static or cross-time correlations regarding the hypothesized causal factor and the level of drug use in this age group. There is still much to be examined and tested. The Ann Arbor Group recommended that as many hypotheses as possible be addressed in the MTF data, and that other data sets be considered for the remainder of the hypotheses. Wherever possible, hypotheses should be examined with multiple data sets.

Question 4. How can these competing and alternative hypotheses be tested?

- The MTF study constitutes an important national resource for exploring these hypotheses. Now that the hypotheses have been identified, researchers at the University of Michigan can begin addressing the ones for which data are available.

- It would be useful to explore in more detail other data sets that might have appropriate indicators and develop mechanisms by which the hypotheses could be tested in those data sets.

Question 5. What other indicators are there from other data sources that either confirm or refute the 1993 MTF results?

- There are other data sets which might be relevant to address the observed rise in drug use among adolescents:

  — The National Household Survey on Drug Abuse (NHSDA), formerly administered by the National Institute on Drug Abuse, now located administratively in the Office of Applied Studies in the Substance Abuse and Mental Health Services Administration;

  — The Youth Risk Behavior Surveys conducted under the auspices of Centers for Disease Control and Prevention;

  — The SEARCH data set that may be somewhat limited in geographic scope; and

  — School-based surveys conducted by the Addiction Research Foundation in Ontario, Canada.

- With regard to specific indicators that would allow replication of the analyses conducted with the MTF study, there was not sufficient familiarity with these other data sets to make much comment.

- However, it is known that the NHSDA does contain questions about perceived harmfulness and the usual 12 to 17 year-old breakdown might be further broken down into 8th-, 10th-, and 12th-graders.

- It is suspected that the NHSDA does not adequately cover school dropouts to address the influence on survey results of dropping out.

- The number of school suspensions is said to have risen in recent years and, simultaneously, the retention rates may have increased as well. These assertions need to be tested empirically.

- If retention rates have increased enough, this would mean that some of those who would formerly have dropped out are remaining in school, and they might be influencing the aggregate rates of use.

- It seems unlikely, however, that this would account for the sharp 1-year increase that was observed in all grades in 1993.

In the end, however, it is clear that there will remain a great deal which cannot be empirically proved or disproved. Ideally, there should be data from multiple sources that are comparable. In the absence of such data, policymakers will have to proceed on their partially informed judgements about what is happening and why. This is the way policy decisions usually are made. Hopefully, the exercise of the Ann Arbor Group will help by offering a fairly comprehensive list of issues to be considered, as well as its partially informed judgements about what have been the most important determinants of the observed rise in drug use rates from 1992 to 1993.

APPENDIX A

BACKGROUND INFORMATION FOR THE ONDCP MEETING ON ADOLESCENT DRUG USE

Background Information

for the

ONDCP Meeting on Adolescent Drug Use

on

April 26-27, 1994, Ann Arbor

Lloyd Johnston

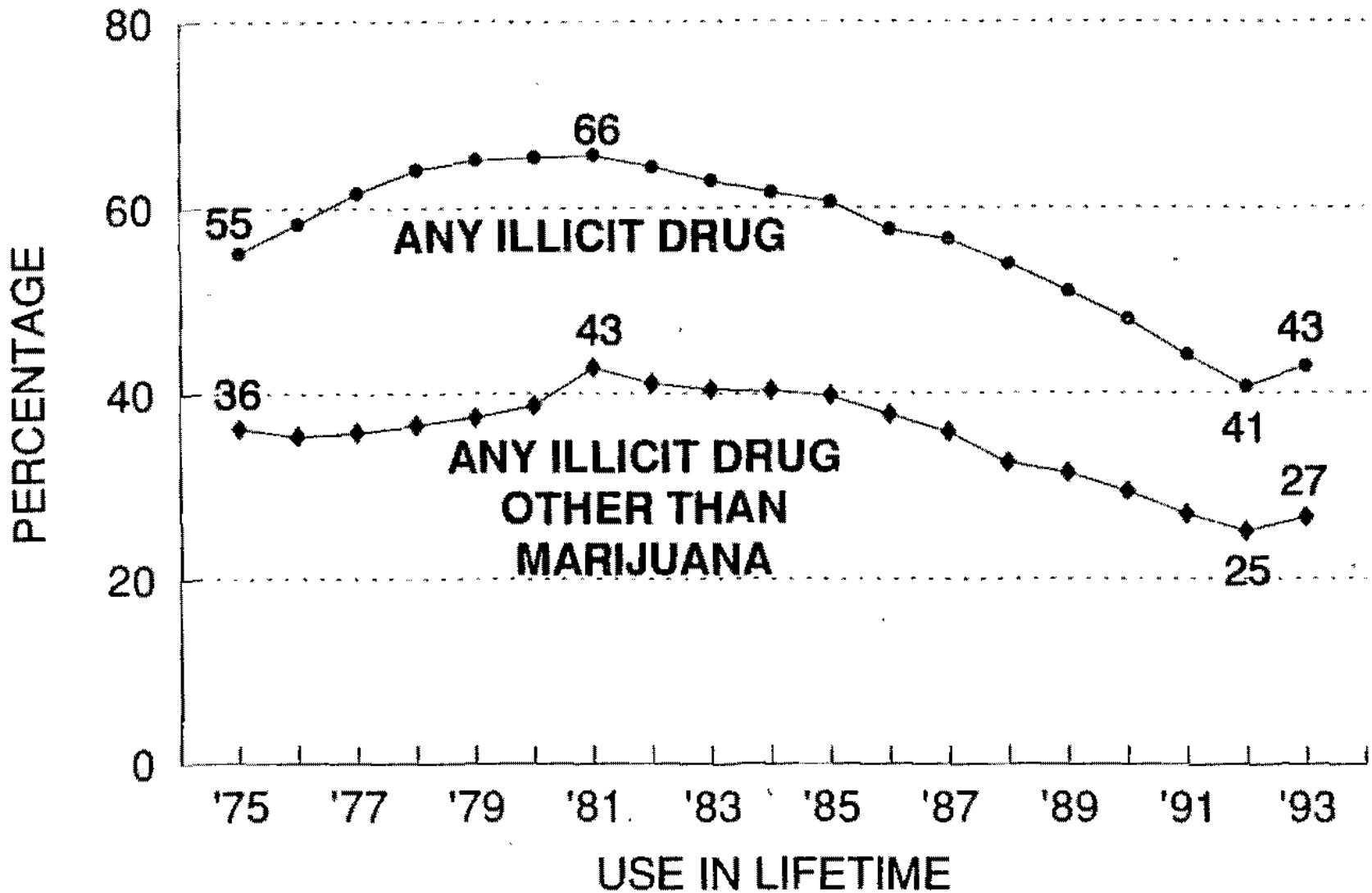
Note to Participants

Enclosed are some figures detailing the phenomenon under consideration--namely, the recent increase in several forms of illicit drug use and in cigarette smoking. For each drug showing such an increase, plus cocaine, which has not as of yet, there are long-term trend data for subgroups based on region, urbanicity, racial/ethnic classification, and socioeconomic status as measured by parents' average education. Please note that the racial/ethnic group trends are based on two-year moving averages to damp out random perturbations. This also makes them less sensitive to one-year changes, such as in 1993.

Many of the numbers associated with these graphs are contained in the tables attached to the January 1994 press release.

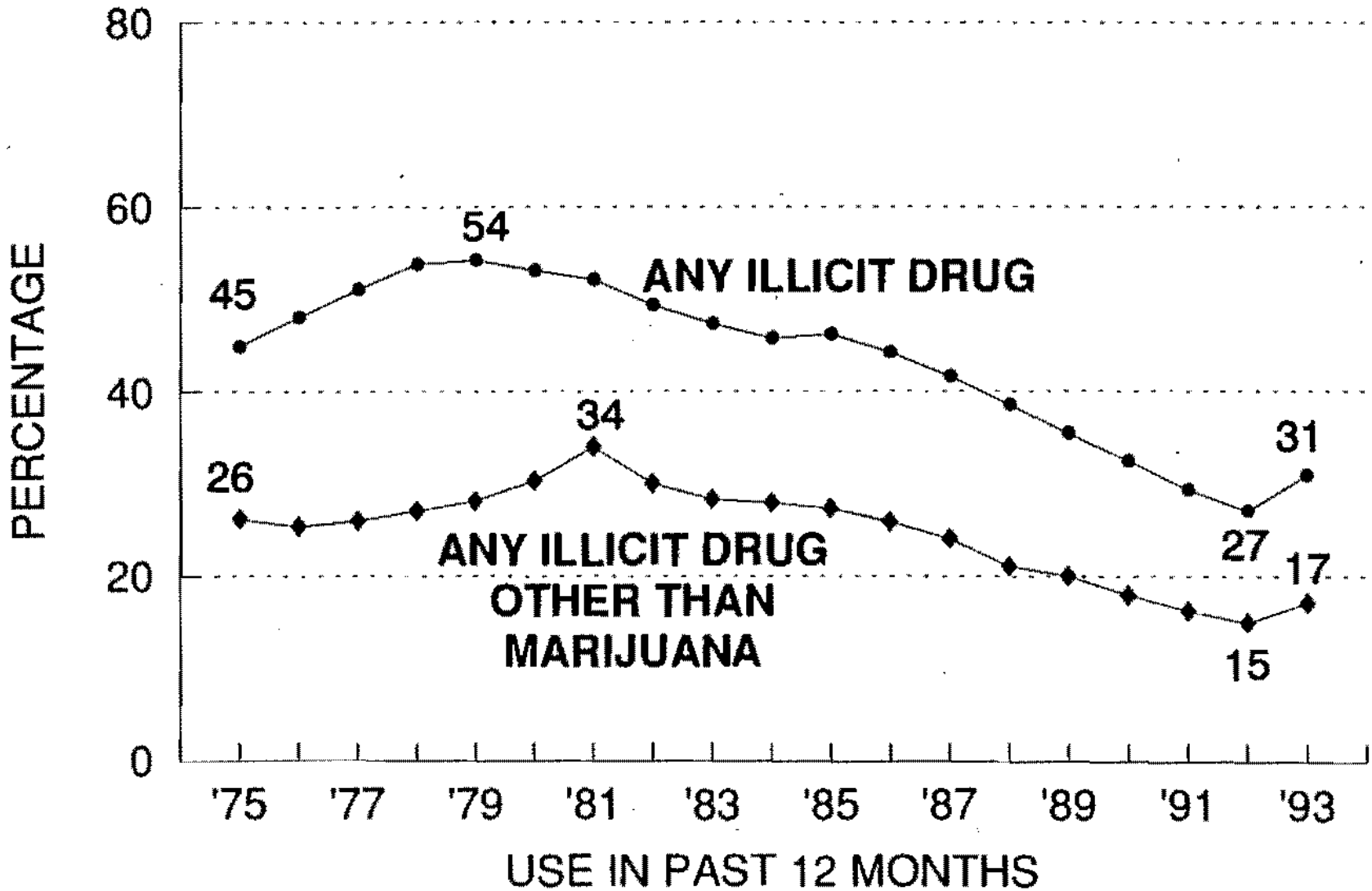
TRENDS IN LIFETIME PREVALENCE OF AN ILLICIT DRUG USE INDEX

TWELFTH GRADERS



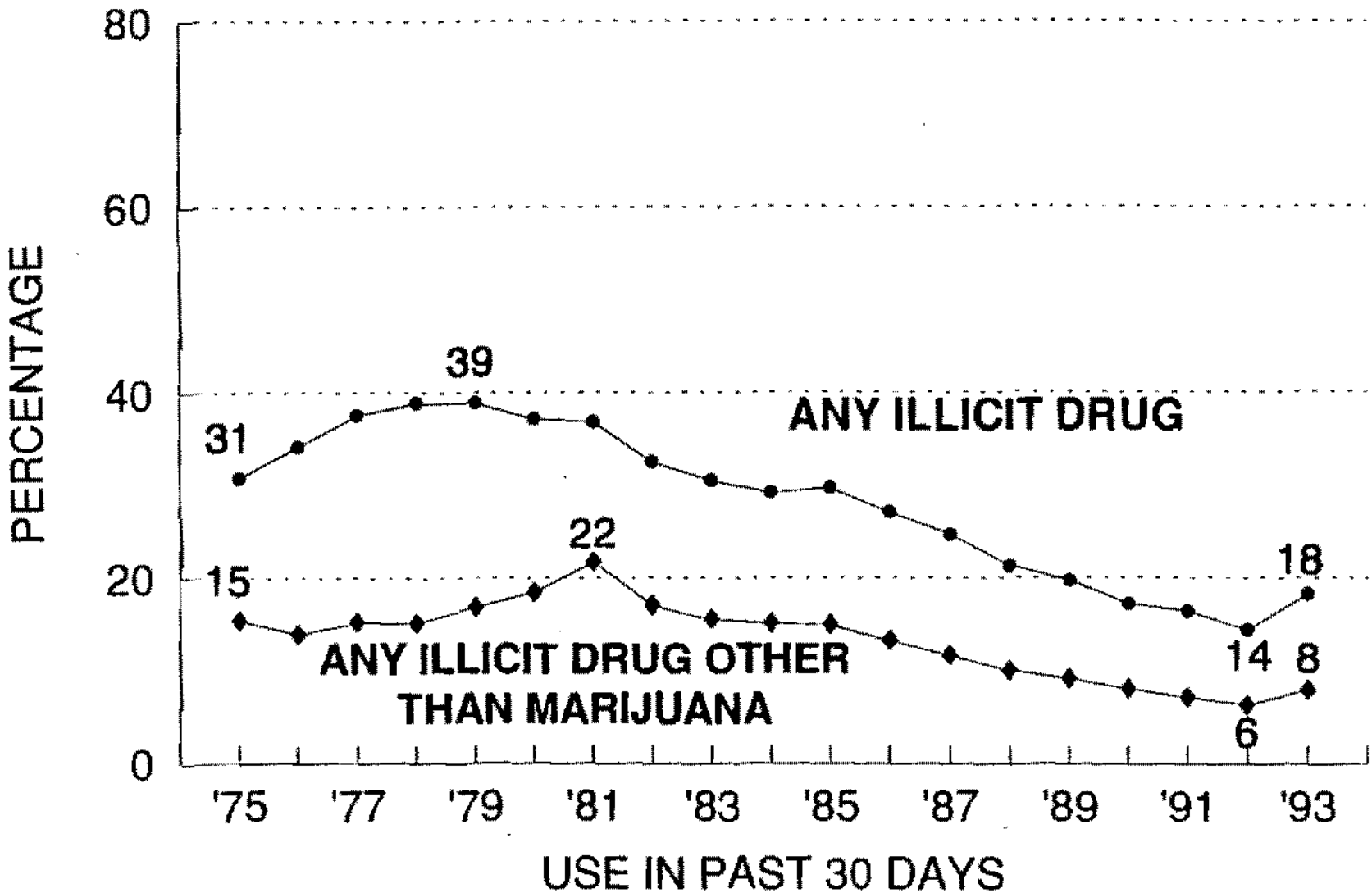
TRENDS IN ANNUAL PREVALENCE OF AN ILLICIT DRUG USE INDEX

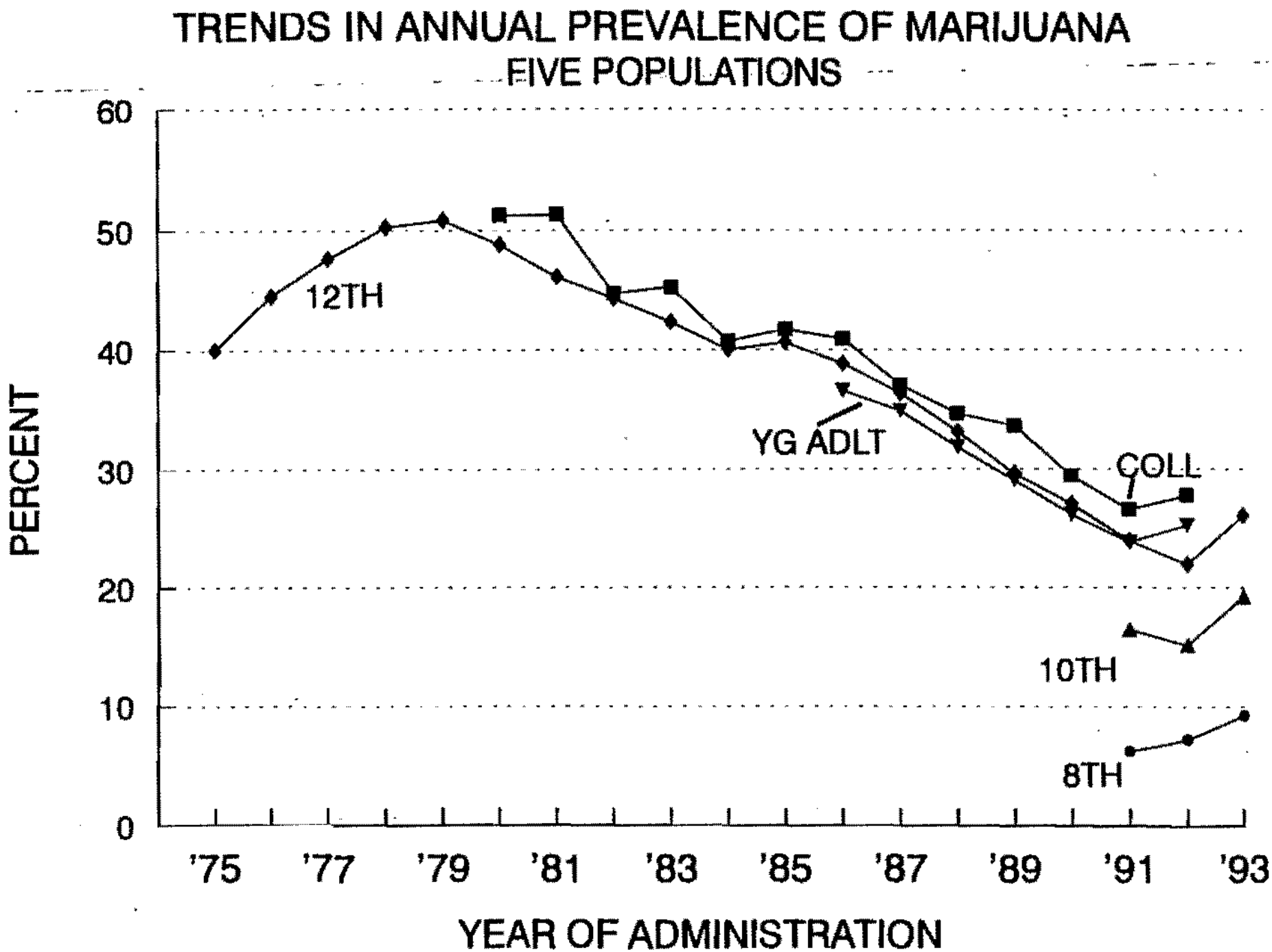
TWELFTH GRADERS



TRENDS IN 30-DAY PREVALENCE OF AN ILLICIT DRUG USE INDEX

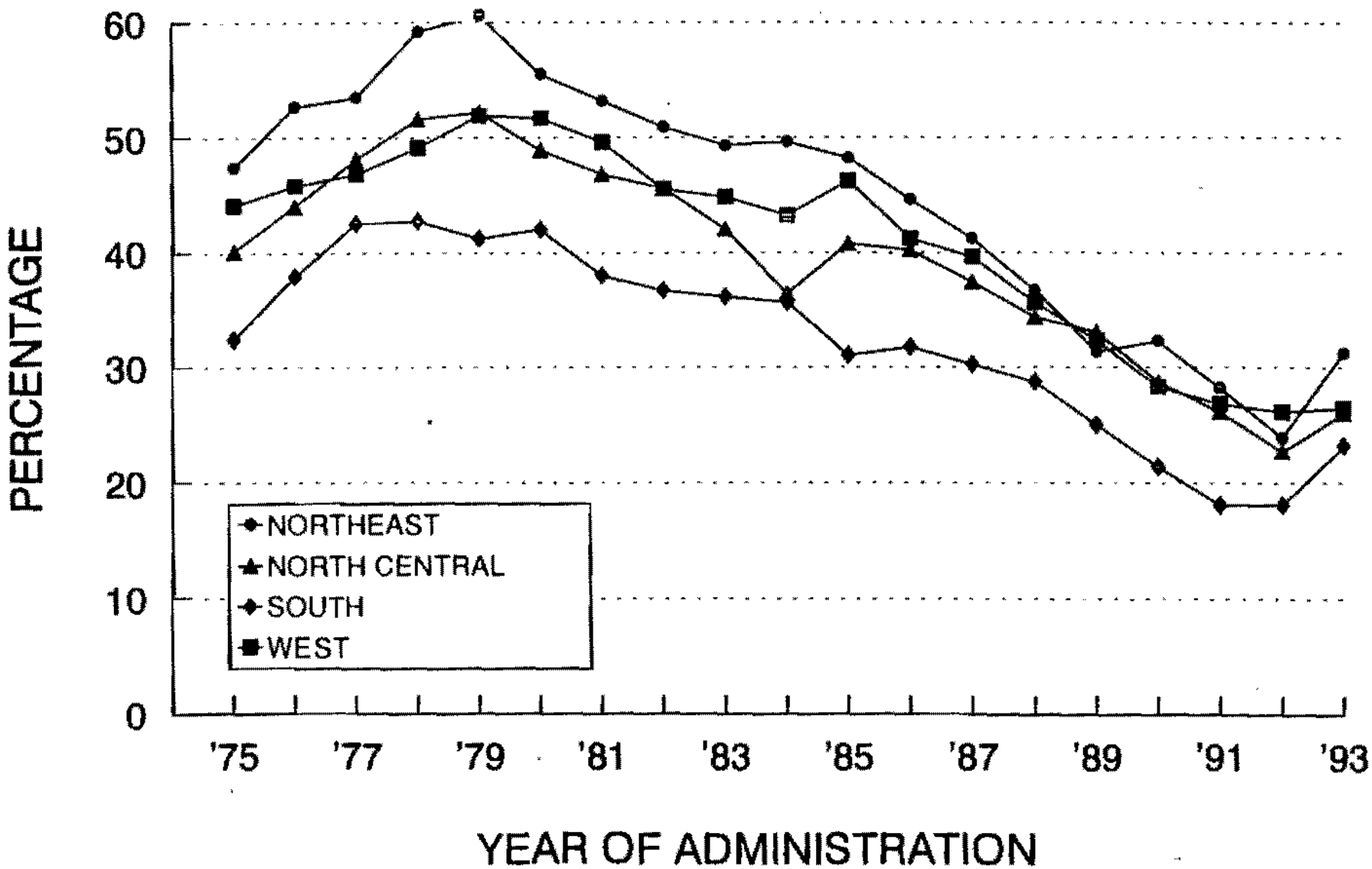
TWELFTH GRADERS



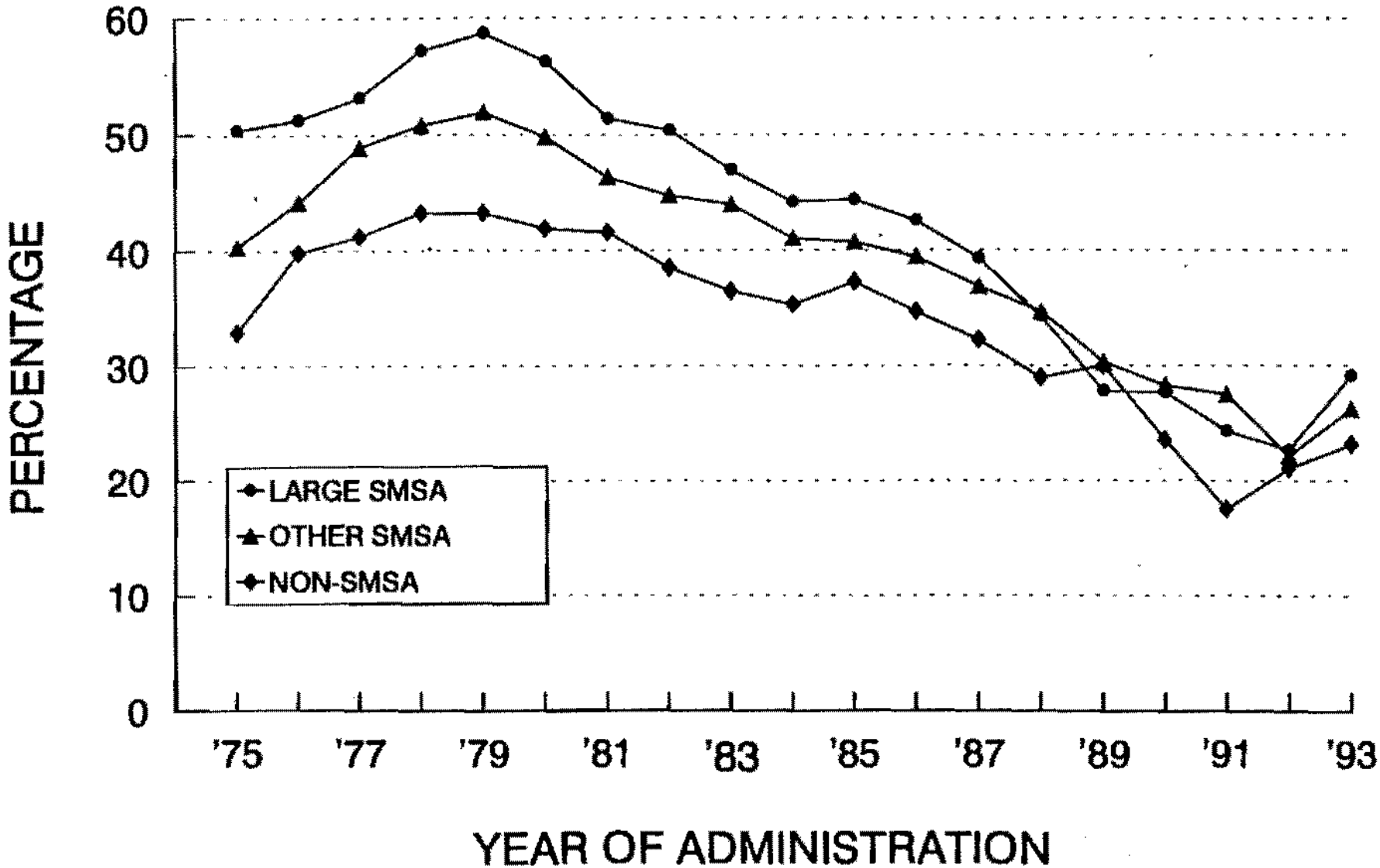

TRENDS IN ANNUAL PREVALENCE OF MARIJUANA
FIVE POPULATIONS
PERCENT
60
50
40
30
20
10
0
12TH
YG ADLT
COLL
10TH
8TH
'75
'77
'79
'81
'83
'85
'87
'89
'91
'93
YEAR OF ADMINISTRATION

TRENDS IN ANNUAL PREVALENCE OF MARIJUANA BY REGION

TWELFTH GRADERS

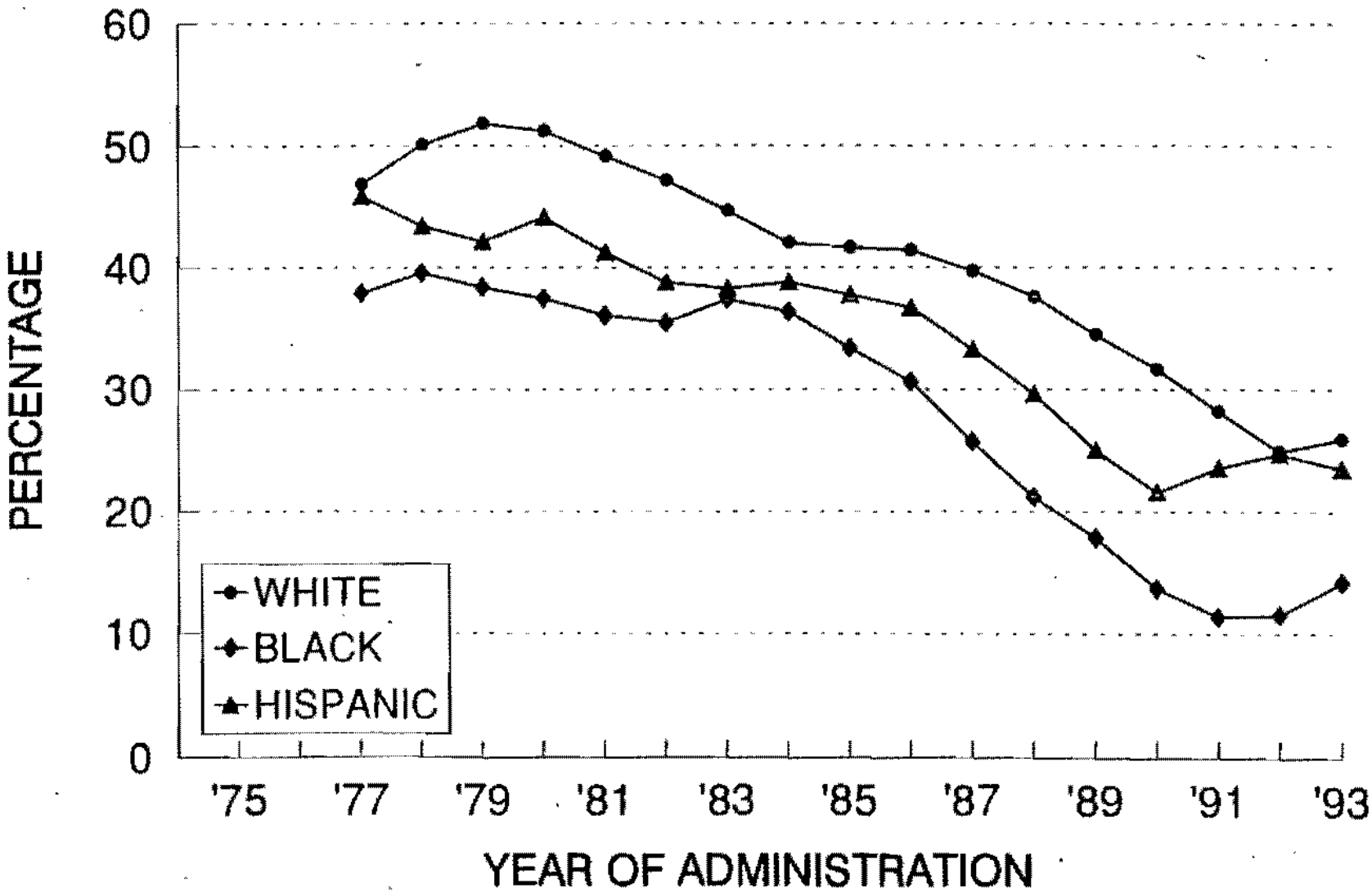


TRENDS IN ANNUAL PREVALENCE OF MARIJUANA BY URBANICITY
TWELFTH GRADERS



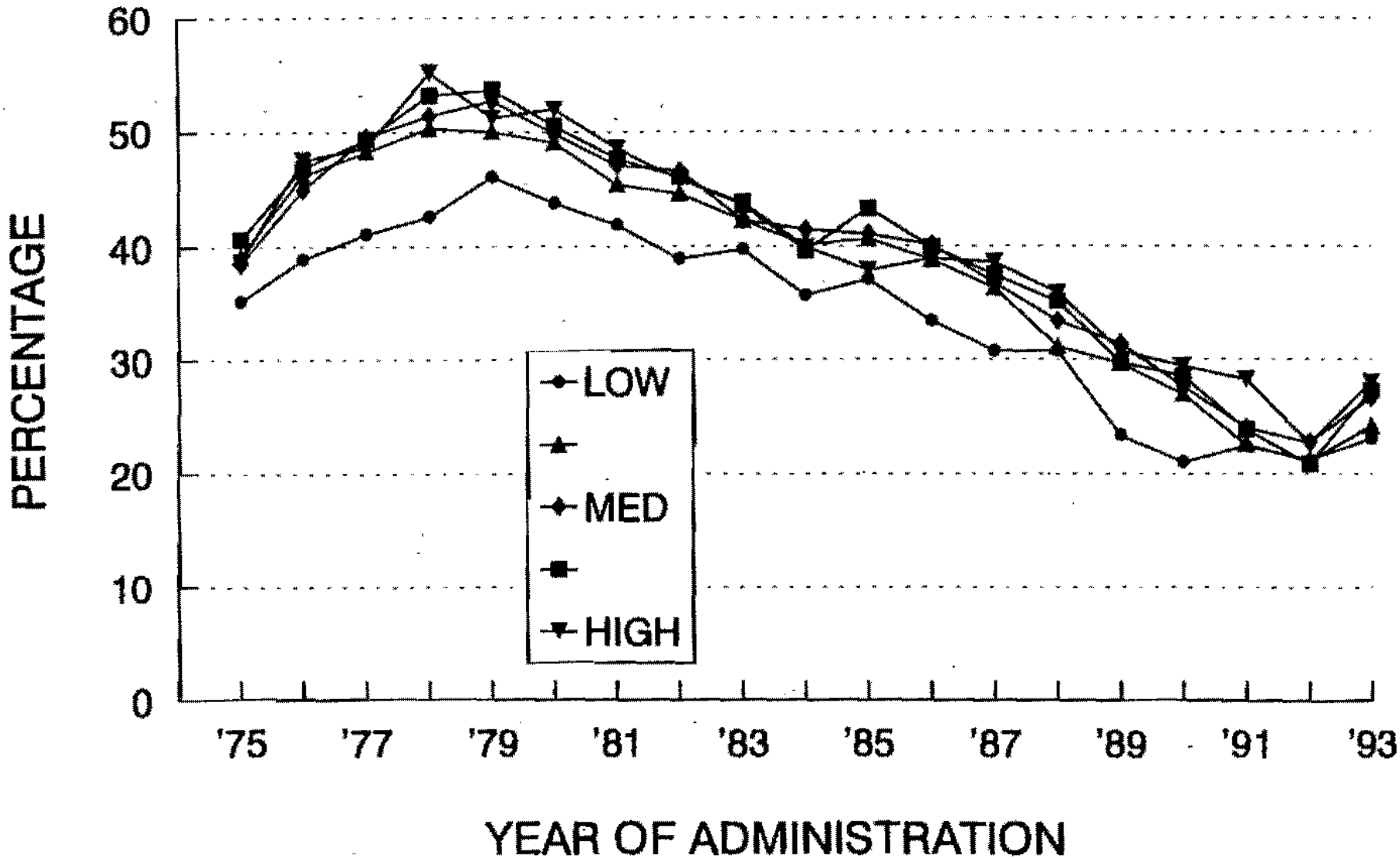
TRENDS IN ANNUAL PREVALENCE OF MARIJUANA BY RACE

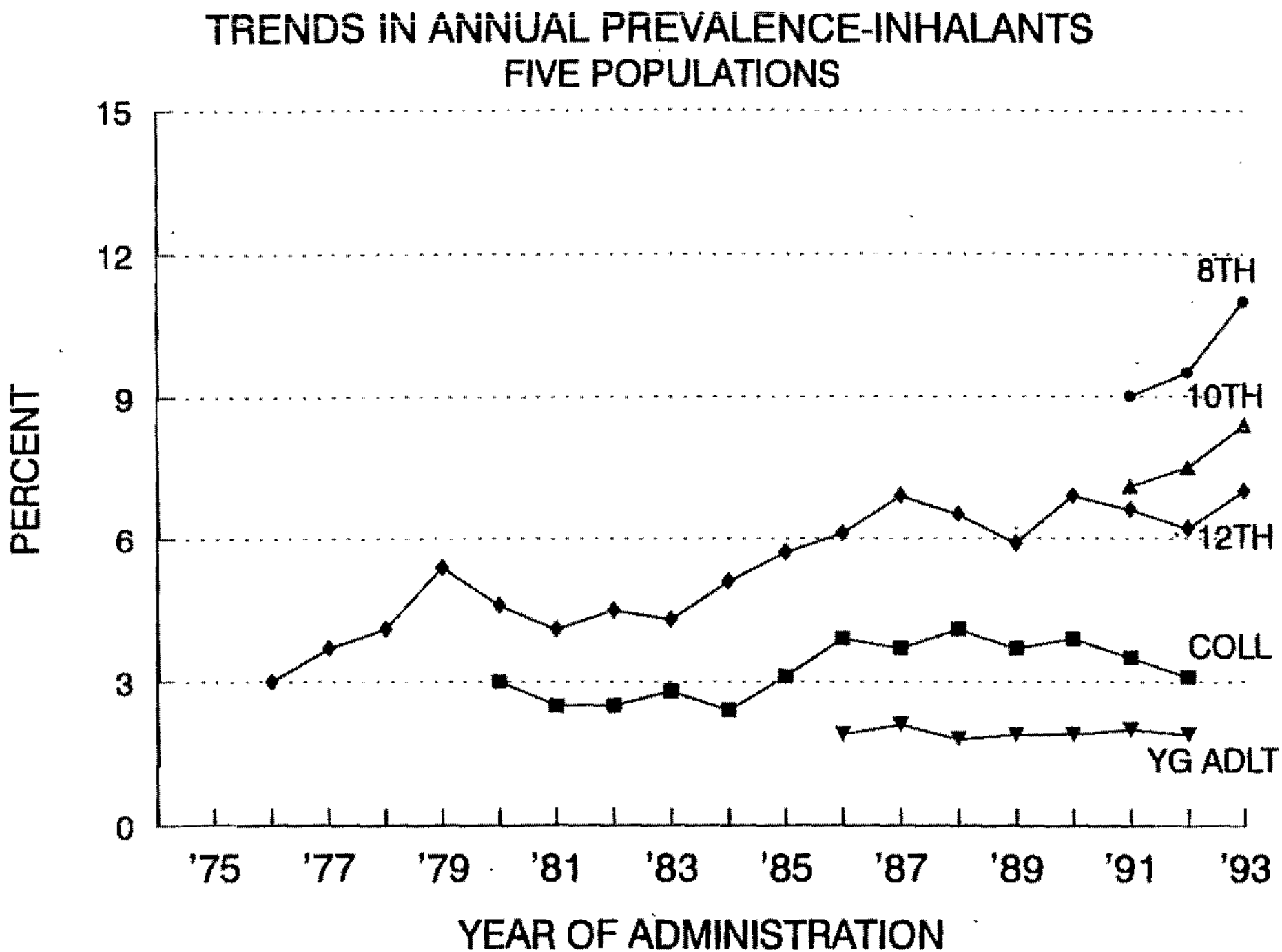
TWELFTH GRADERS



TRENDS IN ANNUAL PREVALENCE OF MARIJUANA BY SOCIAL CLASS

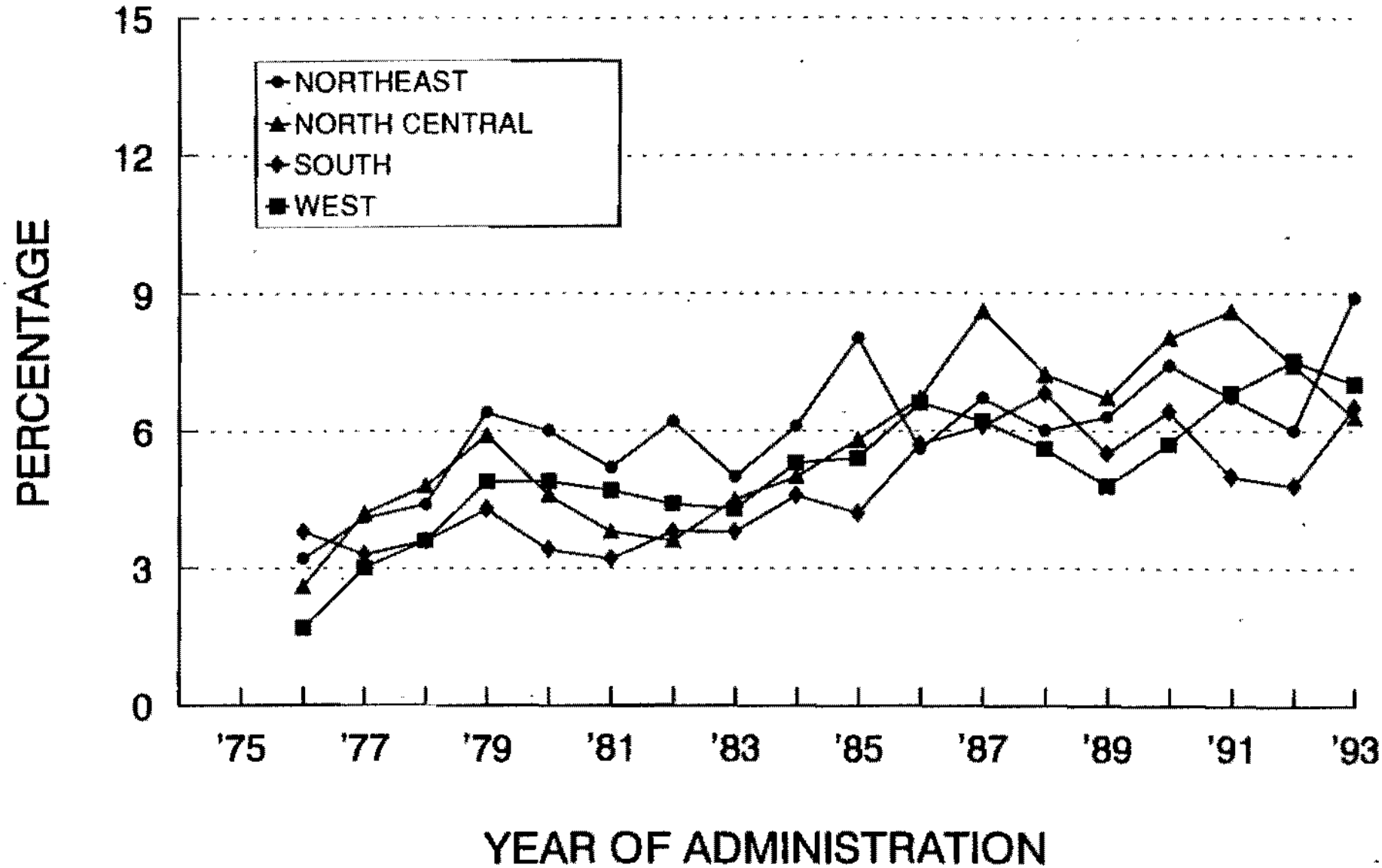
TWELFTH GRADERS



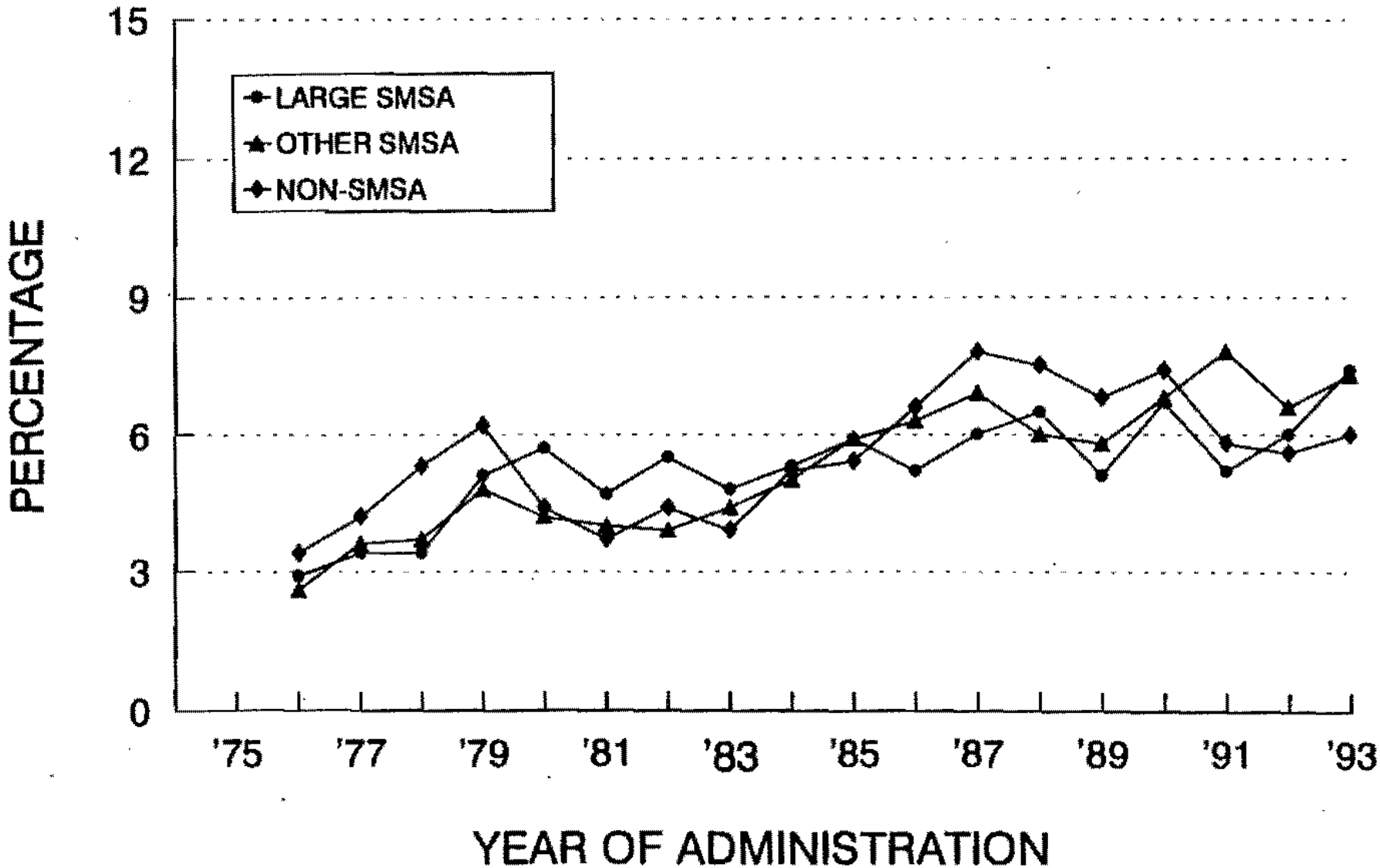

TRENDS IN ANNUAL PREVALENCE-INHALANTS
FIVE POPULATIONS
PERCENT
15
12
9
6
3
0
8TH
10TH
12TH
COLL
YG ADLT
'75
'77
'79
'81
'83
'85
'87
'89
'91
'93
YEAR OF ADMINISTRATION

TRENDS IN ANNUAL PREVALENCE OF INHALANTS BY REGION

TWELFTH GRADERS

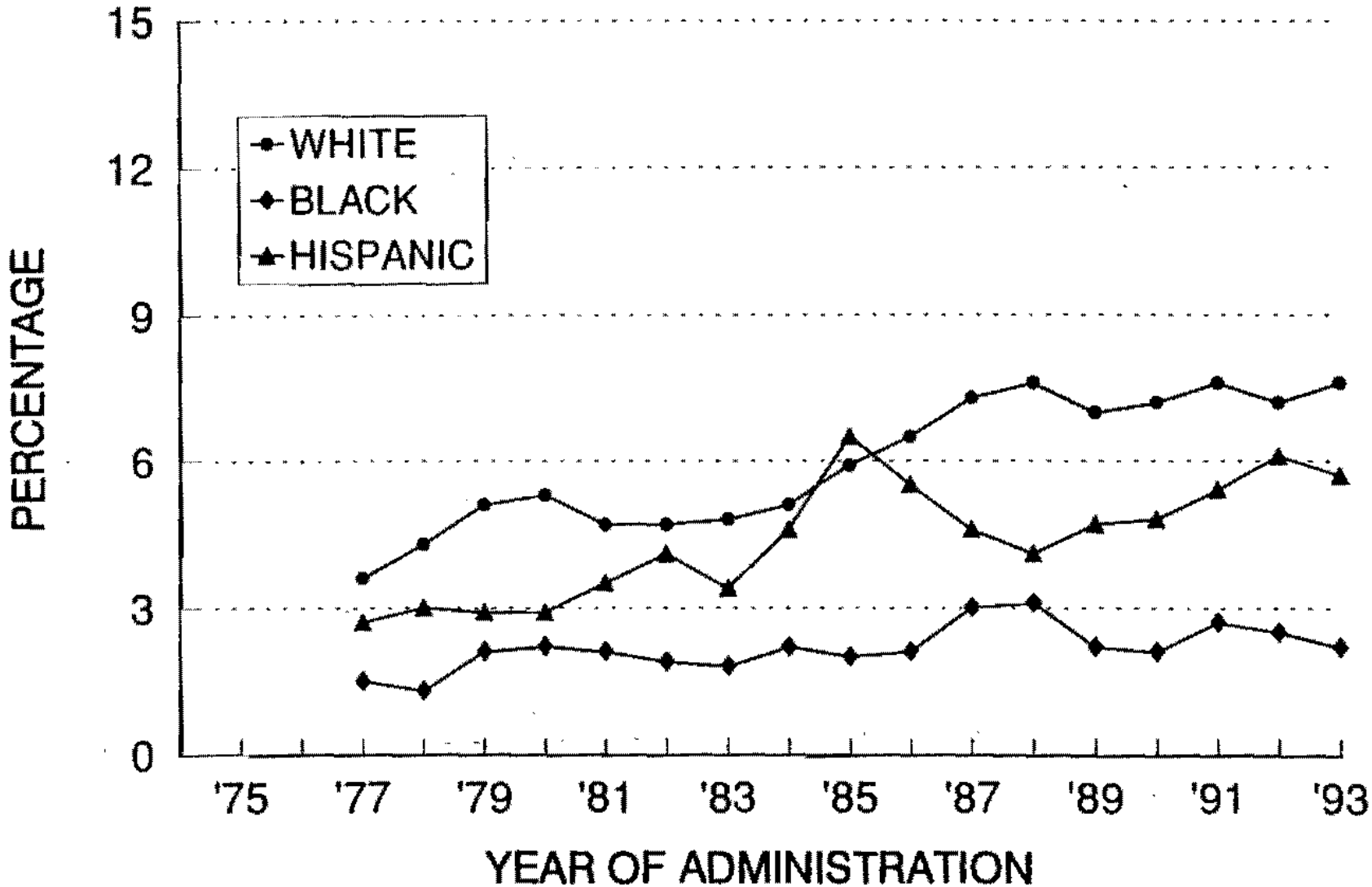


TRENDS IN ANNUAL PREVALENCE OF INHALANTS BY URBANICITY
TWELFTH GRADERS



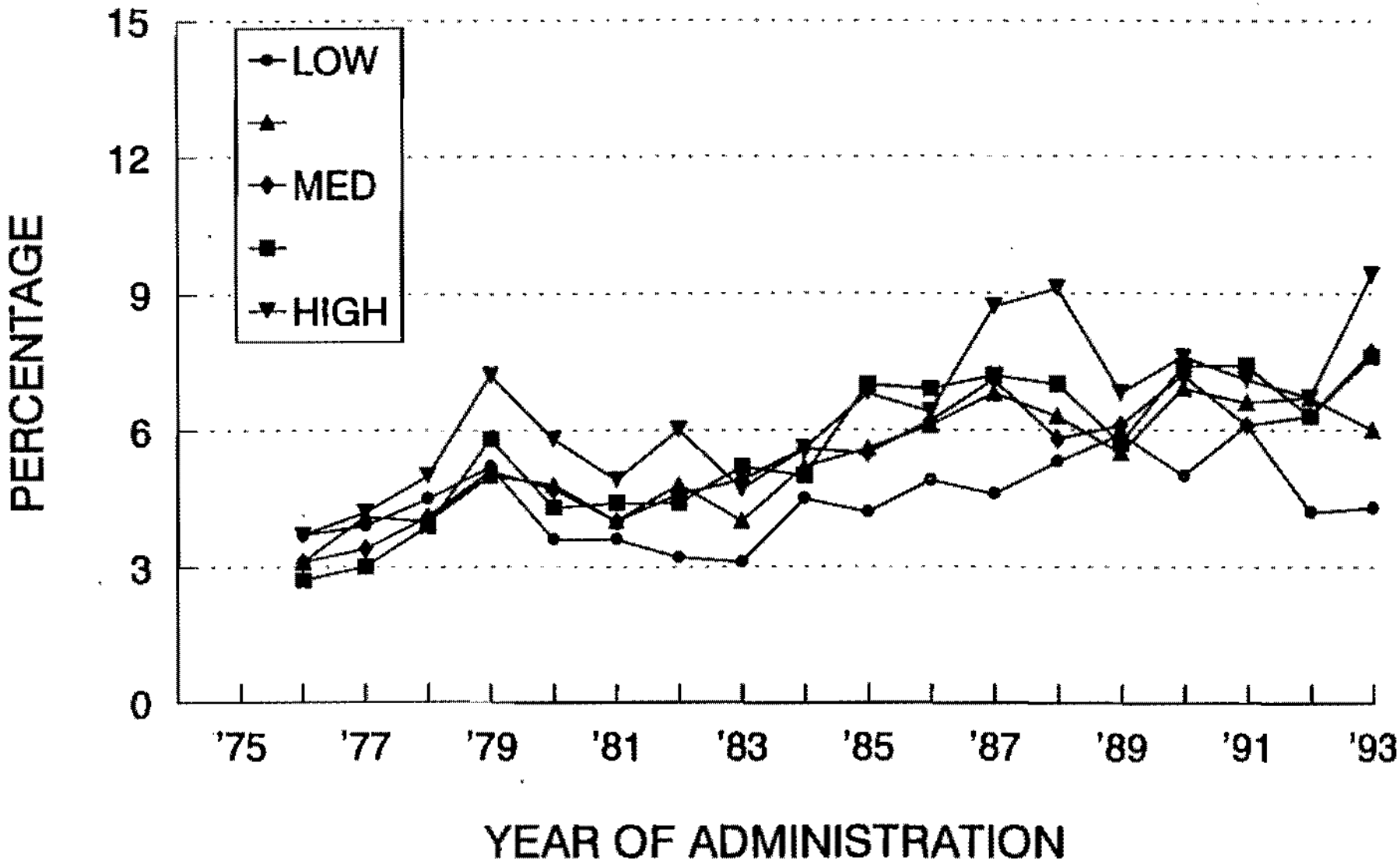
TRENDS IN ANNUAL PREVALENCE OF INHALANTS BY RACE

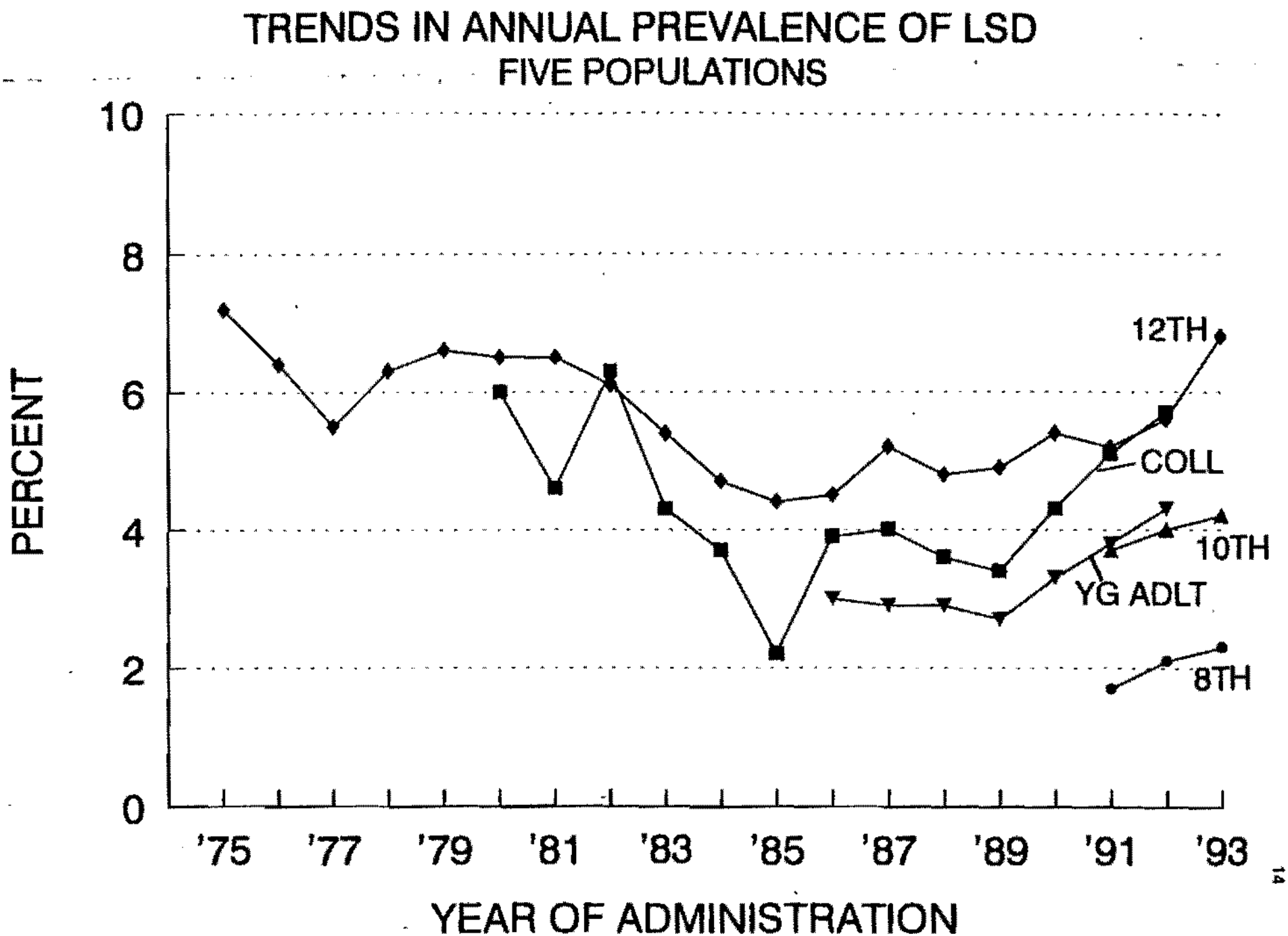
TWELFTH GRADERS



TRENDS IN ANNUAL PREVALENCE OF INHALANTS BY SOCIAL CLASS

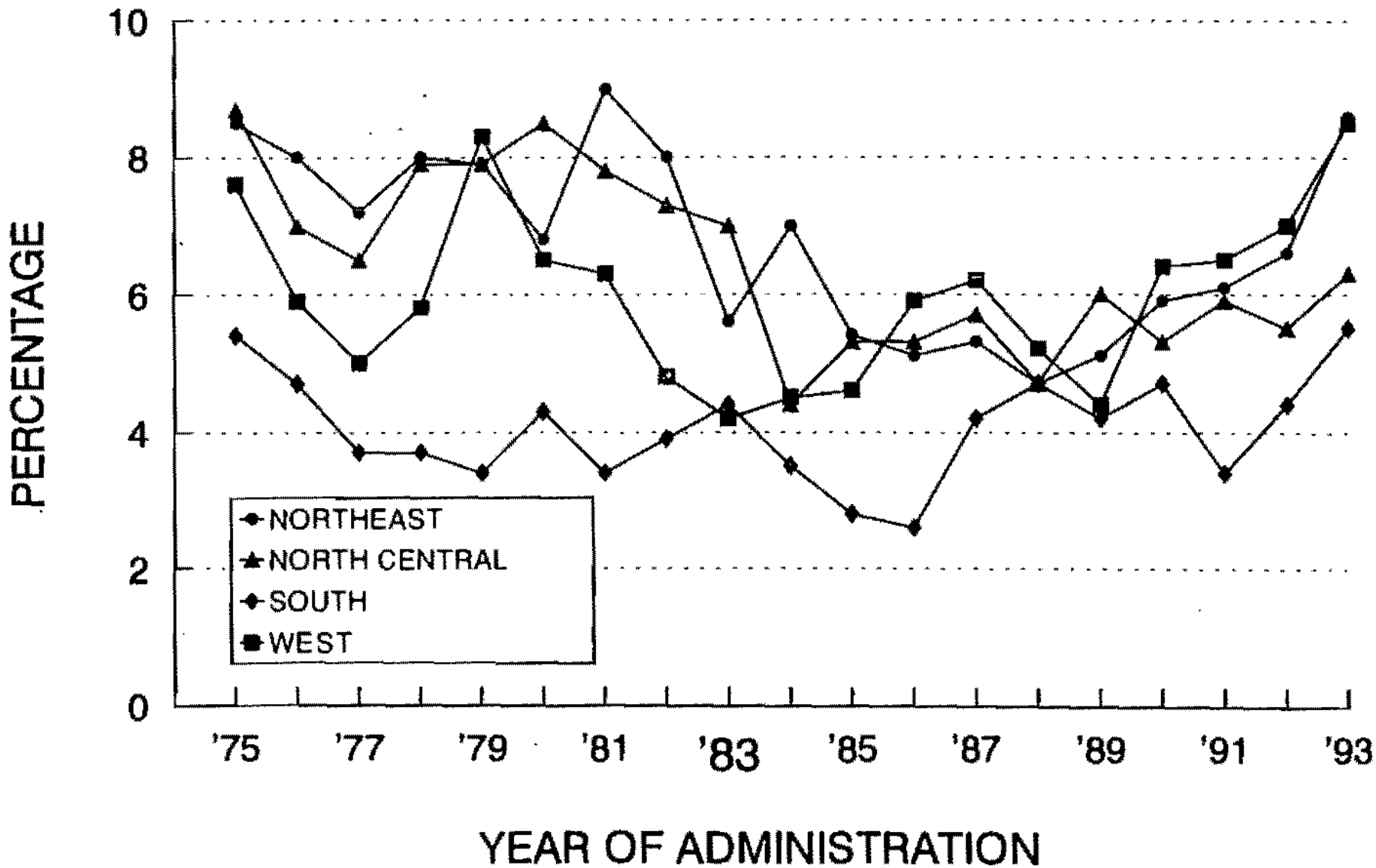
TWELFTH GRADERS



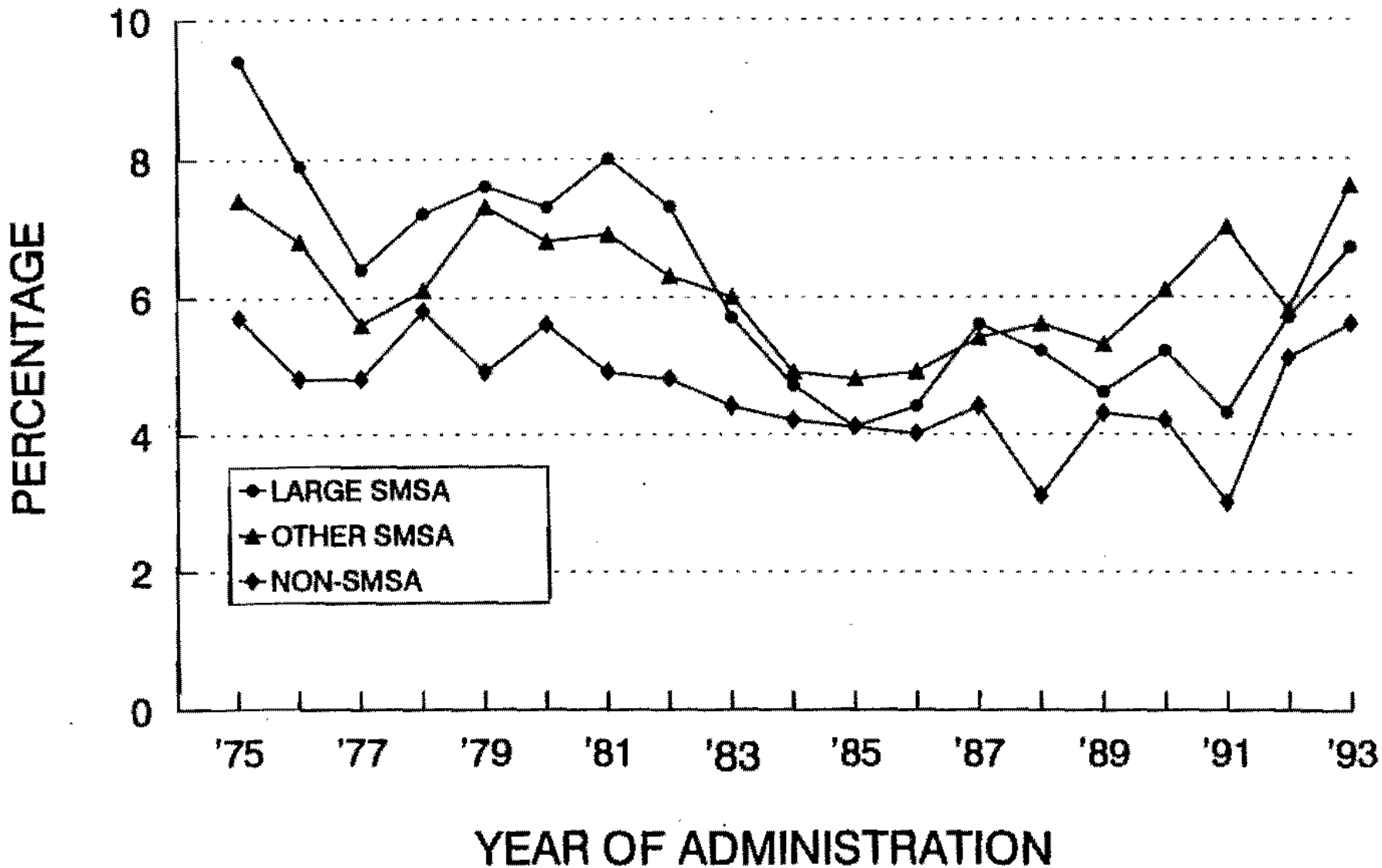

TRENDS IN ANNUAL PREVALENCE OF LSD
FIVE POPULATIONS
PERCENT
10
8
6
4
2
0
'75
'77
'79
'81
'83
'85
'87
'89
'91
'93
YEAR OF ADMINISTRATION
12TH
COLL
10TH
YG ADLT
8TH

TRENDS IN ANNUAL PREVALENCE OF LSD BY REGION

TWELFTH GRADERS

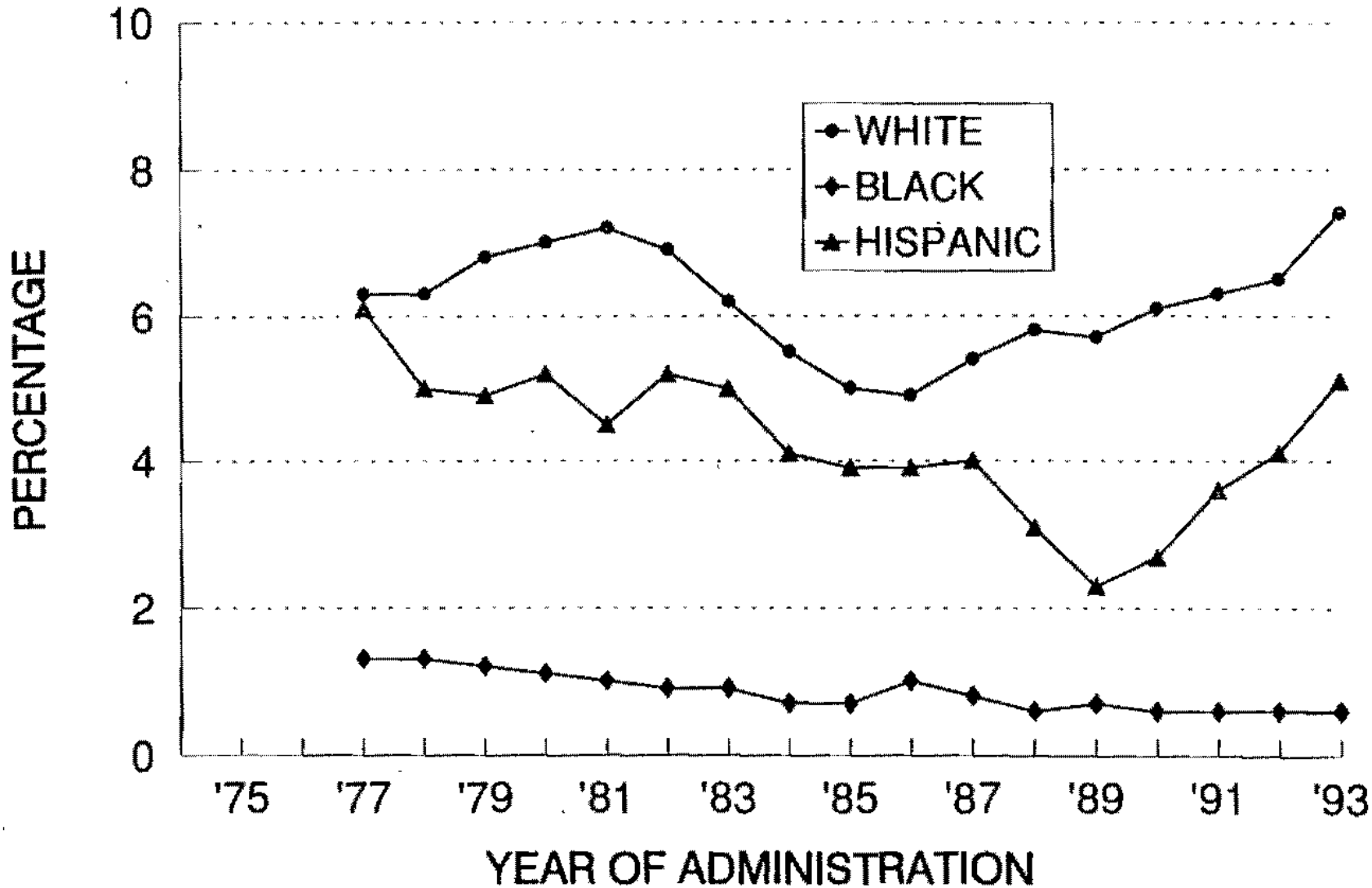


TRENDS IN ANNUAL PREVALENCE OF LSD BY URBANICITY
TWELFTH GRADERS



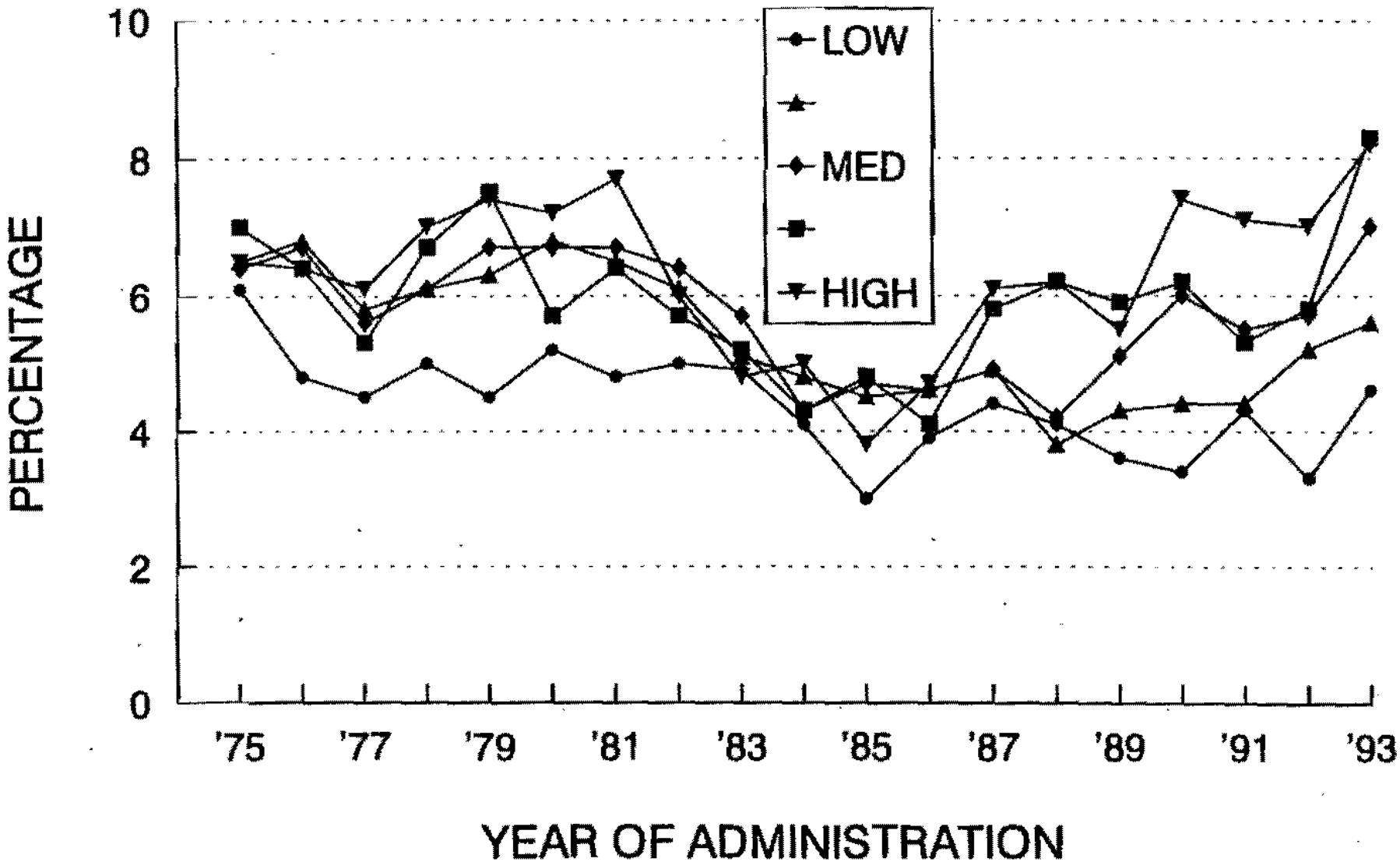
TRENDS IN ANNUAL PREVALENCE OF LSD BY RACE

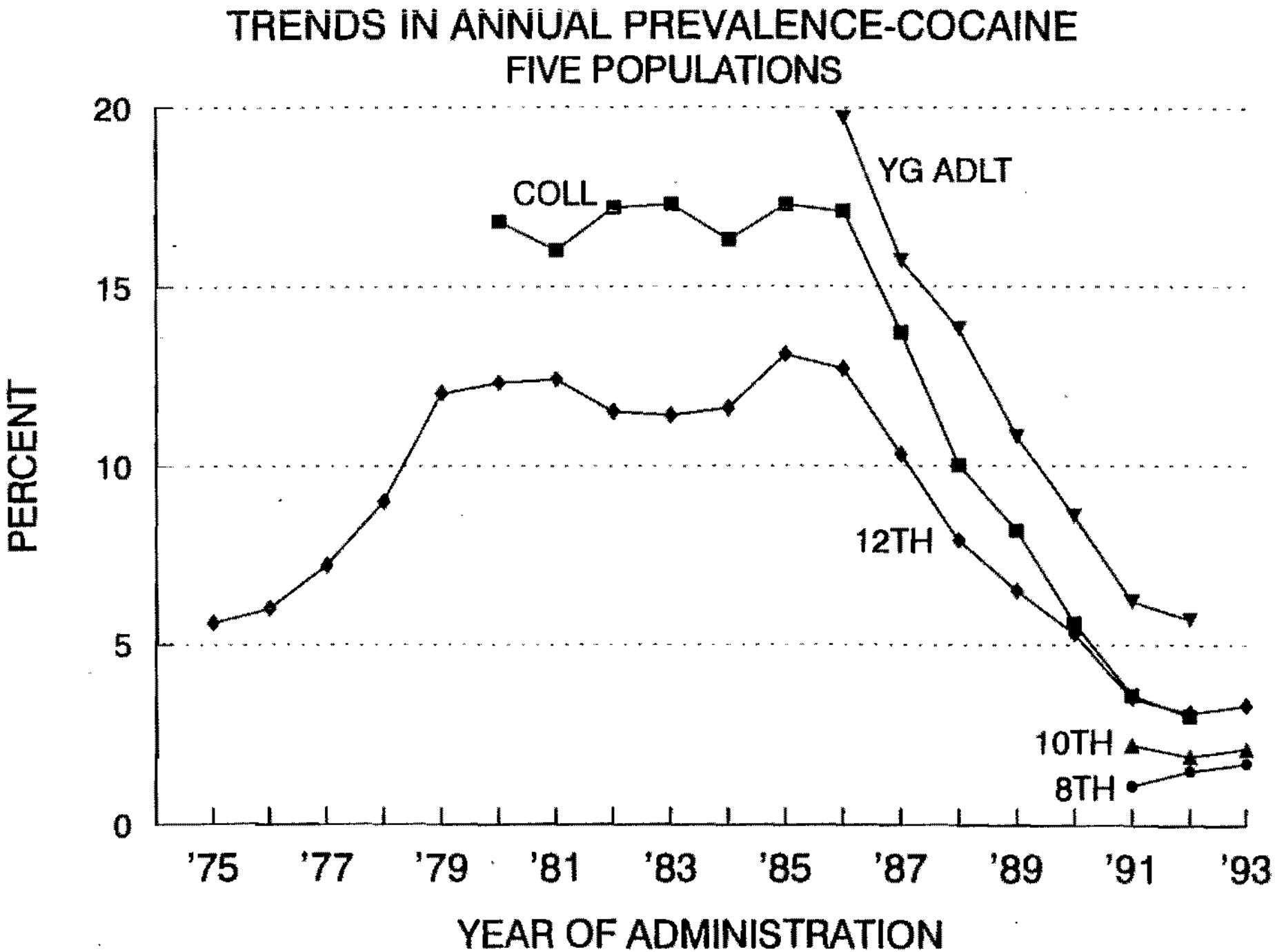
TWELFTH GRADERS



TRENDS IN ANNUAL PREVALENCE OF LSD BY SOCIAL CLASS

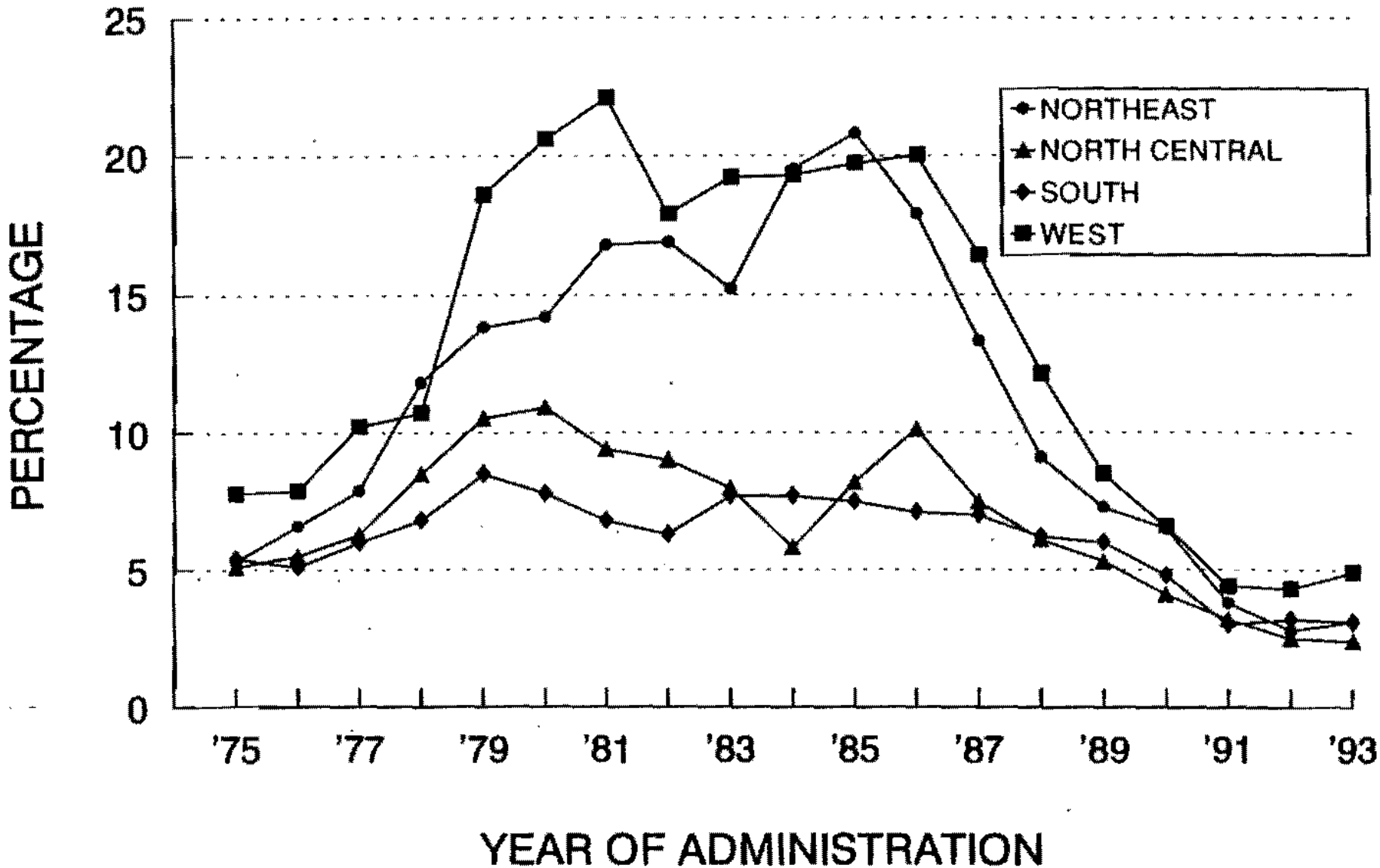
TWELFTH GRADERS



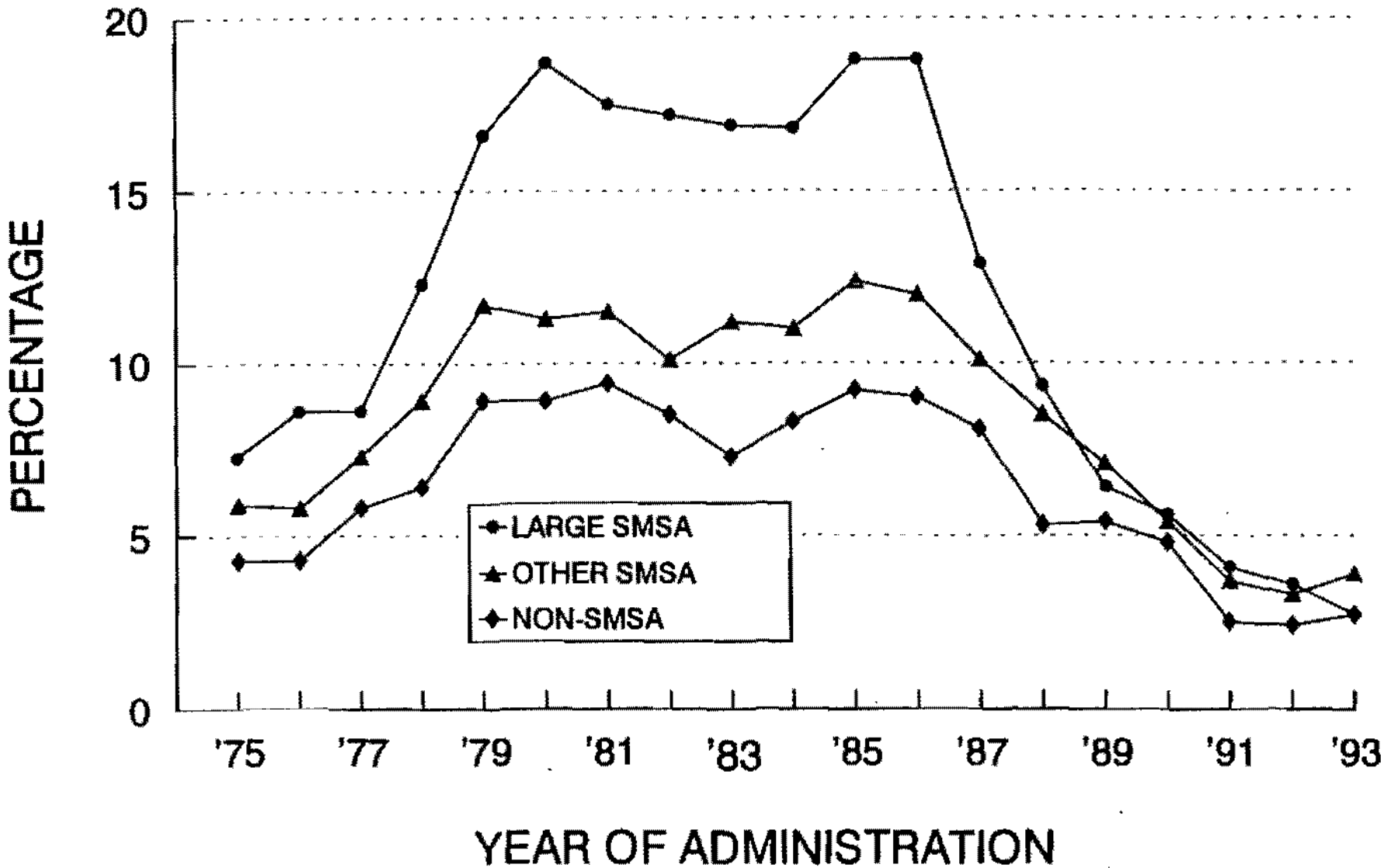

TRENDS IN ANNUAL PREVALENCE-COCAINE
FIVE POPULATIONS
PERCENT
20
15
10
5
0
COLL
YG ADLT
12TH
10TH
8TH
'75
'77
'79
'81
'83
'85
'87
'89
'91
'93
YEAR OF ADMINISTRATION

TRENDS IN ANNUAL PREVALENCE OF COCAINE BY REGION

TWELFTH GRADERS

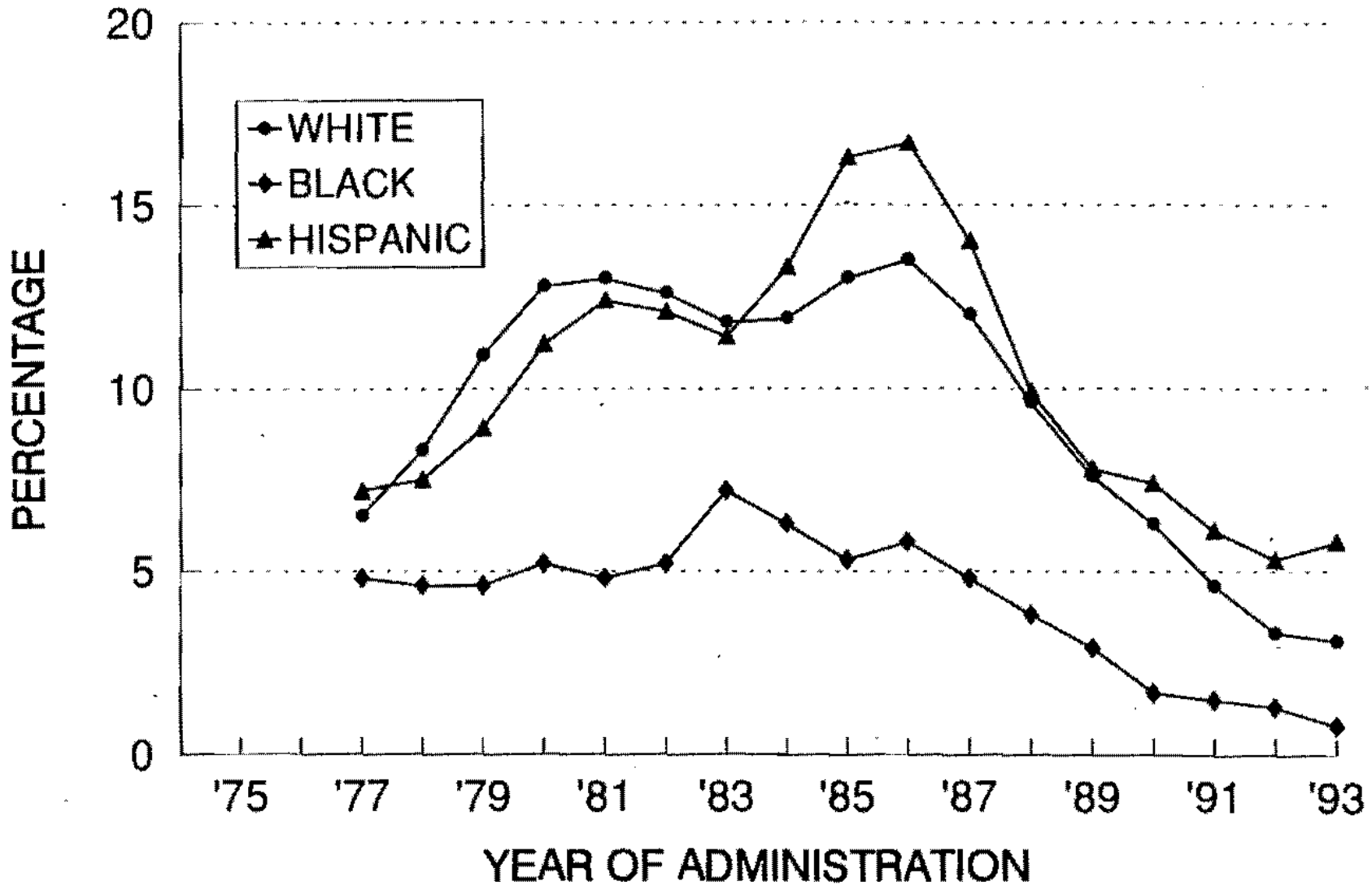


TRENDS IN ANNUAL PREVALENCE OF COCAINE BY URBANICITY
TWELFTH GRADERS



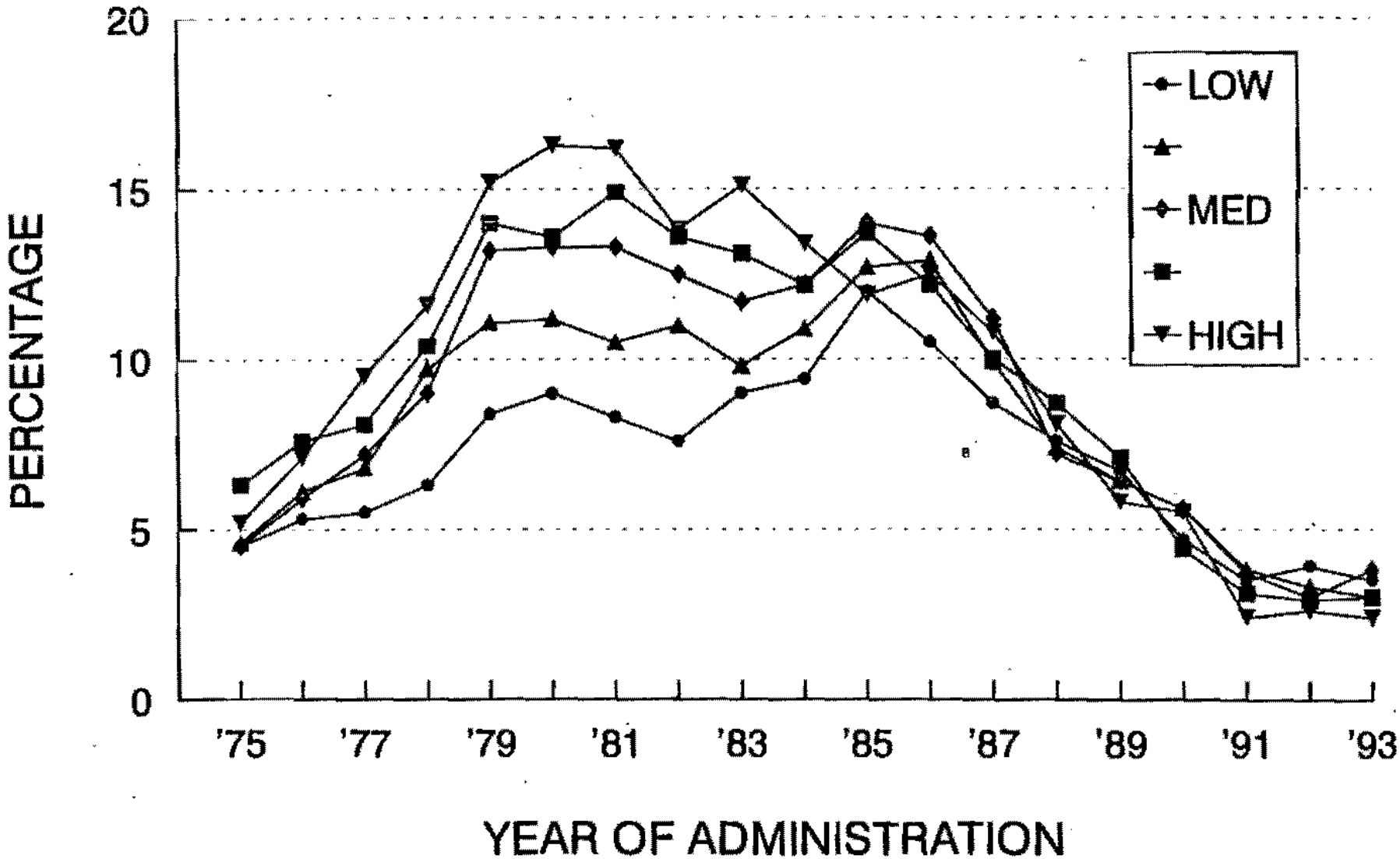
TRENDS IN ANNUAL PREVALENCE OF COCAINE BY RACE

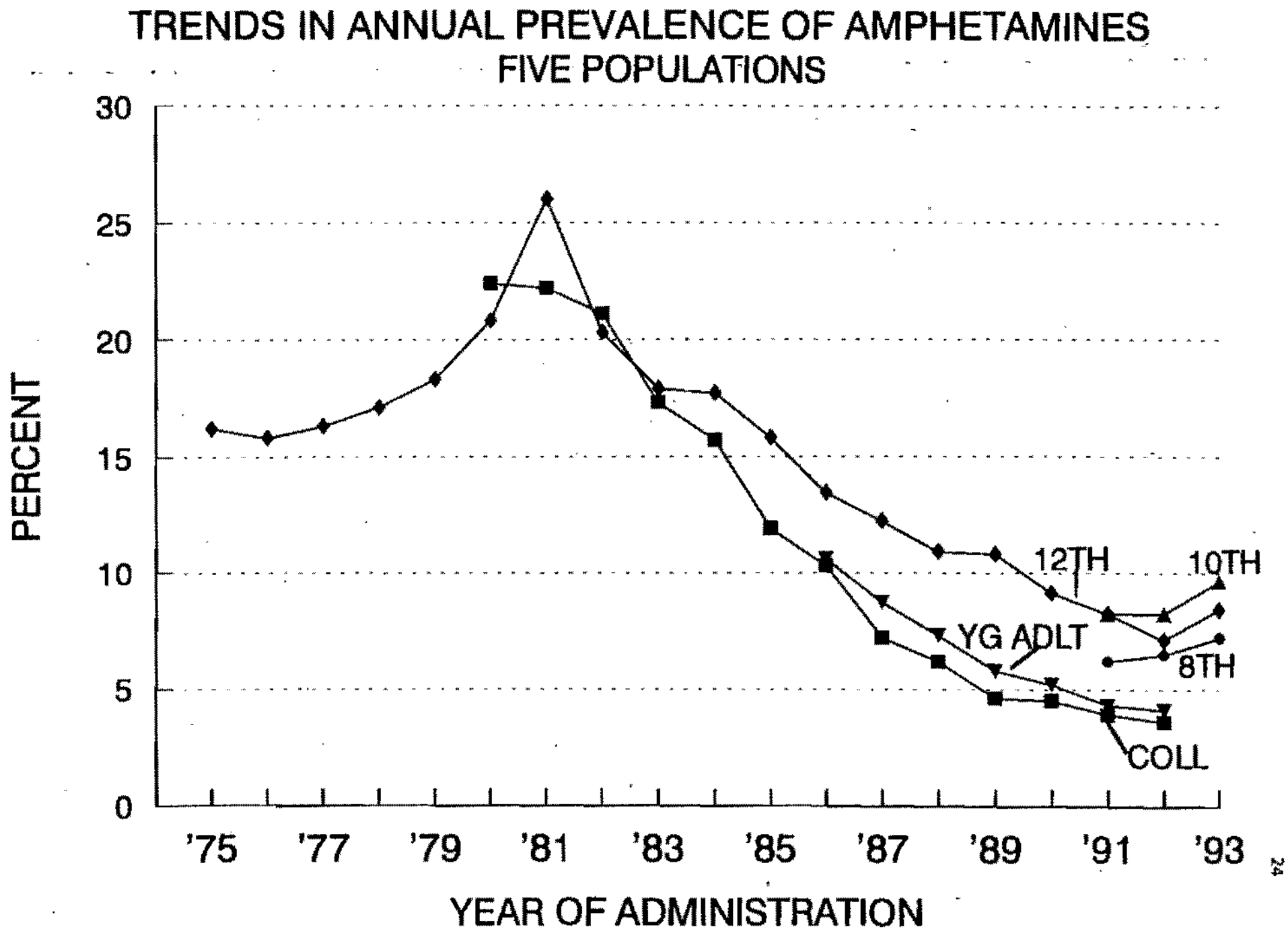
TWELFTH GRADERS



TRENDS IN ANNUAL PREVALENCE OF COCAINE BY SOCIAL CLASS

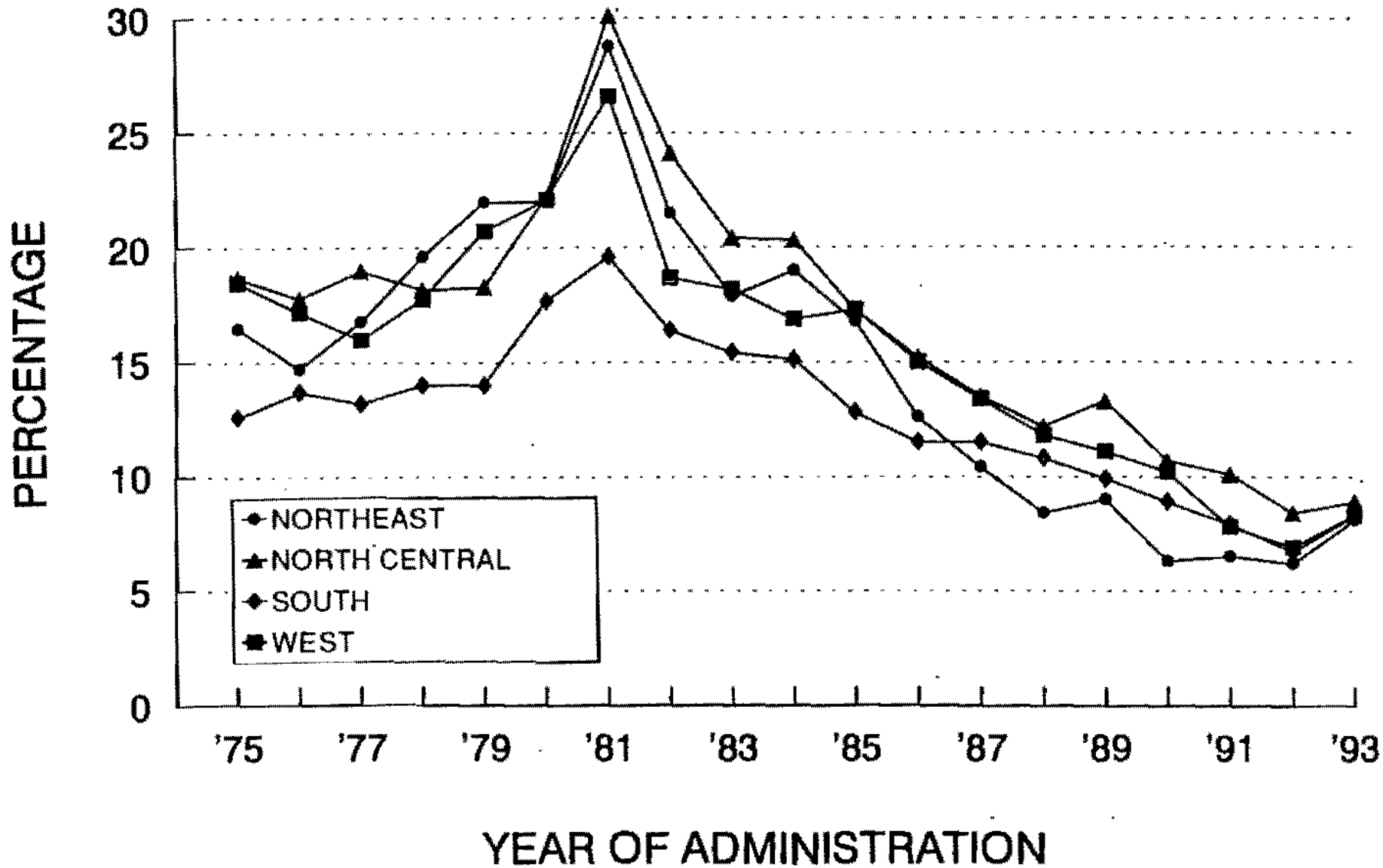
TWELFTH GRADERS



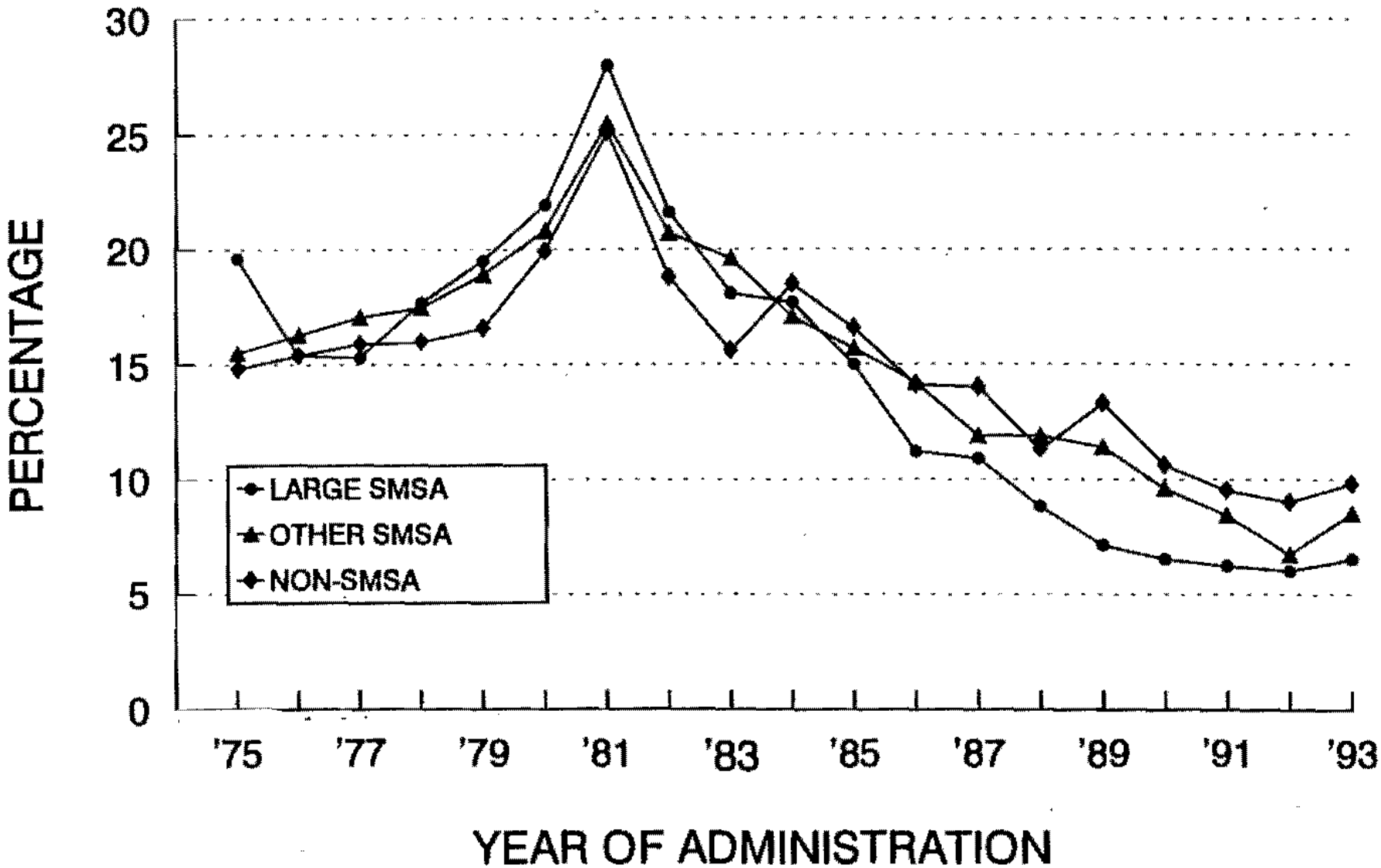

TRENDS IN ANNUAL PREVALENCE OF AMPHETAMINES
FIVE POPULATIONS
PERCENT
30
25
20
15
10
5
0
'75
'77
'79
'81
'83
'85
'87
'89
'91
'93
YEAR OF ADMINISTRATION
12TH
10TH
YG ADLT
8TH
COLL

TRENDS IN ANNUAL PREVALENCE OF AMPHETAMINES BY REGION

TWELFTH GRADERS

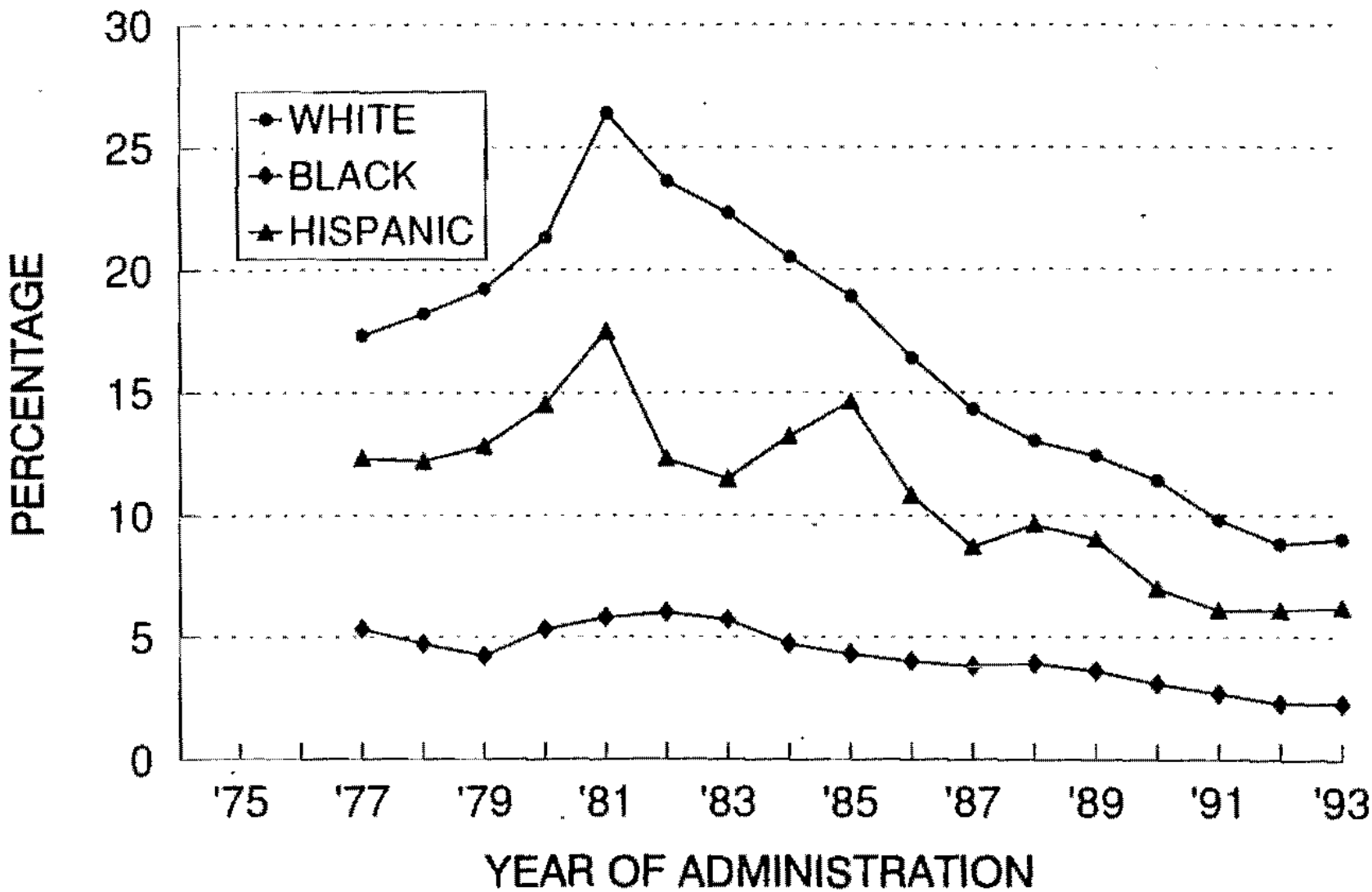


TRENDS IN ANNUAL PREVALENCE OF AMPHETAMINES BY URBANICITY
TWELFTH GRADERS



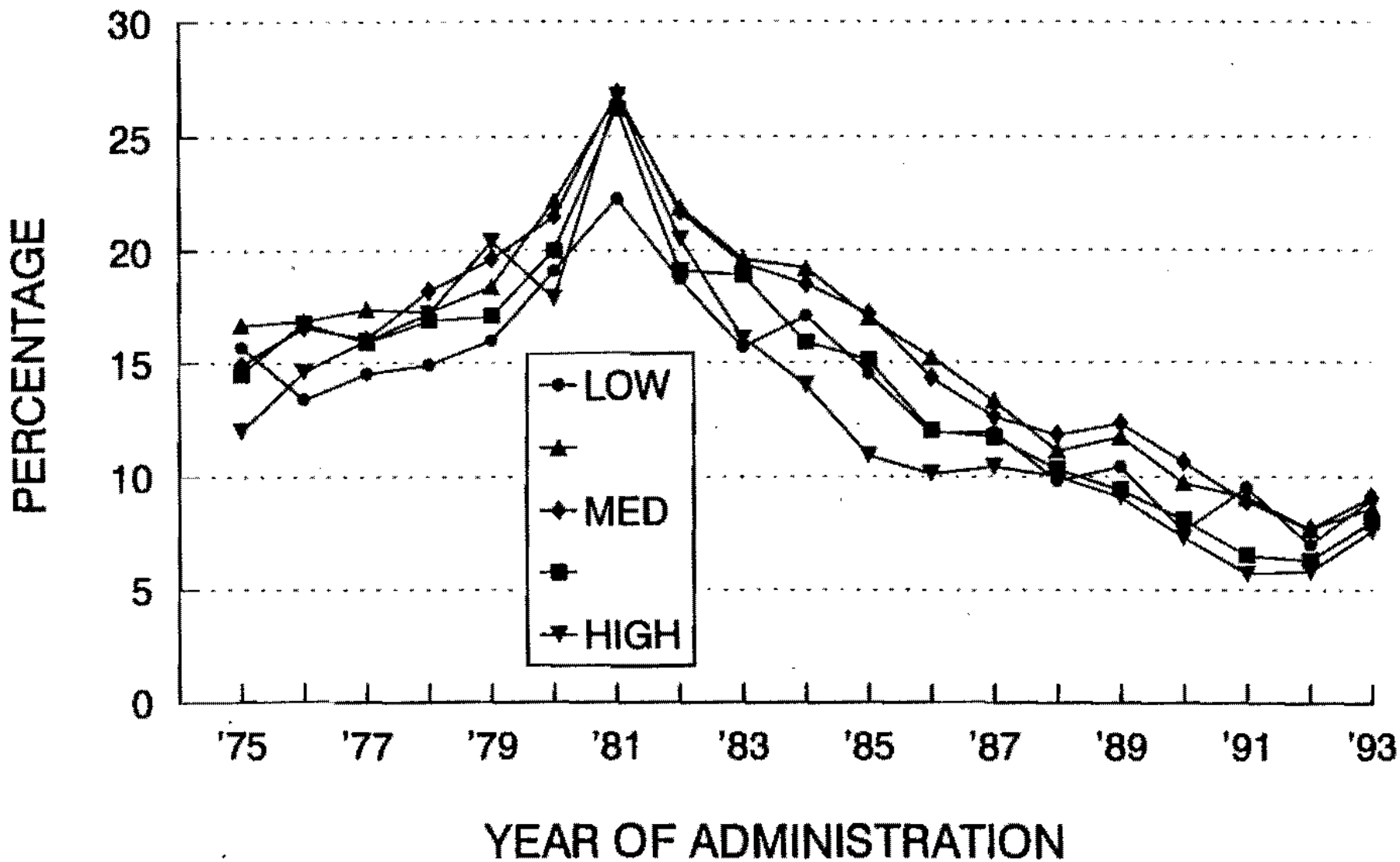
TRENDS IN ANNUAL PREVALENCE OF AMPHETAMINES BY RACE

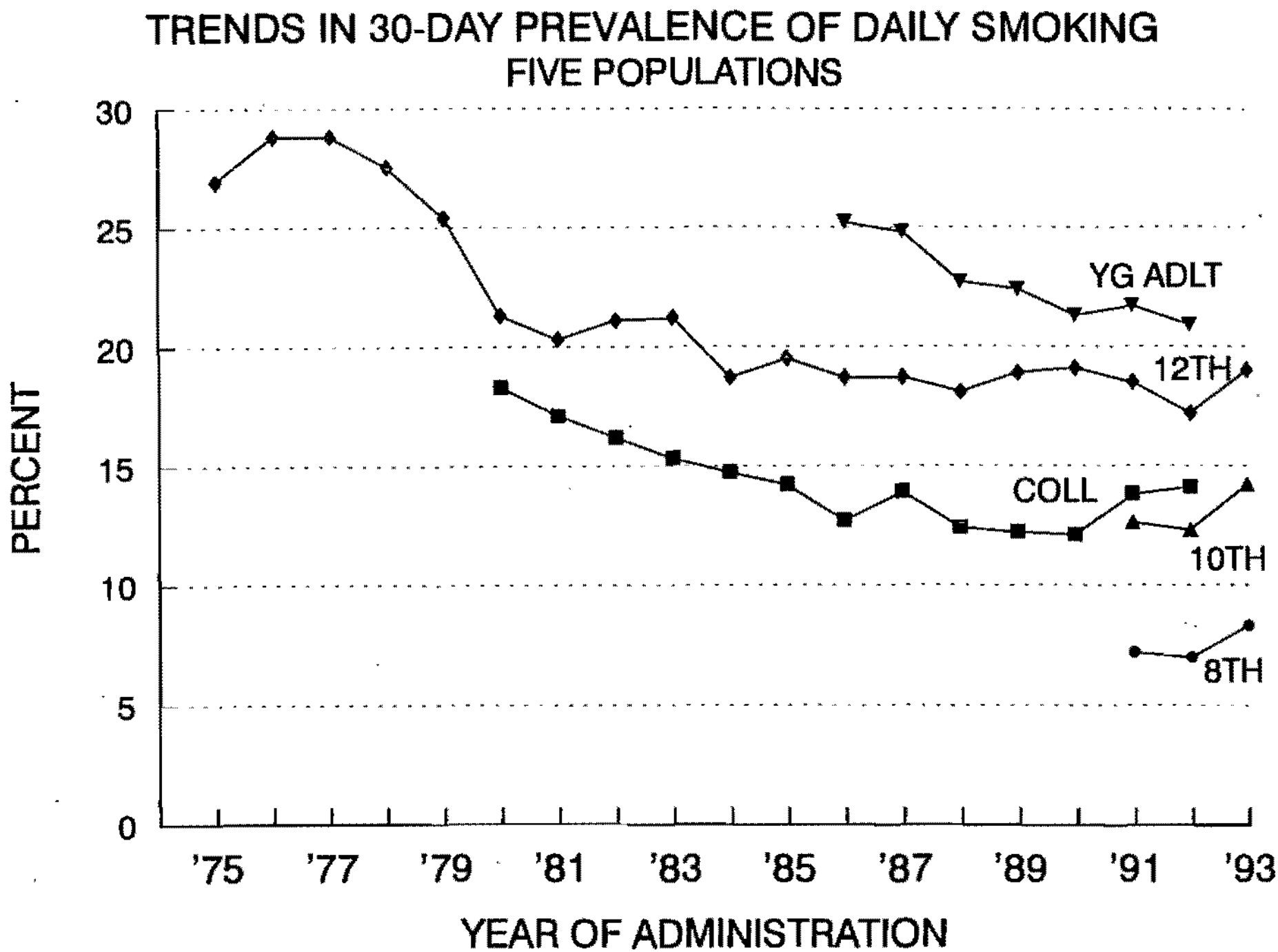
TWELFTH GRADERS



TRENDS IN ANNUAL PREVALENCE OF AMPHETAMINES BY SOCIAL CLASS

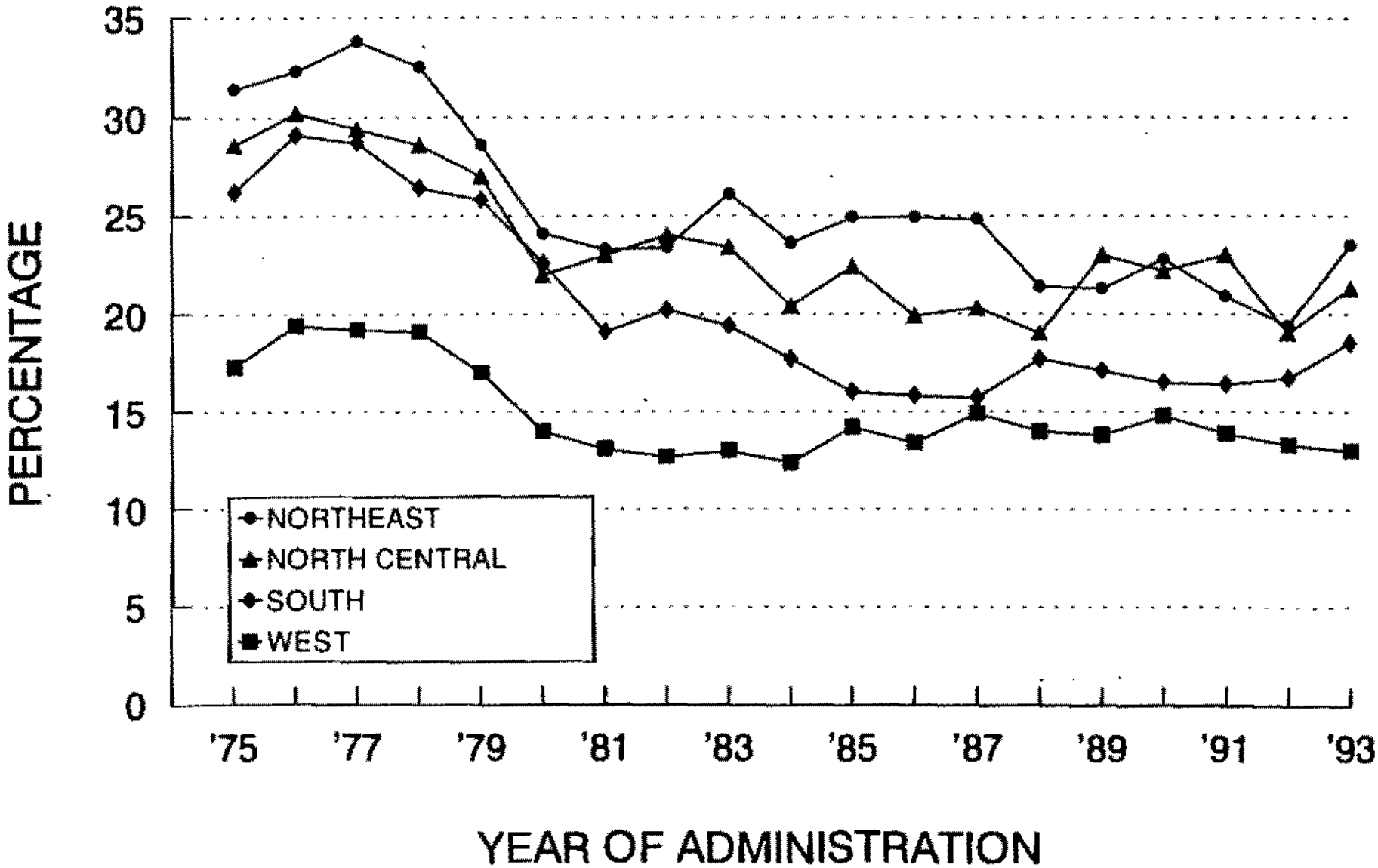
TWELFTH GRADERS



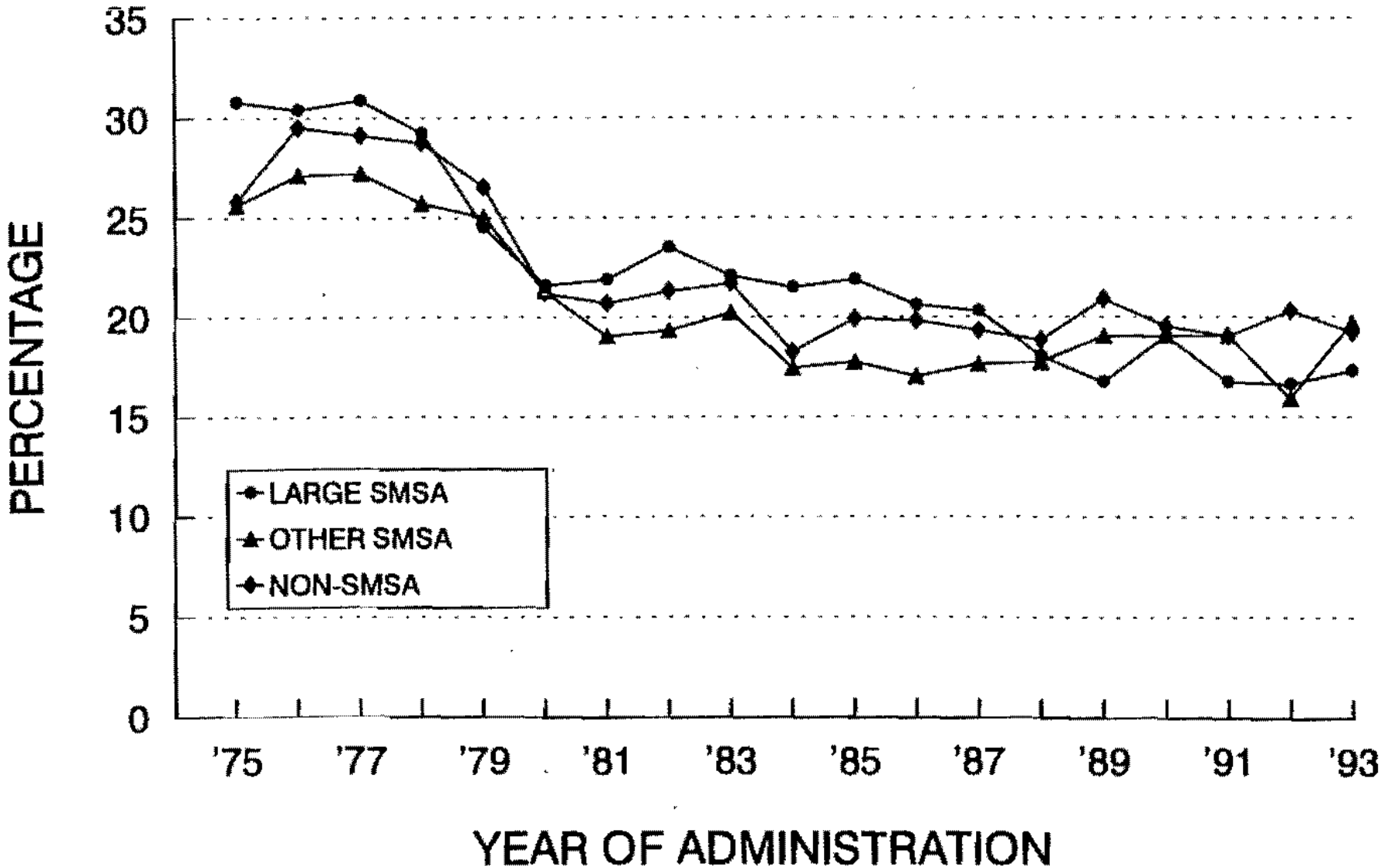

TRENDS IN 30-DAY PREVALENCE OF DAILY SMOKING
FIVE POPULATIONS
PERCENT
30
25
20
15
10
5
0
YG ADLT
12TH
COLL
10TH
8TH
'75
'77
'79
'81
'83
'85
'87
'89
'91
'93
YEAR OF ADMINISTRATION

TRENDS IN DAILY PREVALENCE OF CIGARETTES BY REGION

TWELFTH GRADERS

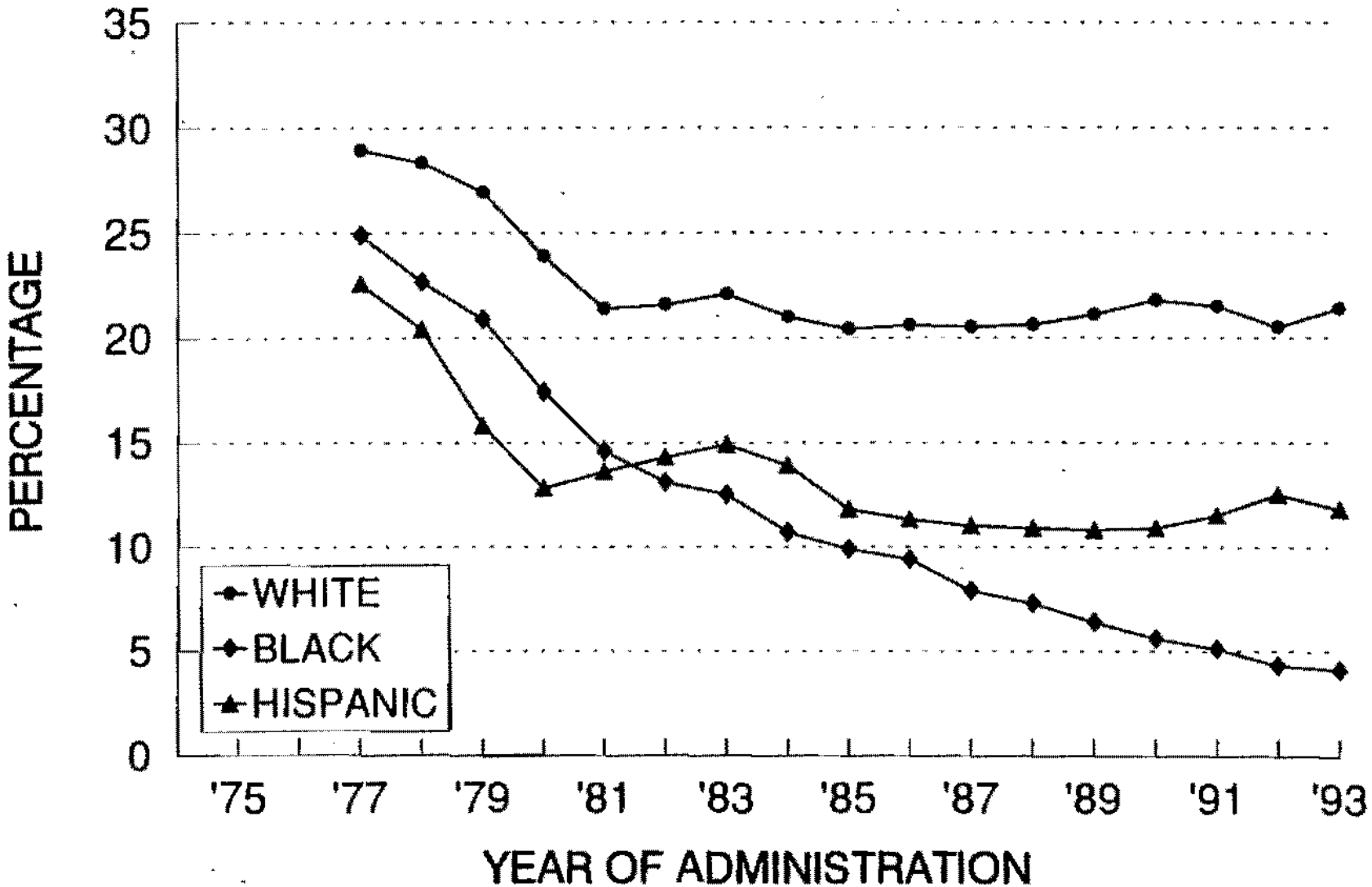


TRENDS IN DAILY PREVALENCE OF CIGARETTES BY URBANICITY
TWELFTH GRADERS



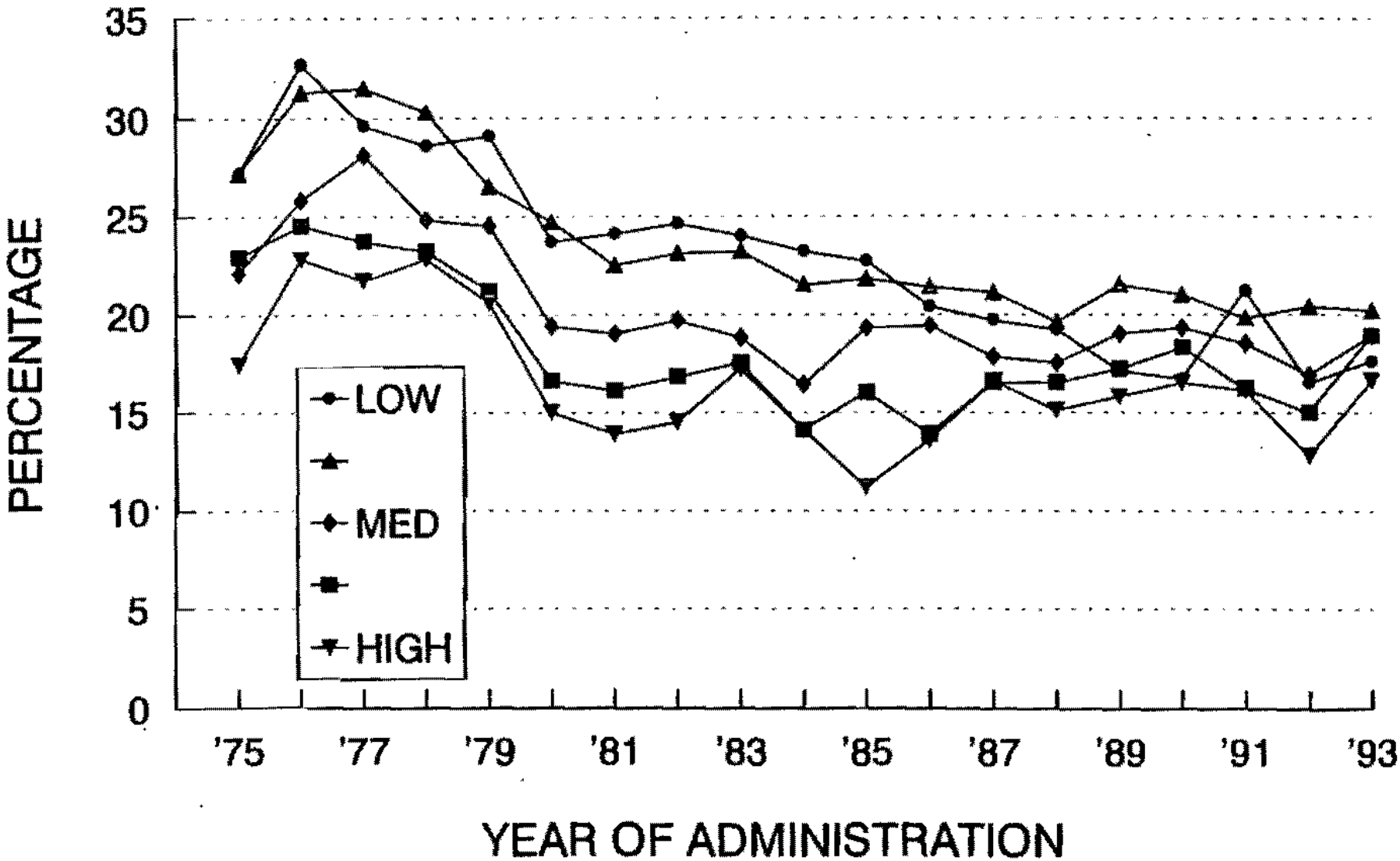
TRENDS IN DAILY PREVALENCE OF CIGARETTES BY RACE

TWELFTH GRADERS



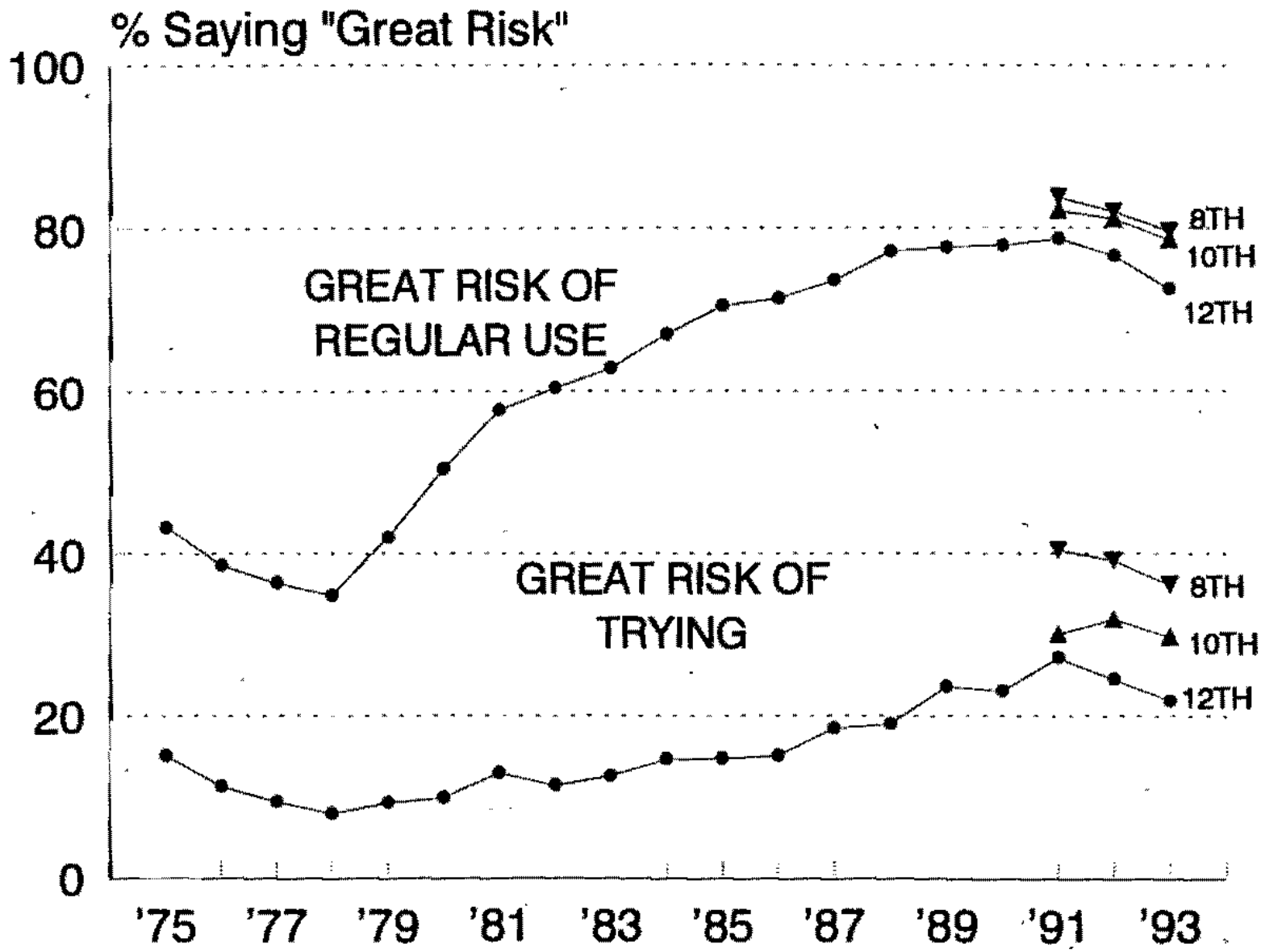
TRENDS IN DAILY PREVALENCE OF CIGARETTES BY SOCIAL CLASS

TWELFTH GRADERS



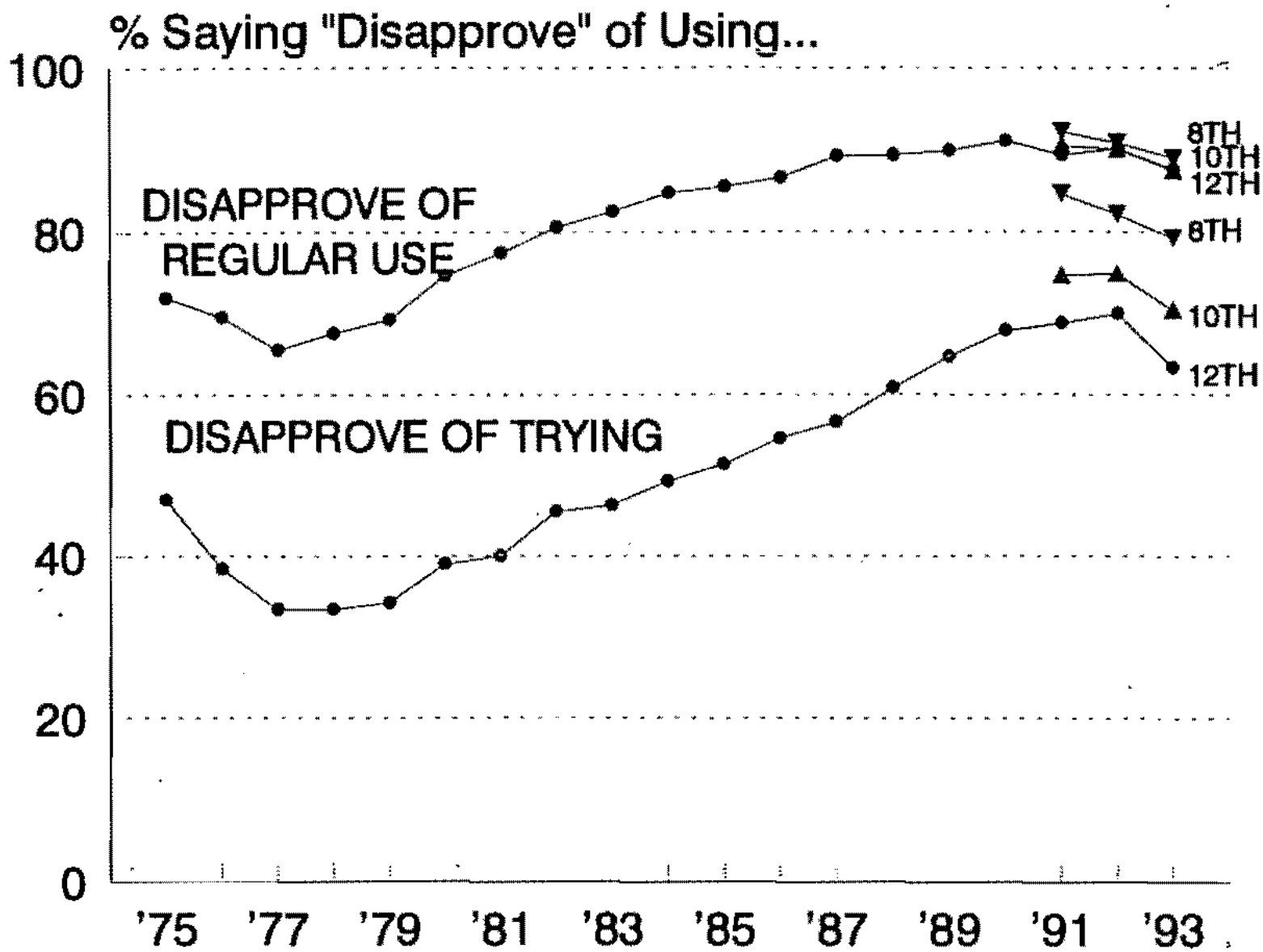
TRENDS IN PERCEIVED RISK OF MARIJUANA USE

EIGHTH, TENTH, and TWELFTH GRADERS



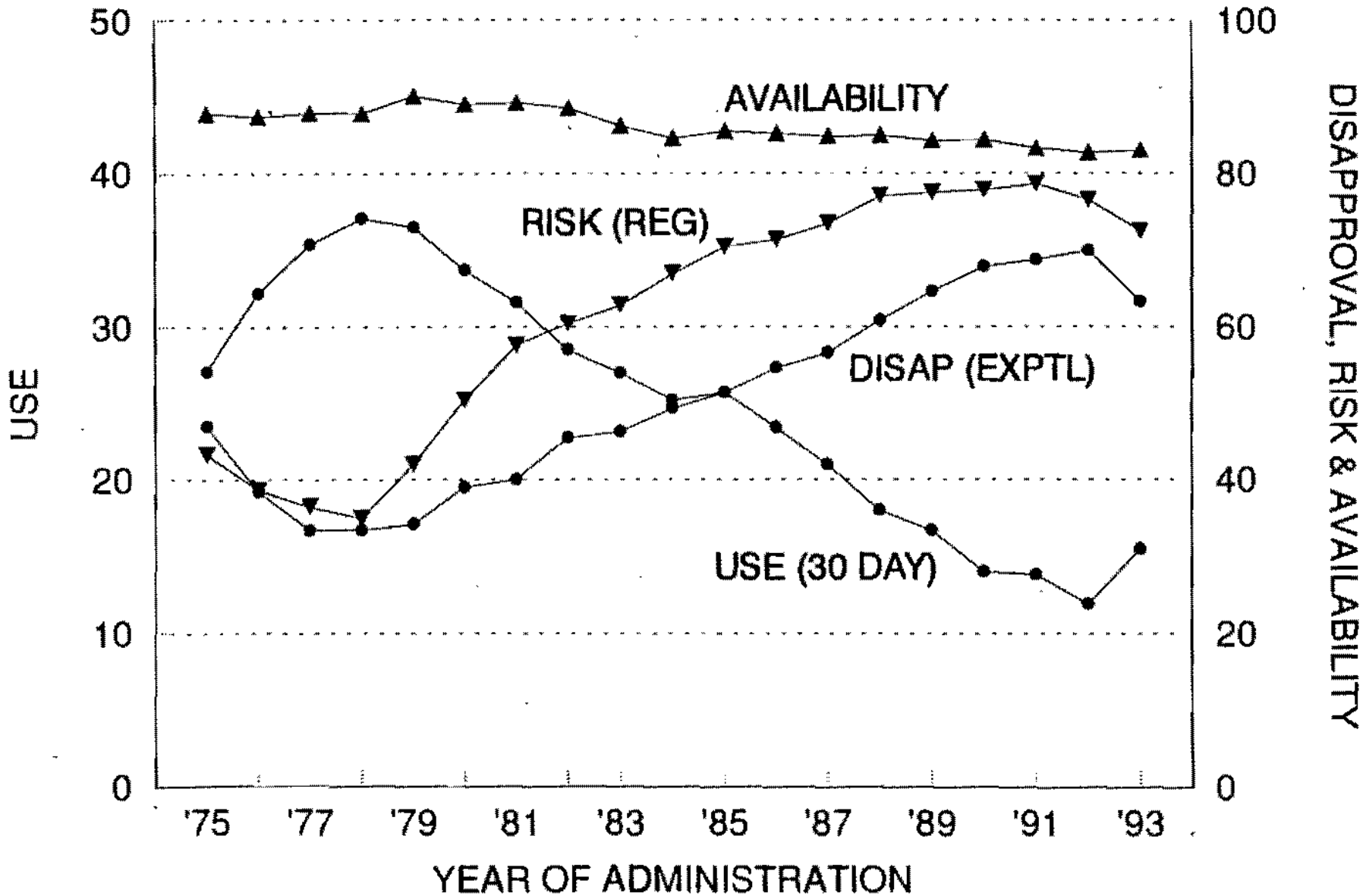
TRENDS IN DISAPPROVAL OF MARIJUANA USE

EIGHTH, TENTH, and TWELFTH GRADERS



MARIJUANA: TRENDS IN DISAPPROVAL OF TRYING, AVAILABILITY, PERC. RISK OF REGULAR USE, AND PREVALENCE OF USE IN PAST 30 DAYS

TWELFTH GRADERS

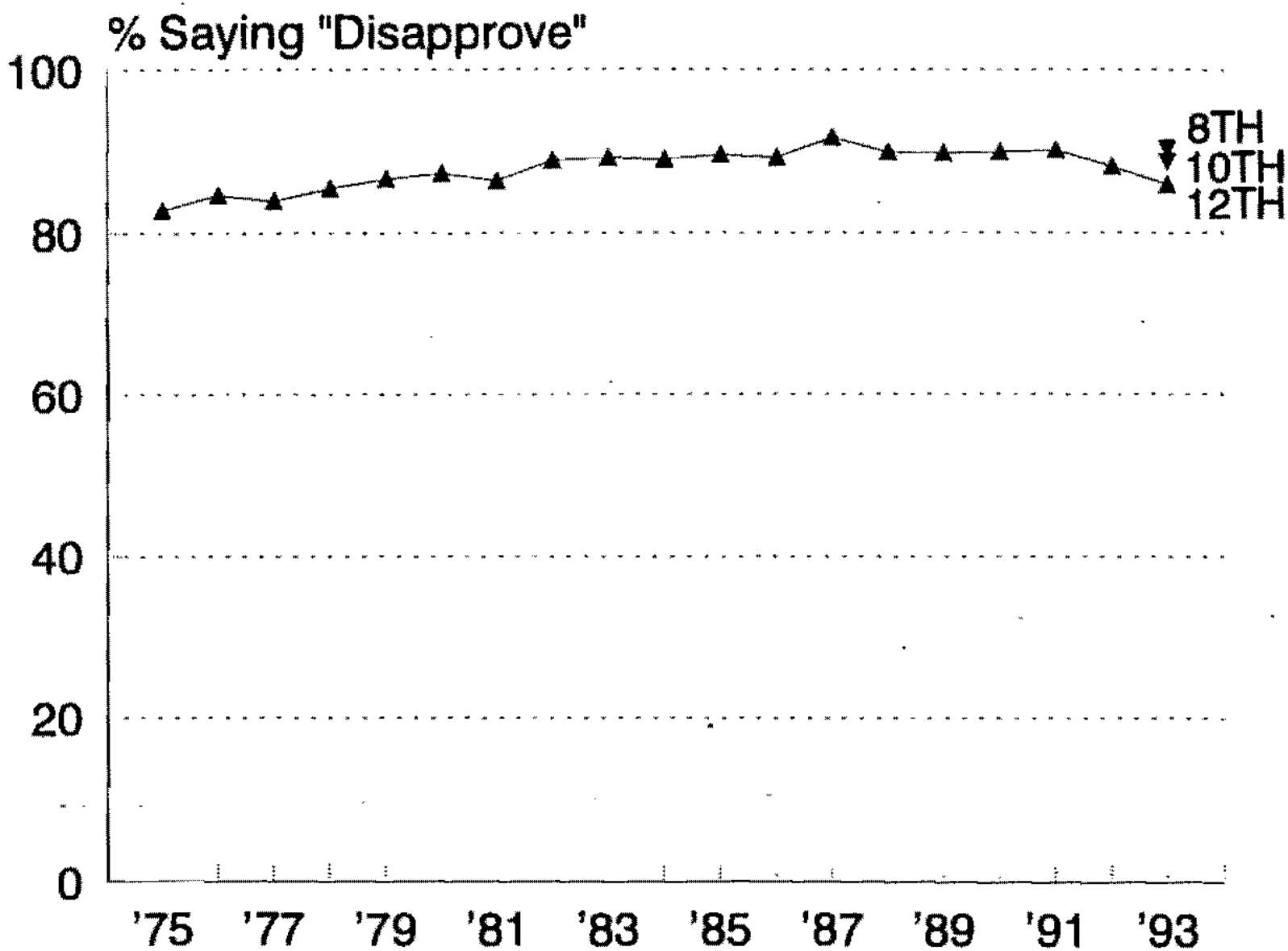


TRENDS IN PERCEIVED RISK OF TRYING LSD ONCE OR TWICE

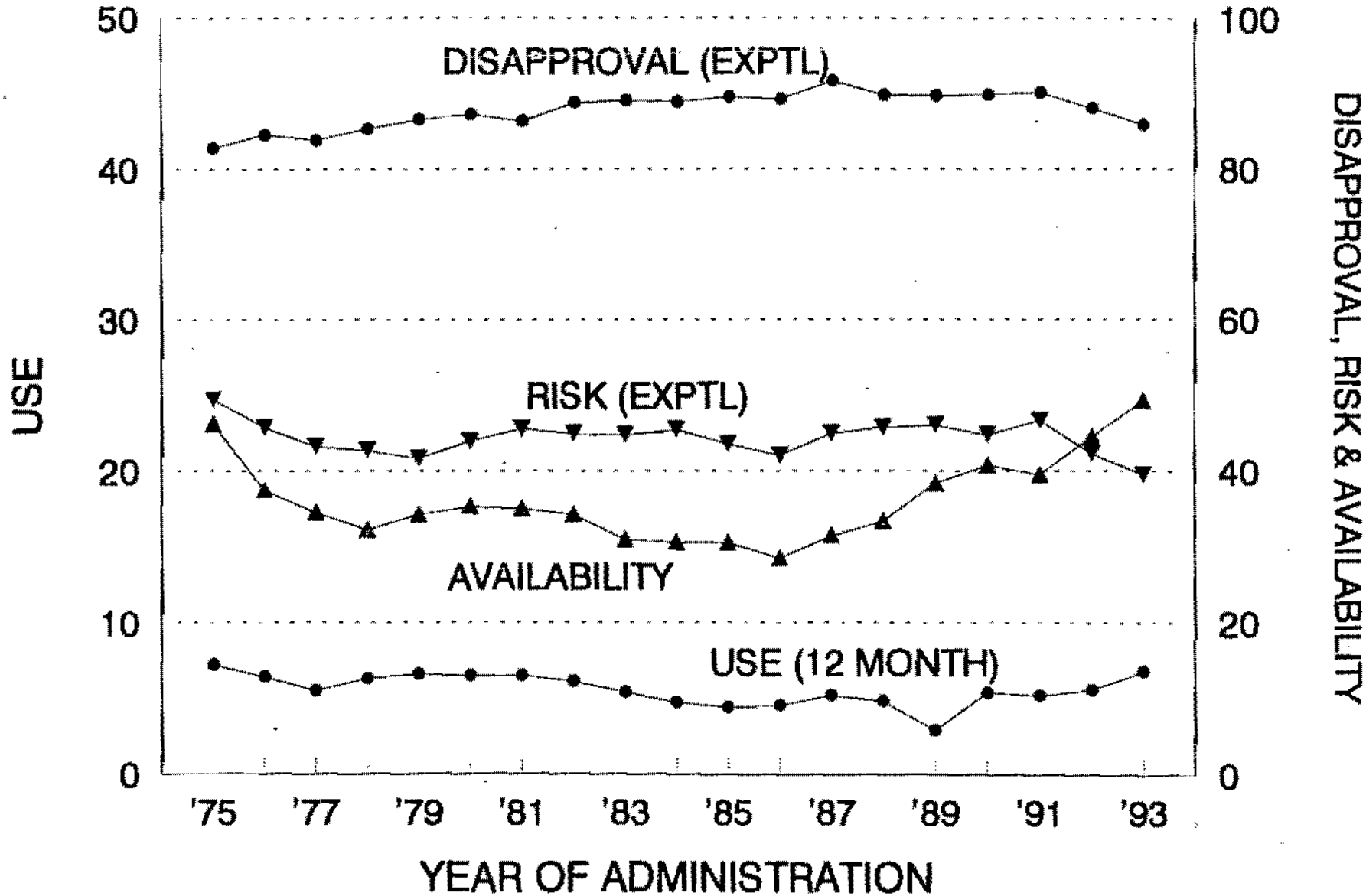
EIGHTH, TENTH, and TWELFTH GRADERS

TRENDS IN DISAPPROVAL OF TRYING LSD ONCE OR TWICE

EIGHTH, TENTH, and TWELFTH GRADERS



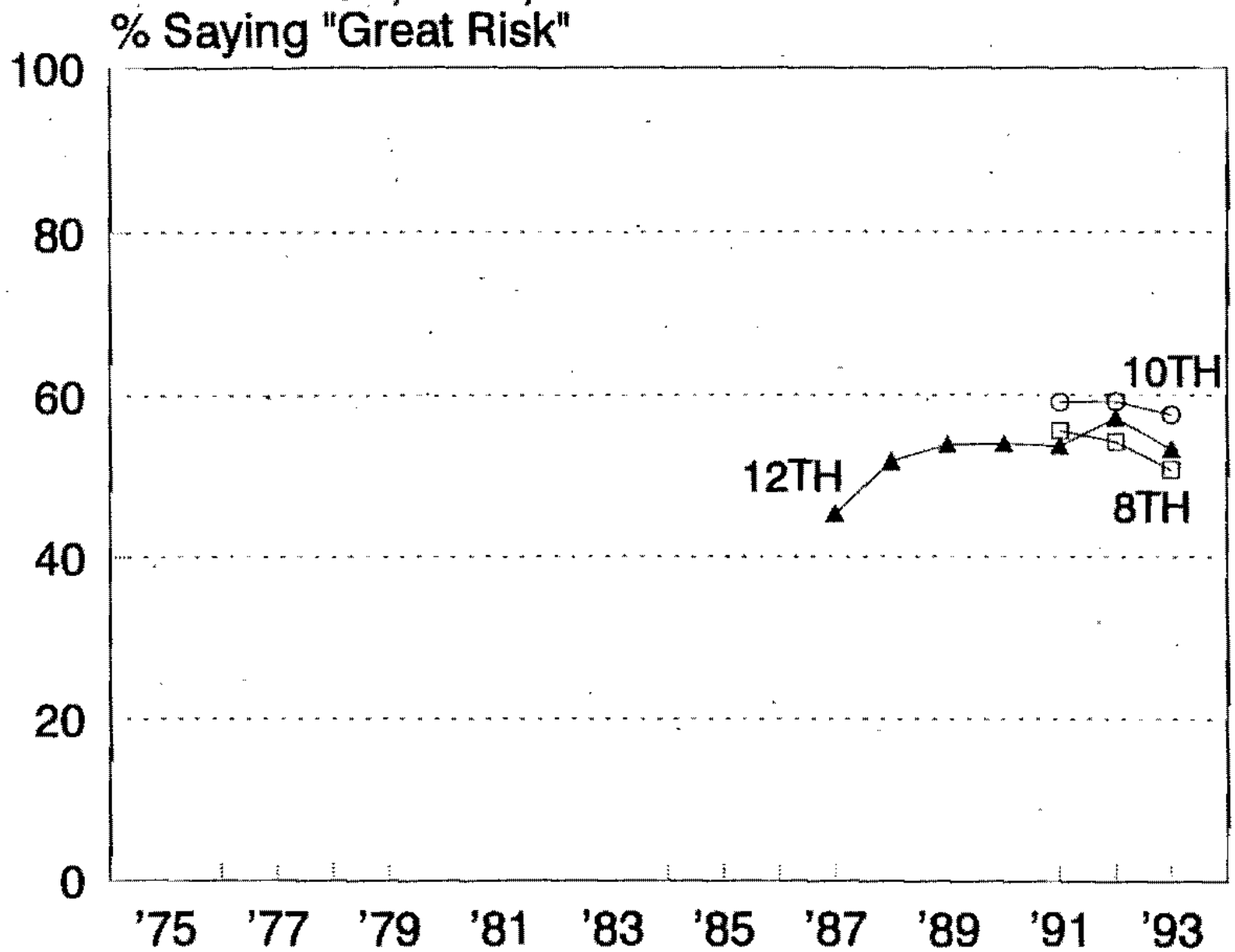
LSD: TRENDS IN PERCEIVED AVAILABILITY, PERCEIVED RISK OF AND DISAPPROVAL OF TRYING, AND PREVALENCE OF USE IN PAST YEAR
TWELFTH GRADERS



TRENDS IN PERC. RISK OF TRYING COCAINE POWDER

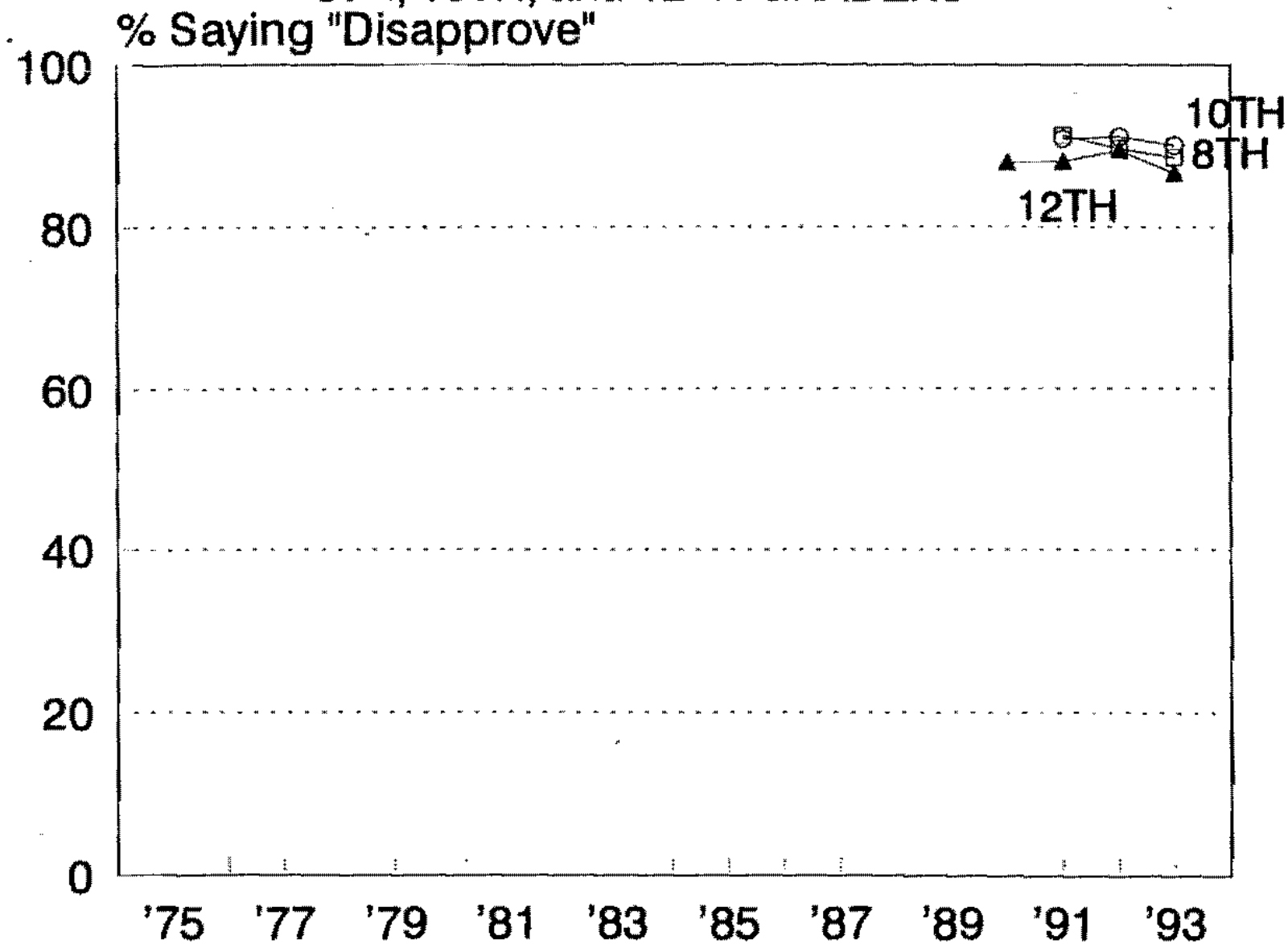
ONCE OR TWICE

8TH, 10TH, and 12TH GRADERS



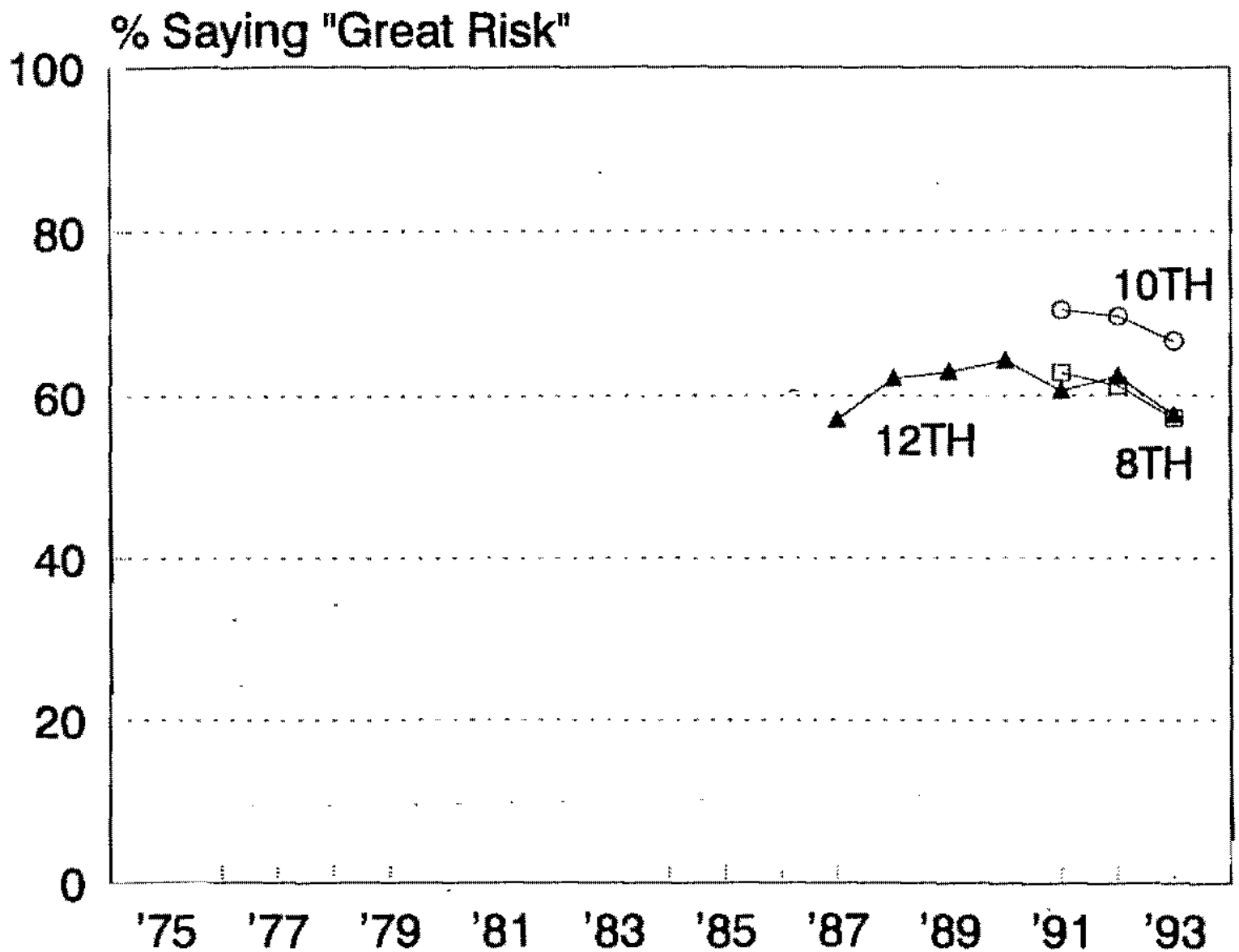
TRENDS IN DISAPPROVAL OF TRYING COCAINE POWDER ONCE OR TWICE

8TH, 10TH, and 12TH GRADERS

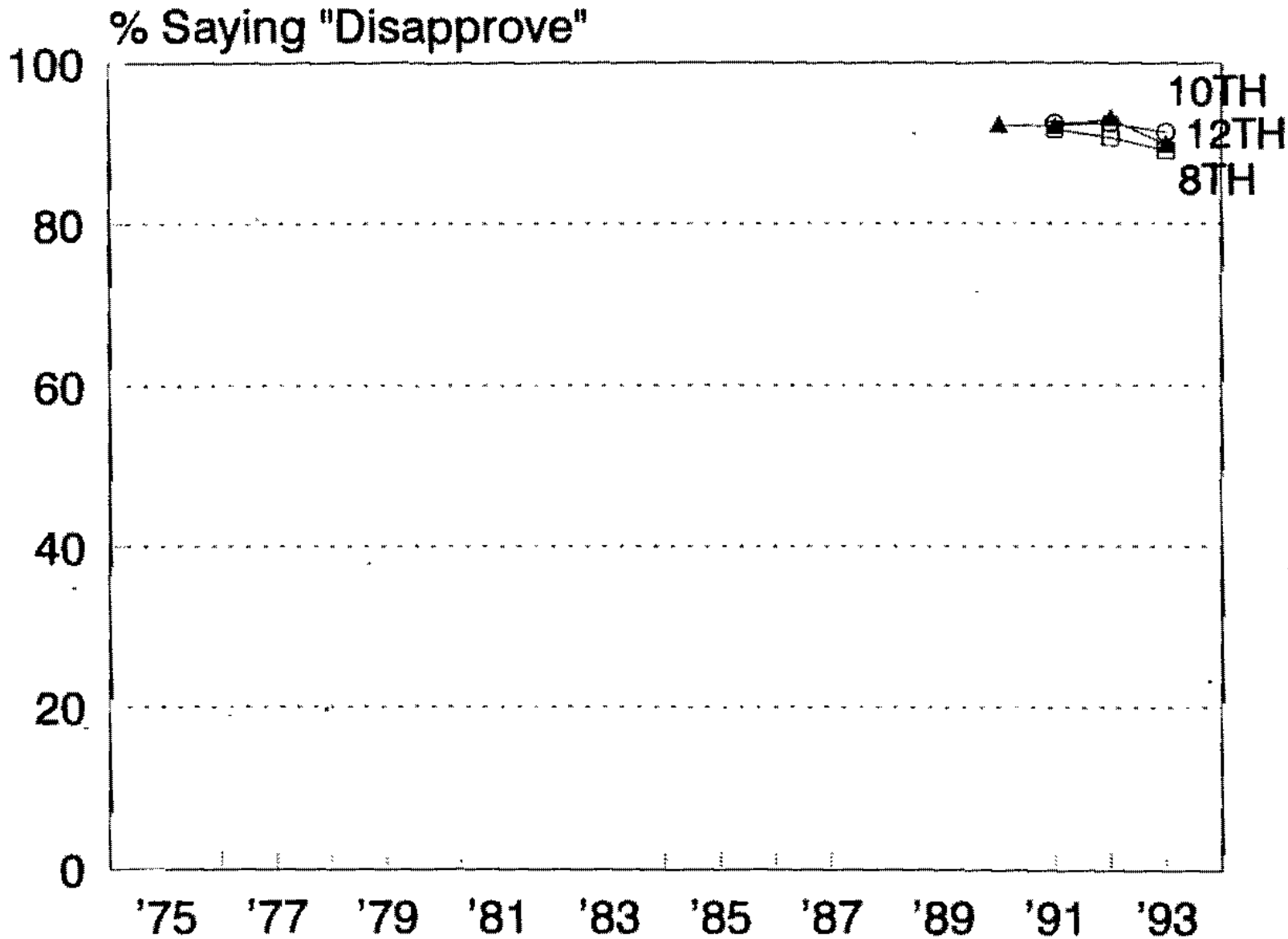


TRENDS IN PERC. RISK OF TRYING CRACK ONCE OR TWICE

8TH, 10TH, and 12TH GRADERS

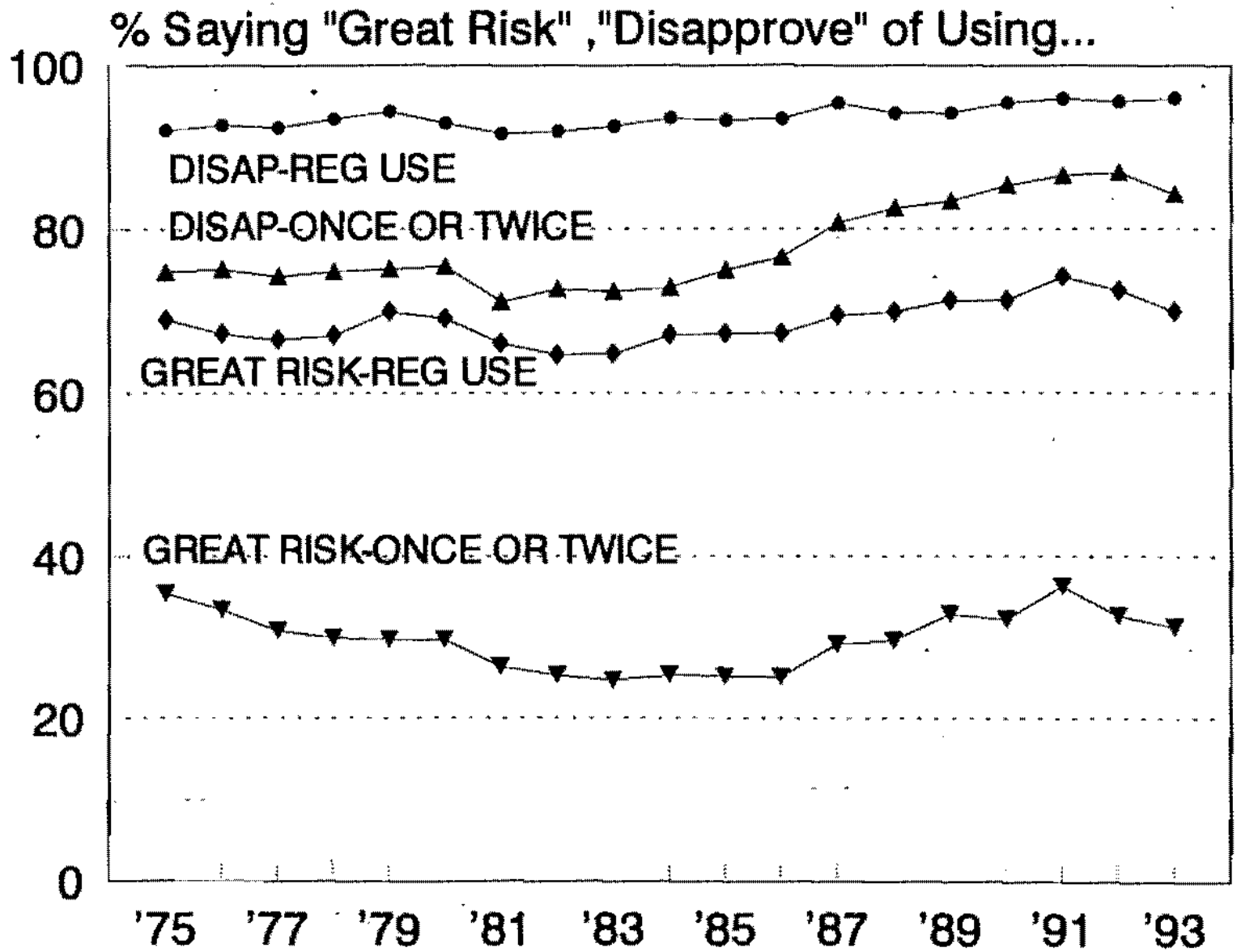


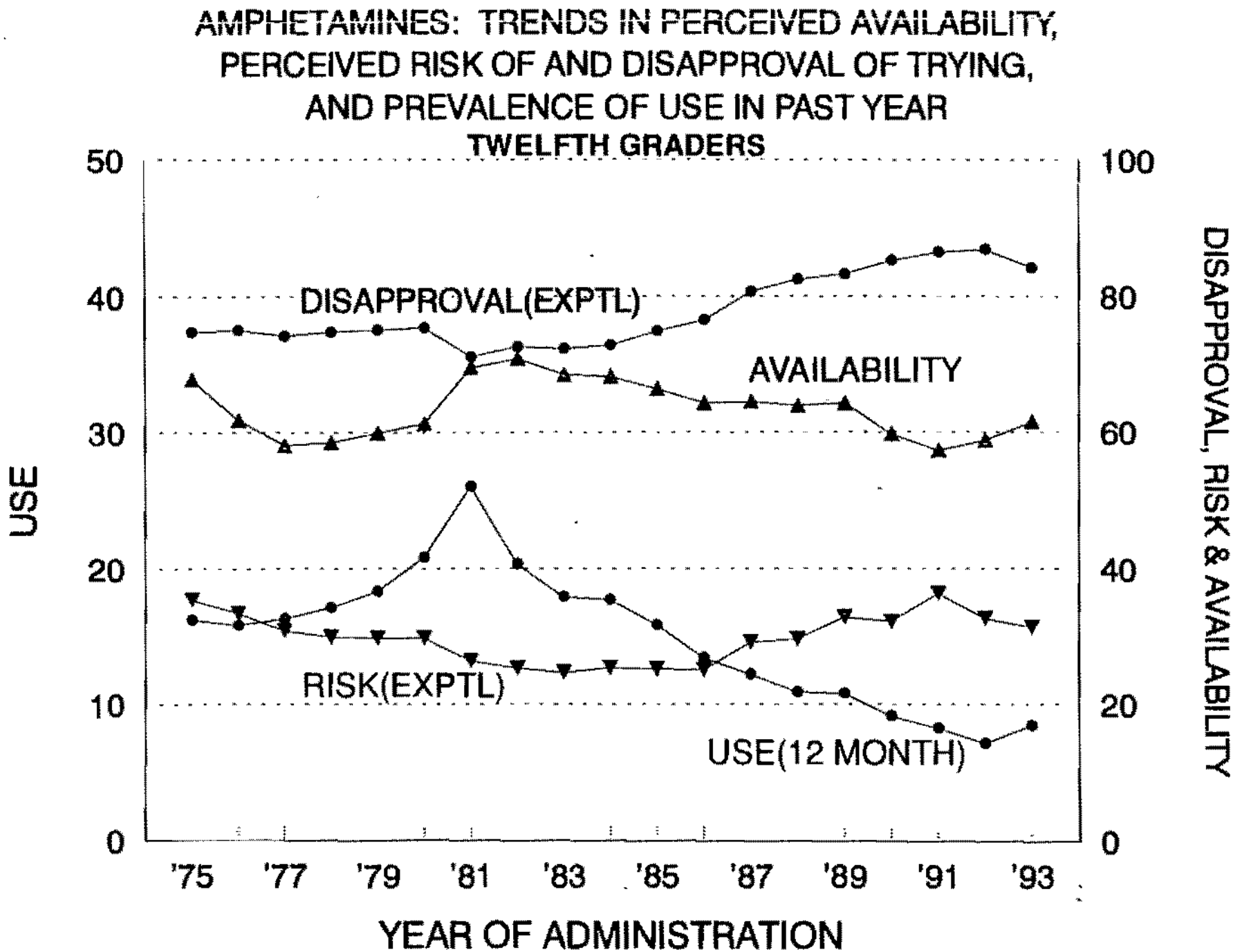
TRENDS IN DISAPPROVAL OF TRYING CRACK ONCE OR TWICE
8TH, 10TH, and 12TH GRADERS



TRENDS IN RISK AND DISAPPROVAL OF AMPHETAMINE USE

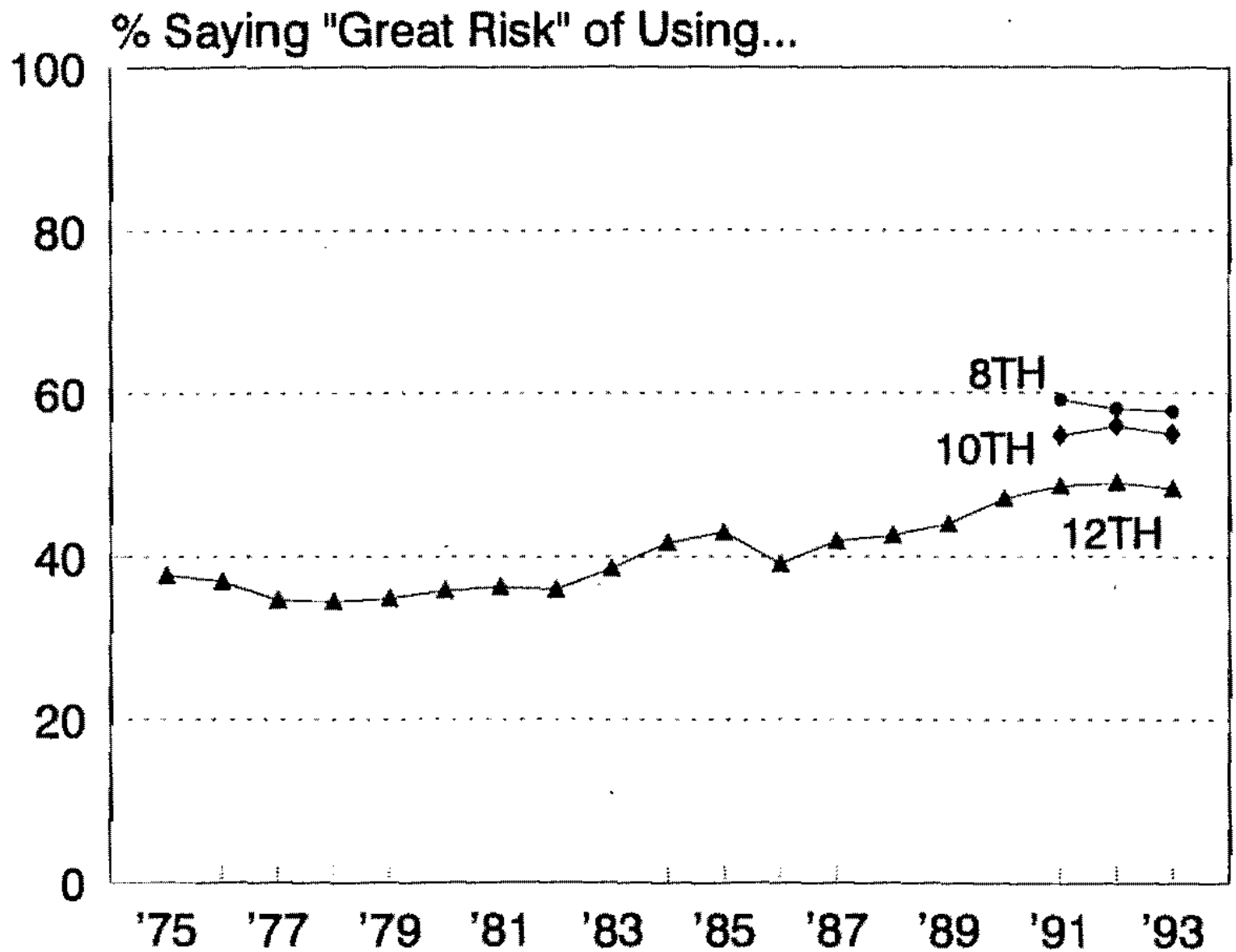
TWELFTH GRADERS




AMPHETAMINES: TRENDS IN PERCEIVED AVAILABILITY,
PERCEIVED RISK OF AND DISAPPROVAL OF TRYING,
AND PREVALENCE OF USE IN PAST YEAR
TWELFTH GRADERS
DISAPPROVAL(EXPTL)
AVAILABILITY
RISK(EXPTL)
USE(12 MONTH)
USE
DISAPPROVAL, RISK & AVAILABILITY
YEAR OF ADMINISTRATION
0
10
20
30
40
50
0
20
40
60
80
100
'75
'77
'79
'81
'83
'85
'87
'89
'91
'93

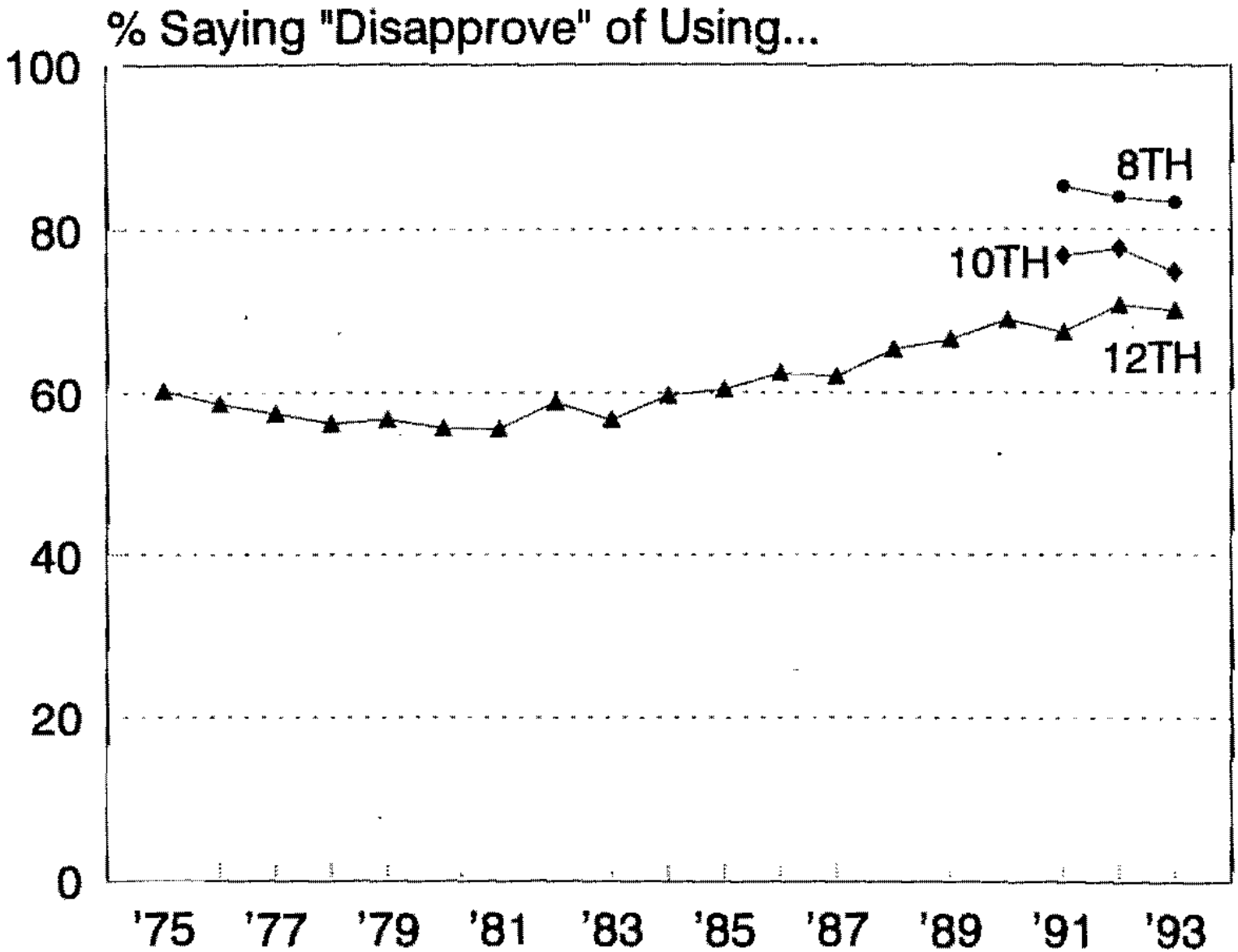
TRENDS IN PERCEIVED RISK OF BINGE DRINKING

8TH, 10TH, and 12TH GRADERS

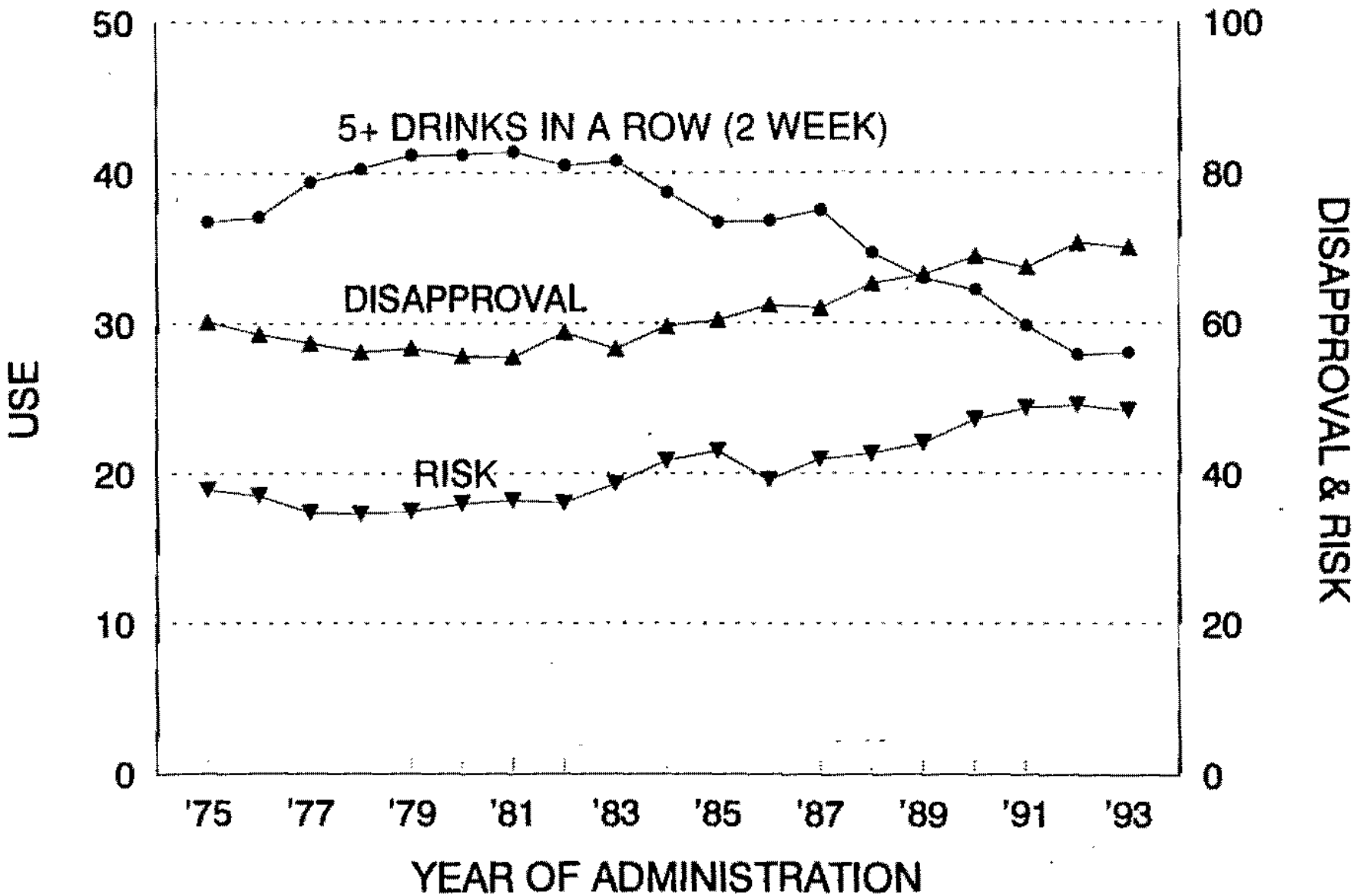


TRENDS IN DISAPPROVAL OF BINGE DRINKING

8TH, 10TH, and 12TH GRADERS

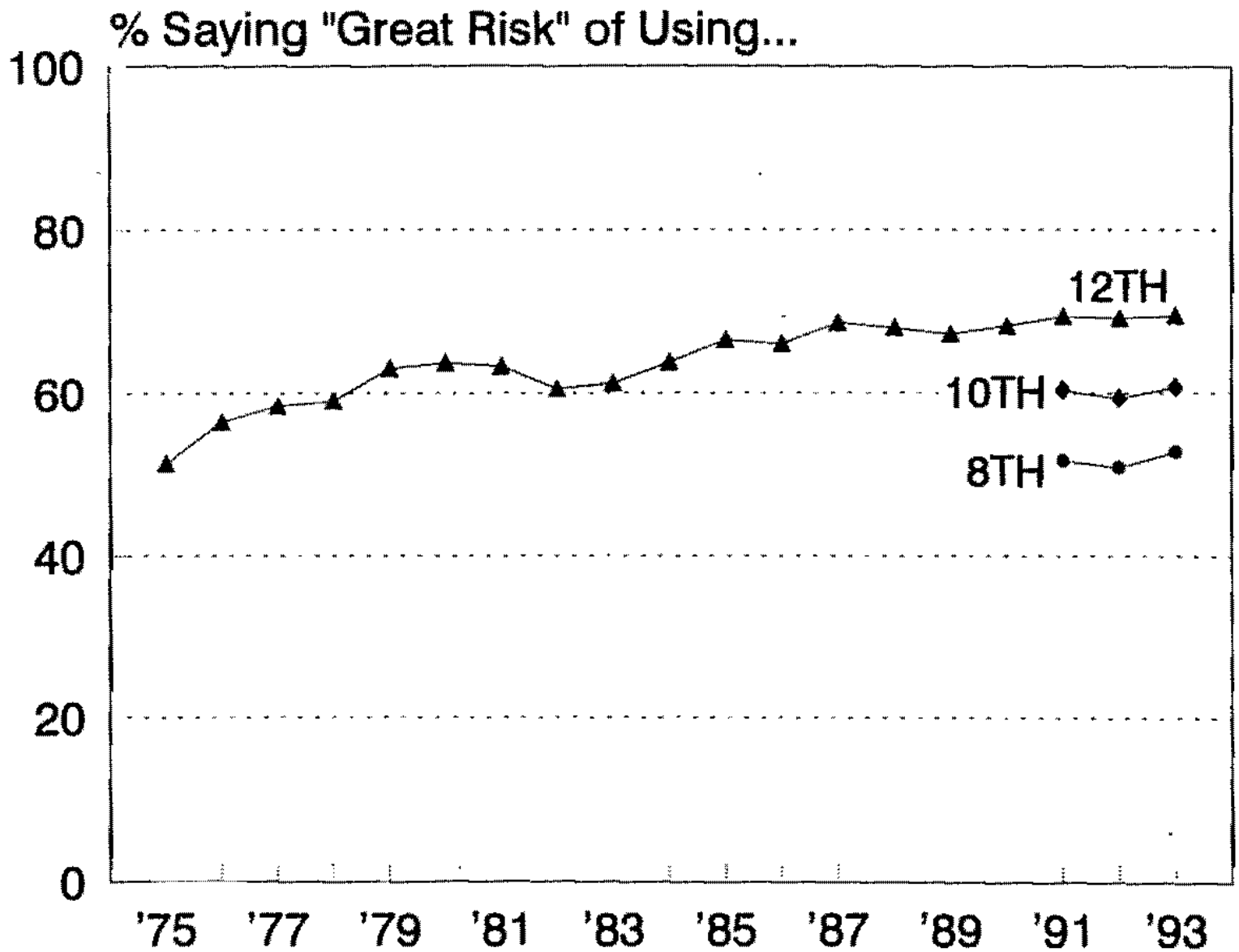


BINGE DRINKING: TRENDS IN PERCEIVED RISK, DISAPPROVAL, AND PREVALENCE IN PAST TWO WEEKS
TWELFTH GRADERS



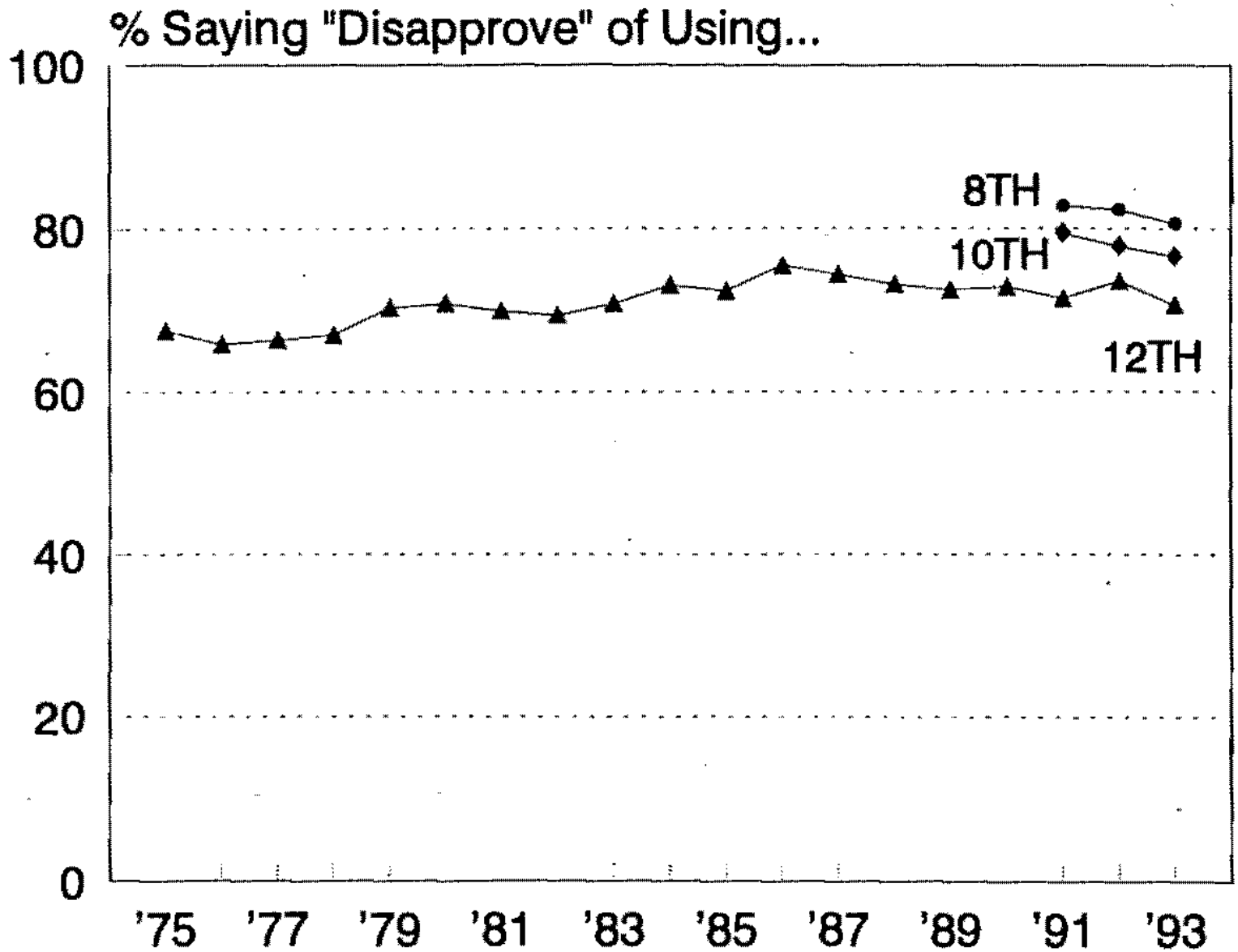
TRENDS IN PERCEIVED RISK OF DAILY CIGARETTE SMOKING

8TH, 10TH, and 12TH GRADERS

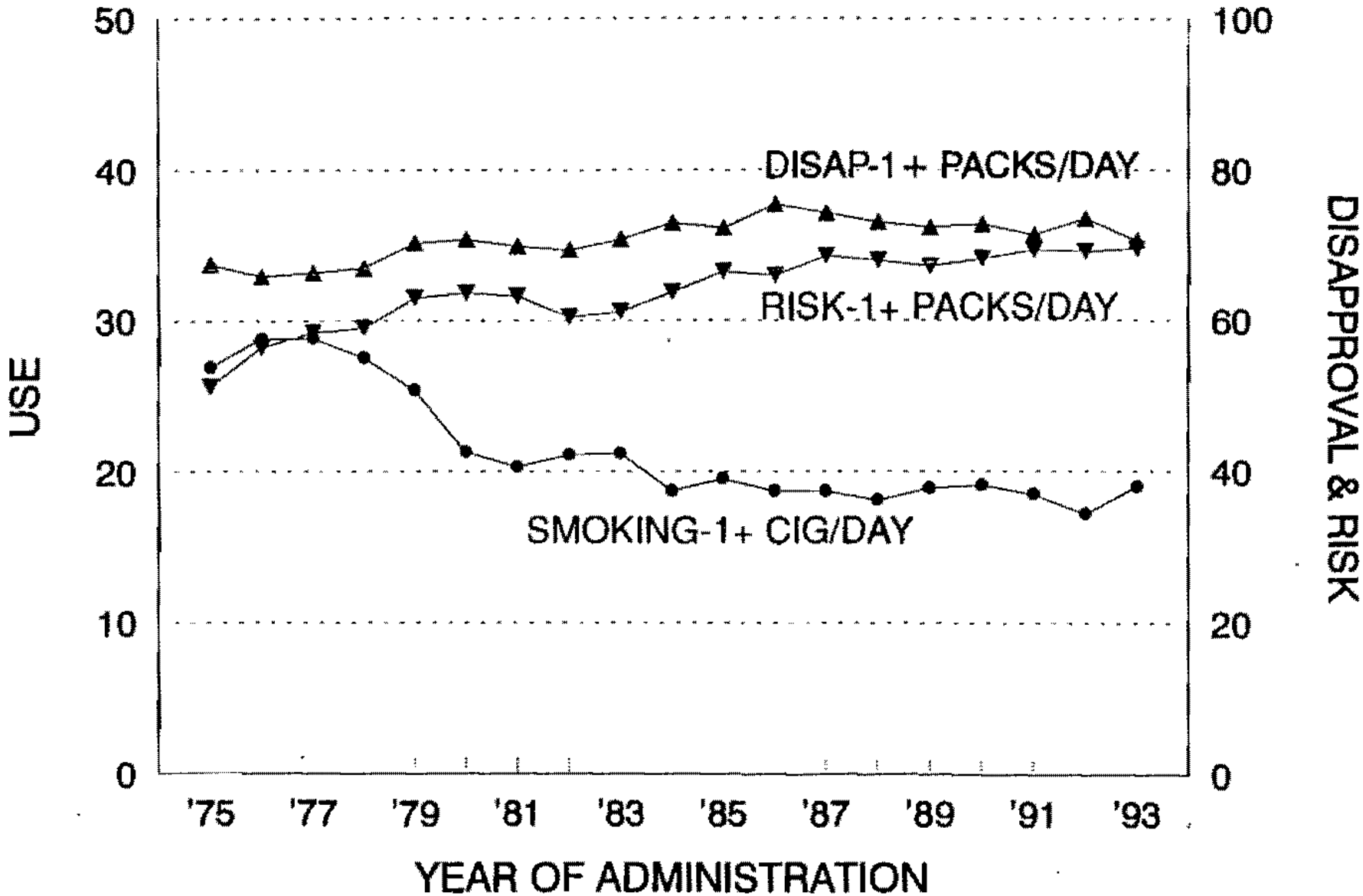


TRENDS IN DISAPPROVAL OF DAILY CIGARETTE SMOKING

8TH, 10TH, and 12TH GRADERS



DAILY SMOKING: TRENDS IN PERCEIVED RISK, DISAPPROVAL, AND PREVALENCE IN PAST THIRTY DAYS
TWELFTH GRADERS



APPENDIX B

MONITORING THE FUTURE STUDY PRESS RELEASE
JANUARY 31, 1994

The University of Michigan

News and Information Services

412 Maynard
Ann Arbor, Michigan
48109-1399

January 27, 1994 (21)
Contact: Diane Swanbrow
Phone: (313) 747-4416

Drug use rises among American teen-agers, as fewer see dangers and as peer norms begin to change. Cigarette smoking among teens also begins to increase.

FOR RELEASE AT 1:30 P.M. EST, MONDAY, JANUARY 31, 1994.

EDITORS: Results of this survey will be released at a news conference on Jan. 31 at 1:30 p.m. at the Hubert H. Humphrey Building in Washington, D.C. Joining Lloyd Johnston, the principal investigator of the Monitoring the Future Study, will be Donna E. Shalala, Secretary of Health and Human Services, Richard W. Riley, Secretary of Education, and Lee P. Brown, Director of the Office of National Drug Control Policy. For further information on the study, contact Johnston at (313) 763-5043.

ANN ARBOR---Drug use among American young people has been making a clear comeback in the past two years. That is the conclusion of University of Michigan research scientists Lloyd Johnston, Patrick O'Malley, and Jerald Bachman, all at the University's Institute for Social Research.

In the 1993 results from their 19th annual survey of American high school seniors and their third annual survey of eighth- and 10th-graders, the investigators report a sharp rise in marijuana use throughout the country at all three grade levels, as well as an increase in the use of stimulants, LSD, and inhalants. They also note an increase in cigarette smoking in all three grades.

"Last year we reported an upswing in the use of a number of drugs among the eighth-graders," states Johnston, "and at the same time some important attitudes and beliefs about drugs began to soften in all three grades. These attitudes and beliefs---specifically, the dangers believed to be associated with the use of these drugs, as well as personal disapproval of using them---play a critical role in deterring use. When they begin to soften, as they did last

(more)

year, an increase in use can be expected." These attitudes softened still more in 1993.

The Monitoring the Future Study is funded under a series of grants from the National Institute on Drug Abuse (NIDA), a component of the National Institutes of Health. It addresses a broad array of research objectives, including measuring and explaining changes in drug use among American young people. At present, approximately 50,000 students in more than 400 schools are surveyed annually. They constitute nationally representative samples of all eighth-, 10th-, and 12th-grade students in the coterminous United States.

Marijuana. In 1993 the proportion of students reporting any use of marijuana in the prior 12 months was 9 percent for eighth-graders, 19 percent for 10th-graders, and 26 percent for 12th-graders. All of these rates increased by three or four percentage points in the last year or two. (See Table 1.) Put another way, the proportion of eighth-graders using marijuana has increased by half in the last two years, while the proportion of 10th-grade users increased by about a quarter and the proportion of 12th-grade users by about a fifth. "These rates are still well below the peak levels reached in the late 70s," observes Johnston, "but they clearly represent a reversal of the declines we recorded for more than a decade." (See Figure 6.)

LSD. Other drugs have also been on the increase. LSD use has been increasing gradually at all three grade levels. Johnston notes, "LSD was one of the earliest drugs to fall from favor in the epidemic of the last 15 years, as concerns about its harmful effects mounted. Today youngsters may need to learn the same lessons the hard way, since they have had fewer firsthand opportunities to learn from events around them. Of course, there is an alternative: We could do a better job educating and persuading them than we have been doing in the last few years."

Inhalants. The use of inhalants (like glues, solvents, and aerosols) also rose in the past two years at all three grade levels. Inhalants are unusual in that they are most likely to be used actively in the earlier grade levels, the

investigators note. For example, 11 percent of the eighth-graders (one in every nine) reported using an inhalant in the previous year, compared with 8 percent of the 10th-graders and 7 percent of the 12th-graders. Among 12th-graders, inhalant use has risen fairly steadily from the mid-70s to the late-80s. (See Table 3.) Over the most recent two years, inhalant use rose again, at all three grade levels. (See Figure 6.) "We don't think that young people fully understand the dangers of inhalants, perhaps because most of the substances inhaled are common household products," the investigators state, "but they definitely can be lethal."

Stimulants. This class of drugs, comprised of the prescription-controlled amphetamines, was at one time the second most widely used after marijuana. Stimulant use began to fall from favor after 1981, perhaps in part because of the growing popularity of cocaine, and use dropped to a relatively low level. However, use has risen at all three grade levels over the past one to two years. (See Table 1 and Figure 6.)

"Certainly the combination of drugs now growing in popularity---marijuana, LSD, and amphetamines---is reminiscent of what was popular in the early days of the drug epidemic," observes Johnston. "Other drugs then followed in popularity. I certainly hope that we are not seeing a rebirth of the old epidemic."

Attitudes and Beliefs about Drugs. Johnston adds, "The changes in use would worry me less if the underlying attitudes and beliefs were not also continuing to shift in a direction favorable to drug use. Unfortunately, the perceived dangers of nearly all of the illicit drugs declined in 1993 at all grade levels." (See Tables 6 and 7.) There was a fair drop in the proportions seeing marijuana use as dangerous at any level, even regular use.

The perceived risks associated with crack and powdered cocaine also dropped in all three grades. Personal disapproval of crack and cocaine use also fell. While there was little change in the actual use of either crack or powdered cocaine in 1993, the investigators fear that these changes in beliefs and attitudes could presage an increase in their use, as well. (more)

"With more young people smoking cigarettes and using marijuana, and with the psychological and social constraints on use declining, the stage is set for a potential resurgence of cocaine and crack use in this population," comments Johnston. "This is one of the reasons we take these developments so seriously. The country cannot afford another cocaine epidemic. We are already struggling to reduce a large population of heavy users through costly programs; we certainly don't need any more recruits to this group from a new generation."

Social norms against use, reflected in the proportion of students who disapprove use of these drugs, have been softening in the last year or so for marijuana, LSD, amphetamines, crack, and powdered cocaine. (See Tables 8 and 9.)

Alcohol. The legal drugs, alcohol and cigarettes, are still the most widely used at all grade levels. Two-thirds of the eighth-graders and nearly nine-tenths of the 12th-graders have tried alcohol, while a quarter of the eighth-graders and half of the 12th-graders have used in the month prior to the survey. Episodes of heavy drinking are also common. Asked if they had five or more drinks in a row on at least one occasion in the prior two weeks, 14 percent of eighth-graders, 23 percent of 10th-graders, and 28 percent of 12th-graders said they had.

These statistics on drinking have changed relatively little since 1991, but the 12th-graders have had a longer-term decline in episodes of heavy drinking---one which began in the early 80s and now seems to be decelerating. (See Tables 1 and 5.)

Cigarettes. "Most people would probably tell you that smoking rates among young Americans are declining," observes Johnston, "since they know that adult smoking rates are declining. In fact, however, the rates for high school seniors have been fairly steady for nearly a decade, and now are on the increase." The rate of daily smoking rose significantly in all three grade levels in 1993---from 7 percent to 8 percent among eighth-graders, from 12 percent to 14 percent among 10th-graders, and from 17 percent to 19 percent among 12th-graders.

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Johnston states, "It is unconscionable that cigarette smoking is increasing among our young people, given all that we know about the eventual health care costs, disease, and premature death which will result from this insidious form of drug use. It is clear that as a society we have not been doing what it takes to protect our children. Because these extraordinary health consequences don't show up for 30 years, we have been able to turn a blind eye to this tragedy."

While perceptions of the dangers associated with smoking have, if anything, risen slightly over the past two years, still nearly half (47 percent) of the eighth-graders do not believe that there is a great risk associated with pack-a-day smoking. Among seniors, more than 30 percent still do not believe there is great risk. (See Table 6.)

In addition, personal disapproval of smoking has fallen over the past two years in all grades. This means that peer norms are becoming less restrictive. (See Table 8.) "Here we are 30 years past the first Surgeon General's report on smoking and health, and we still have a substantial fraction of our children becoming smokers: Indeed, we now have a rising proportion. That should be unacceptable to every parent, every educator, every politician, indeed to every citizen in the country," asserts Johnston.

Racial/ethnic differences. Three major racial/ethnic groups (white, Black, and Hispanic) were distinguished in certain analyses, and trends in two-year moving averages were examined. "In general, and contrary to conventional wisdom, Black students report the lowest rates of use for virtually all drugs, licit and illicit; and this is true at all three grade levels included in the survey."

In the long term trends observed among seniors, the three groups generally show similar trends, with three major exceptions: (1) Blacks have shown a long term, continuing decline in smoking while whites and Hispanics leveled off some years ago; (2) Blacks have not shown the increase in LSD use which has been observed among whites and Hispanics in recent years; and (3) Blacks have shown less increase in inhalant use over the years than the other two groups.

(more)

Demographic comparisons. The recent increases in the use of marijuana, LSD, stimulants, and inhalants generally are occurring across most sectors of society. They are not just concentrated in large cities or particular regions of the country, for example.

* * * * * *

The Monitoring the Future Study is also widely known as the National High School Senior Survey. It has been conducted under a series of research grants from the National Institute on Drug Abuse. Surveys have been carried out each year since 1975 by the University of Michigan's Institute for Social Research. The 1993 samples are comprised of roughly 17,000 seniors in 139 public and private high schools nationwide, selected to be representative of all seniors in public and private high schools in the coterminous United States. They complete self-administered questionnaires given to them in their classrooms by U-M personnel.

Beginning in 1991, similar surveys of nationally representative samples of eighth- and 10th-graders have been conducted annually. In 1993, the 10th-grade sample was comprised of 15,500 students in 128 schools, while the eighth-grade sample contained 18,800 students in 159 schools. Other years had similar sample sizes.

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(LJohnston;JBachman;PO'Malley;ISR)(R1-3;ISR;Ed1-2A;Rtsp)
(TC/1-8)[drug]

TABLE 1

Trends in Prevalence[1] of Various Drugs for Three Populations: Eighth, Tenth, and Twelfth Graders

	Lifetime				Annual				30-Day				Daily			
	1991	1992	1993	'92–'93 change	1991	1992	1993	'92–'93 change	1991	1992	1993	'92–'93 change	1991	1992	1993	'92–'93 change
Any Illicit Drug[a]																
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	44.1	40.7	42.9	+2.2s	29.4	27.1	31.0	+3.9sss	16.4	14.4	18.3	+3.9sss	—	—	—	—
Any Illicit Drug[b] Other Than Marijuana																
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	26.9	25.1	26.7	+1.6	16.2	14.9	17.1	+2.2ss	7.1	6.3	7.9	+1.6sss	—	—	—	—
Marijuana/Hashish																
8th Grade	10.2	11.2	12.6	+1.4ss	6.2	7.2	9.2	+2.0sss	3.2	3.7	5.1	+1.4sss	0.2	0.2	0.4	+0.2ss
10th Grade	23.4	21.4	24.4	+3.0ss	16.5	15.2	19.2	+4.0sss	8.7	8.1	10.9	+2.8sss	0.8	0.8	1.0	+0.2
12th Grade	36.7	32.6	35.3	+2.7s	23.9	21.9	26.0	+4.1sss	13.8	11.9	15.5	+3.6sss	2.0	1.9	2.4	+0.5s
Inhalants[c,4]																
8th Grade	17.6	17.4	19.4	+2.0s	9.0	9.6	11.0	+1.6s	4.4	4.7	5.4	+0.7	0.2	0.3	0.3	0.0
10th Grade	15.7	16.6	17.5	+0.9	7.1	7.6	8.4	+0.9	2.7	2.7	3.3	+0.6s	0.1	0.1	0.2	+0.1
12th Grade	17.6	16.6	17.4	+0.8	6.6	6.2	7.0	+0.8	2.4	2.3	2.5	+0.2	0.2	0.1	0.1	0.0
Hallucinogens[d]																
8th Grade	3.2	3.8	3.9	+0.1	1.9	2.5	2.6	+0.1	0.8	1.1	1.2	+0.1	0.1	0.1	0.1	0.0
10th Grade	6.1	6.4	6.8	+0.4	4.0	4.3	4.7	+0.4	1.6	1.8	1.9	+0.1	*	0.1	0.1	0.0
12th Grade	9.6	9.2	10.9	+1.7ss	5.8	5.9	7.4	+1.5ss	2.2	2.1	2.7	+0.6s	0.1	0.1	0.1	0.0
LSD																
8th Grade	2.7	3.2	3.5	+0.3	1.7	2.1	2.3	+0.2	0.6	0.9	1.0	+0.1	*	*	*	0.0
10th Grade	5.6	5.8	6.2	+0.4	3.7	4.0	4.2	+0.2	1.5	1.6	1.6	0.0	*	0.1	*	0.0
12th Grade	8.8	8.6	10.3	+1.7ss	5.2	5.6	6.8	+1.2ss	1.9	2.0	2.4	+0.4	0.1	0.1	0.1	0.0
PCP[e]																
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	2.9	2.4	2.9	+0.5	1.4	1.4	1.4	0.0	0.5	0.6	1.0	+0.4	0.1	0.1	0.1	+0.1
Hallucinogens Other than LSD																
8th Grade	1.4	1.7	1.7	0.0	0.7	1.1	1.0	−0.1	0.3	0.4	0.5	+0.1	*	*	*	0.0
10th Grade	2.2	2.5	2.8	+0.3	1.3	1.4	1.9	+0.5s	0.4	0.5	0.7	+0.2	*	*	*	0.0
12th Grade	3.7	3.3	3.9	+0.6	2.0	1.7	2.2	+0.5s	0.7	0.5	0.8	+0.3s	*	*	*	0.0

SOURCE: Monitoring The Future Study, The University Of Michigan.

(Table continued on next page)

TABLE 1 (continued)

Trends in Prevalence of Various Drugs for Three Populations: Eighth, Tenth, and Twelfth Graders

	Lifetime				Annual				30-Day				Daily			
	1991	1992	1993	'92–'93 change	1991	1992	1993	'92–'93 change	1991	1992	1993	'92–'93 change	1991	1992	1993	'92–'93 change
Cocaine																
8th Grade	2.3	2.9	2.9	0.0	1.1	1.5	1.7	+0.2	0.5	0.7	0.7	0.0	0.1	*	0.1	0.0
10th Grade	4.1	3.3	3.6	+0.3	2.2	1.9	2.1	+0.2	0.7	0.7	0.9	+0.2	0.1	*	0.1	0.0
12th Grade	7.8	6.1	6.1	0.0	3.5	3.1	3.3	+0.2	1.4	1.3	1.3	0.0	0.1	0.1	0.1	0.0
Crack																
8th Grade	1.3	1.6	1.7	+0.1	0.7	0.9	1.0	+0.1	0.3	0.5	0.4	–0.1	*	*	0.1	0.0
10th Grade	1.7	1.5	1.8	+0.3	0.9	0.9	1.1	+0.2	0.3	0.4	0.5	+0.1	*	*	*	0.0
12th Grade	3.1	2.6	2.6	0.0	1.5	1.5	1.5	0.0	0.7	0.6	0.7	+0.1	0.1	0.1	0.1	0.0
Other Cocaine[f]																
8th Grade	2.0	2.4	2.4	0.0	1.0	1.2	1.3	+0.1	0.5	0.5	0.6	+0.1	*	*	*	0.0
10th Grade	3.8	3.0	3.3	+0.3	2.1	1.7	1.8	+0.1	0.6	0.6	0.7	+0.1	*	*	*	0.0
12th Grade	7.0	5.3	5.4	+0.1	3.2	2.6	2.9	+0.3	1.2	1.0	1.2	+0.2	0.1	*	0.1	0.0
Heroin																
8th Grade	1.2	1.4	1.4	0.0	0.7	0.7	0.7	0.0	0.3	0.4	0.4	0.0	*	*	*	0.0
10th Grade	1.2	1.2	1.3	+0.1	0.5	0.6	0.7	+0.1	0.2	0.2	0.3	+0.1	*	*	*	0.0
12th Grade	0.9	1.2	1.1	–0.1	0.4	0.6	0.5	–0.1	0.2	0.3	0.2	–0.1	*	*	*	0.0
Ice[g]																
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	3.3	2.9	3.1	+0.2	1.4	1.3	1.7	+0.4	0.6	0.5	0.6	+0.1	0.1	0.1	0.1	–0.1
Other Opiates																
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	6.6	6.1	6.4	+0.3	3.5	3.3	3.6	+0.3	1.1	1.2	1.3	+0.1	0.1	*	*	0.0
Stimulants																
8th Grade	10.5	10.8	11.8	+1.0	6.2	6.5	7.2	+0.7	2.6	3.3	3.6	+0.3	0.1	0.1	0.1	0.0
10th Grade	13.2	13.1	14.9	+1.8ss	8.2	8.2	9.6	+1.4s	3.3	3.6	4.3	+0.7	0.1	0.1	0.3	+0.2s
12th Grade	15.4	13.9	15.1	+1.2	8.2	7.1	8.4	+1.3ss	3.2	2.8	3.7	+0.9ss	0.2	0.2	0.2	0.0
Tranquilizers																
8th Grade	3.8	4.1	4.4	+0.3	1.8	2.0	2.1	+0.1	0.8	0.8	0.9	+0.1	*	*	0.1	0.0
10th Grade	5.8	5.9	5.7	–0.2	3.2	3.5	3.3	–0.2	1.2	1.5	1.1	–0.4s	*	*	*	0.0
12th Grade	7.2	6.0	6.4	+0.4	3.6	2.8	3.5	+0.7s	1.4	1.0	1.2	+0.2	0.1	*	*	0.0
Nitrites[f]																
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	1.6	1.5	1.4	–0.1	0.9	0.5	0.9	+0.4	0.4	0.3	0.6	+0.3	0.2	0.1	0.1	0.0
Barbiturates																
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	6.2	5.5	6.3	+0.8	3.4	2.8	3.4	+0.6	1.4	1.1	1.3	+0.2	0.1	*	0.1	0.0

TABLE 1 (continued)

Trends in Prevalence of Various Drugs for Three Populations: Eighth, Tenth, and Twelfth Graders

	Lifetime				Annual				30-Day				Daily			
	1991	1992	1993	'92–'93 change	1991	1992	1993	'92–'93 change	1991	1992	1993	'92–'93 change	1991	1992	1993	'92–'93 change
Alcohol[b]																
Any use																
8th Grade	70.1	69.3	67.1	−2.2	54.0	53.7	51.6	−2.1	25.1	26.1	26.2	+0.1	0.5	0.6	0.8	+0.2
10th Grade	83.8	82.3	80.8	−1.5	72.3	70.2	69.3	−0.9	42.8	39.9	41.5	+1.6	1.3	1.2	1.6	+0.4s
12th Grade	88.0	87.5	87.0	−0.5	77.7	76.8	76.0	−0.8	54.0	51.3	51.0	−0.3	3.6	3.4	2.5	−0.9s
Been Drunk[g]																
8th Grade	26.7	26.8	26.4	−0.4	17.5	18.3	18.2	−0.1	7.6	7.5	7.8	+0.3	0.1	0.1	0.2	+0.1
10th Grade	50.0	47.7	47.9	+0.2	40.1	37.0	37.8	+0.8	20.5	18.1	19.8	+1.7s	0.2	0.3	0.4	+0.1
12th Grade	65.4	63.4	62.5	−0.9	52.7	50.3	49.6	−0.7	31.6	29.9	28.9	−1.0	0.9	0.8	0.9	+0.1
5+ drinks in last 2 weeks																
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	12.9	13.4	13.5	+0.1
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	22.9	21.1	23.0	+1.9s
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	29.8	27.9	27.5	−0.4
Cigarettes																
Any use																
8th Grade	44.0	45.2	45.3	+0.1	—	—	—	—	14.3	15.5	16.7	+1.2	7.2	7.0	8.3	+1.3s
10th Grade	55.1	53.5	56.3	+2.8s	—	—	—	—	20.8	21.5	24.7	+3.2ss	12.6	12.3	14.2	+1.9s
12th Grade	63.1	61.8	61.9	+0.1	—	—	—	—	28.3	27.8	29.9	+2.1s	18.5	17.2	19.0	+1.8ss
1/2pack+/day																
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	3.1	2.9	3.5	+0.6s
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	6.5	6.0	7.0	+1.0
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	10.7	10.0	10.9	+0.9
Smokeless Tobacco[i]																
8th Grade	22.2	20.7	18.7	−2.0s	—	—	—	—	6.9	7.0	6.6	−0.4	1.6	1.8	1.5	−0.3
10th Grade	28.2	26.6	28.1	+1.5	—	—	—	—	10.0	9.6	10.4	+0.8	3.3	3.0	3.3	+0.3
12th Grade	—	32.4	31.0	−1.4	—	—	—	—	—	11.4	10.7	−0.7	—	4.3	3.3	−1.0ss
Steroids[f]																
8th Grade	1.9	1.7	1.6	−0.1	1.0	1.1	0.9	−0.2	0.4	0.5	0.5	0.0	*	*	0.1	0.0
10th Grade	1.8	1.7	1.7	0.0	1.1	1.1	1.0	−0.1	0.6	0.6	0.5	−0.1	0.1	*	*	0.0
12th Grade	2.1	2.1	2.0	−0.1	1.4	1.1	1.2	+0.1	0.8	0.6	0.7	+0.1	0.1	0.1	0.1	+0.1

NOTES: Level of significance of difference between the two years: s=.05, ss=.01, sss=.001. '—' indicates data not available. '*' indicates less than .05 percent. Any apparent inconsistency between the change estimate and the prevalence estimates for the two years is due to rounding error.
"Prevalence" means the percent of a population using the drug one or more times in the specified time interval (i.e. in lifetime, past 12 months, or past 30 days). "Daily" use is defined as using 20 or more times in the past 30 days. (For cigarettes and smokeless tobacco, daily use is the use once or more per day in the past 30 days.)
Approx. N: 8th Grade = 17,500 in 1991; 18,600 in 1992; 18,300 in 1993, 10th Grade = 14,800 in 1991; 14,800 in 1992; 15,300 in 1993, 12th Grade = 15,000 in 1991; 16,800 in 1992; 16,300 in 1993.

[a]Use of "any illicit drugs" includes any use of marijuana, hallucinogens, cocaine, and heroin, or any use of other opiates, stimulants, barbiturates, methaqualone (excluded since 1990), or tranquilizers not under a doctor's orders.
[b]Use of "other illicit drugs" includes any use of hallucinogens, cocaine, and heroin, or any use of other opiates, stimulants, barbiturates, methaqualone (excluded since 1990), or tranquilizers not under a doctor's orders.
[c]Data based on five questionnaire forms in 1991-1993; N is five-sixths of N indicated.
[d]Unadjusted for underreporting of amyl and butyl nitrites (inhalants) or PCP (hallucinogens).
[e]12th grade only: Data based on a single questionnaire form; N is one-sixth of N indicated in 1991-1993.
[f]12th grade only: Data based on four questionnaire forms in 1990-1993; N is four-sixths of N indicated.
[g]12th grade only: This drug was asked about in two of the six questionnaire forms. N is one-third of N indicated.
[h]Data based on one questionnaire form for 8th and 10th grades. Data based on three of six questionnaire forms for 12th grade. N is one-half of N indicated.
[i]Data based on one questionnaire form. For 12th graders, N is one-sixth of N indicated. For 8th and 10th graders, N is one-half of N indicated.

TABLE 2

Long-Term Trends in Lifetime Prevalence of Various Types of Drugs for Twelfth Graders

	Percent ever used																			
	Class of 1975	Class of 1976	Class of 1977	Class of 1978	Class of 1979	Class of 1980	Class of 1981	Class of 1982	Class of 1983	Class of 1984	Class of 1985	Class of 1986	Class of 1987	Class of 1988	Class of 1989	Class of 1990	Class of 1991	Class of 1992	Class of 1993	'92–'93 change
Approx. N =	9400	15400	17100	17800	15500	15900	17500	17700	16300	15900	16000	15200	16300	16300	16700	15200	15000	15800	16300	
Any Illicit Drug[a,b]	55.2	58.3	61.6	64.1	65.1	65.4	65.6	64.4	62.9	61.6	60.6	57.6	56.6	53.9	50.9	47.9	44.1	40.7	42.9	+2.2s
Any Illicit Drug Other Than Marijuana[b,c]	36.2	35.4	35.8	36.5	37.4	38.7	42.8	41.1	40.4	40.3	39.7	37.7	35.8	32.5	31.4	29.4	26.9	25.1	26.7	+1.6
Marijuana/Hashish	47.3	52.8	56.4	59.2	60.4	60.3	59.5	58.7	57.0	54.9	54.2	50.9	50.2	47.2	43.7	40.7	36.7	32.6	35.3	+2.7s
Inhalants[d]	—	10.3	11.1	13.0	12.7	11.9	12.3	12.8	13.6	14.4	15.4	15.9	17.0	16.7	17.6	18.0	17.6	16.6	17.4	+0.8
Inhalants Adjusted[f]	—	—	—	—	18.2	17.3	17.2	17.7	18.2	18.0	18.1	20.1	18.6	17.5	18.6	18.5	18.0	17.0	17.7	+0.7
Amyl & Butyl Nitrites[f,e]	—	—	—	—	11.1	11.1	10.1	9.8	8.4	8.1	7.9	8.6	4.7	3.2	3.3	2.1	1.6	1.5	1.4	–0.1
Hallucinogens	16.3	15.1	13.9	14.3	14.1	13.3	13.3	12.5	11.9	10.7	10.3	9.7	10.3	8.9	9.4	9.4	9.6	9.2	10.9	+1.7ss
Hallucinogens Adjusted[h]	—	—	—	—	17.7	15.6	15.3	14.3	13.6	12.3	12.1	11.9	10.6	9.2	9.9	9.7	10.0	9.4	11.3	+1.9ss
LSD	11.3	11.0	9.8	9.7	9.5	9.3	9.8	9.6	8.9	8.0	7.5	7.2	8.4	7.7	8.3	8.7	8.8	8.6	10.3	+1.7ss
PCP[f,e]	—	—	—	—	12.8	9.6	7.8	6.0	5.6	5.0	4.9	4.8	3.0	2.9	3.9	2.8	2.9	2.4	2.9	+0.5
Cocaine	9.0	9.7	10.8	12.9	15.4	15.7	16.5	16.0	16.2	16.1	17.3	16.9	15.2	12.1	10.3	9.4	7.8	6.1	6.1	0.0
Crack[i]	—	—	—	—	—	—	—	—	—	—	—	—	5.4	4.8	4.7	3.5	3.1	2.6	2.6	0.0
Other cocaine[j]	—	—	—	—	—	—	—	—	—	—	—	—	14.0	12.1	8.5	8.6	7.0	5.3	5.4	+0.1
Heroin	2.2	1.8	1.8	1.6	1.1	1.1	1.1	1.2	1.2	1.3	1.2	1.1	1.2	1.1	1.3	1.3	0.9	1.2	1.1	–0.1
Other opiates[k]	9.0	9.6	10.3	9.9	10.1	9.8	10.1	9.6	9.4	9.7	10.2	9.0	9.2	8.6	8.3	8.3	6.6	6.1	6.4	+0.3
Stimulants[b,k]	22.3	22.6	23.0	22.9	24.2	26.4	32.2	27.9	26.9	27.9	26.2	23.4	21.6	19.8	19.1	17.5	15.4	13.9	15.1	+1.2
Crystal meth. (Ice)[l]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2.7	3.3	2.9	3.1	+0.2
Sedatives[b,m]	18.2	17.7	17.4	16.0	14.6	14.9	16.0	15.2	14.4	13.3	11.8	10.4	8.7	7.8	7.4	7.5	6.7	6.1	6.4	+0.3
Barbiturates[k]	16.9	16.2	15.6	13.7	11.8	11.0	11.3	10.3	9.9	9.9	9.2	8.4	7.4	6.7	6.5	6.8	6.2	5.5	6.3	+0.8
Methaqualone[b,m]	8.1	7.8	8.5	7.9	8.3	9.5	10.6	10.7	10.1	8.3	6.7	5.2	4.0	3.3	2.7	2.3	1.3	1.6	0.8	–0.8s
Tranquilizers[k]	17.0	16.8	18.0	17.0	16.3	15.2	14.7	14.0	13.3	12.4	11.9	10.9	10.9	9.4	7.6	7.2	7.2	6.0	6.4	+0.4
Alcohol[n]	90.4	91.9	92.5	93.1	93.0	93.2	92.6	92.8	92.6	92.6	92.2	91.3	92.2	92.0	90.7	89.5	88.0	87.5	87.0	–0.5
Been Drunk[l]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	65.4	63.4	62.5	–0.9
Cigarettes	73.6	75.4	75.7	75.3	74.0	71.0	71.0	70.1	70.6	69.7	68.8	67.6	67.2	66.4	65.7	64.4	63.1	61.8	61.9	+0.1
Smokeless Tobacco[m]	—	—	—	—	—	—	—	—	—	—	—	31.4	32.2	30.4	29.2	—	—	32.4	31.0	–1.4
Steroids[l]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3.0	2.9	2.1	2.1	2.0	–0.1

NOTES: Level of significance of difference between the two most recent classes: s =.05, ss =.01, sss =.001. '—' indicates data not available.

Footnotes for Table 2–Table 5

[a] Use of "any illicit drugs" includes any use of marijuana, hallucinogens, cocaine, and heroin, or any use of other opiates, stimulants, barbiturates, methaqualone (excluded since 1990), or tranquilizers not under a doctor's orders.

[b] Beginning in 1982 the question about stimulant use (i.e. amphetamines) was revised to get respondents to exclude the inappropriate reporting of non-prescription stimulants. The prevalence rate dropped slightly as a result of this methodological change.

[c] Use of "other illicit drugs" includes any use of hallucinogens, cocaine, and heroin, or any use of other opiates, stimulants, barbiturates, methaqualone (excluded since 1990), or tranquilizers not under a doctor's orders.

[d] Data based on four questionnaire forms in 1976-1988; N is four-fifths of N indicated. Data based on five questionnaire forms in 1989-1993; N is five-sixths of N indicated.

[e] Adjusted for underreporting of amyl and butyl nitrites.

[f] Data based on a single questionnaire form; N is one-fifth of N indicated in 1979-1988 and one-sixth of N indicated in 1989-1993.

[g] Question text changed slightly in 1987.

[h] Adjusted for underreporting of PCP.

[i] Data based on a single questionnaire form in 1986; N is one-fifth of N indicated. Data based on two questionnaire forms in 1987-1989; N is two-fifths of N indicated in 1987-1988 and two-sixths of N indicated in 1989. Data based on six questionnaire forms in 1990-1993.

[j] Data based on a single questionnaire form in 1987-1989; N is one-fifth of N indicated in 1987-1988 and one-sixth of N indicated in 1989. Data based on four questionnaire forms in 1990-1993; N is four-sixths of N indicated.

[k] Only drug use which was not under a doctor's orders is included here.

[l] Data based on two questionnaire forms; N is two-sixths of N indicated. Steroid data based on a single questionnaire form in 1989-1990.

[m] Data based on five questionnaire forms in 1975-1988, six questionnaire forms in 1989, and one questionnaire form in 1990-1993. N is one-sixth of N indicated in 1990-1993. Smokeless tobacco was always included in only one questionnaire form.

[n] Data based on three of the six questionnaire forms in 1993. N is one-half N indicated.

SOURCE: Monitoring The Future Study, The University Of Michigan

TABLE 3

Long-Term Trends in Annual Prevalence of Various Types of Drugs for Twelfth Graders

	Percent who used in last twelve months																			
	Class of 1975	Class of 1976	Class of 1977	Class of 1978	Class of 1979	Class of 1980	Class of 1981	Class of 1982	Class of 1983	Class of 1984	Class of 1985	Class of 1986	Class of 1987	Class of 1988	Class of 1989	Class of 1990	Class of 1991	Class of 1992	Class of 1993	'92–'93 change
Approx. N =	9400	15400	17100	17800	15500	15900	17500	17700	16300	15900	16000	15200	16300	16300	16700	15200	15000	15800	16300	
Any Illicit Drug[a,b]	45.0	48.1	51.1	53.8	54.2	53.1	52.1	49.4	47.4	45.8	46.3	44.3	41.7	38.5	35.4	32.5	29.4	27.1	31.0	+3.9sss
Any Illicit Drug Other Than Marijuana[b,c]	26.2	25.4	26.0	27.1	28.2	30.4	34.0	30.1	28.4	28.0	27.4	25.9	24.1	21.1	20.0	17.9	16.2	14.9	17.1	+2.2ss
Marijuana/Hashish	40.0	44.5	47.6	50.2	50.8	48.8	46.1	44.3	42.3	40.0	40.6	38.8	36.3	33.1	29.6	27.0	23.9	21.9	26.0	+4.1sss
Inhalants[d]	—	3.0	3.7	4.1	5.4	4.6	4.1	4.5	4.3	5.1	5.7	6.1	6.9	6.5	5.9	6.9	6.6	6.2	7.0	+0.8
Inhalants Adjusted[f]	—	—	—	—	8.9	7.9	6.1	6.6	6.2	7.2	7.5	8.9	8.1	7.1	6.9	7.5	6.9	6.4	7.4	+1.0
Amyl/Butyl Nitrites[f,x]	—	—	—	—	6.5	5.7	3.7	3.6	3.6	4.0	4.0	4.7	2.6	1.7	1.7	1.4	0.9	0.5	0.9	+0.4
Hallucinogens	11.2	9.4	8.8	9.6	9.9	9.3	9.0	8.1	7.3	6.5	6.3	6.0	6.4	5.5	5.6	5.9	5.8	5.9	7.4	+1.5ss
Hallucinogens Adjusted[h]	—	—	—	—	11.8	10.4	10.1	9.0	8.3	7.3	7.6	7.6	6.7	5.8	6.2	6.0	6.1	6.2	7.8	+1.6ss
LSD	7.2	6.4	5.5	6.3	6.6	6.5	6.5	6.1	5.4	4.7	4.4	4.5	5.2	4.8	4.9	5.4	5.2	5.6	6.8	+1.2ss
PCP[f,x]	—	—	—	—	7.0	4.4	3.2	2.2	2.6	2.3	2.9	2.4	1.3	1.2	2.4	1.2	1.4	1.4	1.4	0.0
Cocaine	5.6	6.0	7.2	9.0	12.0	12.3	12.4	11.5	11.4	11.6	13.1	12.7	10.3	7.9	6.5	5.3	3.5	3.1	3.3	+0.2
Crack[i]	—	—	—	—	—	—	—	—	—	—	—	4.1	3.9	3.1	3.1	1.9	1.5	1.5	1.5	0.0
Other cocaine[j]	—	—	—	—	—	—	—	—	—	—	—	—	9.8	7.4	5.2	4.6	3.2	2.6	2.9	+0.3
Heroin	1.0	0.8	0.8	0.8	0.5	0.5	0.5	0.6	0.6	0.5	0.6	0.5	0.5	0.5	0.6	0.5	0.4	0.6	0.5	–0.1
Other opiates[k]	5.7	5.7	6.4	6.0	6.2	6.3	5.9	5.3	5.1	5.2	6.9	5.2	5.3	4.6	4.4	4.5	3.5	3.3	3.6	+0.3
Stimulants[k,k]	16.2	15.8	16.3	17.1	18.3	20.8	26.0	20.3	17.9	17.7	15.8	13.4	12.2	10.9	10.8	9.1	8.2	7.1	8.4	+1.3ss
Crystal Meth. (Ice)[j]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.3	1.4	1.3	1.7	+0.4
Sedatives[k,m]	11.7	10.7	10.8	9.9	9.9	10.3	10.5	9.1	7.9	6.6	5.8	5.2	4.1	3.7	3.7	3.6	3.6	2.9	3.4	+0.5
Barbiturates[k]	10.7	9.6	9.3	8.1	7.5	6.8	6.6	5.5	5.2	4.9	4.6	4.2	3.6	3.2	3.3	3.4	3.4	2.8	3.4	+0.6
Methaqualone[k,m]	5.1	4.7	5.2	4.9	5.9	7.2	7.6	6.8	5.4	3.8	2.8	2.1	1.5	1.3	1.3	0.7	0.5	0.6	0.2	–0.4
Tranquilizers[k]	10.6	10.3	10.8	9.9	9.6	8.7	8.0	7.0	6.9	6.1	6.1	5.8	5.5	4.8	3.8	3.5	3.6	2.8	3.5	+0.7s
Alcohol[n]	84.8	85.7	87.0	87.7	88.1	87.9	87.0	86.8	87.3	86.0	85.6	84.5	85.7	85.3	82.7	80.6	77.7	76.8	76.0	–0.8
Been Drunk[l]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	52.7	50.3	49.6	–0.7
Cigarettes	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Smokeless Tobacco[m]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Steroids[l]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.9	1.7	1.4	1.1	1.2	+0.1

NOTES: Level of significance of difference between the two most recent classes: s =.05, ss =.01, sss =.001. '—' indicates data not available.

See Table 2 for relevant footnotes.

TABLE 4

Long-Term Trends in Thirty-Day Prevalence of Various Types of Drugs for Twelfth Graders

	Percent who used in last thirty days																			
	Class of 1975	Class of 1976	Class of 1977	Class of 1978	Class of 1979	Class of 1980	Class of 1981	Class of 1982	Class of 1983	Class of 1984	Class of 1985	Class of 1986	Class of 1987	Class of 1988	Class of 1989	Class of 1990	Class of 1991	Class of 1992	Class of 1993	'92–'93 change
Approx. N =	9400	15400	17100	17800	15500	15900	17500	17700	16300	15900	16000	15200	16300	16300	16700	15200	15000	15800	16300	
Any Illicit Drug[a,b]	30.7	34.2	37.6	38.9	38.9	37.2	36.9	32.5	30.5	29.2	29.7	27.1	24.7	21.3	19.7	17.2	16.4	14.4	18.3	+3.9sss
Any Illicit Drug Other Than Marijuana[b,c]	15.4	13.9	16.2	15.1	16.8	18.4	21.7	17.0	15.4	15.1	14.9	13.2	11.6	10.0	9.1	8.0	7.1	6.3	7.9	+1.6sss
Marijuana/Hashish	27.1	32.2	35.4	37.1	36.5	33.7	31.6	28.5	27.0	25.2	25.7	23.4	21.0	18.0	16.7	14.0	13.8	11.9	15.5	+3.6sss
Inhalants[d]	—	0.9	1.3	1.5	1.7	1.4	1.5	1.5	1.7	1.9	2.2	2.5	2.8	2.6	2.3	2.7	2.4	2.3	2.5	+0.2
Inhalants Adjusted[e]	—	—	—	—	3.2	2.7	2.5	2.5	2.5	2.6	3.0	3.2	3.5	3.0	2.7	2.9	2.6	2.5	2.8	+0.3
Amyl/Butyl Nitrites[f,g]	—	—	—	—	2.4	1.8	1.4	1.1	1.4	1.4	1.6	1.3	1.3	0.6	0.6	0.6	0.4	0.3	0.6	+0.3
Hallucinogens	4.7	3.4	4.1	3.9	4.0	3.7	3.7	3.4	2.8	2.6	2.5	2.5	2.5	2.2	2.2	2.2	2.2	2.1	2.7	+0.6s
Hallucinogens Adjusted[h]	—	—	—	—	5.3	4.4	4.5	4.1	3.5	3.2	3.8	3.5	2.8	2.3	2.9	2.3	2.4	2.3	3.3	+1.0ss
LSD	2.3	1.9	2.1	2.1	2.4	2.3	2.5	2.4	1.9	1.5	1.6	1.7	1.8	1.8	1.8	1.9	1.9	2.0	2.4	+0.4
PCP[f,g]	—	—	—	—	2.4	1.4	1.4	1.0	1.3	1.0	1.6	1.3	0.6	0.3	1.4	0.4	0.5	0.6	1.0	+0.4
Cocaine	1.9	2.0	2.9	3.9	5.7	5.2	5.8	5.0	4.9	5.8	6.7	6.2	4.3	3.4	2.8	1.9	1.4	1.3	1.3	0.0
Crack[i]	—	—	—	—	—	—	—	—	—	—	—	—	1.3	1.6	1.4	0.7	0.7	0.6	0.7	+0.1
Other cocaine[j]	—	—	—	—	—	—	—	—	—	—	—	—	4.1	3.2	1.9	1.7	1.2	1.0	1.2	+0.2
Heroin	0.4	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.3	0.2	0.2	0.3	0.2	–0.1
Other opiates[k]	2.1	2.0	2.8	2.1	2.4	2.4	2.1	1.8	1.8	1.8	2.3	2.0	1.8	1.6	1.6	1.5	1.1	1.2	1.3	+0.1
Stimulants[k,l]	8.5	7.7	8.8	8.7	9.9	12.1	15.8	10.7	8.9	8.3	6.8	5.5	5.2	4.6	4.2	3.7	3.2	2.8	3.7	+0.9ss
Crystal Meth. (Ice)[j]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.6	0.6	0.5	0.6	+0.1
Sedatives[k,m]	5.4	4.5	5.1	4.2	4.4	4.8	4.6	3.4	3.0	2.3	2.4	2.2	1.7	1.4	1.6	1.4	1.5	1.2	1.3	+0.1
Barbiturates[k]	4.7	3.9	4.3	3.2	3.2	2.9	2.6	2.0	2.1	1.7	2.0	1.8	1.4	1.2	1.4	1.3	1.4	1.1	1.3	+0.2
Methaqualone[k,m]	2.1	1.6	2.3	1.9	2.3	3.3	3.1	2.4	1.8	1.1	1.0	0.8	0.6	0.5	0.6	0.2	0.2	0.4	0.1	–0.3
Tranquilizers[k]	4.1	4.0	4.6	3.4	3.7	3.1	2.7	2.4	2.5	2.1	2.1	2.1	2.0	1.5	1.3	1.2	1.4	1.0	1.2	+0.2
Alcohol[n]	68.2	68.3	71.2	72.1	71.8	72.0	70.7	69.7	69.4	67.2	65.9	65.3	66.4	63.9	60.0	57.1	54.0	51.3	51.0	–0.3
Been Drunk[j]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	31.6	29.9	28.9	–1.0
Cigarettes	36.7	36.8	38.4	36.7	34.4	30.5	29.4	30.0	30.3	29.3	30.1	29.6	29.4	28.7	28.6	29.4	28.3	27.8	29.9	+2.1s
Smokeless Tobacco[m]	—	—	—	—	—	—	—	—	—	—	—	11.5	11.3	10.3	8.4	—	—	11.4	10.7	–0.7
Steroids[j]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.8	1.0	0.8	0.6	0.7	+0.1

NOTES: Level of significance of difference between the two most recent classes: s =.05, ss =.01, sss =.001. '—' indicates data not available.

See Table 2 for relevant footnotes.

SOURCE: Monitoring The Future Study, The University Of Michigan.

TABLE 5

Long-Term Trends in Thirty-Day Prevalence of Daily Use of Various Types of Drugs for Twelfth Graders

	Percent who used daily in last thirty days																			
	Class of 1975	Class of 1976	Class of 1977	Class of 1978	Class of 1979	Class of 1980	Class of 1981	Class of 1982	Class of 1983	Class of 1984	Class of 1985	Class of 1986	Class of 1987	Class of 1988	Class of 1989	Class of 1990	Class of 1991	Class of 1992	Class of 1993	'92–'93 change
Approx. N =	9400	15400	17100	17800	15500	15900	17500	17700	16300	15900	16000	15200	16300	16300	15700	15200	15000	15800	16300	
Marijuana/Hashish	6.0	8.2	9.1	10.7	10.3	9.1	7.0	6.3	5.5	5.0	4.9	4.0	3.3	2.7	2.9	2.2	2.0	1.9	2.4	+0.5s
Inhalants[a]	—	*	*	0.1	*	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.2	0.3	0.2	0.1	0.1	0.0
Inhalants Adjusted[a]	—	—	—	—	0.1	0.2	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.3	0.3	0.3	0.5	0.2	0.2	0.0
Amyl & Butyl Nitrites[a,i]	—	—	—	—	*	0.1	0.1	0.0	0.2	0.1	0.3	0.5	0.3	0.1	0.3	0.1	0.2	0.1	0.1	0.0
Hallucinogens	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	*	0.1	0.1	0.1	0.1	0.1	0.0
Hallucinogens Adjusted[b]	—	—	—	—	0.2	0.2	0.1	0.2	0.2	0.2	0.3	0.3	0.2	*	0.3	0.3	0.1	0.1	0.1	–0.1
LSD	*	*	*	*	*	*	0.1	*	0.1	0.1	0.1	*	0.1	*	*	0.1	0.1	0.1	0.1	0.0
PCP[b,c]	—	—	—	—	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.2	0.3	0.1	0.2	0.1	0.1	0.1	0.1	+0.1
Cocaine	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.2	0.2	0.2	0.4	0.4	0.3	0.2	0.3	0.1	0.1	0.1	0.1	0.0
Crack[i]	—	—	—	—	—	—	—	—	—	—	—	—	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.0
Other cocaine[j]	—	—	—	—	—	—	—	—	—	—	—	—	0.2	0.2	0.1	0.1	0.1	*	0.1	0.0
Heroin	0.1	*	*	*	*	*	*	*	0.1	*	*	*	*	*	0.1	*	*	*	*	0.0
Other opiates[k]	0.1	0.1	0.2	0.1	*	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	*	+	0.0
Stimulants[b,k]	0.5	0.4	0.5	0.5	0.6	0.7	1.2	0.7	0.8	0.6	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.0
Crystal Meth. (Ice)[j]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.1	0.1	0.1	0.1	-0.1
Sedatives[k,m]	0.3	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
Barbiturates[k]	0.1	0.1	0.2	0.1	*	0.1	0.1	0.1	0.1	*	0.1	0.1	0.1	*	0.1	0.1	0.1	*	0.1	0.0
Methaqualone[k,m]	*	*	*	*	*	0.1	0.1	0.1	*	*	*	*	*	0.1	*	*	*	0.1	*	–0.1
Tranquilizers[k]	0.1	0.2	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	*	*	0.1	*	0.1	0.1	0.1	*	*	0.0
Alcohol																				
Daily[n]	5.7	5.6	6.1	5.7	6.9	6.0	6.0	5.7	5.5	4.8	6.0	4.8	4.8	4.2	4.2	3.7	3.6	3.4	2.5	–0.9s
Been drunk daily[j]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.9	0.8	0.9	+0.1
5+ drinks in a row/ last 2 weeks	36.8	37.1	39.4	40.3	41.2	41.2	41.4	40.5	40.8	38.7	36.7	36.8	37.5	34.7	33.0	32.2	29.8	27.9	27.5	–0.4
Cigarettes																				
Daily	26.9	28.8	28.8	27.5	25.4	21.3	20.3	21.1	21.2	18.7	19.5	18.7	18.7	18.1	18.9	19.1	18.5	17.2	19.0	+1.8ss
Half-pack or more per day	17.9	19.2	19.4	18.8	16.5	14.3	13.5	14.2	13.8	12.3	12.5	11.4	11.4	10.5	11.2	11.3	10.7	10.0	10.9	+0.9
Smokeless Tobacco[m]	—	—	—	—	—	—	—	—	—	—	—	4.7	5.1	4.3	3.3	—	—	4.3	3.3	–1.0ss
Steroids[j]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.1	0.2	0.1	0.1	0.1	+0.1

NOTES: Level of significance of difference between the two most recent classes: s =.05, ss =.01, sss =.001. '—' indicates data not available. Any apparent inconsistency between the change estimate and the prevalence estimates for the two most recent classes is due to rounding error. '*' indicates less than .05 per cent.

See Table 2 for relevant footnotes.

TABLE 6

Trends in Harmfulness of Drugs as Perceived by Eighth, Tenth, and Twelfth Graders, 1991–1993

Q. *How much do you think people risk harming themselves (physically or in other ways), if they . . .*	Percentage saying "great risk"*											
	8th Grade				10th Grade				12th Grade			
	1991	1992	1993	'92–93 change	1991	1992	1993	'92–93 change	1991	1992	1993	'92–93 change
Try marijuana once or twice	40.4	39.1	36.2	–2.9sss	30.0	31.9	29.7	–2.2s	27.1	24.5	21.9	–2.6
Smoke marijuana occasionally	57.9	56.3	53.8	–2.5ss	48.6	48.9	46.1	–2.8ss	40.6	39.6	35.6	–4.0s
Smoke marijuana regularly	83.8	82.0	79.6	–2.4ss	82.1	81.1	78.5	–2.6ss	78.6	76.5	72.5	–4.0ss
Try inhalants once or twice	35.9	37.0	36.5	–0.5	37.8	38.7	40.9	+2.2ss	—	—	—	—
Take inhalants regularly	65.6	64.4	64.6	+0.2	69.8	67.9	69.6	+1.7s	—	—	—	—
Try crack once or twice	62.8	61.2	57.2	–4.0sss	70.4	69.6	66.6	–3.0sss	60.6	62.4	57.6	–4.8ss
Take crack occasionally	82.2	79.6	76.8	–2.8ss	87.4	86.4	84.4	–2.0ss	76.5	76.3	73.9	–2.4
Try cocaine powder once or twice	55.5	54.1	50.7	–3.4sss	59.1	59.2	57.5	–1.7s	53.6	57.1	53.2	–3.9s
Take cocaine powder occasionally	77.0	74.3	71.8	–2.5s	82.2	80.1	79.1	–1.0	69.8	70.8	68.6	–2.2
Try one or two drinks of an alcoholic beverage (beer, wine, liquor)	11.0	12.1	12.4	+0.3	9.0	10.1	10.9	+0.8	9.1	8.6	8.2	–0.4
Take one or two drinks nearly every day	31.8	32.4	32.6	+0.2	36.1	36.8	35.9	–0.9	32.7	30.6	28.2	–2.4
Have five or more drinks once or twice each weekend	59.1	58.0	57.7	–0.3	54.7	55.9	54.9	–1.0	48.6	49.0	48.3	–0.7
Smoke one or more packs of cigarettes per day	51.6	50.8	52.7	+1.9	60.3	59.3	60.7	+1.4	69.4	69.2	69.5	+0.3
Use smokeless tobacco regularly	35.1	35.1	36.9	+1.8	40.3	39.6	44.2	+4.6sss	37.4	35.5	38.9	+3.4s
Take steroids[b]	64.2	69.5	70.2	+0.7	67.1	72.7	73.4	+0.7	65.6	70.7	69.1	–1.6
Approx. N =	17437	18662	18366		14719	14808	15298		2549	2684	2759	

NOTE: Level of significance of difference between the two most recent classes: s =.05, ss =.01, sss =.001.
'—' indicates data not available.

SOURCE: Monitoring The Future Study, The University Of Michigan.

*Answer alternatives were: (1) No risk, (2) Slight risk, (3) Moderate risk, (4) Great risk, (5) Can't say, drug unfamiliar.
[b]8th and 10th grade: Data based on a single questionnaire form in 1993; N is one-half N indicated.

TABLE 7

Long-Term Trends in Harmfulness of Drugs as Perceived by Twelfth Graders

Q. *How much do you think people risk harming themselves (physically or in other ways), if they . . .*	Percentage saying "great risk"*																			
	Class of 1975	Class of 1976	Class of 1977	Class of 1978	Class of 1979	Class of 1980	Class of 1981	Class of 1982	Class of 1983	Class of 1984	Class of 1985	Class of 1986	Class of 1987	Class of 1988	Class of 1989	Class of 1990	Class of 1991	Class of 1992	Class of 1993	'92–'93 change
Try marijuana once or twice	16.1	11.4	9.5	8.1	9.4	10.0	13.0	11.5	12.7	14.7	14.8	15.1	18.4	19.0	23.6	23.1	27.1	24.5	21.9	–2.6
Smoke marijuana occasionally	18.1	15.0	13.4	12.4	13.5	14.7	19.1	18.3	20.6	22.6	24.5	25.0	30.4	31.7	36.5	36.9	40.6	39.6	35.6	–4.0s
Smoke marijuana regularly	43.3	38.6	36.4	34.9	42.0	50.4	57.6	60.4	62.8	66.9	70.4	71.3	73.5	77.0	77.5	77.8	78.6	76.5	72.5	–4.0ss
Try LSD once or twice	49.4	45.7	43.2	42.7	41.6	43.9	45.5	44.9	44.7	45.4	43.5	42.0	44.9	45.7	46.0	44.7	46.6	42.3	39.5	–2.8
Take LSD regularly	81.4	80.8	79.1	81.1	82.4	83.0	83.5	83.5	83.2	83.8	82.9	82.6	83.8	84.2	84.3	84.5	84.3	81.8	79.4	–2.4
Try PCP once or twice	—	—	—	—	—	—	—	—	—	—	—	—	55.6	58.8	56.6	55.2	51.7	54.8	50.8	–4.0s
Try cocaine once or twice	42.6	39.1	35.6	33.2	31.5	31.3	32.1	32.8	33.0	35.7	34.0	33.5	47.9	51.2	54.9	59.4	59.4	56.8	57.6	+0.8
Take cocaine occasionally	—	—	—	—	—	—	—	—	—	—	—	54.2	66.8	69.2	71.8	73.9	75.5	75.1	73.3	–1.8
Take cocaine regularly	73.1	72.3	68.2	68.2	69.5	69.2	71.2	73.0	74.3	78.8	79.0	82.2	88.5	89.2	90.2	91.1	90.4	90.2	90.1	–0.1
Try crack once or twice	—	—	—	—	—	—	—	—	—	—	—	—	57.0	62.1	62.9	64.3	60.6	62.4	57.6	–4.8ss
Take crack occasionally	—	—	—	—	—	—	—	—	—	—	—	—	70.4	73.2	75.3	80.4	76.5	76.3	73.9	–2.4
Take crack regularly	—	—	—	—	—	—	—	—	—	—	—	—	84.6	84.8	85.6	91.6	90.1	89.3	87.5	–1.8
Try cocaine powder once or twice	—	—	—	—	—	—	—	—	—	—	—	—	45.3	51.7	53.8	53.9	53.6	57.1	53.2	–3.9s
Take cocaine powder occasionally	—	—	—	—	—	—	—	—	—	—	—	—	56.8	61.9	65.8	71.1	69.8	70.8	68.6	–2.2
Take cocaine powder regularly	—	—	—	—	—	—	—	—	—	—	—	—	81.4	82.9	83.9	90.2	88.9	88.4	87.0	–1.4
Try heroin once or twice	60.1	58.9	55.8	52.9	50.4	52.1	52.9	51.1	50.8	49.8	47.3	45.8	53.6	54.0	53.8	55.4	55.2	50.9	50.7	–0.2
Take heroin occasionally	75.6	75.6	71.9	71.4	70.9	70.9	72.2	69.8	71.8	70.7	69.8	68.2	74.6	73.8	75.5	76.6	74.9	74.2	72.0	–2.2
Take heroin regularly	87.2	88.6	86.1	86.6	87.5	86.2	87.5	86.0	86.1	87.2	86.0	87.1	88.7	88.8	89.5	90.2	89.6	89.2	88.3	–0.9
Try amphetamines once or twice	35.4	33.4	30.8	29.9	29.7	29.7	26.4	25.3	24.7	25.4	25.2	25.1	29.1	29.6	32.8	32.2	36.3	32.6	31.3	–1.3
Take amphetamines regularly	69.0	67.3	66.6	67.1	69.9	69.1	66.1	64.7	64.8	67.1	67.2	67.3	69.4	69.8	71.2	71.2	74.1	72.4	69.9	–2.5
Try crystal meth. (ice) once or twice	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	61.6	61.9	57.5	–4.4s
Try barbiturates once or twice	34.8	32.5	31.2	31.3	30.7	30.9	28.4	27.5	27.0	27.4	26.1	25.4	30.9	29.7	32.2	32.4	35.1	32.2	29.2	–3.0
Take barbiturates regularly	69.1	67.7	68.6	68.4	71.6	72.2	69.9	67.6	67.7	68.5	68.3	67.2	69.4	69.6	70.5	70.2	70.5	70.2	66.1	–4.1ss
Try one or two drinks of an alcoholic beverage (beer, wine, liquor)	5.3	4.8	4.1	3.4	4.1	3.8	4.6	3.5	4.2	4.6	5.0	4.6	6.2	6.0	6.0	8.3	9.1	8.6	8.2	–0.4
Take one or two drinks nearly every day	21.5	21.2	18.5	19.6	22.6	20.3	21.6	21.6	21.6	23.0	24.4	25.1	26.2	27.3	28.5	31.3	32.7	30.6	28.2	–2.4
Take four or five drinks nearly every day	63.5	61.0	62.9	63.1	66.2	65.7	64.5	65.5	66.8	68.4	69.8	66.5	69.7	68.5	69.8	70.9	69.5	70.5	67.8	–2.7
Have five or more drinks once or twice each weekend	37.8	37.0	34.7	34.5	34.9	35.9	36.3	36.0	38.6	41.7	43.0	39.1	41.9	42.6	44.0	47.1	48.6	49.0	48.3	–0.7
Smoke one or more packs of cigarettes per day	51.3	56.4	58.4	59.0	63.0	63.7	63.3	60.5	61.2	63.8	66.5	66.0	68.6	68.0	67.2	68.2	69.4	69.2	69.5	+0.3
Use smokeless tobacco regularly	—	—	—	—	—	—	—	—	—	—	—	25.8	30.0	33.2	32.9	34.2	37.4	35.5	38.9	+3.4s
Take steroids	—	—	—	—	—	—	—	—	—	—	—	—	—	—	63.8	69.9	65.6	70.7	69.1	–1.6
Approx. N =	2804	2918	3052	3770	3250	3234	3604	3557	3305	3262	3250	3020	3315	3276	2796	2553	2549	2684	2759	

NOTE: Level of significance of difference between the two most recent classes: s = .05, ss = .01, sss = .001. '—' indicates data not available.

SOURCE: Monitoring The Future Study, The University Of Michigan.

*Answer alternatives were: (1) No risk, (2) Slight risk, (3) Moderate risk, (4) Great risk, and (5) Can't say, drug unfamiliar.

TABLE 8

Trends in Disapproval of Drug Use by Eighth, Tenth, and Twelfth Graders, 1991–1993

Q. *Do you disapprove of people who . . .*	Percent who disapprove or strongly disapprove[a]											
	8th Grade				10th Grade				12th Grade[b]			
	1991	1992	1993	'92–'93 change	1991	1992	1993	'92–'93 change	1991	1992	1993	'92–'93 change
Try marijuana once or twice	84.6	82.1	79.2	–2.9sss	74.6	74.8	70.3	–4.5sss	68.7	69.9	63.3	–6.6sss
Smoke marijuana occasionally	89.5	88.1	85.7	–2.4sss	83.7	83.6	79.4	–4.2sss	79.4	79.7	75.5	–4.2ss
Smoke marijuana regularly	92.1	90.8	88.9	–1.9ss	90.4	90.0	87.4	–2.6sss	89.3	90.1	87.6	–2.5s
Try inhalants once or twice	84.9	84.0	82.5	–1.5s	85.2	85.6	84.8	–0.8	—	—	—	—
Take inhalants regularly	90.6	90.0	88.9	–1.1s	91.0	91.5	90.9	–0.6	—	—	—	—
Try LSD once or twice[c]	—	—	90.2	—	—	—	88.6	—	90.1	88.1	85.9	–2.2
Take LSD regularly[c]	—	—	93.6	—	—	—	93.8	—	96.4	95.5	95.8	+0.3
Try crack once or twice	91.7	90.7	89.1	–1.6ss	92.5	92.5	91.4	–1.1	92.1	93.1	89.9	–3.2ss
Take crack occasionally	93.3	92.5	91.7	–0.8	94.3	94.4	93.6	–0.8	94.2	95.0	92.8	–2.2s
Try cocaine powder once or twice	91.2	89.6	88.5	–1.1s	90.8	91.1	90.0	–1.1	88.0	89.4	86.6	–2.8s
Take cocaine powder occasionally	93.1	92.4	91.6	–0.8	94.0	94.0	93.2	–0.8	93.0	93.4	91.2	–2.2s
Try one or two drinks of an alcoholic beverage (beer, wine, liquor)	51.7	52.2	50.9	–1.3	37.6	39.9	38.5	–1.4	29.8	33.0	30.1	–2.9
Take one or two drinks nearly every day	82.2	81.0	79.6	–1.4	81.7	81.7	78.6	–3.1ss	76.5	75.9	77.8	+1.9
Have five or more drinks once or twice each weekend	85.2	83.9	83.3	–0.6	76.7	77.6	74.7	–2.9ss	67.4	70.7	70.1	–0.6
Smoke one or more packs of cigarettes per day	82.8	82.3	80.6	–1.7s	79.4	77.8	76.5	–1.3	71.4	73.5	70.6	–2.9
Use smokeless tobacco regularly	79.1	77.2	77.1	–0.1	75.4	74.6	73.8	–0.8	—	—	—	—
Take steroids[c]	89.8	90.3	89.9	–0.4	90.0	91.0	91.2	+0.2	90.5	92.1	92.1	0.0
Approx. N =	17390	18503	18435		14750	14774	15334		2547	2645	2268	

NOTE: Level of significance of difference between the two most recent classes: s = .05, ss = .01, sss = .001.
'—' indicates data not available.

SOURCE: Monitoring The Future Study, The University Of Michigan.

[a]Answer alternatives were: (1) Don't disapprove, (2) Disapprove, (3) Strongly disapprove. For 8th and 10th grades, there was another category–"Can't say, drug unfamiliar"–which was included in the calculation of these percentages.

[b]The twelfth grade questions ask about people who are 18 or older.

[c]8th and 10th grade: Data based on a single questionnaire form in 1993; N is one-half of N indicated.

TABLE 9

Long-Term Trends in Disapproval of Drug Use by Twelfth Graders

Q. *Do you disapprove of people (who are 18 or older) doing each of the following?*[b]	Percentage "disapproving"*																			
	Class of 1975	Class of 1976	Class of 1977	Class of 1978	Class of 1979	Class of 1980	Class of 1981	Class of 1982	Class of 1983	Class of 1984	Class of 1985	Class of 1986	Class of 1987	Class of 1988	Class of 1989	Class of 1990	Class of 1991	Class of 1992	Class of 1993	'92–'93 change
Try marijuana once or twice	47.0	38.4	33.4	33.4	34.2	39.0	40.0	45.5	46.3	49.3	51.4	54.6	56.6	60.8	64.6	67.8	68.7	69.9	63.3	–6.6sss
Smoke marijuana occasionally	54.8	47.8	44.3	43.5	45.3	49.7	52.6	59.1	60.7	63.5	65.8	69.0	71.6	74.0	77.2	80.5	79.4	79.7	75.5	–4.2ss
Smoke marijuana regularly	71.9	69.5	65.5	67.5	69.2	74.6	77.4	80.6	82.5	84.7	85.5	86.6	89.2	89.3	89.8	91.0	89.3	90.1	87.6	–2.5s
Try LSD once or twice	82.8	84.6	83.9	85.4	86.6	87.3	86.4	88.8	89.1	88.9	89.5	89.2	91.6	89.8	89.7	89.8	90.1	88.1	85.9	–2.2
Take LSD regularly	94.1	95.3	95.8	96.4	96.9	96.7	96.8	96.7	97.0	96.8	97.0	96.6	97.8	96.4	96.4	96.3	96.4	95.5	95.8	+0.3
Try cocaine once or twice	81.3	82.4	79.1	77.0	74.7	76.3	74.6	76.6	77.0	79.7	79.3	80.2	87.3	89.1	90.5	91.5	93.6	93.0	92.7	–0.3
Take cocaine regularly	93.3	93.9	92.1	91.9	90.8	91.1	90.7	91.5	93.2	94.5	93.8	94.3	96.7	96.2	96.4	96.7	97.3	96.9	97.5	+0.6
Try crack once or twice	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	92.3	92.1	93.1	89.9	–3.2sss
Take crack occasionally	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	94.3	94.2	95.0	92.8	–2.2s
Take crack regularly	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	94.9	95.0	95.5	93.4	–2.1s
Try coke powder once or twice	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	87.9	88.0	89.4	86.6	–2.8s
Take coke powder occasionally	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	92.1	93.0	93.4	91.2	–2.2s
Take coke powder regularly	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	93.7	94.4	94.3	93.0	–1.3
Try heroin once or twice	91.5	92.6	92.5	92.0	93.4	93.5	93.5	94.6	94.3	94.0	94.0	93.3	96.2	95.0	95.4	95.1	96.0	94.9	94.4	–0.5
Take heroin occasionally	94.8	96.0	96.0	96.4	96.8	96.7	97.2	96.9	96.9	97.1	96.8	96.6	97.9	96.9	97.2	96.7	97.3	96.8	97.0	+0.2
Take heroin regularly	96.7	97.5	97.2	97.8	97.9	97.6	97.8	97.5	97.7	98.0	97.6	97.6	98.1	97.2	97.4	97.5	97.8	97.2	97.5	+0.3
Try amphetamines once or twice	74.8	75.1	74.2	74.8	75.1	75.4	71.1	72.6	72.3	72.8	74.9	76.5	80.7	82.5	83.3	85.3	86.5	86.9	84.2	–2.7s
Take amphetamines regularly	92.1	92.8	92.5	93.5	94.4	93.0	91.7	92.0	92.6	93.6	93.3	93.5	95.4	94.2	94.2	95.5	96.0	95.6	95.0	+0.4
Try barbiturates once or twice	77.7	81.3	81.1	82.4	84.0	83.9	82.4	84.4	83.1	84.1	84.9	86.8	89.6	89.4	89.3	90.5	90.6	90.3	89.7	–0.6
Take barbiturates regularly	93.3	93.6	93.0	94.3	95.2	95.4	94.2	94.4	95.1	95.1	95.5	94.9	96.4	95.3	95.3	96.4	97.1	96.5	97.0	+0.5
Try one or two drinks of an alcoholic beverage beer, wine, liquor	21.6	18.2	15.6	15.6	15.8	16.0	17.2	18.2	18.4	17.4	20.3	20.9	21.4	22.6	27.3	29.4	29.8	33.0	30.1	–2.9
Take one or two drinks nearly every day	67.6	68.9	66.8	67.7	68.3	69.0	69.1	69.9	68.9	72.9	70.9	72.8	74.2	75.0	76.5	77.9	76.5	75.9	77.8	+1.9
Take four or five drinks nearly every day	88.7	90.7	88.4	90.2	91.7	90.8	91.8	90.9	90.0	91.0	92.0	91.4	92.2	92.8	91.6	91.9	90.6	90.8	90.6	–0.2
Have five or more drinks once or twice each weekend	60.3	58.6	57.4	56.2	56.7	55.6	55.5	68.8	56.6	59.6	60.4	62.4	62.0	65.3	66.6	68.9	67.4	70.7	70.1	–0.6
Smoke one or more packs of cigarettes per day	67.5	65.9	66.4	67.0	70.3	70.8	69.9	69.4	70.8	73.0	72.3	75.4	74.3	73.1	72.4	72.8	71.4	73.5	70.6	–2.9
Take steriods	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	90.8	90.5	92.1	92.1	0.0
Approx. N =	2677	2957	3085	3686	3221	3261	3610	3651	3341	3254	3265	3113	3302	3311	2799	2566	2547	2645	2268	

NOTE: Level of significance of difference between the two most recent classes: s = .05, ss = .01, sss = .001. '—' indicates data not available.

SOURCE: Monitoring The Future Study, The University Of Michigan.

*Answer alternatives were: (1) Don't disapprove, (2) Disapprove, and (3) Strongly disapprove. Percentages are shown for categories (2) and (3) combined.

[b]The 1975 question asked about people who are "20 or older."

TABLE 10

Trends in Perceived Availability of Drugs
Eighth, Tenth, and Twelfth Graders, 1991–1993

Q. *How difficult do you think it would be for you to get each of the following types of drugs, if you wanted some?*	Percentage saying "fairly easy" or "very easy" to get[a]								
	8th Grade			10th Grade			12th Grade		
	1992	1993	'92–'93 change	1992	1993	'92–'93 change	1992	1993	'92–'93 change
Marijuana	42.3	43.8	+1.5	65.2	68.4	+3.2ss	82.7	83.0	+0.3
Crack	25.6	25.9	+0.3	33.7	33.0	–0.7	43.5	43.6	+0.1
Cocaine Powder	25.7	25.9	+0.2	35.0	34.1	–0.9	48.0	45.4	-2.6
LSD	21.5	21.8	+0.3	33.6	35.8	+2.2	44.5	49.2	+4.7ss
PCP[b]	18.0	18.6	+0.5	23.7	23.4	–0.3	31.7	31.7	0.0
Heroin	19.7	19.8	+0.1	24.3	24.3	0.0	34.9	33.7	–1.2
Other Opiates[b]	19.8	19.0	–0.8	26.9	24.9	–2.0	37.1	37.5	+0.4
Amphetamines	32.2	31.4	–0.8	43.4	46.4	+3.0s	58.8	61.5	+2.7
Crystal Meth. (Ice)[b]	16.0	15.1	–0.9	18.8	16.4	–2.4s	26.0	26.6	+0.6
Barbiturates	27.4	26.1	–1.3	38.0	38.8	+0.8	44.0	44.5	+0.5
Tranquilizers	22.9	21.4	–1.5	31.6	30.5	–1.1	40.9	41.1	+0.2
Cigarettes	77.8	75.5	–2.3ss	89.1	89.4	+0.3	—	—	—
Alcohol	76.2	73.9	–2.3ss	88.6	88.9	+0.3	—	—	—
Steroids	24.0	22.7	–1.3	37.6	33.6	–4.0ss	46.8	44.8	–2.0
Approx. N =	8355	16775		7014	14652		2586	2670	

NOTES: Level of significance of difference between the two years: s =.05, ss =.01, sss =.001.
'—' indicates data not available.

SOURCE: Monitoring The Future Study, The University Of Michigan.

[a]Answer alternatives were: (1) Probably impossible, (2) Very difficult, (3) Fairly difficult, (4) Fairly easy, (5) Very easy. For 8th and 10th grades, there was another category—"Can't say, drug unfamiliar"—which was included in the calculation of these percentages.
[b]8th and 10th grade only: 1993 data from one questionnaire form only. N is one-half of N indicated.

TABLE 11

Long-Term Trends in Perceived Availability of Drugs, Twelfth Graders

Q. *How difficult do you think it would be for you to get each of the following types of drugs, if you wanted some?*	Percentage saying "fairly easy" or "very easy" to get*																			
	Class of 1975	Class of 1976	Class of 1977	Class of 1978	Class of 1979	Class of 1980	Class of 1981	Class of 1982	Class of 1983	Class of 1984	Class of 1985	Class of 1986	Class of 1987	Class of 1988	Class of 1989	Class of 1990	Class of 1991	Class of 1992	Class of 1993	'92–'93 change
Marijuana	87.8	87.4	87.9	87.8	90.1	89.0	89.2	88.5	86.2	84.6	85.5	85.2	84.8	85.0	84.3	84.4	83.3	82.7	83.0	+0.3
Amyl & Butyl Nitrites	—	—	—	—	—	—	—	—	—	—	—	—	23.9	25.9	26.8	24.4	22.7	25.9	25.9	0.0
LSD	46.2	37.4	34.5	32.2	34.2	35.3	35.0	34.2	30.9	30.6	30.5	28.5	31.4	33.3	38.3	40.7	39.5	44.5	49.2	+4.7ss
PCP	—	—	—	—	—	—	—	—	—	—	—	—	22.8	24.9	28.9	27.7	27.6	31.7	31.7	0.0
MDMA (ecstasy)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	21.7	22.0	22.1	24.2	28.1	+3.9ss
Some other psychedelic	47.8	35.7	33.8	33.8	34.6	35.0	32.7	30.6	26.6	26.6	26.1	24.9	25.0	26.2	28.2	28.3	28.0	29.9	33.5	+3.6s
Cocaine	37.0	34.0	33.0	37.8	45.5	47.9	47.5	47.4	43.1	45.0	48.9	51.5	54.2	55.0	58.7	54.5	51.0	52.7	48.5	–4.2s
Crack	—	—	—	—	—	—	—	—	—	—	—	—	41.1	42.1	47.0	42.4	39.9	43.5	43.6	+0.1
Cocaine powder	—	—	—	—	—	—	—	—	—	—	—	—	52.9	50.3	53.7	49.0	46.0	48.0	45.4	–2.6
Heroin	24.2	18.4	17.9	16.4	18.9	21.2	19.2	20.8	19.3	19.9	21.0	22.0	23.7	28.0	31.4	31.9	30.6	34.9	33.7	–1.2
Some other narcotic (including methadone)	34.5	26.9	27.8	26.1	28.7	29.4	29.6	30.4	30.0	32.1	33.1	32.2	33.0	35.8	38.3	38.1	34.6	37.1	37.5	+0.4
Amphetamines	67.8	61.8	58.1	58.5	59.9	61.3	69.5	70.8	68.5	68.2	66.4	64.3	64.5	63.9	64.3	59.7	57.3	58.8	61.5	+2.7
Crystal meth. (ice)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	24.1	24.3	26.0	26.6	+0.6
Barbiturates	60.0	54.4	52.4	50.6	49.8	49.1	54.9	55.2	52.5	51.9	51.3	48.3	48.2	47.8	46.4	45.9	42.4	44.0	44.5	+0.5
Tranquilizers	71.8	65.5	64.9	64.3	61.4	59.1	60.8	58.9	55.3	54.5	54.7	51.2	48.6	49.1	45.3	44.7	40.8	40.9	41.1	+0.2
Steroids	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	46.7	46.8	44.8	–2.0
Approx. N =	2627	2865	3065	3598	3172	3240	3578	3602	3386	3269	3274	3077	3271	3231	2806	2549	2476	2586	2670	

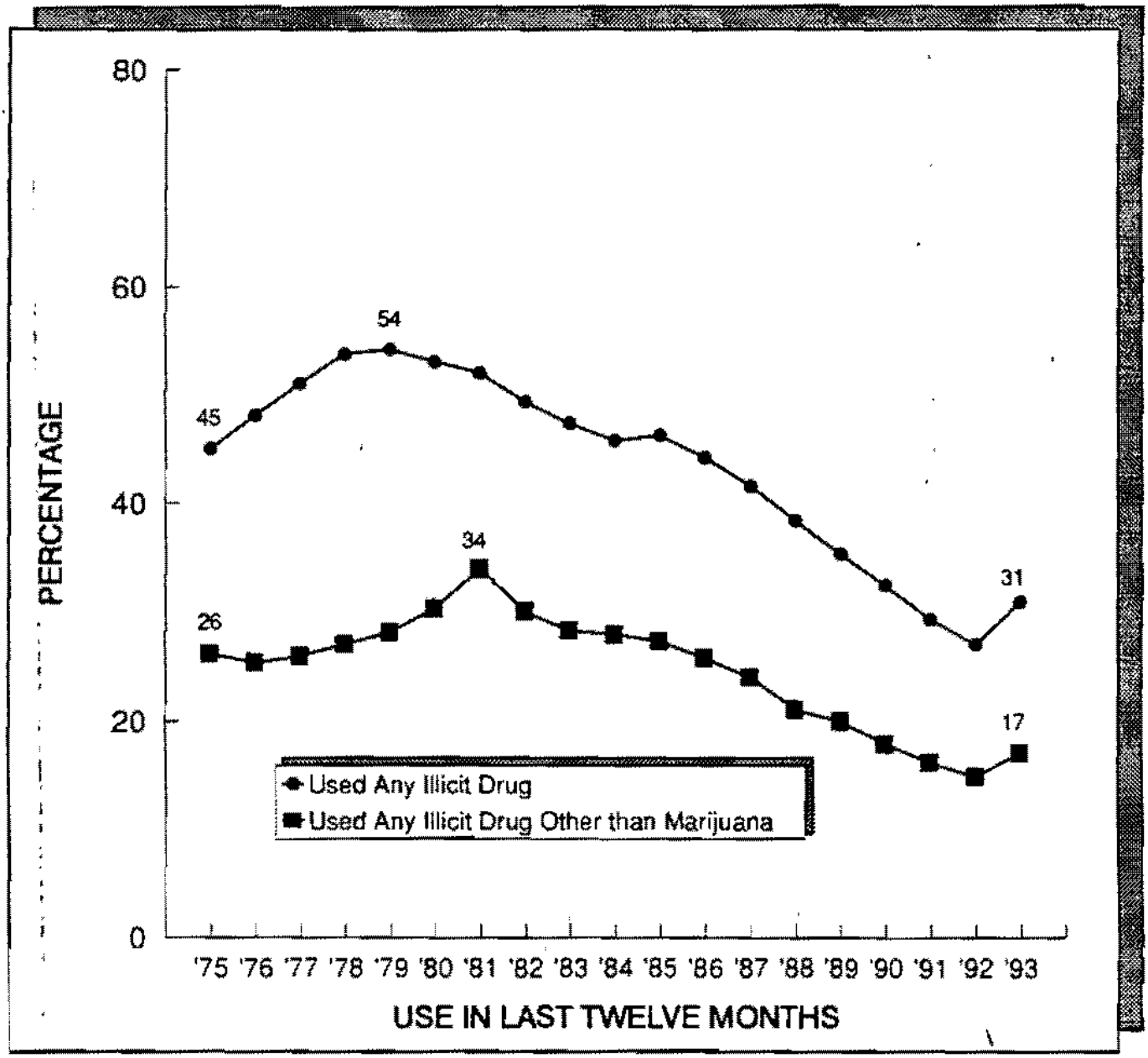
NOTE: Level of significance of difference between the two most recent classes: s = .05, ss = .01, sss = .001. '—' indicates data not available.

SOURCE: Monitoring The Future Study, The University Of Michigan.

*Answer alternatives were: (1) Probably impossible, (2) Very difficult, (3) Fairly difficult, (4) Fairly easy, and (5) Very easy.

FIGURE 1

Trends in Annual Prevalence of an Illicit Drug Use Index for Twelfth Graders



NOTES: Use of "any illicit drugs" includes any use of marijuana, hallucinogens, cocaine, and heroin, or any use which is not under a doctor's orders of other opiates, stimulants, barbiturates, methaqualone (excluded since 1990), or tranquilizers.

Beginning in 1982 the question about stimulant use (i.e., amphetamines) was revised to get respondents to exclude the inappropriate reporting of non-prescription stimulants. The prevalence rate dropped slightly as a result of this methodological change.

FIGURE 2

Marijuana: Trends in Perceived Availability,
Perceived Risk of Regular Use,
and Prevalence of Use in Past Thirty Days for Twelfth Graders

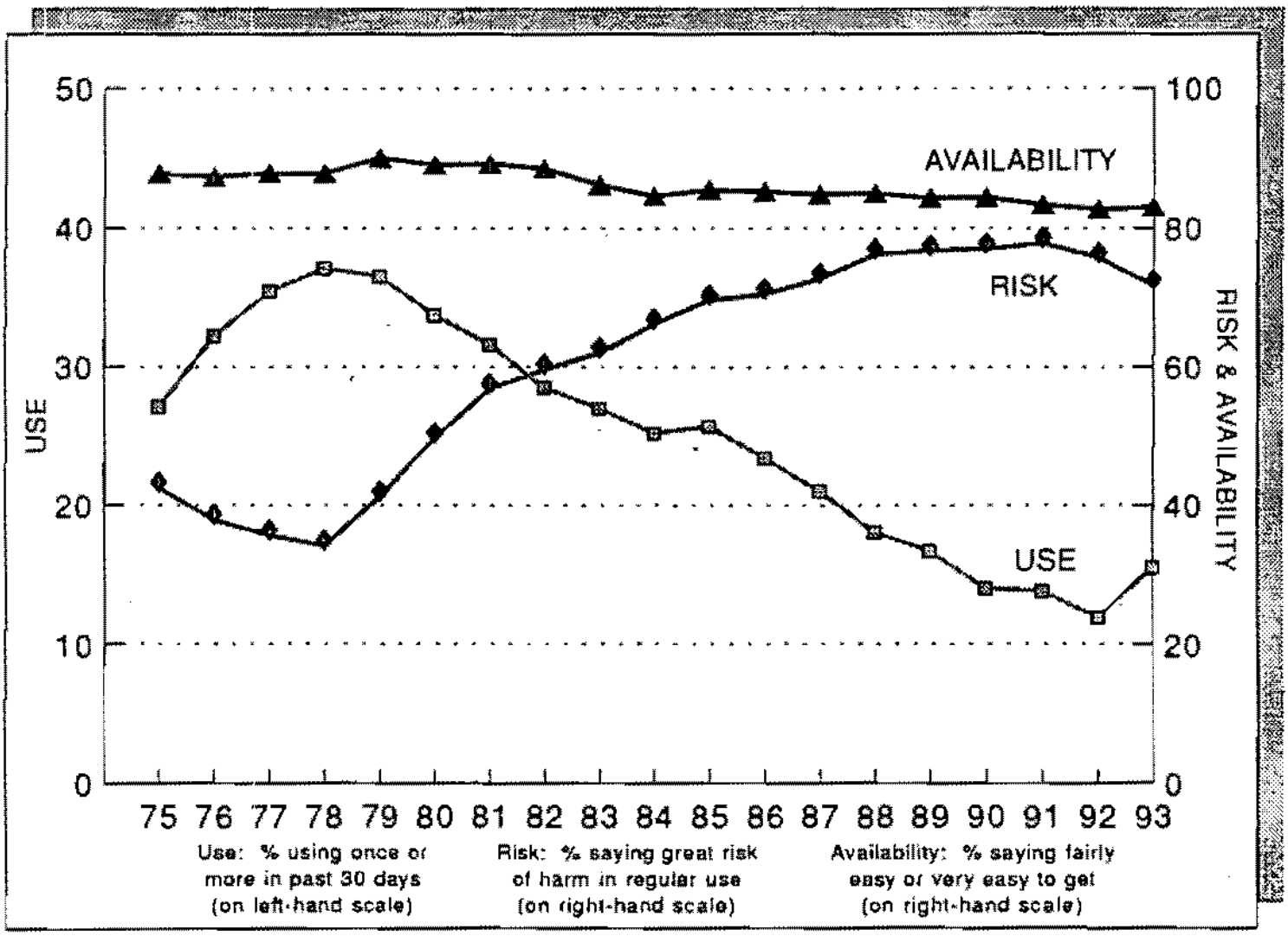
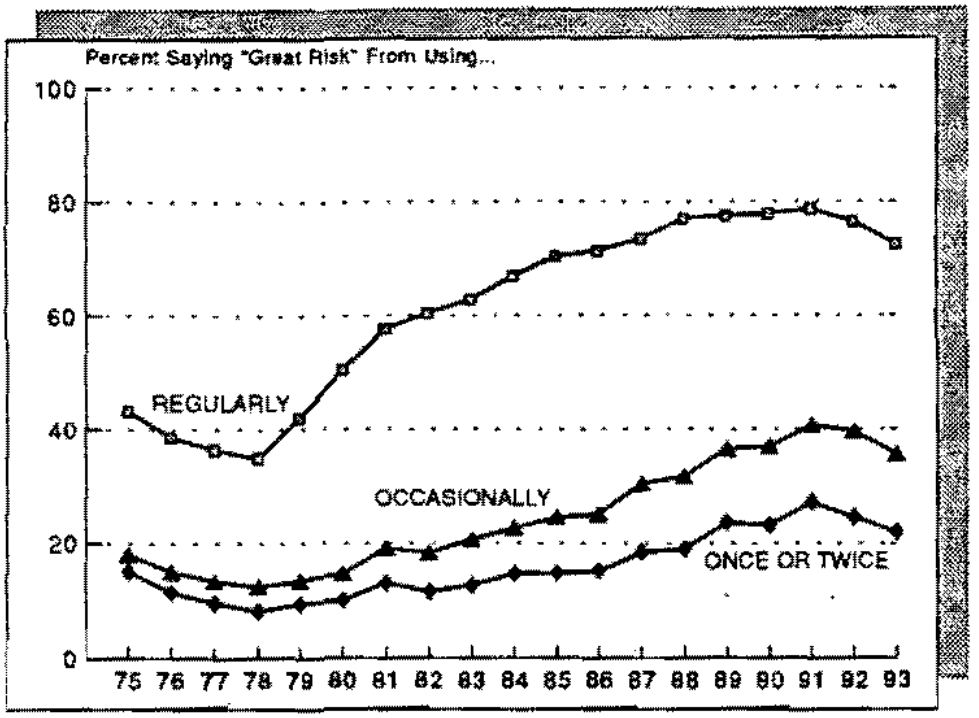
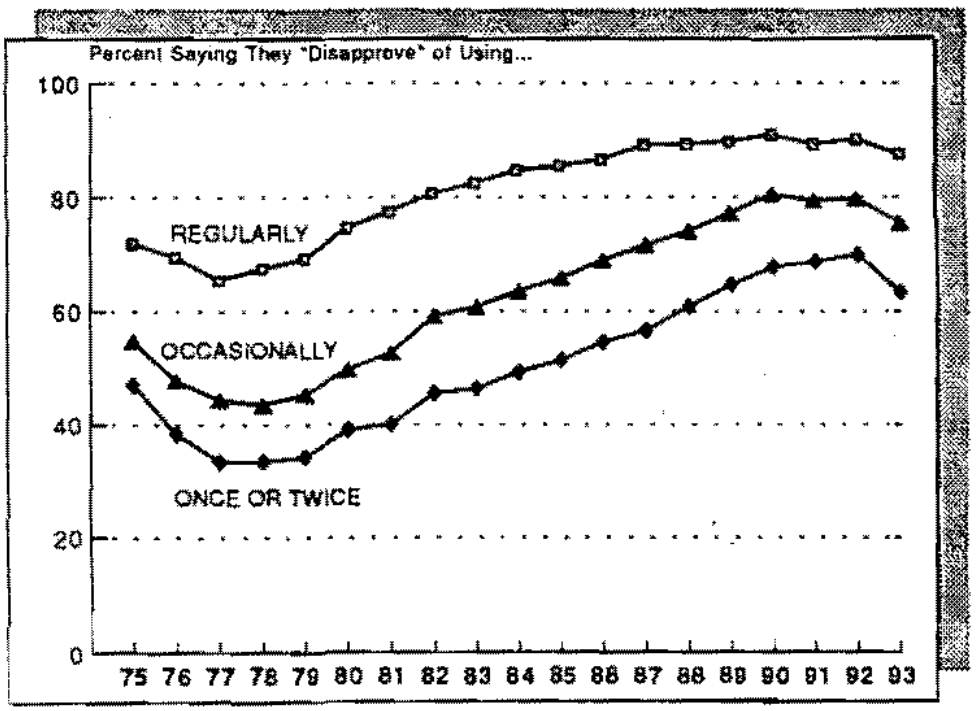


FIGURE 3

Trends in Perceived Harmfulness and Disapproval of Marijuana Use for Twelfth Graders



Perceived Harmfulness



Disapproval

FIGURE 4

Cocaine: Trends in Perceived Availability,
Perceived Risk of Trying,
and Prevalence of Use in Past Year for Twelfth Graders

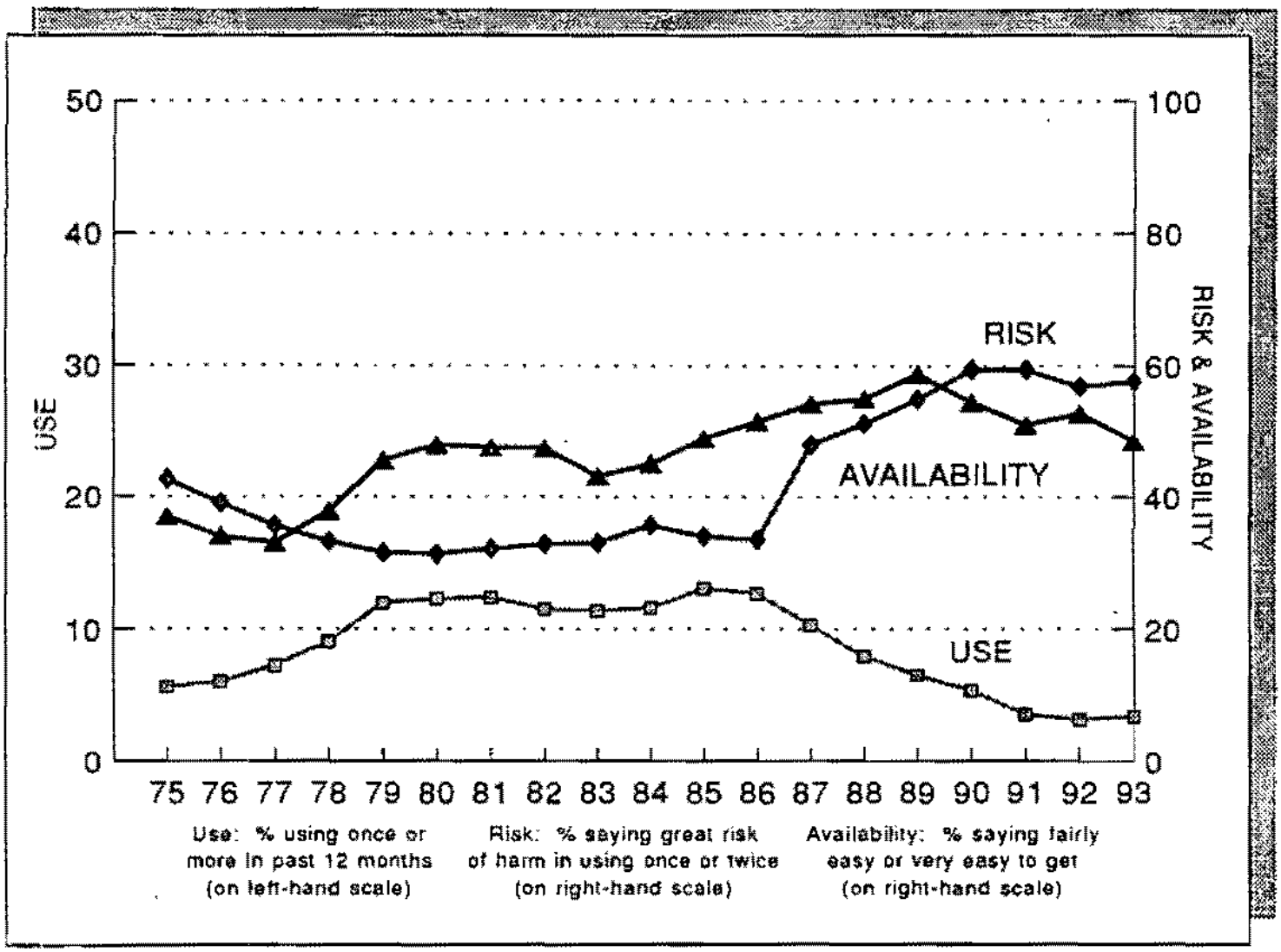
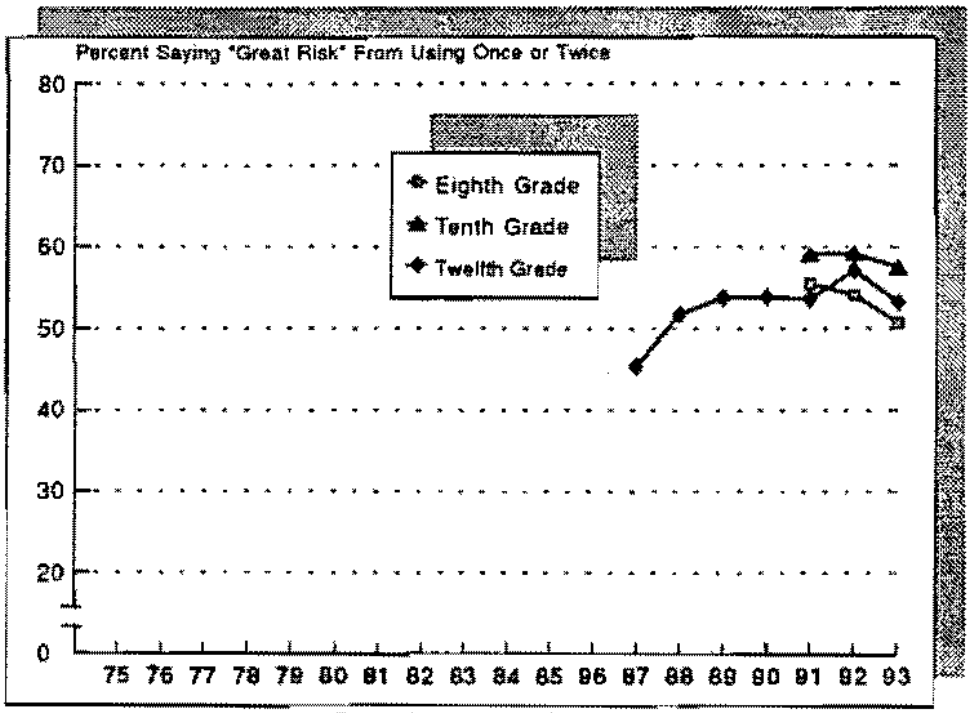
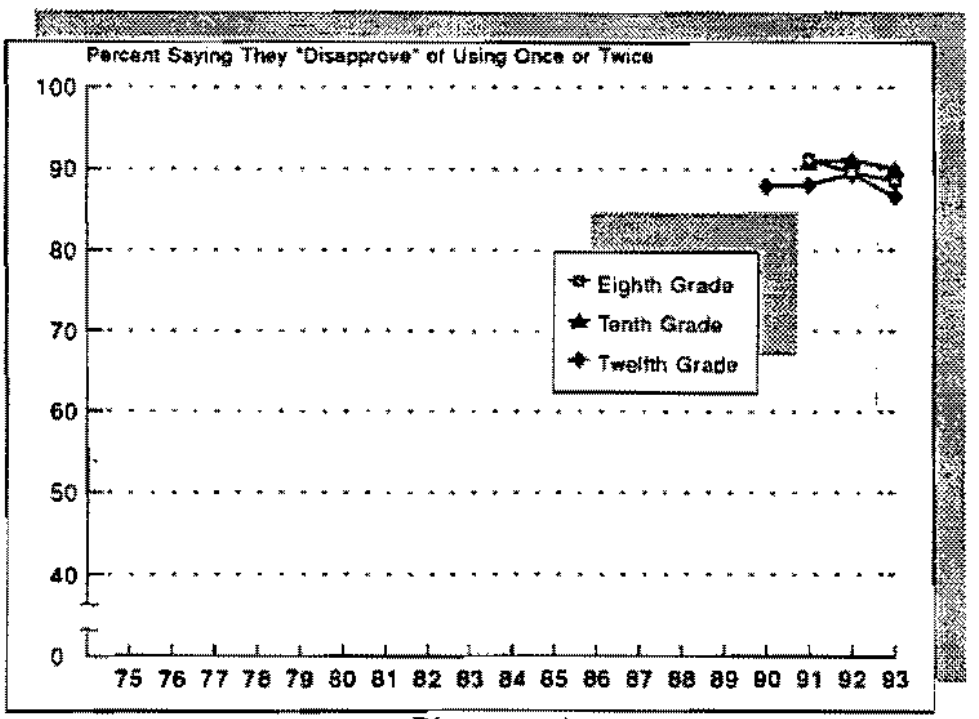


FIGURE 5

Trends in Perceived Harmfulness and Disapproval of Cocaine Powder for Eighth, Tenth, and Twelfth Graders

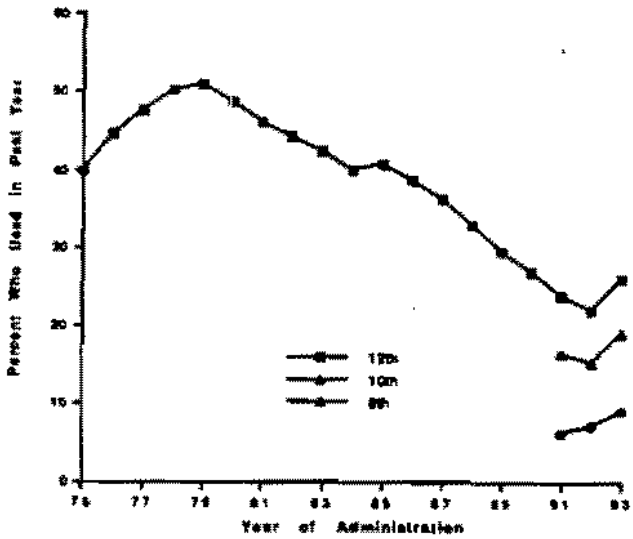


Perceived Harmfulness

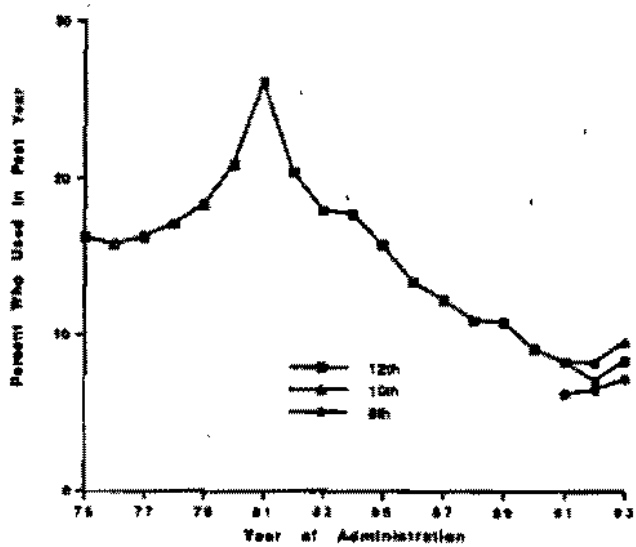


Disapproval

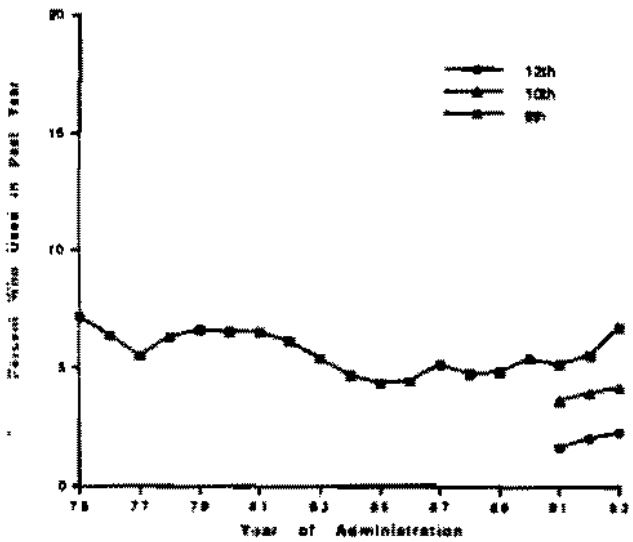
FIGURE 6
Trends in Annual Use of Selected Drugs by Grade, 1975-1993



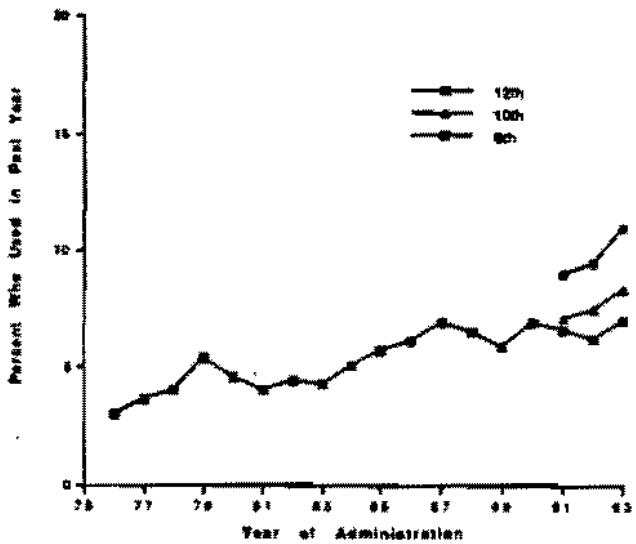
Use of Marijuana in Past Year



Use of Amphetamines in Past Year*



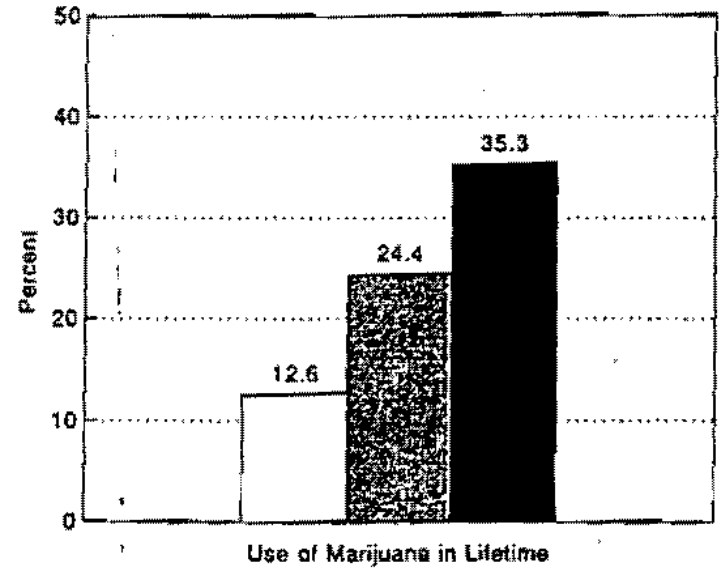
Use of LSD in Past Year

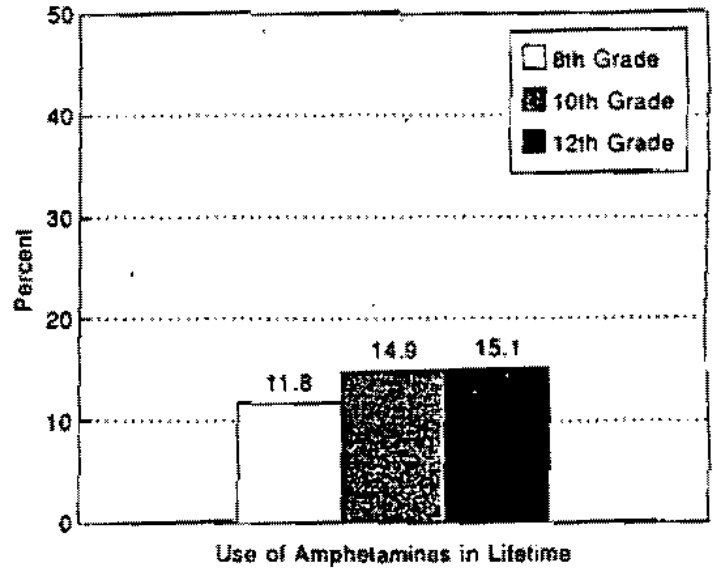


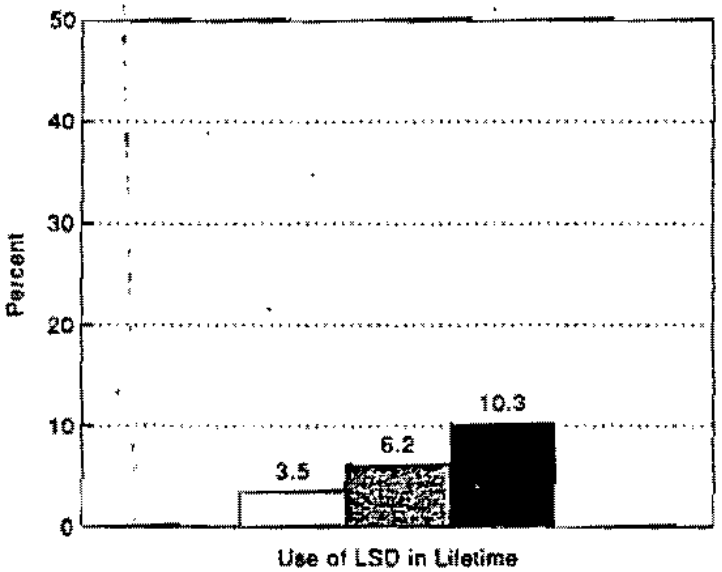
Use of Inhalants (unadjusted) in Past Year

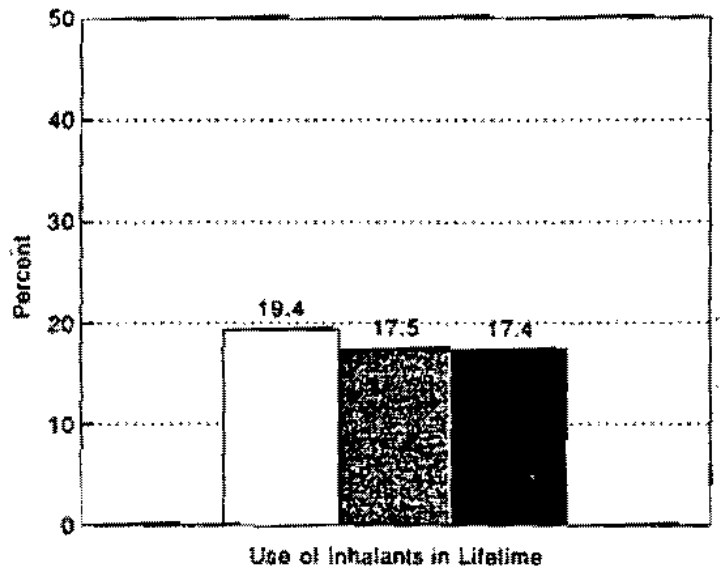
*Beginning in 1982, the question about stimulant use (i.e., amphetamines) was revised to get respondents to exclude the inappropriate reporting of non-prescription stimulants. The prevalence dropped slightly as a result of this methodological change.

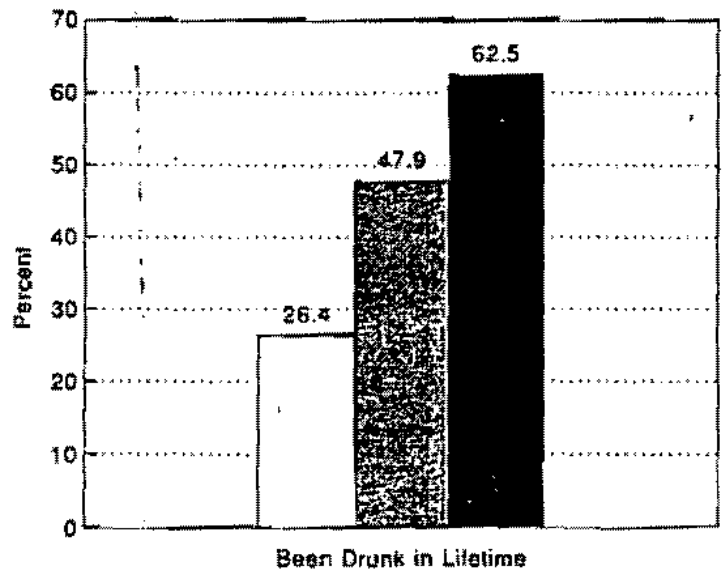
FIGURE 7
Lifetime Use of Selected Drugs by Grade, 1993

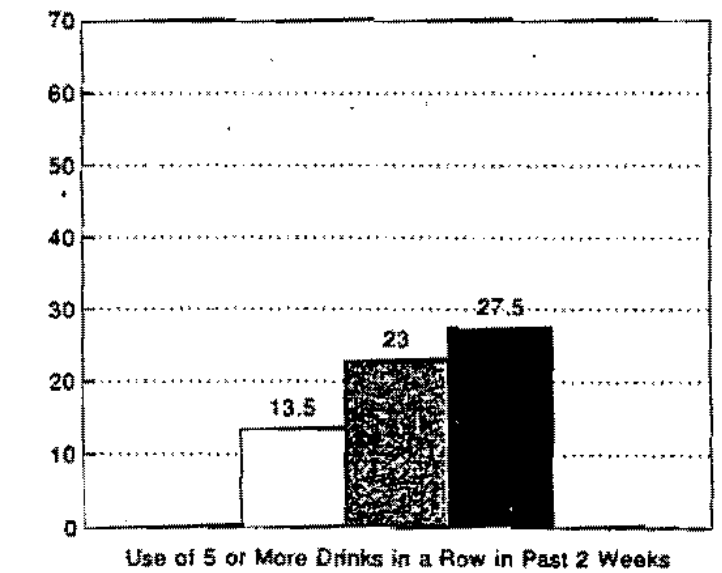












Heroin Users in New York, Chicago, and San Diego

Executive Office of the President
Office of National Drug Control Policy
Lee P. Brown, Director

November 1994

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ADOLESCENT ALCOHOL/TOBACCO USE

OFFICE OF NATIONAL DRUG CONTROL POLICY

Prepared for:

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Office of National Drug Control Policy
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Task No. 93/3G ■ August 1995

I. INTRODUCTION

This report documents an analysis performed by CSR, Incorporated, investigating the relationship between adolescent alcohol and tobacco use and the subsequent use of other drugs. The notion that alcohol and tobacco can lead to the use of so-called harder drugs is commonly referred to as the "gateway" theory. Evidence supporting the gateway theory was explored using three national databases: (1) the 1992 National Longitudinal Survey of Youth (NLSY), (2) the 1988 National Adolescent Student Health Survey of the American School Health Association, and (3) the 1991 Youth Risk Behavior Survey sponsored by the Centers for Disease Control and Prevention. Prior to CSR's investigation, few analyses on this subject had been performed using more than one national data set.

Earlier this year the General Accounting Office (GAO) released a report examining drug use among youth and the risk factors associated with such use (GAO, 1993). Although the study used several national data sets (such as the National Institute on Drug Abuse's National Household Survey on Drug Abuse (NHSDA), the High School Senior Survey, and the Bureau of Labor Statistics' NLSY, different analyses were performed with each data set, and only the NLSY was used to evaluate risk factors for drug use. The GAO study found that early alcohol use among youth was associated with early use of marijuana and cocaine. This conclusion was drawn by GAO after examining the results of "odds ratios" obtained from logistic regression models.

It is not clear, however, whether GAO distinguished between prior drug use, subsequent drug use, and concurrent drug use when evaluating these risk factors. Although such distinctions may not have been necessary for GAO's purposes, these distinctions become critical when examining the gateway concept. Furthermore, the interpretation of odds ratios becomes moot in situations where the outcome event—in this case, a particular type of drug use—occurs frequently in the database. Since GAO found that 42 and 47 percent of survey respondents used marijuana and cocaine respectively over time, it is clear that some outcome events under consideration by GAO were indeed frequent and that GAO's approach to the study may have been flawed.

In October of this year, Columbia University's Center on Addiction and Substance Abuse released a study on gateway drugs, using data from the NHSDA. This study focuses primarily on cocaine use and has flaws similar to those already described for the GAO report.

CSR's analysis focused on two methodologies: (1) contingency table analysis using relative risk statistics and chi-square tests and (2) logistic regression. These are some of the most common methods for analyzing categorical data. For the most part, the variables used in the analysis were those common to all databases. This allowed us to evaluate the extent to which the data were consistent across databases.

All computer analyses conducted for this investigation were performed by Abt Associates, based on detailed instructions provided by CSR. These instructions are provided in Appendix A to this report.

The results of the analysis from each of the three databases were compared to determine (1) the degree to which the gateway drug concept is supported by the data and (2) whether the associations found were consistent across databases. Support for the gateway theory, if evident, may help the Office of National Drug Control Policy's attempts to increase prevention efforts targeting the use of gateway drugs among adolescents.

This report is divided into six sections. Following this introductory section, Section II presents a literature review, Section III describes the databases used in the analyses, Section IV presents a discussion of the methodology (including a discussion of the theory behind the various analysis techniques), Section V presents the finding of the analysis, and Section VI presents a summary of the findings. Appendix A lists the instructions given to Abt Associates for implementing the study methodology. Appendix B provides more detailed tables that consider additional risk factors (marijuana) and outcomes (amphetamines and psychedelics). Finally, Appendix C presents a table of literature analyzed for this study.

II. LITERATURE REVIEW

Kandel's work (1975) was among the first of empirically based literature to identify a progression of drug use. In a cross-sectional study of 5,468 adolescents in New York State, Kandel applied Guttman scalogram techniques to data collected from self-administered questionnaires and identified several key concepts that have formed the basis for much of the subsequent research on the gateway theory. Her findings indicated that drug use progression follows a fairly stable sequence, starting with nonuse of any substance to use of "legal drugs" (e.g., beer/wine, cigarettes), to cannabis, to pills (e.g., "ups," "downs," tranquilizers) to psychedelics, to cocaine, and to heroin. She emphasized that the first step of legal drug use is a necessary step between nonuse and illegal drug use, citing that progression from nonuse to illegal use almost never exists (only 1 percent incidence in her study) and that marijuana use is a crucial step on the way to using other drugs.

Kandel (1975) also reported that youths in her cohorts did not progressed from beer/wine to illicit drug use without having first used hard liquor or cigarettes. Her findings showed that progression to marijuana use appears predominantly among adolescents who have already used hard liquor or tobacco.

Kandel's findings were later supported by Huba, Wingard, and Bentler (1981), who compared Kandel's progressive or simplex model to the latent variable model. The data they studied were questionnaire responses collected from 1,634 7th–11th graders in Los Angeles schools. Using maximum likelihood estimation under confirmatory factor analysis and causal modeling with latent variable procedures, they found that both models fit well, displaying a basic alcohol-marijuana-hard-drug sequence of drug use progression.

Adding yet another dimension to the understanding of the gateway theory and the progressive nature of drug use, Donovan and Jessor (1983) found that problem drinking could be placed between use of marijuana and use of pills in the progression of drug using behavior. Basing their Guttman scalogram analysis on the 1974 and 1978 National Study of Adolescent

Drinking, they found that use of illicit drugs, especially use of illicit drugs other than marijuana, tends to not occur in the absence of problem drinking.

Yamaguchi and Kandel (1994) surveyed the Donovan and Jessor study with 1,325 original subjects from Kandel's 1975 study. Strengthening Kandel's earlier findings by adding a longitudinal dimension and by using structured interviews and Guttman Scaling, they confirmed not only the progression of drug use but also identified a difference with regard to the importance of alcohol and cigarettes when comparing male and female progression to marijuana use. While alcohol played a significant role for males, alcohol or cigarettes were significant for females. For males, alcohol use precedes marijuana use; alcohol and marijuana use precede other illicit drug use; and alcohol, cigarettes, and marijuana use precede the use of prescribed psychoactive drugs. For females, either alcohol or cigarettes precede marijuana; alcohol, cigarettes, and marijuana precede other illicit drugs; and alcohol and either cigarettes or marijuana precede prescribed psychoactive drugs.

Mills and Noyes (1984) expanded the gateway theory in several ways in their study of 8th-, 10th-, and 12th-grade students in Maryland. Using survey data collected from 2,036 students and validated on a sample of 2,414 students from a later survey, Mills and Noyes were able to refine Kandel's stages, finding strong support for drug use progression starting with legal drugs (both alcohol and tobacco), then followed by marijuana and eventually by hard drugs. They also identified that this progression was both sequential and cumulative; that is, users did not replace their earlier drugs of choice as they tried newer ones, but rather they continued their use of current drugs as they experimented with the harder drugs. This cumulative aspect was later confirmed by Ellickson, Hayes, and Bell (1992) and Yu and Williams (1992).

In addition, Mills and Noyes (1984) also found significant correlations between the age of first use and the number and frequency of drugs currently being used. Students who initiated drug use at an earlier age were more likely to be using a larger selection of other drugs, as well as using them more often.

In their 1985 study of 27,355 7th–12th graders in New York State, Welte and Barnes found strong overall support for the progression of drug use for older students, starting with

alcohol, then progressing to marijuana, pills (e.g., barbiturates, amphetamines, tranquilizers) and then to hard drugs (e.g., heroin, cocaine, hallucinogens). Tobacco served as an intermediate role between alcohol and marijuana for younger subjects, particularly females. Using Guttman scaling, they confirmed the importance of alcohol as the initial drug used by their subjects, citing that unless alcohol is used, there is little use of any other drugs, including tobacco and over-the-counter drugs and substances (e.g., solvents, glue, air fresheners, nonprescription cough medications).

Although Newcomb and Bentler (1986) confirmed a sequence in drug use behavior, they suggested that the sequence may be more complex than previously reported. Their findings, based on structured equations and chi-square analysis of longitudinal data collected from 7th–9th graders in Los Angeles County, indicate that there may not be a single sequence of drug use, but rather several small sequences that differ by the "developmental period" (p. 118). Furthermore, their study did not find alcohol to be the gateway drug that the literature suggests. Instead, their data indicate that cigarette use is crucial in the progression to cannabis and hard-drug use. They report: "Clearly, cigarettes are the true Gateway drug facilitating increased involvement in harder drugs, without the direct impact of alcohol. This is particularly true at the earlier age period" (p. 118).

Fleming, Leventhal, Glynn, and Ershler (1989) sought to expand the understanding of the role of the earliest, most widely available and used licit substances—alcohol and cigarettes—in relation to the earliest used illicit substance, marijuana. Using Guttman scaling and chi-square analysis on interview data gathered from 1,007 6th-10th graders in Milwaukee, Wisconsin, they found support for earlier research on the sequential nature of drug use, stating that "it was shown that having tried substances lower on the Guttman scale made one significantly more likely to be using substances higher on the scale two years later" (p. 269). Fleming, et al. also identified tobacco use as the drug most often used first by their subjects.

Further expanding their earlier longitudinal work with 1,160 of the former adolescents from Kandel's 1975 study, Kandel, Yamaguchi and Chen (1992) further defined and expanded Kandel's previously identified stages of drug use and introduced a fourth stage to the her original sequence as follows: (1) legal drugs (i.e., alcohol and tobacco), (2) marijuana,

(3) illicit drugs other than marijuana, and (4) medically prescribed drugs. They also offered further confirmation for the observation that male progression to illicit drugs is dependant on prior use of alcohol, whereas female progression is dependent on prior use of either cigarettes or alcohol.

Yu and Williams (1992) study confirmed the findings of Mills and Noyes regarding the significance of age of first use. Analyzing data from the 1986 New York State Youth Alcohol Survey, Yu and Williams demonstrated that the age at which alcohol use is initiated plays a significant role in the individual's initiation to other drugs, including cigarettes. Using Guttman scaling and logit analysis techniques to examine telephone surveys of 3,000 New York State residents ages 16–24, their findings provided further support for the progressive nature of drug use as well as the greater degree of importance of the role played by cigarettes for women in their progression to other drugs.

Continuing to expand the gateway theory, Ellickson et al. (1992) used a longitudinal Guttman scalogram analysis in their study, which followed 4,145 West Coast 7th–10th graders for 4 years. They were able to demonstrate the importance of distinguishing between any use of gateway drugs and what they perceive as the more important initiation of to frequent or regular use of these drugs, reinforcing the earlier work of Donovan and Jessor (1983), in which they stressed the crucial role of problem drinking in the sequence. Ellickson et al. found strong support for the hypothesis that increased involvement with legal substances (i.e., alcohol and cigarettes) precedes initial use of cocaine and other illicit drugs. Furthermore, they also were able to support Mills' and Noyes' (1984) finding that drug use is cumulative for adolescents who continue to use gateway drugs as they gain experience with new drugs.

Blaze-Temple and Lo (1992) examined a sample of Australian adolescents to ascertain any similarities between the drug use behaviors of this youth population and the behaviors of the North American youth population that frequently comprise the subject pool of most literature. Their findings, based on a Guttman scaling of responses to survey and interview data on 1,093 teenagers from Perth, Australia, determined a direct path from alcohol and tobacco to illicit drugs other than marijuana, as well as a direct path from alcohol and tobacco to marijuana to other illicit drugs. They also supported Mills' and Noyes' (1984)

findings that drug use was not only sequential but also cumulative. Finally, their results identified alcohol and tobacco as important gateway drugs, with tobacco more clearly a risk factor for the use of marijuana and other illicit drugs than alcohol.

In a recent study, Torabi, Bailey, and Majd-Jabbari (1993) evaluated cigarette smoking as a predictor of alcohol and other drug use by children and adolescents. Their findings confirmed that cigarette smoking by 5th–12th graders was a powerful predictor of their later use of alcohol and other drugs. Using chi-square and stepwise multiple regression analysis on data gathered from 20,629 5th–12th graders in Indiana, they found that smokers were "much more likely" (p. 304) than non-smokers to use all drugs listed in the survey (i.e., alcohol, marijuana, cocaine, crack, inhalants, amphetamines, tranquilizers, prescription narcotics, psychedelics, heroin, and steroids) and that this likelihood increased along with the frequency of cigarette smoking. Nonsmokers' use of drugs other than alcohol and smokeless tobacco was almost nonexistent, and the reported use of alcohol by nonsmokers was one-third less than reported use by one-pack-a-day smokers.

In another 1993 study, Kandel and Yamaguchi introduced crack-cocaine use into the gateway theory when they studied 1,108 12th graders in New York in order to establish the position of crack-cocaine use in patterns of drug involvement. Using modified, log-linear, Guttman scale analysis on survey data, they found that cigarettes and alcohol were initiated at an earlier age than illicit drugs—in only 1 percent of the cases did subjects use marijuana first, and for both males and females, progression to crack-cocaine occurred only when experimentation with both alcohol and cigarettes took place before marijuana use. They also found support for earlier findings showing differences in the importance of alcohol and tobacco use for males and females (e.g., Yamaguchi and Kandel, 1984; Welte and Barns, 1985). In addition, Kandel and Yamaguchi confirmed that the age of onset into drug use is a crucial risk factor for progression to more serious drugs—adolescents who progressed to cocaine, especially crack-cocaine, began using cigarettes, alcohol, or marijuana an average of 2 years earlier than did adolescents who did not go progress to crack-cocaine. This finding supports the earlier findings of Mills and Noyes (1984) and Yu and Williams (1992).

Golub and Johnson (1994) took a different approach in their study of onset of drug use. They noted that other studies have typically focused on adolescents drawn from the general

population primarily reflecting the substance use patterns of less serious users and therefore potentially masking different pathways followed by those who become serious users. They studied 994 "serious drug users" in New York City who were drawn from the "Careers in Crack" data set. Using data gathered from interviews conducted during 1988–89, they sought to determine whether the drug use pathways of serious drug users are similar to those identified in research on the general population. In light of the increased popularity and availability of marijuana, they also examined the importance of alcohol as the drug first used. Their findings indicate that, for the serious drug user, alcohol plays a less important role as the substance first used than would be expected from the developmental models, while they confirmed marijuana's role as an intermediate step to more serious drug use (e.g. cocaine, intravenous drugs, crack-cocaine). They were unable to include tobacco in their drug use sequencing because it was not included in the Careers in Crack-Cocaine data set.

Recent research on the gateway theory performed by Merrill, Fox, Lewis, and Pulver (1994) finds strong support for drug use progression (i.e., alcohol and tobacco to marijuana to hard drugs) as well as for the different roles played by alcohol and tobacco for males and females. They also confirmed that the earlier individuals begin gateway drug use, the more likely they are to use illicit drugs (more than one-half of adults who began smoking before age 15 had also tried illicit drugs at least once in their lifetimes; only one-quarter of smokers who started after age 17 tried illicit drugs) and to use them regularly (adults who began smoking before age 15 are three times more likely to be regular drug users than adults who did not start smoking until after 17). They also showed that adults who use any gateway drug are 1.8 times more likely to proceed to use other drugs than are those who do not use gateway drugs. Adults who use two or three gateway drugs are even more likely to proceed to use other drugs (3.0 and 19.5 times more likely, respectively). Individuals whose adolescent gateway drug use is more frequent are more likely to go on to other drug use (e.g., Merrill et al. state that "a child who smokes more than 15 cigarettes a day is more than twice as likely to use an illicit drug and 16 times more likely to use cocaine than one who smokes but on a less than daily basis" [p. 33]).

Limitations to the Gateway Theory

Few studies question the progressive nature of drug use. What is often questioned, however, is how or why that progression actually occurs. For example, one explanation for the progressive nature of drug use discussed by Oetting and Beauvis (1987) calls attention to the suggestion that the selection of a substance is more likely related to the drug's availability and the general attitudes of the drug user's peers toward the drug than to a "physiological response" to a previously used substance.

Another explanation attempts to relate personality to patterns of adolescent substance use (Wingard , Huba, and Bentler, 1979). In a longitudinal study of 1,634 7th–9th graders attending 11 schools in metropolitan Los Angeles, Wingard et al. found that drug use was associated with a "heterogeneous constellation of several traits and attitudes which included non-abidance with the law, extraversion, liberalism, leadership, lack of diligence, and lack of deliberateness" (p. 140).

Farrell and Danish (1993) examined data collected from 1,256 middle-school students in the public school system of a large southeastern city in an effort to determine the relationship of adolescent drug use with peer-drug associations and emotional restraint. Their goal was to determine whether drug use caused either peer-drug associations or emotional restraint or if it was the result of them. Their findings demonstrate that "there is no single cause for drug use, but rather multiple pathways through which adolescents initiate or increase their drug involvement" (p. 333).

Finally, another factor stressed by several authors is that the use of one substance does not necessarily lead to the use of another substance (Kandel, 1975; Mills and Noyes, 1984; Windel, Barnes, and Welte, 1989). Kandel states: "The notion of stages in drug behavior does not imply that these stages are either obligatory or universal, nor that all adolescents must progress through each in turn, as has been proposed by Piaget or Kohlberg for stages in moral development" (1989).

SUMMARY

The review of the literature suggests the following conclusions:

- ***Initiation of drug use is progressive in nature.***—The literature has demonstrated that there is a progression in drug use beginning with nonuse of any substances, followed by initial use of at least one licit substance, followed by initial use of an illicit substance (usually marijuana), finally followed by hard drug use (Blaze-Temple and Lo, 1992; Ellickson et al., 1992; Fleming et al., 1989; Huba et al., 1981; Kandel, 1975; Kandel and Yamaguchi, 1993; Kandel, Yamaguchi, and Chen, 1992; Merrill et al., 1994; Mills and Noyes, 1984; Welte and Barnes, 1985; Yamaguchi and Kandel, 1984; Yu and Williams, 1992). The final stage of this progression appears to be initiation of the use of medically prescribed psychoactive drugs (Kandel, Yamaguchi and Chen, 1992). While variations in this progression are reported—for instance, the inclusion of problem drinking by Donovan and Jessor (1983) or the diminished role of alcohol in the progression suggested by Newcomb and Bentler (1986)—the sequence of progressive drug use appears to be consistent and fairly invariate among studies.

- ***Initiation of drug use is cumulative.***—The literature has indicated that as individuals progress in their drug use, their use tends to be cumulative in that they do not cease their use of earlier substances but rather continue using the earlier substances, often with greater intensity, as they try new ones (Blaze-Temple and Lo, 1992; Ellickson et al., 1992; Mills and Noyes, 1984; Yu and Williams, 1992).

- ***The relative importance of alcohol and tobacco varies for males and females.***—While alcohol appears to be a significant predictor for males' future drug use, alcohol and tobacco share significance for females' future drug use (Kandel and Yamaguchi, 1993; Kandel, Yamaguchi, and Chen, 1992; Welte and Barnes, 1985; Yamaguchi and Kandel, 1984; Yu and Williams, 1992).

- ***The definition of "gateway drug" varies from study to study.***— While some literature identify alcohol, tobacco, and marijuana as gateway substances (e.g., Merrill

et.al., 1994) others identify either alcohol (e.g., Welte and Barnes, 1985) or tobacco (e.g., Blaze-Temple and Lo, 1992; Newcomb and Bentler, 1986) or both (e.g., Ellickson et al., 1992) as gateway drugs. The significance of the initiation of alcohol and tobacco use cannot be undorstated. This is not to say that the initiation of marijuana use is not as pivotal; however, the literature clearly shows that without the initiation of alcohol and tobacco use, the initiation of other substance use is highly unlikely to occur. Marijuana has not been proven to be a gateway drug; once an individual initiates the marijuana use, he or she has already "stepped through" the gateway. Consequently, prevention efforts consistently target use of licit substances, citing these findings.

- ***The age of onset to regular drug use is more important to note than simply age of onset to any drug use.***—While the age of drug use initiation is important in predicting future drug use (Yu and Williams, 1992) and its frequency (Mills and Noyes, 1984), there is evidence that the initiation of regular gateway drug use is even more so (Ellickson, et al., 1992); the earlier an individual initiates gateway drug use, the more likely he/she will use illicit drugs in the future. For those who use gateway drugs regularly, the likelihood of future use increases.

III. DATABASES USED

This chapter describes the databases used in analyzing the relationships and patterns of licit and illicit drug use among adolescents.

The Youth Risk Behavior Survey (YRBS) is a school-based survey for which students in grades 9–12 are interviewed. The survey excluded dropouts as well as other students who were absent from school on the day of the interview. Oversampling of schools with larger African-American and Hispanic populations was performed. The 1991 survey had 12,272 respondents.

The 1988 National Adolescent Student Health Survey (NASHS) also is a school-based survey for which students in grades 8 and 10 are interviewed. Approximately one-half of the sampling strata represented rural regions. The number of respondents who were asked questions about drugs (on Form 2 of the survey) was 3,789.

The National Longitudinal Survey of Labor Market Experience of Youth (NLSY) is a multistage, stratified sample of dwelling units in the United States. Adolescents between the ages of 14 and 21 were interviewed for each dwelling unit selected into the sample in 1979. Oversampling was performed for African-Americans, Hispanics, and economically disadvantaged youth. In the initial cohort, 12,686 respondents were interviewed.

The NASHS and the YRBS databases are retrospective databases with the data collected at one point in time. The NLSY, on the other hand, is a longitudinal study of one cohort. Many NLSY respondents are no longer adolescents in followup surveys.

Because at least one purpose of this investigation is to compare results obtained from one database with those from another, a preliminary analysis was performed to determine which variables were common to all three databases. In addition to alcohol and tobacco, only cocaine and marijuana data are included in all databases. Consequently, only these drugs were considered when determining the effect of the risk factors on drug use.

Likewise, for those analyses performed where age is not factored into the drug use outcome, drug information has not been counted if the age of onset is greater than 19 years (note that many respondents currently participating in the NLSY are in their mid-30s). On the other hand, when separate analyses were performed by age group category, drug outcomes occurring after adolescence were included. This approach allowed us to capture as much information as possible from each database, while at the same time enabling us to compare this information across compatible sources.

Both the YRBS and the NLSY have variables related to "age of first use" for particular drugs. The NASHS, on the other hand, has a "grade of first use" category for selected drugs. To perform the analysis, age of first use has been approximated for the NASHS based on the grade-of-first-use variables.

IV. METHODOLOGY

This section describes the methodology used in the analysis, as well as the theory behind each approach.

RELATIVE RISK ANALYSIS

Relative risk analysis is based on the concept of incidence rates. Subjects of a population are categorized at a baseline time period as having or not having a particular "risk factor," which is hypothesized to impact the likelihood of one later acquiring some outcome. To perform the analysis, prevalence cases (i.e., cases where both the risk factor and the outcome occur during the baseline time period) usually are excluded first. Then the population is followed during a specified time period, and the number of new outcomes is recorded. The number of new outcome cases divided by the number of members in the population is defined to be the "incidence rate" for the outcome event.

From this information, a contingency table (such as the one given below) can be created in which all members of the population (except the prevalence cases) are classified into one of four cells based on their risk factors and outcome characteristics. The relative risk statistic can be calculated by comparing the two incidence rates suggested by the table. The first incidence rate gives the incidence of the outcome event among the subset of the population having the risk factor present at the baseline time period. The second incidence rate records the incidence of the same event among those in the population not having the risk factor at the baseline time period. The ratio of these two incidence rates gives the relative risk statistic. In the table below, the relative risk is given by $[A/(A+B)]/[C/(C+D)]$.

	Outcome Event	
Risk Factor	**Occurred**	**Did Not Occur**
Present	A	B
Not present	C	D

A relative risk statistic equal to, for example, 1.5, would indicate that an individual having the specified risk factor is 1.5 times more likely to be associated with the outcome event than someone not having the risk factor.

For this analysis, the potential risk factors examined are as follows:

- Prior use of alcohol;
- Prior use of tobacco; and
- Prior use of alcohol and tobacco only.

The outcome events considered are given below:

- Subsequent use of marijuana; and
- Subsequent use of cocaine.

Based on the above-listed potential risk factors and outcomes, six contingency tables were created. For example, using the second potential risk factor listed above and the first listed outcome event, one obtains the following contingency table:

	Subsequent Marijuana Use	
Initial Tobacco Use	**Occurred**	**Did Not Occur**
Present	A	B
Not present	C	D

The gateway concept hinges on the notion of prior use of alcohol and/or tobacco and *subsequent use* of other drugs. Hence, to perform the analysis it was essential that the data include the age of "first use" for all risk factors and outcomes. One limitation with this approach, however, is that the first-use time periods are broadly defined in terms of years (or grades) in all three databases. If it happens that the steps in the transitional path from the risk factor drug to the outcome drug progress in a matter of months rather than years, the databases will, in all likelihood, show the same age of first use for each drug, masking the actual gateway path. Hence, as an exploratory tool, the relative risk analysis also was

performed without regard to age of first use. In this latter approach, any use of the drug in question was counted as an outcome regardless of whether the use began prior to or subsequent to initial use of the risk factor. Discrepancies between the results from the two approaches were used to evaluate the extent to which the transitional path from risk factor to outcome drug may have been masked by the age of first use variable.

It also should be noted that the approach used to measure relative risk from the three databases deviates slightly from the principles of relative risk theory as outlined earlier. Specifically, the theory of relative risk requires that the period of time allowed for each test subject to acquire the outcome characteristic be the same for all subjects (i.e., all subjects are followed for the same period of time). In two of the databases (the NASHS and the YRBS) this requirement cannot be met because they are not longitudinal data sets, but rather "snapshots" of student behavior taken at one point in time. One student might indicate that she used tobacco at age 13 and began to use marijuana at age 14, while another might indicate that he began to use tobacco at age 12 and marijuana at age 15. Both students would have been counted in this analysis as having had the tobacco use risk factor and having acquired the marijuana drug use outcome. If both students, on the other hand, had been followed in a longitudinal study for several years beginning when the female student was age 13 and the male student was age 12 (hence, meeting the constant time period requirement of relative risk theory), the marijuana use of only the male student would only be counted if the study lasted at least 3 years. In the third database (the NLSY), which is longitudinal, this requirement for allowing each survey participant the same amount of time to acquire the outcome could, at least in theory, have been met if prevalence cases (respondents claiming they have used the risk factor drug as well as the outcome drug at the time of the first interview) had been excluded, but they were not. Another principle of relative risk theory was not followed for the NLSY, however, as described in the next paragraph.

It also should be noted that in a strict approach to relative analysis, the subjects are classified as having or not having the risk factor at one time, and that is at the beginning of the study. With the approach used in this investigation, participants in the NLSY were considered to have a particular risk factor if they indicated during any interview that they had used the risk factor drug.

These deviations from the strict principles of relative risk analysis discussed above apply also to the logistic regression analysis (discussed below), as logistic regression is also used to estimate relative risk. We do not feel, however, that these deviations will create substantial bias in our findings. Assuming the gateway theory is valid, the time required to acquire the outcome of illicit drug use, given prior use of alcohol or tobacco, probably does not exceed a few years. Hence, most respondents in the databases will have had sufficient time to acquire the outcome. This is particularly true for the NLSY, in which all subjects are followed over time.

CHI-SQUARE CONTINGENCY TABLE TESTS

The relative risk statistic in and of itself does not measure the statistical significance of the relationships between the risk factors and the outcomes. To illustrate this, consider again the contingency table for tobacco and marijuana, shown above, with the following table:

	Subsequent Marijuana Use	
Initial Tobacco Use	**Occurs**	**Does Not Occur**
Present	10	2
Not Present	5	6

According to this table, the relative risk for tobacco users (i.e., relative to nonusers) for becoming marijuana users is 1.8 (or 10/12 divided by 5/11). This information by itself would suggest that tobacco users are 1.8 times more likely to become marijuana users than tobacco nonusers. The chi-square test statistic for this table, however, is 3.6. Using a 95-percent statistical confidence level, this chi-square statistic suggests that there is no sign of statistical dependence between tobacco use and subsequent use. In other words, the relationship suggested by the table cannot be proven to be other than random.

For each 2-by-2 table generated for the relative risk analysis, a chi-square test was performed to test the dependence between the outcome and the specified risk factor. Relative

risk statistics generated from tables having insignificant chi-square statistics were considered unreliable.

LOGISTIC REGRESSION

In cases where the outcome event is rare, the relative risk statistic can be approximated by the odds ratio statistic. Using again the "A, B, C, D" notation for the counts in the four cells of the contingency table, the odds ratio is defined as $A/B/C/D$. To see how the odds ratio statistic relates to the relative risk statistic discussed above, consider again the formula for relative risk:

$$RR = [A/(A+B)]/[C/(C+D)].$$

When the outcome event is a rare occurrence, A is small compared with B, and C is small compared with D. As a result, the quantity $(A+B)$ can be approximated by B, and $(C+D)$ can be approximated by D. Using these approximations, the relative risk statistic reduces to the odds ratio statistic. Odds ratios can be obtained directly from the results of a logistic regression procedure.

The benefit of using logistic regression is that it enables one to examine odds ratios for particular "prior use" variables (which may be a good proxy for relative risk), while at the same time controlling for association with other prior use and demographic variables. Thus, logistic regression results allow one to make such statements as, "After adjusting for age, race, and sex characteristics, it was found that tobacco users are X times more likely than tobacco nonusers to become marijuana users." Note, however, that when the outcome event is not rare (as may be the case with such drugs as marijuana), the odds ratio becomes a poor approximation to the relative risk statistic. This becomes important if the resultant odds ratio statistic is being used as a proxy to measure relative risk (as it usually is). Hence, a cautious examination of the database is required before interpreting the logistic regression results.

The logistic regression model has the following form:

$$Y=1/[1+e^{-(a+b1*x1+b2*x2+...bn*xn)}]$$

in which Y is the probability of the outcome, $b1$ through bn are coefficients estimated by the model, and $x1$ through xn are independent variables. Each of the model coefficients represents the natural logarithm of the odds ratio for the variable it is associated with.

For this analysis, three independent variables were created for prior use of tobacco, alcohol, and marijuana, respectively. Here, note that for each of these variables, it is any prior use and not exclusive prior use, since the model already takes this into account. Additional independent variables related to race and gender, as well as variables, to measure interactions between independent variables, also were considered.

Separate models were created for each outcome event, with the outcome event (i.e., use of a particular drug) defined to be the dependent (response) variable in each model. A stepwise, backward, elimination regression procedure was used for each model to eliminate insignificant variables in each model.

There is a lack of consensus within the statistical community concerning whether regressions based on sample data should be performed using sampling weights (Korn and Graubard, 1991). Many believe that sampling weights should not be used for the simple reason that weighted regressions were developed to address problems of heteroscedasticity in the data, and that such techniques are not applicable to issues concerning the representativeness of the sample. This position was taken with this study. Because using sampling weights in regression analyses is a popular technique, however, results from this approach were also evaluated for comparative purposes only.

V. FINDINGS

In this section, the results of the contingency table analyses are presented first, followed by a discussion of the loglinear logistic modeling and longlinear procedures.

CONTINGENCY TABLE ANALYSES

Table 1 presents the relative risks for all risk factor and outcome combinations for the three databases, based on the contingency table analyses. For each risk factor/outcome combination the relative risk statistic is presented twice, based on defining the risk and outcomes in two separate ways. The first way defines the risk factors in terms of prior use and the outcomes in terms of subsequent use (see the "Prior Use" columns in Table 1). The second method simply defines both the risk factors and outcomes in terms of any use (see the "Any Use" columns in Table 1). Large disparities between the relative risk statistics obtained from these two approaches may point to limitations of the databases in capturing the true sequence pattern of drug use. This could occur because age of first use is defined too broadly (i.e., in terms of years instead of years and months). On the other hand, large disparities between the two types of relative risk definitions may simply indicate that the risk factor drug and the outcome drug tend to be experimented with concurrently, or even that the outcome drug is tried first. Unfortunately, the databases cannot distinguish between all of these possibilities. Unless otherwise noted, the term "relative risk" will be used in this discussion to mean the relative risk based on prior use of the risk factor and subsequent use of the outcome drug.

In addition to the relative risk statistic, the table also includes information on the percentage of the "risk factor present" population (people indicating prior use of a particular drug or combination of drugs) who also have the outcome (subsequent use of a particular drug or combination of drugs). This latter piece of information is useful because a high relative risk for a particular risk factor outcome may be associated with a small segment of the population. Thus the percent outcome statistic gives one an idea about the number of people at risk for each risk factor. For cases where the chi-square statistic for the table

Table 1

Relative Risks and Percent Outcome* Statistics for Various Risk Factor/Outcome Combinations, by Database and by Drug Use Definition

	National Longitudinal Survey of Labor Market Experience of Youth				Youth Risk Behavior Survey				National Adolescent Student Health Survey			
	Prior Use		Any Use		Prior Use		Any Use		Prior Use		Any Use	
Risk Factor, Outcome	RR	Percent Outcome	RR	Percent Outcome	RR	Percent Outcome	RR	Percent Outcome	RR	Percent Outcome	RR	Percent Outcome
Alcohol, Marijuana	0.5	35.8	2.1	72.2	1.7	27.0	21.0	39.6	1.7	21.2	9.6	37.3
Alcohol, Cocaine	1.2	16.2	4.8	22.2	4.2	6.1	147.8	7.6	4.1	6.8	13.3	8.9
Alcohol, Marijuana or Cocaine	0.8	50.9	2.1	73.2	2.1	29.1	20.8	39.9	2.0	24.1	8.5	37.5
Tobacco, Marijuana	1.3	75.4	1.7	85.6	1.9	44.2	3.9	74.9	1.4	29.3	3.9	65.3
Tobacco, Cocaine	1.8	23.9	2.5	29.1	4.9	12.1	10.1	20.1	4.2	11.7	10.9	22.5
Tobacco, Marijuana or Cocaine	1.3	75.4	1.6	86.0	2.4	52.1	3.9	75.1	2.0	39.6	3.9	65.9
Alcohol and Tobacco, Marijuana	0.6	40.8	1.7	88.6	1.7	39.5	3.9	75.6	1.2	24.3	3.8	65.8
Alcohol and Tobacco, Cocaine	1.5	20.5	2.9	31.9	4.8	11.7	10.3	20.3	4.1	11.9	11.2	23.5
Alcohol and Tobacco, Marijuana or Cocaine	1.1	68.5	1.7	89.0	2.2	49.2	3.9	75.8	1.8	36.5	3.8	68.2

*Defined to be the percentage of individuals having the risk factor who also have the outcome.

Table 1

indicated that there is no statistical dependence between having the risk factor and having the outcome, the relative risk is not given and is denoted as "ns" (not significant).

One notes from the table that the "prior use" relative risk statistics obtained from the Youth Risk Behavior Survey (YRBS) and the National Adolescent Student Health Survey (NASHS) are very similar, and differ somewhat from those obtained from the National Longitudinal Survey of Labor Market Experience of Youth (NLSY). This may be attributable to the fact that the NLSY cohort began reporting in 1979, and all participants had completed their teen years some time during the following 6 years—a period during which drug use (particularly marijuana and cocaine) was more prevalent than it is today. Data from the NASHS and the YRBS, on the other hand, were collected in 1988 and 1991, respectively.

This discrepancy between the NLSY and the other two databases can be seen by examining the marijuana outcomes and cocaine outcomes in the table. For the NLSY, 72 percent of all cohort participants who had engaged in alcohol use had also at some time in their lives engaged in marijuana use, compared with 40 and 37 percent for the YRBS and the NASHS, respectively. 22 percent of all alcohol users in the NLSY had used cocaine, compared with 8 and 9 percent of all alcohol users in the YRBS and the NASHS, respectively.

Considering tobacco users, 86 percent of the NLSY participants admitting to tobacco use had also used marijuana, compared with 75 and 65 percent for the YRBS and the NASHS, respectively. Twenty-nine percent of all NLSY participants admitting to tobacco use had also engaged in cocaine use at some point in their lives, compared with 20 and 23 percent for the YRBS and the NASHS, respectively.

On the other hand, when examining relative risk, the YRBS and the NASHS show higher relative risks of the cocaine and marijuana outcomes for the alcohol and tobacco risk factors. Considering the relative risk statistics based on prior use of the risk factor and subsequent use of the outcome, the table indicates that the relative risk for subsequent marijuana use given prior alcohol use is 1.7 for both the YRBS and the NASHS, while it is only 0.5 for the NLSY. The relative risk for subsequent cocaine use given prior alcohol use is approximately 4 for the YRBS and the NASHS, while it is 1.2 for the NLSY.

For subsequent marijuana use given prior tobacco use, the relative risks are 1.9 for the YRBS, 1.4 for the NASHS, and 1.1 for the NLSY. For subsequent cocaine use given prior tobacco use, the relative risks are 4.9 for the YRBS, 4.2 for the NASHS, and 1.8 for the NLSY. Based on these data, one might conclude from Table 1 that although illicit drug use has dropped for alcohol and tobacco users (related to the NLSY being an older database), illicit drug use has dropped at a disproportionally faster rate for alcohol nonusers and tobacco nonusers.

Comparing the relative risk statistic based on prior and subsequent use of the risk factor and outcome drug respectively with the relative risk statistic based on any use of the outcome drug, one notes large discrepancies between the YRBS and the NASHS (in the NLSY these discrepancies appear less pronounced). For example, for the YRBS, Table 1 indicates that the relative risk for marijuana use given prior use of alcohol is 1.7. However, when the relative risk statistic is calculated based on any alcohol use and any marijuana use, the statistic jumps to 21. For the NASHS, the relative risk statistic for this risk factor/outcome combination changes from 1.7 to 9.6. One must bear in mind, though, that such relative risks based on any use of the risk factor and any use of the outcome drug have much weaker implications in terms of cause and effect than do the "prior use" relative statistics. As mentioned earlier, there is always the possibility that when relative risk is defined in terms of any use of the risk factor and any use of the outcome drug, the use of the outcome drug may have actually occurred prior to the use of the risk factor drug. If, however, one considers it at least a possibility that the use of the outcome drug frequently occurred shortly after the first use of the risk factor and that the age of first use variable could not detect such a difference in age of first use (because age of first use is measured in the databases in years—or grades—rather than years and months), then the relative risk statistics based on "any use" can be thought of as an estimate of the maximum value conceivable for the true relative risk.

For the drug use outcome defined to be either marijuana use or cocaine use, Table 1 suggests that the relative risks are not much different from those associated with a marijuana only outcome. This again is confirmed by the "Percent Outcome" column in the table. For a given risk factor, the percentage of respondents having used both the risk factor drug and marijuana (defined in terms of any use) is about the same as the percentage of respondents having used the risk factor drug and either marijuana or cocaine. In other

words, allowing for cocaine use in addition to marijuana use when defining the outcome generates very few additional cases. This indeed implies a "stepping-stone" effect for cocaine users: Those who use cocaine have already used marijuana.

To summarize the relative risk information contained in Table 1, for the NLSY, there seems to be very little relationship between prior use of alcohol and subsequent use of any of the outcome drugs under consideration. The largest relative risk for alcohol as a risk factor occurred for subsequent use of cocaine, and was only 1.2. When considering tobacco as a risk factor, the relative risks are somewhat higher for the NLSY when considering subsequent use of cocaine (having a relative risk approximately equal to 2), but not particularly so for subsequent marijuana use where the relative risk is only 1.3.

For the YRBS and the NASHS, both databases produced very similar relative risk data for the risk factors and outcome drugs considered. The relative risk for subsequent marijuana use and the relative risk for subsequent cocaine use are approximately 2 and 4 respectively for prior use of both alcohol and tobacco.

CONTINGENCY TABLE ANALYSIS BY DEMOGRAPHIC CATEGORIES

Table 2 presents the results of the contingency table analyses by sex and race (i.e., male and female, African-American and non-African-American), and Table 3 presents results for analyses by age. These tables only focus on alcohol and tobacco as prior-use drugs.

One notes in Table 2 that the relative risks for illicit drug use tend to be somewhat higher for females than for males. All three databases, for example, show higher relative risks in the case of women for subsequent cocaine use given prior tobacco use. On the other hand, it is interesting to note that for many of the prior use/outcome combinations listed in the table, the percentage of individuals having the prior use activity who then go on to engage in the outcome activity (i.e., subsequent use of a particular drug) is lower for women than for men. This apparent discrepancy can be explained as follows: Men who do not use tobacco or alcohol are more likely to use illicit drugs than are women who do not use tobacco or alcohol.

Table 2

Percent Outcome* and Relative Risks (RR) for Various Risk Factor/Outcome Combinations, Broken Down by Sex and Race

Data Base/ (Risk Factor, Outcome)	Male		Female		Non African American Male		Non African American Female		African American Male		African American Female	
	Percent Outcome	RR	Percent Outcome	RR	Percent Outcome	RR	Percent Outcome	RR	Percent Outcome	RR	Percent Outcome	RR
NLSY												
Alcohol, Marijuana	39.0	ns	31.4	ns	39.2	0.5	32.4	.5	36.0	0.5	25.2	0.5
Alcohol, Cocaine	18.9	ns	12.7	1.2	19.7	ns	13.8	ns	13.9	ns	4.3	ns
Tobacco, Marijuana	67.9	ns	62.9	1.2	69.6	ns	65.6	1.2	58.0	ns	49.6	ns
Tobacco, Cocaine	26.7	1.5	21.4	2.6	28.5	1.6	23.2	2.5	17.1	ns	8.0	3.2
YRBS												
Alcohol, Marijuana	29.1	1.6	24.7	2.0	29.2	1.7	25.9	2.4	27.9	ns	17.3	ns
Alcohol, Cocaine	7.2	3.0	4.6	12.5	7.7	3.4	5.5	14.3	3.6	ns	1.0	ns
Tobacco, Marijuana	49.7	2.0	39.4	1.9	51.0	2.2	39.5	2.0	21.0	0.6	36.7	1.4
Tobacco, Cocaine	16.2	5.0	8.4	5.4	16.3	4.7	8.6	4.8	13.7	6.3	2.9	ns
NASHS												
Alcohol, Marijuana	22.9	1.6	19.4	1.9	23.3	1.6	19.0	2.2	19.2	ns**	23.2	2.2
Alcohol, Cocaine	7.5	4.0	6.2	4.3	8.2	3.4	6.3	6.7	2.3	ns	5.0	ns
Tobacco, Marijuana	31.7	1.3	27.5	1.7	31.2	1.3	27.7	1.9	53.3	ns	15.7	ns
Tobacco, Cocaine	11.2	3.0	12.0	7.3	11.1	2.8	12.3	8.7	0	ns	8.2	ns

*Defined to be the percentage of people heaving the risk factor who also have the outcome.

**ns indicates chi square statistic not significant.

Table 2

For the breakouts by race in Table 2, race categories were defined to be African-American or non-African-American, to allow for consistency across all databases. As it turned out, however, the sample sizes were too small in each database to generate meaningful estimates of relative risk for African-Americans: In most cases, the significance level of the chi-square statistic was greater than 0.05 for this group. Still, Table 2 makes it apparent that for most risk-factor-and-outcome combinations, a smaller percentage of persons using the risk factor drug (i.e., alcohol or tobacco) go on to use illicit drugs when comparing African-Americans with non-African-Americans.

Table 3 also presents the relative risks of subsequent use of marijuana and cocaine using alcohol and tobacco as prior-use drugs, but categorizes the data by age group. One notes from the table that for many of the risk factor/outcome combinations, the relative risks frequently decrease as age increases. This pattern is apparent in all three databases, and is most apparent for marijuana. For example, considering tobacco as a prior-use drug and marijuana as the outcome drug in the YRBS, the relative risk is 3.6 for 14-year-olds, 2.3 for 15-year-olds, 1.8 for 16-year-olds, 1.6 for 17-year-olds, and 1.8 for 18-year-olds.

REGRESSION ANALYSIS

The logistic regressions were performed both with and without sampling weights. As discussed in a previous section, it is our belief that using the sampling weight as a weighting variable for a regression procedure is, technically speaking, not appropriate. Such analyses have been performed for comparative purposes only and will be discussed later.

Table 4 presents for each database and for each outcome drug the model coefficients, the standard errors of the coefficients, and odds ratios associated with the risk factors. The odds ratio for each model parameter is obtained by raising e to the power of the parameter's model coefficient. This odds ratio is then used to approximate relative risk.

To generalize calculating the relative risk of having the outcome event for a population having the risk factor(s), in which relative risk is defined to be relative to a population not having the risk factor(s), one performs the following steps: (1) One plugs the coefficients into the model, multiplying them by either 0 or 1, depending on whether the independent variable

Table 3

Relative Risk for Various Risk Factor/Outcome Combinations by Age

Risk Factor, Outcome	Age							
	13	14	15	16	17	18	19	20
National Longitudinal Survey of Labor Market Experience of Youth								
Alcohol, Marijuana	NA	1.1	0.6	0.6	0.5	0.5	0.50	ns
Alcohol, Cocaine	NA	3.1	1.6	1.2	1.4	1.2	1.2	1.6
Tobacco, Marijuana	NA	ns	1.2	1.3	1.3	1.1	1.1	1.0
Tobacco, Cocaine	NA	ns	2.3	2.8	2.6	2.4	1.9	1.6
Youth Risk Behavior Survey								
Alcohol, Marijuana	NA	2.5	3.1	1.4	1.3	1.4	NA	NA
Alcohol, Cocaine	NA	2.9	8.4	5.2	2.1	4.8	NA	NA
Tobacco, Marijuana	NA	3.6	2.3	1.8	1.6	1.8	NA	NA
Tobacco, Cocaine	NA	4.7	3.3	7.0	4.0	4.3	NA	NA
National Adolescent Student Health Survey								
Alcohol, Marijuana	1.8	ns	1.6	1.4	1.3	NA	NA	NA
Alcohol, Cocaine	ns	5.2	2.3	3.5	ns	NA	NA	NA
Tobacco, Marijuana	1.2	2.0	1.3	1.6	ns	NA	NA	NA
Tobacco, Cocaine	3.9	ns	3.9	4.2	4.5	NA	NA	NA

ns indicates that the chi-square statistic is not significant.

Table 3

Table 4

Logistic Regression Coefficients, Standard Errors, and Odds Ratios for Predicting Use of Marijuana and Cocaine

Final Independent Variable	Predictor Variable (Outcome Drug)								
	Model 1 Marijuana			Model 2 Cocaine			Model 3 Marijuana or Cocaine		
	Coef	S.E.	O.R.	Coef	S.E.	O.R.	Coef	S.E.	O.R.
National Longitudinal Survey of Labor Market Experience of Youth									
Alcohol	-1.5	0.06	0.22	-0.42	0.09	0.66	-0.83	0.05	0.44
Tobacco	0.29	0.07	1.34	0.36	0.07	1.44	0.79	0.06	2.20
Race	—	—	—	-0.52	0.10	0.59	—	—	—
Sex	-0.74	0.06	0.47	-0.52	0.08	0.59	-0.67	0.06	0.51
Race/Sex Interaction	-0.44	0.08	0.64	-0.98	0.23	0.37	-0.50	0.07	0.61
Marijuana	—	—	—	2.76	0.16	15.8	—	—	—
Youth Risk Behavior Survey									
Alcohol	0.25	0.06	1.30	-0.10	0.30	0.91	0.42	0.07	1.53
Tobacco	0.92	0.08	2.50	0.67	0.13	1.20	1.29	0.08	3.62
Race	0.18	0.06	1.20	-0.90	0.20	0.40	0.18	0.06	1.20
Sex	-0.56	0.05	0.57	-0.58	0.12	0.56	-0.55	0.05	0.58
Marijuana	—	—	—	2.70	0.20	14.94	—	—	—
National Adolescent Student Health Survey									
Alcohol	0.44	0.12	1.57	0.02	0.41	1.02	0.64	0.12	1.89
Tobacco	0.89	0.15	2.44	1.08	0.23	2.95	1.41	0.13	4.08
Sex	-0.62	0.11	0.54	-0.41	0.22	0.66	-0.68	0.11	0.51
Marijuana	—	—	—	2.74	0.34	15.54	—	—	—

Coef=Coefficient
S.E.=Standard Error
O.R.=Odds Ratio
Note: Dash (—) indicates that the variable was not significant or appropriate for the model.

Table 4

(i.e., risk factor) is present or not, adds all terms together and raises e to this power; (2) One repeats the procedure for the population being compared (i.e., the population not having the risk factors of interest); (3) the results from Step 1 are divided by the results from Step 2.

Considering marijuana as the outcome drug for the YRBS, Table 4 shows that the odds ratio associated with prior alcohol use is 1.3. Using this statistic to approximate relative risk, one could then conclude that after controlling for prior use of cigarettes, for race, and for sex, individuals in the database who use alcohol are 1.3 times more likely to go on to use marijuana than are individuals who do not use alcohol. When making such conclusions, however, one should heed the warning mentioned in an earlier section that the odds ratio only approximates the relative risk statistic when the outcome event in question is a fairly rare event in the population. To the extent that some of the outcomes in question are not rare events, these estimates of relative risk obtained from the logistic regressions may have some degree of bias. This is particularly true for marijuana when considered as an outcome in all three databases. For example, Table 4 shows that in the NLSY, more than 75 percent of tobacco users had subsequently tried marijuana. For the YRBS approximately 44 percent of such users went on to use marijuana, and in the NASHS the figure is close to 30 percent.

Continuing with the example of prior alcohol use and subsequent marijuana use for the NASHS, one also notes that based on the odds ratio for tobacco, Table 4 implies that when controlling for alcohol, race, and sex, individuals in the database who use tobacco are 2.4 times more likely to go on to use marijuana than are individuals who do not use cigarettes. Furthermore, to determine the effect of prior alcohol use combined with prior use of tobacco, one first adds the coefficients associated with the two prior-use drugs and then raises e to this power. This is equivalent to multiplying the odds ratios associated with the two prior-use drugs. Hence the table suggests that, when controlling for race and sex, individuals who use alcohol and tobacco are $e^{(.44+.89)}$, or 3.8 times more likely to subsequently engage in marijuana use than are individuals who use neither alcohol nor tobacco.

One should note here that the contingency table analyses discussed above did not allow one to make such statements. When two prior-use drug categories were considered previously in the contingency tables, the relative risks obtained were defined in terms of being relative to those persons not using both prior drugs. Such persons may have used one

of the prior use drugs or none of the prior-use drugs. These two possibilities could not be distinguished in the analysis. In the case of the logistic regression, however, when the odds ratios for the two prior-use drug categories are added together, the estimated relative risk is always relative to those persons who have used neither prior-use drug. Hence, the relative risk statistics associated with prior use of two drugs obtained from the logistic regression are not comparable with those obtained from the contingency table analyses. Specifically, in such cases, one would expect the relative risks obtained from the logistic regressions to be somewhat higher than those obtained from the contingency table analyses (since the relative risk in the logistic case is relative to those who have neither risk factor rather than being relative to those who simply do not have both risk factors).

The model coefficients presented in Table 4 were obtained by performing a backward elimination regression procedure. Using this approach, each model was initially specified with the following components: (1) a 0,1 main-effects term for each hypothesized risk factor (i.e., gateway drug), indicating prior use; (2) an interaction term for each combination of the prior use main-effects terms; (3) a 0,1 main-effects to define the race category (i.e., African-American, non-African-American); (4) a 0,1 main-effects term to define the sex of the respondent; and (5) an interaction term to capture possible interaction between sex and race. Next, after the regressions were run once with all of these parameters, the statistically insignificant independent variable terms were removed from the models and the models were rerun. As a result, one notes in the table that different models—corresponding to different outcome drugs—may have different sets of independent variables. Also, particular independent variables may have been found to be statistically significant for one database and not for another.

Considering alcohol as a risk factor, one notes from Table 4 that, generally, it is not a strong risk factor, which is consistent with the contingency table analyses. On the other hand, the relative risks for illicit drug use given prior tobacco use are somewhat higher. For subsequent marijuana use given prior tobacco use, the relative risks (as approximated by the logistic odds ratios) are 2.5 in the YRBS, 1.57 in the NASHS, and 1.34 in the NLSY. For subsequent cocaine use given prior tobacco use, the relative risks are 1.2 for the YRBS, 2.95 for the NASHS and 1.44 for the NLSY.

The logistic regression analysis indicate that the sex of the respondent is a key variable in the models. This variable was coded as 1 if the respondent was a female and 0 if the respondent was a male. One notes in the tables that the odds ratios for the variable sex is less than unity for all databases in all models. This indicates that for a given prior-use drug, the relative risk of using the outcome drug is higher for males. In other words, if the population of interest is male and the relative risk is defined as being relative to a population of women, then the relative risks for the risk factor/outcome combinations will be higher than what is found for the general population. For example, Table 4 indicates that, in the NLSY, the relative risk of subsequent cocaine use given prior tobacco use after adjusting for race, sex, and other types of prior drug use is 1.44. Here, the term "relative" simply means relative to a non-tobacco user. On the other hand, if the relative risk is calculated for males who are prior tobacco users, and the risk is defined as being relative to people who both have not used tobacco and who are not males, then the relative risk is 2.44.

One notes here that the use of the sex variable is somewhat different here than in the case of the contingency tables. When considering the sex of the respondent in the contingency table analyses, separate analyses were performed within each sex category. The relative risks obtained were thus specific to a particular sex category and it was found that generally, the relative risk of going on to use illicit drugs given prior use of the one of the risk factors is higher for women than it is for men. The sex variable in the logistic regression, on the other hand, indicates that simply being male is a risk factor like alcohol and tobacco, and that males have a greater chance of using illicit drugs than do females (all other things being equal).

In addition to the 0,1 sex indicator variable, the 0,1 race variable (0 equals non-African-American, 1 equals African-American) was found to be significant in two of the three databases (the YRBS and the NLSY) and in both cases the odds ratio associated with the variable is less than unity. This suggests that after controlling for the other parameters listed in the models, African-American youth are less likely to use the outcome drugs in question than are non-African-American youth.

LOGISTIC REGRESSION BY AGE GROUP

In the NLSY the age of the respondent on each data record is not fixed because the database is longitudinally structured. Thus an age variable cannot be included as an independent variable when performing a regression analysis with this database. To take age into consideration, while at the same time performing a consistent analysis across all three databases, it was decided to repeat the unweighted regression analyses by age group. The way this worked for the NLSY is that for each separate age group analysis, alcohol, tobacco and other drug use information on the data record was counted only when the activity occurred while the respondent was not older than the age group category. For example, when analyzing the data for 15-year-olds in the NLSY, if tobacco use began at age 14, marijuana use at 15, and cocaine use at age 16, then the outcome event of subsequent marijuana use given prior tobacco use would have been counted, but the outcome event of subsequent cocaine use would not.

Unfortunately, this approach was not entirely successful. When separate logistic regressions were run by age category, it was frequently found in each of the databases that the reduction in sample size could not support the analysis: The standard errors for the prior-use model coefficients often became very large, making these coefficients statistically unreliable.

WEIGHTED LOGISTIC REGRESSION

The results of the weighted logistic regressions are presented in Table 5 and are, generally, consistent with the results from the unweighted regressions. As mentioned in an earlier section, using survey weights in a regression procedure is considered inappropriate by many in the statistical community. As mentioned earlier, however, using sampling weights in regression is a popular technique. Hence, results from this approach are provided for comparative purposes.

For the YRBS, the weighted logistic regression are almost identical to the unweighted results when the outcome event is defined to be subsequent marijuana use. For subsequent

Table 5

Logistic Regression Coefficients Standard Errors, and Odds Ratios for Predicting Use of Marijuana, Cocaine Psychedelics, and Amphetamines (weighted)

Database/Final Independent Variables	Predictor Variable (Outcome Drug)								
	(Model 1) Marijuana			(Model 2) Cocaine			(Model 3 Marijuana or Cocaine		
	Coef	S.E.	O.R.	Coef	S.E.	O.R.	Coef	S.E.	O.R.
NLSY									
Alcohol	-1.6	.05	.21	-.46	.08	.63	-1.49	.06	.22
Tobacco	.44	.06	1.56	.40	.06	1.49	.58	.09	1.79
Race	-.21	.10	.80	-.58	.13	.56	—	—	—
Sex	-.69	.05	.50	-.56	.07	.57	-.70	.05	.49
Race/Sex Interaction	-.35	.13	.70	-.94	.27	.39	-.37	.13	.69
Marijuana	—	—	—	2.74	.14	15.46	—	—	—
YRBS									
Alcohol	.42	.07	1.52	-.60	.29	.55	.37	.07	1.45
Tobacco	1.09	.07	2.98	1.20	.13	3.34	1.11	.07	3.03
Race	.23	.08	1.26	—	—	—	.20	.08	1.22
Sex	-.36	.05	.70	-.69	.12	.50	-.35	.05	.70
Marijuana	—	—	—	2.58	.25	13.13	—	—	—
NASHS									
Alcohol	.42	.12	1.52	—	—	—	.42	.12	1.53
Tobacco	2.05	.44	7.78	.99	.22	2.70	2.30	.45	9.99
Sex	-.48	.11	.61	—	—	—	-.63	.12	.53
Marijuana	—	—	—	2.73	.30	15.30	—	—	—
Alcohol/Tobacco Interaction	-1.34	.47	.25	—	—	—	-1.70	.48	.18

Note: Dash indicates that variable was not significant or not appropriate for model.

Table 5

cocaine use, the model coefficients are very similar for the sex and marijuana independent variables. For the alcohol and tobacco independent variables, however, the coefficients and odds ratios differ. For tobacco the odds ratio is higher, (3.3 compared with 1.2), and for alcohol it is lower (0.54 compared with 0.91). This latter odds ratio suggests that young alcohol users are about one-half as likely to go on to use marijuana than are alcohol nonusers. This result is not consistent with what was found in the contingency table analyses for the YRBS and is not credible. Although it is true that in the case of the NLSY, the odds ratios for alcohol in many of the models are less than unity, it is important to keep in mind, as indicated in an earlier section, that the NLSY data come from an earlier time period when illicit drug was more common among adolescents.

For the NASHS, the results for the weighted logistic regressions are again similar to those obtained in the unweighted case. Where differences occur, however, the results from the weighted regression seem counterintuitive. For example, when marijuana is considered the outcome drug, there is a 0,1 interaction term for alcohol and tobacco use (which equals 1 when prior alcohol and prior tobacco use are present) whose corresponding odds ratio is less than unity (0.25). With the inclusion of this term, the model suggests that alcohol users are 1.52 times more likely to go on to use marijuana than are non-alcohol users, tobacco users 7.78 times more likely than non-tobacco users, and users of both alcohol and tobacco 2.83 times more likely (when compared with nonusers of both alcohol and tobacco). This is not particularly credible.

In the case of the NLSY, the weighted logistic regression results differ very little from the unweighted runs. A few differences are apparent, however. For marijuana as the outcome event, for example, the race variable is significant, with an odds ratio equal to 0.8.

In summary, the values of the model coefficients for the weighted logistic regressions are generally very similar to those obtained from the unweighted regressions. In cases were discrepancies exist, the results from the unweighted regressions appear somewhat more credible.

VI. SUMMARY OF FINDINGS

Both the contingency table analyses and the logistic regression analyses suggest only a weak relationship between prior use of alcohol and subsequent use of marijuana or cocaine in all three databases. The relationships are somewhat stronger between prior tobacco use and subsequent marijuana use and prior tobacco use and subsequent cocaine use, although here, the relationships appear weaker in the NLSY. In the case of prior use of tobacco and subsequent use of cocaine, the relative risks obtained from regression analyses were 1.4 for the NLSY, 1.2 for the YRBS, and 3.0 for the NASHS. For prior use of tobacco and subsequent use of marijuana, the regression relative risks were 1.3 for the NLSY, 2.5 for the YRBS, and 2.4 for the NASHS.

In the case of the NLSY, most of the study participants were adolescents during a time when illicit drug use was more common than it is today. Although, as expected, adolescent drug use was higher in the NLSY than in the other two databases, the relative risk statistics for subsequent drug use given prior alcohol and tobacco use were lower in the NLSY. This suggests that, although illicit drug use has dropped for alcohol and tobacco users, illicit drug use has dropped at a disproportionally faster rate for alcohol nonusers and tobacco nonusers.

Results of the regression analyses were generally consistent with those obtained for the contingency table analyses, although the values of the odds ratios were higher in the contingency table analyses for relative risks involving subsequent use of cocaine given prior use of alcohol were 1.2 for the NLSY, 4.2 for the YRBS, and 4.1 for the NASHS. In the case of the regression analyses, none of these odds ratios was greater than unity. Results for the case of prior use of tobacco and subsequent use of cocaine are similar.

The regression analyses also indicate that being a male appears, in and of itself, to be a mild risk factor for marijuana use and for cocaine use. On the other hand, the regression models suggest African-American youth appear less likely to use illicit drugs (i.e., being African-American is not a risk factor). For all three databases, the sample sizes were to small to obtain statistically significant results when performing separate analyses by race.

Results from the contingency table analyses suggest that the relative risk of subsequent drug use given prior alcohol and tobacco use tend to decrease with age. In the case of the regression analysis, an age variable could not be included in the models since one of the databases (i.e., NLSY) was longitudinal. As an alternative, separate analyses were performed by age group. The resulting standard errors of the model coefficients using this approach, however, suggested that the models were unreliable. Results from the weighted regressions models were consistent with results from the unweighted models.

APPENDIX A

METHODOLOGY (PROGRAMMING INSTRUCTIONS FOR ABT)

This section provides detailed instructions for performing the analysis based on the concepts discussed above. Instructions are ordered and detailed in steps that relate to the necessary progression of the investigation.

STEP 1

For each database, calculate the relative risks and chi-square significance for all contingency tables suggested by the seven risk factors and six outcomes listed in Section I. When marijuana is considered as a risk factor or part of a risk factor, it should not be evaluated as an outcome. Hence, all outcomes involving marijuana should be skipped when the drug also is included as a risk factor or part of a risk factor. All results should be based on weighted counts using the sampling weight given in the databases.

When performing this analysis, the following should be noted. First, "prior use" for each risk factor is to be defined in terms of being prior to the outcome. Hence, for each record, the "age of first use" for the risk factor will have to be compared to the age of first use for the outcome. For the National Adolescent Student Health Survey, age of first use will be estimated by evaluating the variables, current age, current grade, and "grade of first use." The difference between the current grade and grade of first use will be calculated. The result then will be subtracted from the current age. Also, it should be noted that wherever possible, "first use" for the risk factors should pertain to first regular use.

Using the "A, B, C, D" notations for the contingency cells as given in Section II above, the record will fall into cell A if there is regular use of the potential risk factor, as well as subsequent use of the outcome drug; cell B if there is regular use of the potential risk factor and no use of the outcome drug; cell C if there is no regular use of the potential risk factor but reported use of the outcome drug; and cell D if there is no regular use of the potential risk factor and no use of the outcome drug. If the onset of use for the outcome drug occurs

concurrently with the onset of regular use of the risk factor (i.e., it is not possible to determine that the onset of use for the outcome is in fact subsequent to the onset of regular use for the risk factor), the record will not be included in any cell.

As indicated in the previous section, drug information in the National Longitudinal Survey of Labor Market Experience of Youth (NLSY) will not be counted if the age of onset is greater than 19 years of age for this part of the analysis. These data will be captured at a later stage.

For each risk factor-outcome combination, produce a 2-by-2 contingency table, the relative risk, and chi-square significance results.

STEP 2

Next, repeat the analysis, defining the seven risk factors in terms of "ever used regularly" rather than in terms of "prior regular use." If the tables based on the ever-used risk factors are substantially different than those obtained from the prior-use risk factors, this may indicate that defining the age of first use in terms of years (rather than years and months) is too broad a time period to capture the sequence pattern of drug use. If this seems to be the case, CSR, Incorporated, should be contacted before Abt proceeds further with the analysis.

STEP 3

Next, repeat Step 1, performing the analysis by (1) age group (13, 14, 15, 16, 17, 18, and 19 years), (2) by sex, and (3) within sex by race (African-American, or non-African-American). Complete nesting of age by sex by race will not be performed in order to limit the number of tables produced. Interaction relationships apparent only from complete nesting will be examined by other analyses.

For the NLSY database, add an additional age group category of 20 years and older for this breakout only. For the sex and race breakouts, drug use will not be counted in the NLSY if the age of onset is greater than 19 years of age.

Note that the age group variable corresponds to age at interview (determining the corresponding age for the NLSY is discussed below). Analyzing the data by this age variable will help us to determine when the transition from alcohol, tobacco, and marijuana to so-called harder drugs begins to take place.

For the NLSY database, age group classification can be determined by answering the following question: By the time the respondent was *X* years old, had the respondent ever used the outcome drug in question, and if so, did the respondent have prior involvement with the risk factor (i.e., prior to using the outcome drug)? A set of decision rules is given below to perform this classification.

Using the notation "A, B, C, D" for the contingency table cells as given in Section II above, the NLSY record will fall into one of cells A, B, C, or D, if the respondent ever belonged to the age group subsequent to the first interview (which took place in 1979). Once this determination is made, the respondent will be classified into the following:

- Cell A, if (1) age of first use for risk factor is less than the age group value, and (2) the age of first use for the outcome event is less than or equal to the age group value, and (3) age of first use for the risk factor is less than age of first use for the outcome.

- Cell B, if (1) age of first use for the risk factor is less than the age group value and (2) the age of first use for the outcome event is equal to zero or greater than the age group value (for the NLSY, age of first use equal to zero means never used).

- Cell C, if (1) age of first use for risk factor is equal to zero or greater than the age group value and (2) the age of first use for the outcome event is less than or equal to the age group value.

- Cell D, if (1) age of first use for risk factor is equal to zero or greater than the age group value and (2) the age of first use for the outcome event is equal to zero or greater than the age group value.

It is also important to note that many questions in the NLSY are repeated, even in situations where they may appear redundant. As a result, the information contained on a data record may not always be internally consistent. For example, the question "Have you ever used marijuana?" may be answered "yes" in one year and "no" in a subsequent year. Consequently, all variables in the NLSY pertaining to drug use and age of first use need to be examined when classifying a data record. In cases of conflicting data, drug use will be counted if any variable indicates its use. In cases where there is conflicting information for the age of first use, the information provided the first time will be used.

STEP 4

Perform a logistic regression without using sampling weights for each of the outcome events with each of the three databases. To perform the regression, create a model with the following terms:

- A 0, 1 main-effects term for each hypothesized risk factor (i.e., the gateway drugs), indicating any prior use. In the case of analyzing cocaine use as an outcome, for example, this would lead to three independent variables: one variable for any prior use of alcohol, one variable for any prior use of tobacco, and one variable for any prior use of marijuana.

- An interaction term for each combination of the 0, 1 variables discussed above (e.g., for the cocaine outcome, this yields three two-way interactions and one three-way interaction).

- One 0, 1 main-effects terms for the two race categories of African-American and non-African-American.

- A 0, 1 main-effects term for sex.

- An interaction term for each two-way interaction between sex and race.

- An age-of-first-use variable for each risk factor. The value of this variable will equal zero for cases where the drug has not been used.

After the regression is run the first time, all insignificant terms should be removed from the model and the model run again. It is suggested that this be done because the presence of extraneous terms in the model can have an impact on the values of the coefficients for the nonextraneous terms when the database is nonorthogonal.

STEP 5

Repeat the logistic regressions in Step 4 using the sampling weights.

STEP 6

Because of the structure of the NLSY database, an age variable cannot be included in the logistic models. This stems from the fact that each record in the database is prospective and reflects behaviors spanning several age groups. As a result, to take age into consideration, separate analyses need to be performed by age group.

Perform the logistic regressions in Steps 4 and 5 by age group category: 14, 15, 16, 17, 18, and 19 years.

For the NLSY, an additional age category for age 20 and above will be included. Also, note that each record in the NLSY will be included in the particular age group classification if the respondent has ever belonged to the age group subsequent to the initial 1979 interview. For the risk factor to be counted, the age of first use must be less than or equal to the age

group. If there is an outcome for a particular drug, each risk factor only will be considered to be present when its age of first use is less than the age of first use for the outcome. In addition, for the outcome to count, its age of first use also must be less than the age group category.

STEP 7

Perform a loglinear model test for each outcome drug for the three databases. For the main-effects variables, include terms for the following parameters:

- Prior tobacco use;
- Prior alcohol use;
- Race (i.e., African-American or non-African-American); and
- Sex.

Since many of the interactions are not needed, a hierarchical model should not be used. The only interactions that are of interest are those that pertain to the outcome variable. Along with the main-effects variables, the following interactions should be tested:

- Outcome*Risk Factor Drug 1*Risk Factor Drug 2*Race*Sex;
- Outcome*Risk Factor Drug 1*Risk Factor Drug 2*Race;
- Outcome*Risk Factor Drug 1*Risk Factor Drug 2;
- Outcome*Risk Factor Drug 1*Race*Sex;
- Outcome*Risk Factor Drug 2*Race*Sex;
- Outcome*Risk Factor Drug 1*Race;
- Outcome*Risk Factor Drug 2*Race;
- Outcome*Risk Factor Drug 1*Sex; and
- Outcome*Risk Factor Drug 2*Sex.

APPENDIX B

Table B-2.

Percent Outcome* and Relative Risks (RR) for Various Risk Factor/Outcome Combinations by Sex and Race

Risk Factor, Outcome	Male		Female		Male, Non-African American		Female, Non-African American		Male, African-American		Female, African-American	
	Percent Outcome	RR	Percent Outcome	RR	Percent Outcome	RR	Percent Outcome	RR	Percent Outcome	RR	Percent Outcome	RR
National Longitudinal Survey of Youth												
Alcohol, Marijuana	39.0	ns**	31.4	ns	39.2	0.5	32.4	0.5	38.0	0.5	25.2	0.5
Alcohol, Cocaine	18.9	ns	12.7	1.2	19.7	ns	13.8	ns	13.9	ns	4.3	ns
Alcohol, Psychedelics	7.5	0.6	4.3	0.7	8.2	0.6	4.7	0.6	2.6	ns	1.3	ns
Alcohol, Amphetamines	14.1	0.6	11.5	0.8	15.7	0.6	12.6	0.7	4.0	0.6	3.5	ns
Tobacco, Marijuana	67.9	ns	62.9	1.2	69.6	ns	65.6	1.2	58.0	ns	49.6	ns
Tobacco, Cocaine	26.7	1.5	21.4	2.6	28.5	1.6	23.2	2.5	17.1	ns	8.0	3.2
Tobacco, Psychedelics	12.2	1.7	9.1	2.9	13.7	1.7	10.1	2.8	4.5	ns	2.3	3.6
Tobacco, Amphetamines	22.9	1.6	20.0	2.0	26.1	1.7	22.0	1.9	6.3	ns	6.8	2.3
Youth Risk Behavior Survey												
Alcohol, Marijuana	29.1	1.6	24.7	2.0	29.2	1.7	25.9	2.4	27.9	ns	17.3	ns
Alcohol, Cocaine	7.2	3.0	4.8	12.5	7.7	3.4	5.5	14.3	3.6	ns	1.0	ns
Tobacco, Marijuana	49.7	2.0	39.4	1.9	51.0	2.2	39.5	2.0	21.0	0.6	36.7	1.4
Tobacco, Cocaine	16.2	5.0	8.4	5.4	16.3	4.7	8.6	4.8	13.7	6.3	2.9	ns
National Adolescent Student Health Survey												
Alcohol, Marijuana	22.9	1.6	19.4	1.9	23.3	1.6	19.0	2.2	19.2	ns	23.2	2.2
Alcohol, Cocaine	7.5	4.0	6.2	4.3	8.2	3.4	6.3	6.7	2.3	ns	5.0	ns
Alcohol, Psychedelics	5.0	8.3	3.8	14.8	5.6	7.1	4.2	12.3	0.2	ns	1.3	ns

*Defined to be the percentage of people having the risk factor who also have the outcome.

Table B-2 *(continued)*

Risk Factor, Outcome	Male		Female		Male, Non-African American		Female, Non-African American		Male, African-American		Female, African-American	
	Percent Outcome	RR	Percent Outcome	RR	Percent Outcome	RR	Percent Outcome	RR	Percent Outcome	RR	Percent Outcome	RR
Alcohol, Amphetamines	8.6	7.2	9.2	4.2	9.4	6.7	10.3	5.5	4.0	ns	2.8	ns
Tobacco, Marijuana	31.7	1.3	27.5	1.7	31.2	1.3	27.7	1.9	53.3	ns	15.7	ns
Tobacco, Cocaine	11.2	3.0	12.0	7.3	11.1	2.8	12.3	8.7	0.0	ns	8.2	ns
Tobacco, Psychedelics	7.4	3.6	7.4	12.3	7.3	2.9	7.6	12.5	0.0	ns	3.3	ns
Tobacco, Amphetamines	10.7	2.0	13.3	2.4	9.6	1.5	14.2	2.3	37.9	26.6	5.0	ns

Table B-3

Relative Risk By Age for Various Risk Factor/Outcome Combinations

Risk Factor, Outcome	Age							
	13	14	15	16	17	18	19	20
National Longitudinal Survey of Youth								
Alcohol, Marijuana	NA	1.1	0.6	0.6	0.5	0.5	0.5	ns*
Alcohol, Cocaine	NA	3.1	1.6	1.2	1.4	1.2	1.2	1.6
Alcohol, Psychedelics	NA	2.6	2.1	1.6	1.3	0.9	.80	0.7
Alcohol, Amphetamines	NA	1.3	1.5	1.2	1.1	0.8	0.8	0.8
Tobacco, Marijuana	NA	ns	1.2	1.3	1.3	1.1	1.1	1.0
Tobacco, Cocaine	NA	ns	2.3	2.8	2.6	2.4	1.9	1.6
Tobacco, Psychedelics	NA	ns	3.3	3.3	2.9	2.6	2.1	1.6
Tobacco, Amphetamines	NA	ns	3.6	2.6	2.8	2.1	1.8	1.5
Youth Risk Behavior Survey								
Alcohol, Marijuana	NA	2.5	3.1	1.4	1.3	1.4	NA	NA
Alcohol, Cocaine	NA	2.9	8.4	5.2	2.1	4.8	NA	NA
Tobacco, Marijuana	NA	3.6	2.3	1.8	1.6	1.8	NA	NA
Tobacco, Cocaine	NA	4.7	3.3	7.0	4.0	4.3	NA	NA
National Adolescent Student Health Survey								
Alcohol, Marijuana	1.8	ns	1.6	1.4	1.3	NA	NA	NA
Alcohol, Cocaine	ns	5.2	2.3	3.5	ns	NA	NA	NA
Alcohol, Psychedelics	5.9	7.3	7.5	5.4	ns	NA	NA	NA
Alcohol, Amphetamines	9.1	2.9	2.9	6.9	ns	NA	NA	NA
Tobacco, Marijuana	1.2	2.0	1.3	1.6	ns	NA	NA	NA
Tobacco, Cocaine	3.9	ns	3.9	4.2	4.5	NA	NA	NA
Tobacco, Psychedelics	ns	5.4	4.7	3.3	2.3	NA	NA	NA
Tobacco, Amphetamines	ns	3.0	1.8	2.7	ns	NA	NA	NA

*ns indicates that the chi-square statistic is not significant.

APPENDIX C

Table B-4

Logistic Regression Coefficients, Standard Errors, and Odds Ratios for Predicting Use of Marijuana, Cocaine, Psychedelics, and Amphetamines

Final Independent Variables	Predictor Variable (Outcome Drug)														
	Model 1 Marijuana			Model 2 Cocaine			Model 3 Marijuana or Cocaine			Model 4 Psychedelics			Model 5 Amphetamines		
	Coef	S.E.	O.R.	Coef	S.E.	O.R.	Coef	S.E.	O.R.	Coef	S.E.	O.R.	Coef	S.E.	O.R.
National Longitudinal Survey of Labor Market Experience of Youth															
Alcohol	-1.5	0.06	0.22	-0.42	0.09	0.66	-0.83	0.05	0.44	-0.90	0.13	0.40	-0.65	0.09	0.52
Tobacco	0.29	0.07	1.34	0.36	0.07	1.44	0.79	0.06	2.20	.52	0.11	1.68	0.56	0.08	1.74
Race	—	—	—	-0.52	0.10	0.59	—	—	—	-1.55	0.18	0.21	-1.37	0.12	0.25
Sex	-0.74	0.06	0.47	-0.52	0.08	0.59	-0.67	0.06	0.51	-0.70	0.12	0.50	-0.32	0.08	0.72
Race/Sex Interaction	-0.44	0.08	0.64	-0.98	0.23	0.37	-0.50	0.07	0.61	—	—	—	—	—	—
Marijuana	—	—	—	2.76	0.16	15.8	—	—	—	2.69	0.26	14.7	1.69	0.12	5.42
Youth Risk Behavior Survey															
Alcohol	0.25	0.06	1.30	-0.10	0.30	0.91	0.42	0.07	1.53	NA	NA	NA	NA	NA	NA
Tobacco	0.92	0.08	2.50	0.67	0.13	1.20	1.29	0.08	3.62	NA	NA	NA	NA	NA	NA
Race	0.18	0.06	1.20	-0.90	0.20	0.40	0.18	0.06	1.20	NA	NA	NA	NA	NA	NA
Sex	-0.56	0.05	0.57	-0.58	0.12	0.56	-0.55	0.05	0.58	NA	NA	NA	NA	NA	NA
Marijuana	—	—	—	2.70	0.20	14.94	—	—	—	NA	NA	NA	NA	NA	NA
National Adolescent Student Health Survey															
Alcohol	0.44	0.12	1.57	0.02	0.41	1.02	0.64	0.12	1.89	0.46	0.65	1.60	0.74	0.30	2.09
Tobacco	0.89	0.15	2.44	1.08	0.23	2.95	1.41	0.13	4.08	0.82	0.28	2.28	0.52	0.22	1.67
Sex	-0.62	0.11	0.54	-0.41	0.22	0.66	-0.68	0.11	0.51	—	—	—	—	—	—
Marijuana	—	—	—	2.74	0.34	15.54	—	—	—	3.24	0.51	25.59	1.48	0.22	4.41

Coef=Coefficient
S.E.=Standard Error
O.R.=Odds Ratio
Note: Dash indicates that variable was not significant or not appropriate for model.

RESEARCH ON PROGRESSION OF DRUG USE AND THE GATEWAY EFFECT

AUTHOR(s)	STUDY YEAR	SUBJECTS	METHODS	ANALYSIS	GATEWAY SUPPORTED	CONCLUSIONS
LONGITUDINAL STUDIES						
ELLICKSON, HAYS, AND BELL (1992)	Mid to late 80's	4,145 west coast 7-10th graders	Self-admin Surveys	Longitudinal Guttman Scalogram Analysis	Yes	Cocaine has not supplanted marijuana or pills as the preferred drug in subjects. See strong support for hypothesis that increased involvement with legal drugs, both alcohol and cigarettes, precedes use of cocaine and other illicit drugs. Support hypothesis that adolescents drug use is cumulative; teens continue use of gateway drugs while experimenting with others. *Data provide weak support for treating cocaine initiation as a stage that is distinct from initial use of illicit drugs other than marijuana or pills.*
FLEMING, LEVENTHAL, GLYNN, AND ERSELER (1989)	*1979-1980 and 1981-1982*	*1,007 6-10th grade students from Milwaukee, Wisconsin public schools.*	*Face-to-face interviews.*	*Guttman Scaling* *Chi-square*	*Implied.*	*Point to deficiency in research in focusing on illegal drug use, excluding possible substance use starting at younger ages.* Included legal drugs in their sequence, citing them as most widely available to adolescents. Findings supportive of drug use sequencing. Found that, if subjects start with one substance, that substance will most likely be cigarettes, not marijuana or alcohol. *STRENGTH: Not a retrospective study. Also, use of face-to-face rather than questionnaire. Contains good discussion of the way's regarding drug use.*
KANDEL (1975)	1971	7th and 8th Grade Students in New York State. N=5469 (first and second survey) and 983 (third survey). Third group was sub-set of first.	Structured, self-admin survey, completed: initially, 3-6 month after initial, and 3-9 months post graduation	Scalogram analysis	Implied.	Found progression to start with legal drugs, beer/wine and cigarettes or hard liquor at first: Legal drugs are necessary intermediates between nonuse and marijuana use. Direct progression from nonuse to illegal use almost never exists. Marijuana is a crucial step on the way to other illicit drugs. Progression to marijuana appears predominantly among adolescents who have already progressed to tobacco or hard liquor. No youths in studied cohorts progressed from beer and wine to illicit drug use without first using hard liquor or cigarettes. *Data shows clear sequence in drug use, but not causality.* *Although longitudinal in design, time frame is very limited.*
KANDEL, YAMAGUCHI, AND CHEN (1992)	1990	1,160 individuals previously studied in Kandel's 1975 study.	Structured personnel interviews	Modified Guttman Scaling	Implied.	Defined and expanded Kandel's previously identified stages of drug use, introducing a fourth stage: legal drugs (alcohol and tobacco), marijuana, illicit drugs other than marijuana and medically prescribed drugs. Also confirmed that for men, progression to illicit drugs is dependant on prior use of alcohol, for women either cigarettes or alcohol is sufficient for the progression to occur.
KENCOMB AND BENTLER (1986)	1976-1984	654 7th, 8th, and 9th graders in 11 Los Angeles County schools. Data collected at 3 time periods, 1, 5, and 9 years.	Questionnaire	Chi-square Structural Equations (path)	Yes.	Findings indicate that sequencing may be more complex than thought, suggesting several smaller ones. Alcohol is not shown to be the major gateway drug it is believed to be, but rather seems rather stable and enduring onto itself with little effect on other drug use. The role of cigarettes in progression to into cannabis and hard drug use is great. Identify cigarettes as true gateway drug facilitating increased involvement in hard drugs. *Non-prescriptive drug use seems to be at the end of a mini-sequence of drug use progression but does not, in and of itself, seem to lead to use of other drugs.* *STRENGTH: Longitudinal Data. Included Non-prescription drug use in progression.*

AUTHOR(s)	STUDY YEAR	SUBJECTS	METHODS	ANALYSIS	GATEWAY SUPPORTED	CONCLUSIONS
YAMAGUCHI AND KANDEL (1984)	1980-1982 ???	10325 high school graduates: subjects surveyed in first round of Kandel, 1975. Mean age = 22.7	Personal household interviews, using predominantly structured items with closed responses.	Modified Guttman Scaling	Implied.	Expanded sequencing to include prescribed psychoactive drugs during young adulthood. Found gender differences for drug use progression in use of alcohol (for males) and cigarettes (for females): Men: use of alcohol precedes marijuana; alcohol and marijuana precede other illicit drugs; and alcohol, cigarettes and marijuana precede the use of prescribed psychoactive drugs. Women: either alcohol or cigarettes precede marijuana; alcohol, cigarettes, and marijuana precede other illicit drugs; alcohol and either cigarettes or marijuana precede prescribed psychoactive drugs. ***STRENGTH:*** *Longer term longitudinal study. Went to lengths to test a variety of variable orderings, placing illicit drugs ahead of tobacco, for instance, of the use of alcohol not preceding the use of marijuana.*
CROSS SECTIONAL STUDIES						
BLAIR-TEMPLE AND LO (1992)	1987 ???	1093 13-17 year olds	Interviews in the subjects home with a self-completed questionnaire.	Guttman	Yes	Findings supported a direct path from alcohol/tobacco to illicit drugs other than marijuana as well as a path from alcohol/tobacco to marijuana to other illicit drugs. Support findings that drug use is sequential and cumulative. Identify both alcohol and tobacco as gateway drugs with tobacco having greater predictive value. ***Supports Kandel (1989) that the use of a particular drug does not inevitably lead to the use of other drugs higher up in the sequence, although the use of a drug lower in the sequence is a good predictor of transition to the next stage (after controlling for age and other covariates.***
DONOVAN AND JESSOR (1983)	1974 and 1978 survey data	1974 data: 13,122 7th-12th graders 1978 data: 4,918 10-12th graders	Analysis of National Study of Adolescent Drinking Data	Guttman Scalogram	Implied	Problem drinking could be placed between use of marijuana and the use of pills in the progression of drug using behavior.
COLDS AND JOHNSON (1994)	1984-89	994 "serious drug users"	Face-to-face interviews	T-Test Logistic Regression Model Odds Ratios	Yes	***Subjects generally reported onset to alcohol at a slightly earlier age than marijuana.*** Alcohol played less serious role as first substance used than would be predicted from the developmental models based on the general population. As many or more reported first use as marijuana. ***Subjects born in 1963 and later were more likely to have used marijuana prior to alcohol.*** Marijuana fills intermediate role along pathway to the use of more serious substances such as cocaine powder, I.V. drugs, and crack. Did not include tobacco in their analysis. Data collected retrospectively.
HUBA, WINGARD AND BENTLER (1981)	1975	1,634 7-9th grade students	questionnaires	Maximum Likelihood Estimation Under Confirmatory Factor Analysis Causal Modeling with Latent Variable Procedures	Implied	Found that both progressive (or simplex) and latent variable model models fit well, displaying a basic alcohol-marijuana-hard drug sequencing of drug use initiation.
KANDEL AND YAMAGUCHI (1993)	1988	1188 High School Seniors	Self-Admin Survey	Modified Guttman Scalogram	Implied	Cigarettes and alcoholic beverages (especially beer and wine) were initiated at an earlier age than illicit drugs; *marijuana initiated an average of 3.5 years after cigarettes and alcohol, and cocaine and crack slightly more than 1 year after marijuana.* Progression to crack occurred only when experimentation with both alcohol and tobacco have taken place before marijuana. Age of onset to drugs is crucial to progression to hard drugs. Adolescents who progress to cocaine, especially crack, began smoking cigarettes, drinking alcohol, or smoking marijuana 2 years earlier, on the average, than those who did not go on to cocaine. Supported varying importance of alcohol and tobacco for males and females.

AUTHOR (s)	STUDY YEAR	SUBJECTS	METHODS	ANALYSIS	GATEWAY SUPPORTED	CONCLUSIONS
MERRIL, FOX, LEWIS, AND FULVER (1994)	1991	32,594 American adolescents and adults	1991 National Household Survey on Drug Abuse	*NOT PROVIDED*	Yes	Show strong support for drug use progression (alcohol and tobacco, to marijuana, to hard drugs) as well as for the different roles played by alcohol and tobacco for males and females. Confirmed that the earlier gateway drug use begins, the more likely they are to: use illicit drugs (more than half of adults who began smoking before age 15 tried illicit drugs sometime in their lifetime; only one-quarter of those who started after age 17 tried illicit drugs) and, to use illicit regularly (adults who began smoking before the age of 15 are three times more likely to be regular drug users than adults who did not start smoking until after 17). Findings show that adults using gateway drug are more likely to go on to other drugs (1.6 times more likely), adults who use multiple gateway drugs that chance increases (3.0 for use of two, 19.5 for use of three), and individuals whose adolescent gateway drug use was more frequent are more likely to go on to other drug use (e.g. "a child who smokes more than 15 cigarettes a day is more than twice as likely to use an illicit drug and 16 times more likely to use cocaine than one who smokes but on a less than daily basis" p. 33).
MILLS AND NOYES (1984)	1978-1979	2,036 8, 10 and 12th grade Maryland students. Validated on a 2,614 student sample from a later survey.	Questionnaires	Guttman scaling Principal-Components Analysis Chi-square Regression Analysis Pearson Correlations		Data support progression of drug use behavior with sequence starting with legal drugs rather than marijuana: non-use (of any substance) to use of alcohol and cigarettes, to use of marijuana, to use of hard drugs. Data demonstrated a cumulative pattern to drug use with users adding new drugs to all previous drugs rather than moving on and stopping use of earlier ones. Found significant correlations between age at first use and number, as well as frequency, of drugs used. *Found marijuana to be a significant predictor of pill, cocaine, and hallucinatica use.*
TORABI, BAILEY, AND MAJID-JAHBARI (1993)	1982	20,429 5-12th grade students from Indiana	Questionnaire	Chi-Square Step Wise Multiple Regression	Yes	Confirmed that cigarette smoking (in grades 5-12) is a strong predictor for use of alcohol and other drugs. Use by non-smokers of drugs other than alcohol and smokeless tobacco was almost non-existent. Reported use of alcohol by nonsmokers was 1/3 the rate reported by one-pack-a-day smokers. Smokers were much more likely than non-smokers to use all drugs listed in survey.
MELTZ AND BARNES (1985)	1983	27,335 7-12TH Grade Students in NYS	Anonymous, self-admin. survey	Guttman Scaling, assessing ever-used variables	Yes	*Over-the-counter drugs reduces the availability.* Strong association for Alcohol-Marijuana-Pills-Hard Drugs progression of older students. Younger students, particularly female, showed tobacco to be important step from alcohol to marijuana. *Shows trends for different ethnic groups and gender.* Alcohol entry drug for all groups. Unless alcohol is used, there is very little use of any other drug, including tobacco and over-the-counter drugs. *Focus on the role of alcohol, rather than other drugs, as the gateway drug.*
YU AND WILLIAMS (1992)	1986 (date of survey data used)	3,000 18-24 year old adolescents from NYS. Sample included telephone households within 11 pre-selected counties that represented the characteristics of the youth alcohol-related crashes of the state.	Telephone Survey	Guttman Scaling and Logit Analysis (to assess causal patterns)	Yes	Results suggest a progression in the drug use pattern *from alcohol to alcohol and cigarettes, and from alcohol and cigarettes to alcohol, cigarettes, and marijuana, supporting the Gateway concept. Suggest, however, that age of onset of use of alcohol can significantly impact on the development of future drug use behaviors.* Found that age of onset significantly impacts on future use of cigarettes and marijuana, *with the age of onset at which the results become significant differing for males (age 21)* *Early onset of alcohol use effects the current use of alcohol (increasing the chance of this for females (13 and 16), current drinking significantly), which further intensifies the use of cigarettes; alcohol-cigarette use increases the chance of using marijuana.* Cigarettes are more important in affecting woman's future drug behavior than man's.

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