The Natural History of Drug Use from Adolescence to the Mid-Thirties in a General Population Sample

Kevin Chen, PhD, and Denise B. Kandel, PhD

ABSTRACT

Objectives. This study sought to describe patterns of initiation, persistence, and cessation in drug use in individuals from their late 20s to their mid-30s, within a broad perspective that spans 19 years from adolescence to adulthood.

Methods. A fourth wave of personal interviews was conducted at ages 34–35 with a cohort of men and women (n = 1160) representative of adolescents formerly enrolled in New York State public secondary high schools. A school survey was administered at ages 15–16, and personal interviews with participants and school absentees were conducted at ages 24–25 and 28–29. Retrospective continuous histories of 12 drug classes were obtained at each follow-up.

Results. There was no initiation into alcohol and cigarettes and hardly any initiation into illicit drugs after age 29, the age at which most use ceased. The largest proportion of new users was observed for prescribed psychoactives. Periods of highest use since adolescence based on relative and absolute criteria were delineated. Among daily users, the proportions of heavy users declined for alcohol and marijuana but not for cigarettes.

Conclusions. Cigarettes are the most persistent of any drug used. Drug-focused interventions must target adolescents and young adults. (*Am J Public Health.* 1995;85:41–47)

Introduction

Published research on the natural history of drug use in the general population is scanty.[1] Most knowledge about age-related trends in the use of various drugs derives from cross-sectional surveys of the population, which do not inform on the natural history of drug use by individuals. Furthermore, age comparisons based on different cohorts confound maturational changes associated with chronological age and historical effects on different cohorts. To identify maturational processes, longitudinal data are required, preferably from a cohort-sequential study in which successive cohorts are followed over time. Monitoring the Future, which has followed national cohorts of high school seniors since 1975 and 8th and 10th graders since 1991, represents a unique example of such a design.[2] However, little has been published from this study on the natural history of drug use.[3] Data from single cohorts can provide important hypotheses, but these need to be confirmed by data from other cohorts.

This is a further report on the natural history of the use of legal, illegal, and medically prescribed drugs in a general population cohort that we have followed for 19 years. Two earlier articles covered the 9-year period from ages 15–16 to ages 24–25,[4] and the subsequent 4-year period to ages 28–29.[5] This article extends the period of observation to ages 34–35. While we were particularly concerned with patterns of change over the last interval, we also considered overall patterns of use within the 19-year span covered by our investigation. Follow-up of the cohort through their mid-30s allowed a detailed monitoring of drug behavior after the period of risk for initiation into licit and illicit drugs ended.

Methods

The analyses are based on three follow-ups (in 1980, 1984, and 1990) of a cohort (n = 1160) first contacted in 1971. The cohort represents adolescents enrolled in grades 10 and 11 in New York State public secondary schools in fall 1971. In the original two-stage sample, students were selected from a stratified sample of 18 high schools and a clustered sample of homerooms stratified to represent the different grades within each school.[6] For the first follow-up in 1980, the target population was from the enrollment list of half the homerooms from grades 10 and 11, with homerooms that reported high marijuana use being sampled at twice the rate of the others. Students who had not participated in the initial survey and who were presumably chronic absentees were also selected (and sampled at a lower rate) to permit unbiased estimates of the former student population at the adult follow-up. Completion rates were 81.0% in 1980, 92.5% in 1984, and 95.7% in 1990 (excluding those deceased). Overall, 71.5% (n = 1160) of the initial target sample of students (n = 1622) on the 1971 school enrollment rolls who were still alive were reinterviewed in 1990 at ages 34–35; 545 of the 1160 students (weighted) were from

Kevin Chen and Denise B. Kandel are with the Department of Psychiatry, Columbia University, New York, NY. Dr Kandel is also with the School of Public Health at Columbia University and the New York State Psychiatric Institute.

Requests for reprints should be sent to Denise B. Kandel, PhD, Department of Psychiatry, 722 W 168th St, Box 20, New York, NY 10032.

This paper was accepted August 12, 1994.

Editor's Note. See related editorial by Robins (p 12) in this issue.

TABLE 1—Lifetime Prevalence of Drug Involvement, Initiation, and Cessation of Drug Use from Ages 28–29 (1984) to Ages 34–35 (1990), among Men

Class of Drugs	Lifetime Prevalence,[a] 1990		Initiated Use after 1984		Stopped Use		Used in Past Year in 1990	No. Total Users
					By 1984	Between 1984 and 1989		
	%	SE	% Total Cohort[a]	% among Users	% among Users	% among Users	% among Users	
Alcohol	99.2	0.6	0.2	0.2	3.3	5.0	91.7	531
Cigarettes	80.0	3.1	0.3	0.4	41.2	6.2	52.6	428
Marijuana	78.9	3.1	0.3	0.4	61.4	13.3	25.3	423
Any other illicit drugs[b]	56.0	3.4	0.6	1.1	62.8	19.1	18.2	300
Cocaine/crack	45.9	3.1	1.4	3.1	63.5	21.2	15.3	246
Psychedelics	32.6	2.0	0.5	1.5	88.8	8.7	2.5	175
Heroin	7.6	0.7	0.6	7.9	NA	NA	NA	40
Minor tranquilizers (own)	22.0	1.8	1.6	7.2	69.3	15.7	15.0	118
Sedatives (own)	23.9	1.8	0.4	1.7	87.0	6.3	6.7	128
Stimulants (own)	32.3	2.0	0.9	2.8	90.2	5.1	4.6	173
Any prescribed psychoactives[c]	37.5	2.1	5.0	13.3	67.4	20.4	12.1	201
Minor tranquilizers (Rx)	30.2	2.0	5.2	17.2	64.0	22.5	13.4	160
Sedatives (Rx)	11.9	1.4	1.2	10.1	79.4	11.4	9.2	63
Stimulants (Rx)	5.0	0.9	0.2	4.0	86.5	10.2	3.3	27

Note. NA = not available.
[a]Based on total weighted male cohort (n = 535). Standard errors (SEs) adjusted for design effects.
[b]Any illicit drugs other than marijuana, including cocaine, psychedelics, heroin, and nonprescribed minor tranquilizers, sedatives, and stimulants.
[c]Prescribed minor tranquilizers, sedatives, and/or stimulants.

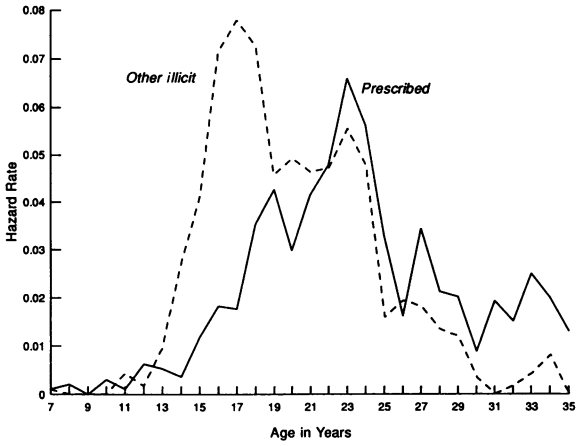
TABLE 2—Lifetime Prevalence of Drug Involvement, Initiation, and Cessation of Drug Use from Ages 28–29 (1984) to Ages 34–35 (1990), among Women

Class of Drugs	Lifetime Prevalence,[a] 1990		Initiated Use after 1984		Stopped Use		Used in Past Year in 1990	No. Total Users
					By 1984	Between 1984 and 1989		
	%	SE	% Total Cohort[a]	% among Users	% among Users	% among Users	% among Users	
Alcohol	98.8	0.6	0.3	0.3	8.8	7.5	83.9	617
Cigarettes	78.4	2.9	0.5	0.6	43.6	8.7	47.7	490
Marijuana	69.2	3.1	0.0	0.0	76.4	9.4	14.3	432
Any other illicit drugs[b]	42.8	3.6	1.5	3.5	74.2	13.0	12.7	268
Cocaine/crack	29.1	2.5	1.1	3.8	70.6	18.1	11.3	182
Psychedelics	20.4	1.6	0.8	3.9	92.1	1.5	6.1	127
Heroin	1.0	0.3	0.5	50.0	NA	NA	NA	6
Minor tranquilizers (own)	19.2	1.6	1.4	7.3	81.4	9.5	9.2	120
Sedatives (own)	15.1	1.4	0.1	0.7	96.8	1.9	1.3	95
Stimulants (own)	21.4	1.6	0.8	3.7	95.2	2.2	2.6	132
Any prescribed psychoactives[c]	50.4	2.0	5.5	10.9	61.6	21.2	17.1	315
Minor tranquilizers (Rx)	42.3	2.0	5.8	13.7	61.0	21.8	17.2	264
Sedatives (Rx)	12.6	1.3	2.7	21.4	65.5	21.3	13.2	79
Stimulants (Rx)	12.0	1.3	0.4	3.3	88.0	5.8	6.2	75

Note. NA = not available.
[a]Based on total weighted female cohort (n = 625). Standard errors (SEs) adjusted for design effects.
[b]Any illicit drugs other than marijuana, including cocaine, psychedelics, heroin, and nonprescribed minor tranquilizers, sedatives, and stimulants.
[c]Prescribed minor tranquilizers, sedatives, and/or stimulants.

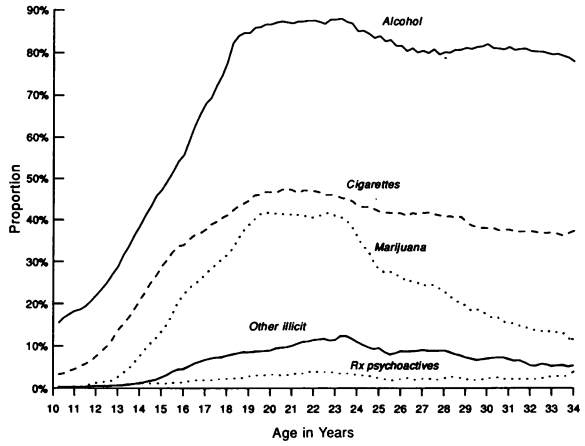
high marijuana-using homerooms; 281 (weighted) were former school absentees.

The structured interview schedule included a chart designed to reconstruct the respondents' drug histories on a month-by-month basis. Information was collected on 12 drug classes in 1980 and 1984: cigarettes, alcoholic beverages, marijuana, psychedelics, cocaine, and heroin, and the medical and nonmedical use of six classes of psychotropic drugs (methadone, minor and major tranquilizers, sedatives,



Note. Unweighted sample, n = 1156.

FIGURE 1—Age-specific hazard rates for illicit drugs other than marijuana and prescribed psychoactive drugs.



Note. Weighted sample, n = 1160.

FIGURE 2—Current monthly use of cigarettes, alcohol, marijuana, other illicit drugs, and prescribed psychoactive drugs, by age.

stimulants, antidepressants, and opiates other than heroin). Because there were very few lifetime users of heroin, methadone, and prescribed antidepressants, only limited questions were asked about these drugs in 1990. As per current definitions, the nonmedical use of pills was considered to be illicit. Colored pill charts developed for general population surveys[7] were shown to respondents to increase the accuracy of their reports about their use of minor tranquilizers, sedatives, and stimulants. At each follow-up, respondents were asked in what months and years they had used each class of drugs; when, how often, and how much (the latter only for alcohol, cigarettes, and marijuana) they had used the drugs at the highest intensity since the prior interview; and how often they had used each class of drugs within the past 12 months. While age of onset was ascertained for all users, the detailed retrospective drug histories were obtained only for persons who had ever used each drug class at least 10 times. Chronological time lines recorded the timing of use of different drugs on the chart.

The sampling weights took into account all relevant features of the sampling design, including the oversampling of high marijuana-using homerooms and the lower sampling of former absentees, and adjusted for the differential participation of the target follow-up sample in each survey. The random subgroup method was used originally to estimate the sampling design effects,[6] which ranged from 0.6 for heroin use, to 1.0 for use of pills on one's own, to 1.8 for use of cigarettes or "any illicit drug." These effects were used to determine the standard errors for the current data. Because design effects were not available for prescribed psychotropic drugs, they were estimated at around 1.0 under the assumption that use of these drugs would not be clustered.

There were few statistically significant differences on 1984 characteristics between participants and nonparticipants in the 1990 survey. The sharpest differences were in the less favorable attitudes toward the 1984 interview expressed by nonparticipants. Nonparticipants were also lighter cigarette smokers, and were somewhat less likely to have used cocaine but more likely to have used illicit drugs other than marijuana. Compared with the initial high school sample, the reinterviewed cohort reflected greater attrition of minorities than of Whites. In 1971, 79.5% were White; in 1990, 86.7% were White.

As noted previously,[4,5] analyses based on retrospective reports will be affected by biases inherent in such reports.* Unreliability in recall affects the results to an unknown degree and must be kept in mind in interpretating the data.

Results

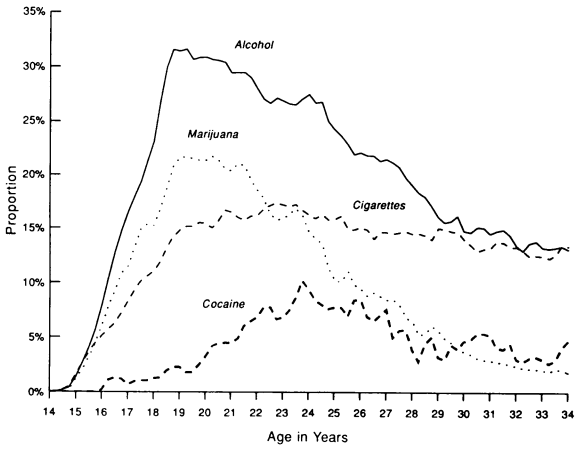
Overall Prevalence, Initiation, and Cessation

The lifetime prevalence of usage of the 12 different drugs by ages 34–35 and the proportions of those initiating and ceasing use over the prior 6-year interval are presented separately for men and women in Tables 1 and 2. Overall, most active patterns of change in drug behavior, whether initiation or cessation, occur by the late 20s.

Initiation. Almost no individuals initiated use of any legal or illegal drug after age 29 (Tables 1 and 2, cols 3 and 4). The highest rates of initiation among men and women are observed for medically prescribed substances. Among those initiating use of a nonmedical drug, the highest rates are observed for heroin and nonprescribed minor tranquilizers. Slightly more than 1% of men and women initiated cocaine use after age 29, representing only 3.1% of lifetime male users and 3.8% of lifetime female users.

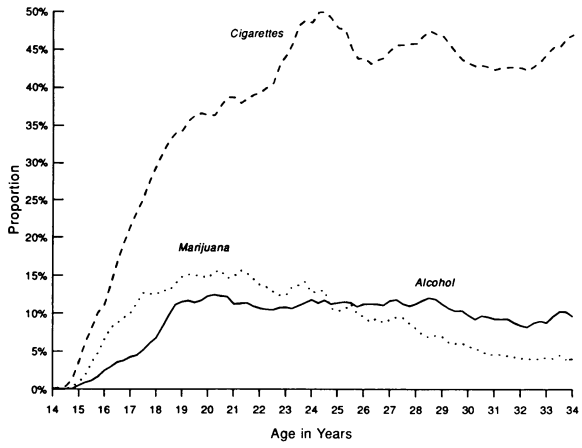
Thus, the previously published hazard functions through ages 28–29 adequately portray the periods of risk for initiation into alcohol, cigarettes, mari-

*Although validity of recall has been previously established for reports of certain drug use patterns,[8–10] underreporting, telescoping, and distortions have generally been shown to affect recall of various life events.[11] As stressed by Featherman,[12] distortions in retrospective reports may not necessarily be greater than those in contemporaneous ones. Event history analyses that were based on focal respondents' and spouses' independent retrospective monthly accounts of their marijuana use between ages 24–25 (1980) and 28–29 (1984) revealed significant effects of spells of marijuana use by one spouse on the other. Such effects confirm the reliability and validity of the drug use reports.



Note. For cigarette smokers, criterion is quantity of cigarettes smoked daily. For alcohol, n = 1130; cigarettes, n = 764; marijuana, n = 696; cocaine, n = 244 (weighted).

FIGURE 3—Periods of highest individual frequency of use for alcohol, cigarettes, marijuana, and cocaine, by age, as a proportion of those who had used each drug class at least 10 times by ages 34–35.



Note. Near-daily or daily use is defined as occurring at least four to six times a week; for cigarettes, the definition is restricted to daily use—that is, 7 days a week. For alcohol, n = 1130; cigarettes, n = 764; marijuana, n = 696 (weighted).

FIGURE 4—Near-daily or daily use of alcohol, cigarettes, and marijuana as a proportion of those who used each drug class at least 10 times by ages 34–35, by age.

juana, and cocaine.[5] The major risk periods for initiation into alcohol, cigarettes, and marijuana are mostly over by age 20, with peaks occurring at ages 16 for cigarettes and 18 for alcohol and marijuana. The risk for cocaine initiation appears to peak at ages 21 to 24 and tapers off by age 30. The overall patterns of risk are very similar for men and women.

Hazard functions through ages 34–35 for use of illicit drugs other than marijuana (including the nonmedical use of pills) and the medically prescribed use of sedatives, minor tranquilizers, and stimulants are shown in Figure 1 for the total sample. (Survival analysis in SPSS can only be implemented on unweighted data.) The curves have similar shapes but cross at about ages 22–23. The hazards for use of illicit drugs are higher than those for use of prescribed drugs prior to that age and are lower afterwards. For both types, the hazards decline sharply after age 24. The hazards for the prescribed drugs are generally higher for women than for men (data not presented).

Cessation. From the late 20s to the mid-30s, a much higher proportion of users stopped than started using drugs (Tables 1 and 2, col 6). Individuals were defined as having stopped using a drug during the interval if they reported using it within the last 12 months in 1984 but not in 1990. About 10% of marijuana users and a fifth of cocaine users stopped their use during this period. However, most of those who ever stopped did so prior to their late 20s (Tables 1 and 2, col 5). For every drug class except psychedelics and medically prescribed psychoactives, a higher proportion of men than women continued to use actively through their mid-30s.

Of all the drugs, alcohol and cigarettes show the most persistence. Among the illicit drugs, persistence is highest for marijuana, followed by cocaine and nonprescribed minor tranquilizers. Minor tranquilizers also show the most persistence among the prescribed psychotropics.

Periods of Stabilization and Decline in Prevalence of Drug Use from Adolescence to Adulthood

The drugs were combined into five classes: cigarettes, alcohol, marijuana, other illicit drugs (psychedelics, cocaine, heroin, nonprescribed use of minor tranquilizers, sedatives, and stimulants), and medically prescribed psychoactive drugs. After they were so classified, their use in any monthly period during the retrospective 19-year follow-up was examined. The 3-month moving averages of monthly use are shown in Figure 2.

The overall shapes of the curves are parallel for men and women, although men consistently have higher rates of use except for prescribed psychotropics (sex-specific data not presented). The sex differences are attenuated for cigarette smoking compared with alcohol and marijuana.

Following sharp increases during adolescence, usage of alcohol and cigarettes stabilizes in the late teens and declines slightly in the late 20s. By contrast, following continuous increases through age 19 and stabilization for a period of 4 to 5 years thereafter, usage of marijuana begins a continuous decline approximately at ages 23–24. By ages 34–35, only 25.3% of male users and 14.3% of female users (19.8% total) were still using marijuana within the past year (see Tables 1 and 2, col 7), compared with 51.0% of male users and 35.2% of female users (41.7% total) during the period of highest usage from ages 19 to 24.

The usage pattern for illicit drugs other than marijuana is similar to that for marijuana. During the early 20s, when usage is most prevalent, almost three times as many men as women use illicit drugs other than marijuana (data not presented). Although 56.0% of men and 42.8% of women (48.9% total) report having ever used illicit drugs other than marijuana in their lifetime (see Tables 1 and 2, col 1), the maximum proportion of users at any one point in time is only 18.9% for men and 7.5% for women (12.4% total). Following initiation, there is less persistence in the use of illicit drugs

than there is in the use of alcohol and cigarettes.

The overall proportions using prescribed psychoactive drugs, although not high, remain flat throughout adulthood and neither decline nor peak at any time by ages 34–35. The low overall usage rates (2% to 4% on average) contrast with the high cumulative level of lifetime prevalence (37.5% for men and 50.4% for women) (Tables 1 and 2, col 1) and are consistent with time-limited medical prescriptions. In contrast to other classes of drugs, a higher proportion of women than men reports using medically prescribed psychoactives (data not presented).

Periods of Highest Drug Use

A maturational trend in the use of marijuana and alcohol appears more clearly from *periods of highest use* than from use per se. At each survey, individuals noted their period of highest use for each drug since the prior survey. Their entire cumulative histories from 1971 to 1990 were scanned, and their periods of overall highest use* for each drug class were determined. A highest use period was defined (1) relative to each individual's history, irrespective of the actual frequency of use; and (2) as an absolute, based on the criterion of daily (or near-daily) use.

Periods relative to each individual user's history. For alcohol and marijuana, the periods of relative highest use peak in late adolescence and early adulthood, from ages 19 to 21 for alcohol and ages 19 to 22 for marijuana (see Figure 3). The subsequent decline, sharper for marijuana than for alcohol, continues until the end of the observation period. For most individuals, the late teens and early 20s are the years of their heaviest drinking and marijuana use. The proportions are consistently higher for alcohol than for marijuana, and higher for both of these two substances than for cigarettes and cocaine throughout the early 20s.

*Highest use period was defined by frequency of use for all drugs except cigarettes. For cigarettes, quantity smoked daily was also taken into account. For respondents who did not report any high use during each of the three follow-up intervals, the highest frequency of use reported for the 12 months preceding each survey defined the period of highest use. Since, at any particular point in time, highest use was defined in relation to drug use up to that time, the periods of highest use may shift as individuals age. What was defined as a period of regular use at a particular time may become a period of high use in light of a subsequent decrease in use.

The contrast between cigarettes and alcohol or marijuana is striking. It was noted earlier[5] that the proportions reporting highest periods of smoking increased sharply through the early 20s and appeared to stabilize by age 22. The longer term follow-up indicates only a slight decline in these proportions by ages 34–35. Cigarette smoking appears to be the most stable of the drug behaviors with respect to quantities consumed.

Periods of daily (or near-daily) use. In the absence of diagnostic criteria to identify cases of substance abuse, daily or near-daily drug use, which have been used as criteria of problematic drug use,[2,13] were examined as objective indicators of substantial involvement. Heaviest use for alcohol and marijuana was defined as near-daily use (i.e., four or more times a week); for cigarettes, it was defined as daily use.

Among those who ever used each drug at least 10 times, the proportions of daily or near-daily users can be examined only for cigarettes, alcohol, and marijuana; for other classes of drugs, the proportions are too low (see Figure 4). The relative positions of the drugs and the shapes of the curves differ from those based on a relative definition of highest use. Except for marijuana, these curves are relatively flat, and the proportions of daily users among lifetime users are consistently much higher for cigarettes than for the other two drugs. The sharply delineated peak periods observed for alcohol and marijuana when defined by a relative criterion disappear with the objective and identical criterion of daily (or near-daily) use for all individuals. The proportions of daily drinkers or smokers as a proportion of all drinkers or smokers remain essentially flat from age 19 onward through the mid-30s, the end of our observation period. About 12% of all drinkers drink at least four times a week; about 45% of all smokers smoke daily. The contrast in the relative and absolute curves for alcohol indicates that the quantities drunk vary more over time than do the proportion of daily drinkers and are much greater in the early 20s than in subsequent years. This is documented directly below.

Near-daily use of marijuana reveals a slight maturational pattern, with a peak in the late teens and early 20s. The decline, however, is much more gradual than that observed when highest use period is based on the relative criterion.

Quantities used during periods of daily use. The quantities of drugs used during periods of daily use are not consistently related to maturational trends in the prevalence of daily use for each drug class. Among smokers, about the same proportions of daily users (27% to 30%) reported smoking at least one and a half packs of cigarettes a day at ages 24–25, 28–29, and 34–35. By contrast, among both daily alcohol drinkers, whose proportions remained stable over the 10-year interval, and daily marijuana users, whose proportions declined, the proportions of heavy users declined by about 50%. Among alcohol drinkers, the proportions who reported drinking five or more drinks at a sitting decreased from 33.7% to 25.5% to 21.9% at each of the three periods; the proportions of near-daily marijuana users smoking two or more marijuana joints decreased from 56.7% to 53.6% to 35.7%. For alcohol, the change in quantities consumed is greatest from the mid- to the late 20s; for marijuana, the change is greatest from the late 20s to the mid-30s.

Not only does the prevalence of daily use decline over time, but the prevalence of heavy usage among these daily users declines as well for alcohol and marijuana but not for cigarettes.

Behavioral Predictors of Continued Use

Two behavioral features of drug histories continue to be strongly associated with persistence of use throughout adulthood: recency and frequency of use at an earlier period. Individuals who stopped using drugs by their mid-30s had not used them as actively nor as intensively by their mid-20s as had individuals who persisted in their use, confirming a pattern we had earlier identified through the late 20s.[5] Depending on the drug, among those who actively used the drug within the prior 12 months at ages 24–25, two to eight times as many individuals were still using the drug at ages 34–35 as among those who were not. Data for men are presented in Table 3.

Frequency of involvement at the earlier period is also a strong predictor of persistence, especially for cigarettes (Table 3). Whereas almost all those who had been using marijuana and cocaine near daily at ages 24–25 were still using these drugs by ages 28–29,[5] only half the marijuana users and 40% of the cocaine users were still doing so by ages 34–35. Except for alcohol, only a fraction of those who were using each class of drug once a

TABLE 3—Percentage Using Each Drug Class in Past Year in 1990 (Ages 34–35), by Drug-Specific Lifetime and Last Year Use in 1980 (Ages 24–25), among Men

Drug Class Used in Past 12 Months in 1990[c]	Panel A: Lifetime Use of Each Drug Class by 1980[a]						Panel B: Frequency of Past Year Use in 1980[b]					
	Never Used		Ever Used, but Not in Past 12 Months		Used in Past 12 Months		Once a Month or Less		2–3 Times a Month to 2–3 Times a Week		4 Times a Week or More	
	%	Total No.	%	Total No.	%	Total No.	%	Total No.	%	Total No.	%	Total No.
Cigarettes	2	110	15	152	72	273	15	32	29	16	83	225
Alcohol	22	5	50	24	93	506	82	65	94	336	96	105
Marijuana	0	125	4	120	34	290	14	91	37	120	51	79
Cocaine	1	337	8	75	18	123	15	98	31	20	44	5

[a]Based on all men (n = 535) classified with respect to their lifetime pattern of use.
[b]Based on those who had used each drug within the past year in 1980, classified with respect to their pattern of use within the past year.
[c]Percentage of each group in Panels A and B.

TABLE 4—Persistence[a] of Marijuana Use in Different Cohorts in the General Population, Based on Cross-Sectional Surveys of the National Household Surveys on Drug Abuse, 1977 to 1991[14–19]

Age	1977	1979	1982	1985	1988	1990	1991
12–13	.50	.50	.25	.59	.36	. . .[b]	.18
14–15	.55	.53	.33	.46	.33	.32	.35
16–17	.65	.55	.50	.33	.39	.38	.34
18–21	.52	.58	.44	.43	.30	.32	.31
22–25	.39	.44	.42	.30	.26	.18	.21
26–29	.27	.35	.31	.29	.19	.15	.13
30–34	.27	.35	.31	.29	.16	.14	.11
35+	.14	.20	.25	.14	.07	.09	.09
Overall lifetime prevalence among 18- to 25-year-olds	59.9%	68.2%	64.1%	60.3%	56.4%	52.2%	50.5%

[a]Ratio of use in last 30 days to lifetime prevalence.
[b]Numbers are too low to provide reliable prevalence estimates.

month or less were still active users 10 years later.

In addition, the persistent use of less commonly used illicit drugs preserves the use of more commonly used illicit and licit drugs. Thus, in 1990, 92.2% of current marijuana users, 88.2% of former marijuana users, and 77.3% of those who never used marijuana drank alcohol in the past year; 63.1%, 43.1%, and 18.7% of each group, respectively, smoked cigarettes within the past year. Among current, former, and never users of cocaine, 94.2%, 89.0%, and 84.6%, respectively, consumed alcohol within the past year; 76.2%, 49.4%, and 31.6%, respectively, smoked cigarettes; and 76.5%, 26.3%, and 3.7%, respectively, used marijuana. The subgroup differences are highest for cigarette smoking and marijuana use.

Conclusions

A 19-year follow-up of a representative population cohort provides unique information about the natural history of drug use from adolescence to adulthood. As previously reported,[5] the major period of risk for initiation into the use of cigarettes, alcohol, and marijuana is mostly over by age 20. The risk period for initiating the use of illicit drugs other than marijuana and of prescribed drugs lasts longer than that for cigarettes, alcohol, and marijuana. While substantial proportions of individuals begin using prescribed drugs after ages 28–29, most drug use is both initiated and stopped before the late 20s.

There appears to be a maturational trend for the use of marijuana and alcohol but not for the use of cigarettes. Not only does the prevalence of high frequency use decline in adulthood, but for most substances except cigarettes, the quantities consumed during the periods of heavy use decline as well. Cigarette smoking, manifested in regular and persistent usage patterns throughout adulthood, probably constitutes one of the most serious drug-related health problems in the population.

The prevalence of the use of prescribed psychotropics does not show much change over time. While a large proportion of individuals has used one of these drugs, the proportion of users at any particular point in time is relatively low, indicating a short duration of use. These are the only classes of drugs for which usage rates are consistently higher for women than for men. For all drugs in general, however, initiation rates are higher for men while cessation rates are higher for women.

A limitation of results based on a single cohort is that age-related patterns may reflect historical and cohort differences rather than true maturational changes. Secondary analyses from repeated cross-sectional surveys of the population in the National Household Survey on Drug Abuse lend supporting evidence for the conclusions based on this cohort. While overall rates of use may be subject to historical factors, identical maturational processes characterize each succeeding cohort. From published data, we calculated the persistence of marijuana use for consecutive age groups from ages 12 to 35 for seven successive surveys beginning in 1977. Persistence was in-

dexed by the ratio of those who used the drug within the last 30 days to those who reported ever having used it (Table 4). There are differences in absolute persistence rates for the same age group over time, which probably reflect historical differences in the popularity of marijuana. However, in every survey, the age-related patterns are the same: persistence increases throughout adolescence (except in 1985), peaks in mid-to-late adolescence (except for 1979, when it peaked at ages 18 to 21), and declines thereafter.

The peak in drug use in adolescence and early adulthood and the subsequent maturational pattern observed for most drugs raise several questions. Why do young people use drugs more heavily than any other group? Why does use, whether light or heavy, decline in the middle 20s? Why does the use of prescribed psychotropic drugs begin at a later age than the use of legal or illegal drugs? Why are there sex differences in the initiation and cessation of drug usage, resulting in higher prevalences of usage of most drugs (except psychotropics) among men than among women?

The answers to these questions are not readily available. Adolescents and young adults are most vulnerable to new experiences, new ideas, and new fads. For many youths, the use of drugs may represent a way of participating in the youth culture, while for a subgroup, drug use may represent a form of self-medication. With increasing age, two parallel processes may converge to lead to a reduction in the use of illicit drugs. The assumption of adult roles, especially family roles such as getting married or becoming a parent, may be associated with greater conformity and a decreased motivation to use illicit drugs.[20,21] Furthermore, increased access to the medical system may lead those who used drugs as self-medication to seek out prescribed psychoactive drugs instead; the finding that the use of prescribed psychoactive drugs is the last stage in the sequence of drug involvement lends support to this interpretation.[22] Thus, different drugs may serve similar functions at different stages of the life span.

It seems clear, however, that most drug-related intervention programs, whether focused on prevention or on treatment, must target adolescents and young adults in their early to mid-20s. By the mid-30s, most drug use is a behavior of the past. □

Acknowledgments

Work on this manuscript was partially supported by research grants DA03196 and DA04866 (D. Kandel, principal investigator) and a research scientist award DA00081 to D. Kandel from the National Institute on Drug Abuse. Partial support for computer costs was provided by Mental Health Clinical Research Center Grant MH30906 from NIMH to the New York State Psychiatric Institute.

We gratefully acknowledge the research assistance of Christine Schaffran and the critical comments of the reviewers of the manuscript.

References

1. Brunswick AF, Messeri PA, Aidala AA. Changing drug use patterns and treatment behavior. In: Watson RR, ed. *Drug and Alcohol Abuse Prevention.* Clifton, NJ: Humana Press; 1990:263–311.
2. Johnston LD, O'Malley PM, Bachman JG. *National Survey Results on Drug Use from the Monitoring the Future Study, 1975–1992.* Rockville, Md: National Institute on Drug Abuse; 1993.
3. O'Malley PM, Bachman JG, Johnston LD. Period, age, and cohort effects on substance use among American youth, 1976–1982. *Am J Public Health.* 1984;74:682–688.
4. Kandel DB, Logan JA. Patterns of drug use from adolescence to young adulthood: I. periods of risk for initiation, continued use, and discontinuation. *Am J Public Health.* 1984;74:660–666.
5. Raveis VH, Kandel DB. Changes in drug behavior from middle to late twenties: initiation, persistence and cessation of use. *Am J Public Health.* 1987;77:607–611.
6. Kandel DB, Single E, Kessler R. The epidemiology of drug use among New York State high school students: distribution, trends and change in rates of use. *Am J Public Health.* 1976;66:43–53.
7. Fishburne P, Abelson H, Cisin I. *The National Survey on Drug Abuse: Main Findings, 1979.* Washington, DC: National Institute on Drug Abuse; 1980.
8. Ball JC. The reliability and validity of interview data obtained from 59 narcotic drug addicts. *Am J Sociol.* 1967;72:650–654.
9. Parry HJ, Balter MB, Cisin IH. Primary levels of underreporting psychotropic drug use (with and without the use of visual aids). *Public Opinion Q.* 1970–1971;34:582–592.
10. Single E, Kandel D, Johnson B. The reliability and validity of drug use responses in a large scale longitudinal survey. *J Drug Issues.* 1975;5:426–443.
11. Uhlenhuth EH, Haberman SJ, Balter MB, Lipman RS. Remembering life events. In: Strauss JS, Babigian H, Roff M, eds. *The Origins and Course of Psychopathology.* New York, NY: Plenum Press; 1977:117–132.
12. Featherman D. Retrospective longitudinal research: methodological consideration. *J Economics Business.* 1980;32:152–169.
13. Kandel DB, Davies M. Progression to regular marijuana involvement: phenomenology and risk factors for near-daily use. In: Glantz M, Pickens R, eds. *Vulnerability to Drug Abuse.* Washington, DC: American Psychological Association; 1992:211–253.
14. Abelson HI, Fishburne PM, Cisin I. *National Survey on Drug Abuse: 1977. Vol I. Main Findings.* Princeton, NJ: Response Analysis Corporation; 1977.
15. Miller JD, Cisin IH, Gardner-Keaton H, et al. *National Survey on Drug Abuse: Main Findings 1982.* Rockville, Md: National Institute on Drug Abuse; 1983.
16. *National Household Survey on Drug Abuse: Main Findings 1985.* Rockville, Md: National Institute on Drug Abuse; 1988.
17. *National Household Survey on Drug Abuse: Main Findings 1988.* Rockville, Md: National Institute on Drug Abuse; 1990.
18. *National Household Survey on Drug Abuse: Main Findings 1990.* Rockville, Md: National Institute on Drug Abuse; 1991.
19. *National Household Survey on Drug Abuse: Main Findings 1991.* Rockville, Md: Substance Abuse and Mental Health Services Administration; 1993.
20. Kandel DB, Yamaguchi K. Job mobility and drug use: an event history analysis. *Am J Sociol.* 1987;92:836–878.
21. Yamaguchi K, Kandel DB. On the resolution of role incompatibility: life event history analysis of family roles and marijuana use. *Am J Sociol.* 1985;90:1284–1325.
22. Kandel DB, Yamaguchi K, Chen K. Stages of progression in drug involvement from adolescence to adulthood: further evidence for the gateway theory. *J Stud Alcohol.* 1992;53:447–457.