Period, Age, and Cohort Effects on Substance Use among Young Americans: A Decade of Change, 1976–86

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Abstract: In an earlier article in this Journal, we reported analyses that differentiated among period, age, and cohort effects on substance use among American youth 18 to 24 years old, from the high school classes of 1976 to 1982 during the period of 1976 to 1982. The present analyses extend the classes and years to 1986, and the age range to 18–28. A cohort-sequential design is employed, based on annual surveys of nationally representative samples of high school seniors, plus annual follow-up surveys of each senior class. Twelve different classes of drugs, both licit and illicit, are examined. Several different types of period, age, and cohort effects over the last decade are identified. Alcohol use (monthly and occasions of heavy use), and the use of marijuana, cocaine, amphetamines, methaqualone, barbiturates, LSD, psychedelics other than LSD, and tranquilizers all showed period effects. Occasions of heavy drinking, cigarette smoking, monthly and daily use of alcohol, and annual prevalence of cocaine, amphetamines, barbiturates, LSD, and narcotics other than heroin showed age effects. Class effects were seen for cigarette smoking and daily marijuana use. (*Am J Public Health* 1988;78:1315–1321.)

Introduction

There are three distinct kinds of change that may occur in the prevalence of illicit and licit drug use: 1) *period effects*—changes with time, reflected across all age groups (also referred to as *secular trends,* or *year effects*); 2) *age effects*—developmental or maturational changes that show up consistently for all graduating classes at the same age period; and 3) *cohort effects*—sustained or lasting differences among different graduating classes (in the present study, also referred to as *class effects,* because the samples are class cohorts rather than birth cohorts).

In an earlier report in this journal, we described patterns of illicit and licit drug use among American young people surveyed from 1976 to 1982 in terms of these three kinds of changes. We will very briefly review some key issues, but refer the reader to the earlier 1984 article,[1] and to a more extensive manuscript available from the authors,* for more details. In this article we extend our analyses through 1986, now reporting on a full decade of annual surveys.

Our purpose in this paper is to account for the variation in prevalence rates of various substances in terms of age, year, and class effects. We accomplish this by positing a model and then testing whether that model does indeed account for the observed variation. As discussed in some detail in the earlier article, all three effects could not be estimated without some additional constraints, constraints that may themselves introduce error. However, if one is willing to make some strong assumptions—for example, that cohort effects are zero—then an estimable model may be posited. Nevertheless, the results of such a process are necessarily ambiguous; there are always alternative explanations that can be advanced.[2]

Methods

The data for this report come from the Monitoring the Future project, an ongoing study of high school seniors conducted by the Institute for Social Research at the University of Michigan. The study design has been described in detail elsewhere[3,4]; briefly, it involves nationally representative surveys of each high school senior class, beginning in 1976, plus follow-up surveys mailed each year to a subset of each senior class sample.** It employs a cohort-sequential design, one in which multiple cohorts are followed across time. This design was selected to permit differentiation of the three types of effects.

Samples and Survey Procedures

A three-stage national probability sample leads to self-completed questionnaire administrations in about 130 high schools (approximately 110 public and 20 private), and yields about 17,000 respondents each year. The response rate is generally about 83 per cent of all seniors, with absentees accounting for nearly all of the nonrespondents.

In addition to the senior-year data collection, annual follow-up surveys are obtained by mail. From each graduating class, 2,400 of those who participated as seniors are selected for follow-up, and randomly divided into two groups, each group numbering about 1,200. Members of one group are invited to participate in the first year after graduation, and every two years after that; those in the other group are invited to participate in the second year after graduation, and every two years after that. The result of this approach is that individual participants are surveyed on a two-year cycle, beginning either one or two years after graduation. Respondents are paid $5 each for follow-up participation. The follow-up samples are drawn so as to be largely self-weighting; however, because the primary focus of the study is on drug use, users of illicit drugs are over-sampled for follow-ups (by a factor of three to one). Weights are used in all analyses to adjust for the differential selection probabilities.

These follow-up procedures were initiated beginning with the follow-up of 1978; the class of 1976 follow-up of 1977 differed from all succeeding follow-ups in that respondents were not paid for participation, so the response rate in that year was somewhat lower. Otherwise, response rates generally have exceeded 75 per cent of the senior year participants

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**The initial year of the study was actually 1975, but because of problems with higher missing data and lower response rates in follow-up, we use the class of 1976 as the starting point for the analyses presented here.

who were selected for follow-up. (Thus, the obtained follow-up samples generally represent at least 63 per cent (.75 · .83) of the initial target sample of seniors. An extensive discussion of the likely effects of excluding absentees and dropouts from the senior surveys is available elsewhere.[4]) Data from follow-up respondents are also weighted to take account of attrition. The procedure used to estimate prevalence in the follow-up samples is to reweight participating follow-up respondents so that each follow-up panel has (when reweighted) the same senior-year prevalence as the total senior-year sample for that class-year. The follow-up prevalence rates would then be derived by applying these weights to follow-up data.

Drug Use Measures

Use of alcohol and illicit drugs during the last 12 months and during the last 30 days are measured by questions having a standard, close-ended format with seven response alternatives ranging from use on 0 occasions to 40 or more occasions. An additional question about heavy use of alcohol asks respondents on how many occasions in the last two weeks they had five or more drinks in a row. The illicit drugs included in this analysis are listed in Table 1. (Legitimate medical use of the psychotherapeutic drugs is not treated in this paper, but has been reported elsewhere.[5]) The questions about cigarette use depart from the standard format because of the different consumption pattern for cigarettes; the questions ask about use in the past 30 days (not at all, less than one cigarette per day, one to five cigarettes per day, about one-half pack per day, about one pack per day, about one-and-a-half packs per day, two packs or more per day).

Analysis

We proceeded by first displaying the observed data graphically and inspecting for evidence of "pure" linear age, period, or class effects. Where the graphical display of the actual data appeared to show specific linear effects, a model that incorporated only that effect was tried and evaluated. The pattern of residuals was also inspected to infer where the model might be inaccurately specified. Finally, other effects were added where it seemed to be necessary. The shapes of the other effects were constrained to be reasonable; for example, increasing linearly, then decreasing linearly. In all cases, only additive models were employed. Further, in all cases only "statistically significant" parameters were retained, but clearly, nominal statistical levels are not to be taken literally with this post hoc procedure. The models were fitted using weighted least squares, a procedure which can incorporate heterogeneity of variance.[6]

Because these fitted functions were selected on the basis of inspection of the data, they often provide an excessively good fit; and this makes any probabilistic statement about the likelihood of the model's "truth" very tentative. Clearly, this procedure is *not* the classical approach of stating an *a priori* hypothesis, and then testing that hypothesis with data. The procedure is instead more of a "data-fitting" exercise, an attempt to achieve a reasonable retrospective interpretation of what happened during a particular historical period across a particular age band. In this context, statistical probabilities are not a basis for deciding to accept or reject hypotheses, but rather are used to help guide the interpretation of the data.

Results

As indicated in Table 1, 18 variables were analyzed, dealing with 12 different drug classes. Complete tables and figures for all 18 measures can be found elsewhere, and are available on request from the authors. Here, we present a summary table that provides an overview of the results of fitting a model to each of the drug use measures. In addition, we present figures for four of the more important drug measures. The summary table indicates, for each drug measure: 1) the nature of the effects that seem to account best for the observed variation in the data; 2) the nominal probability that deviations from a constant-only model could have been observed by chance, given that such a model is an accurate representation of reality; 3) the corresponding probability from the fitted model; and 4) the percentage reduction in error variability accounted for by the fitted model, relative to a constant-only model (this is analogous to a multiple-R^2). Numeric entries indicate a linear effect unless otherwise noted; because of the volatility of substance use during the decade in question, only a minority of effects are strictly monotonically linear. In most cases, a plausible (and simple) model required something other than a strictly straight-line effect. In all cases, however, only additive models have been employed.

Our discussion of results will emphasize the changes between the earlier results based on data through 1982 and the current results based on data through 1986.

Cigarettes

We begin with cigarettes, and will report the results for smoking a half-pack or more per day in some detail in order to facilitate the reader's interpretation of Table 1 and the figures for the other measures.

Figure 1 shows the longitudinal trajectories for rates of use of cigarettes at the level of half-pack or more per day for the classes of 1976–1986, followed up through 1986. The top line of connected open circles shows that the percentage from the class of 1976 smoking a half-pack or more per day was 19 per cent in senior year, rose to 24 per cent the following year, and continued at just about that level through 1986, when the modal age was 28.

The data displayed in Figure 1 suggest strongly that there is a clear class effect. Note that although the senior year data show an overall decline for successive classes of seniors, the various classes do not show corresponding declines in the follow-up data, as would occur if the senior year trends were due to period effects. In addition to the class effect, there is also an evident age effect; all classes show a jump in the percentages smoking a half-pack or more per day in the first three years after high school.

Table 1 provides a quantitative summary of the pattern described above. The entry in the "Constant-only" column of the table indicates a very low probability (zero, to three decimal places) that a constant-only model could adequately describe the data. The fitted model reproduces the observed data quite well; the nominal probability that the model could have generated the observed data is .998, and 90.5 per cent of the variation around a constant-only model is accounted for. The other entries in the third row of Table 1 can be interpreted as follows: The constant is 20.4 per cent, which means that the predicted value for smoking a half-pack or more per day for the first data point—the class of 1976 surveyed in 1976—is 20.4 per cent. There is a linear class effect of −1.0 per cent, so that each successive class is predicted to have 1.0 per cent fewer of such smokers than the preceding class. There is no year effect at all, but there is a nonsimple linear age effect that indicates an increase of 1.7

TABLE 1—Summary Table of Effects

Eighteen Prevalence Measures	Significant Effects (Entries are per cents): Constant	Year	Age	Class	Probability of Model: Constant Only	Fitted Model	Per cent Error Reduction
Cigarettes							
Monthly	36.4		0.9[a]	−1.0	.000	.989	71.3
Daily (any)	28.3		+2.8[b]	−1.1	.000	.999	86.5
Daily (1/2 pack)	20.4		+1.7[c]	−1.0	.000	.998	90.5
Alcohol							
Monthly	71.8	−0.5[d]	+3.1[c]		.000	.795	78.5
Daily	5.7		+0.5[c]		.134	.768	28.6
2 Weeks 5 + Drinks	38.8	0.6[e]	1.8[a]		.000	.950	79.9
Marijuana							
Annual	44.5	2.0[e]	1.2[a]		.000	.998	91.9
Monthly	30.4	2.3[e]	0.4[f]		.000	.939	90.7
Daily	8.2	0.8[e]		−0.2	.000	.980	85.3
Annual Cocaine	5.3	+1.7[g]	+2.9[c]		.000	.990	93.3
Annual Amphetamines	12.4	2.7[h]	−0.7[i]		.000	.880	92.4
Annual Methaqualone	9.1	−1.4[j]			.000	.918	92.3
Annual Barbiturates	9.3	−0.6	−1.9[b]		.000	.995	86.1
Annual LSD	6.4	0.7[e]	−0.2		.000	.690	84.5
Annual Psychedelics	8.2	−0.6			.000	.810	79.4
Annual Tranquilizers	10.7	−0.6			.000	.546	66.4
Annual Heroin	0.2				.902	.902	0.0
Annual Narcotics	5.0		−0.3		.000	.720	52.7

Notes:
[a]Age: Bilinear – increasing 18–21, and decreasing 22–28.
[b]Age: 18 ≠ 19–24.
[c]Age: Increasing to 21, constant thereafter.
[d]Year: Constant to 1979, decreasing thereafter.
[e]Year: Bilinear – increasing 1976–1979, and decreasing 1980–1986.
[f]Age: Bilinear – increasing 18–22, and decreasing 23–28.
[g]Year: Increasing to 1980, constant thereafter.
[h]Year: Bilinear – increasing 1976–1981, and decreasing 1982–1986.
[i]Age: Constant to 21, decreasing thereafter.
[j]Year: Unconstrained 1976–1980, decreasing thereafter. (Table entry is for linear portion, 1981–1986.)

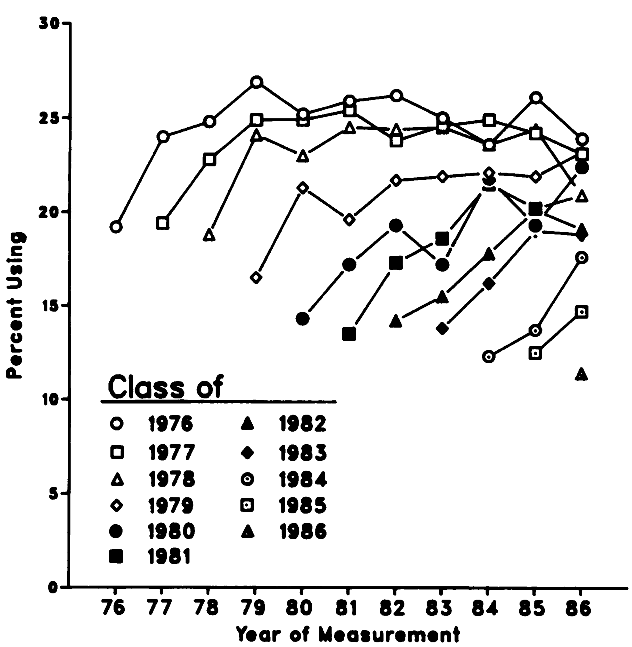

FIGURE 1—Cigarettes: Daily Prevalence (1/2 pack or more per day)

per cent per year of age in rates of half-a-pack or more smoking between ages 18 and 21, with no further age-related changes after age 21.

Thus, the estimated (or predicted) value for the class of 1980 followed up in 1986 would be:

$$20.4\% + 3(1.7\%) + 4(-1.0\%) = 21.5\%.$$

There are three increments of 1.7 per cent, one for each year of age from 18 to 21 (19, 20, and 21), four decrements of 1.0 per cent, one for each class after 1976 (1977, 1978, 1979, and 1980). (The actual observed value is 22.4 per cent; thus there is an error, or residual, of 0.9 per cent.)

The other measures of cigarette use show very similar class effects, but slightly different age effects. For monthly cigarette use (that is, smoking at least one cigarette in the prior 30 days), use increases linearly, and modestly, until the age of approximately 21, after which use at that particular level actually declines at about the same modest pace.

The measure of daily use of cigarettes (that is, smoking at least one cigarette per day in the prior 30 days) shows a jump of almost 3 per cent in just the first year after high school graduation, with no further consistent increase.

The findings for these measures, taken together, indicate that:

- cigarette use has declined with successive cohorts;
- regular users increase their amount of cigarette use soon after leaving high school; and
- whereas a very few individuals may initiate regular smoking after high school, practically no one does so after age 21.

These results amplify and extend the previous results that were based on fewer data points; in particular, the larger number of data points from the post high school age groups makes clearer the somewhat different age trends for the different measures. (The earlier age effects simply distinguished 18-year olds from others, for daily and half-pack a day smoking; monthly prevalence failed to show a clear age effect.)

The class or cohort effect is now estimated at about −1.0 per cent for all three measures, compared to about −1.5 per cent in the earlier analysis. The more recent cohorts have not been evidencing as much of a difference from class to class as the earlier cohorts did, and the slope of the overall linear regression line for all cohorts is now only two-thirds as steep. In fact, a close inspection indicates that a more complicated class effect would fit the data for all three measures slightly better than the simple linear effect, although the already very good fits preclude any great improvement. The nature of the more complicated effect is that, although the overall average decline is approximately 1 per cent per class (as shown in Table 1), the earlier classes of 1976 through 1980 were declining at about 1.5 per cent per class, whereas the later classes of 1981–1986 have been declining much more slowly (at about 0.4 per cent per class for the entire interval). Indeed, the very recent cohorts of 1984–1986 may be declining still more slowly, or not at all; it is more difficult to estimate precisely a cohort effect for the recent cohorts because there are only a few data points available. For example, the cohort of 1986 provides only one data point, and the cohort of 1985 only two points.

We believe that the decline in successive classes is likely due, at least in part, to the increased concern in recent years about the harmful health consequences of smoking and to the increased generally negative attitudes toward public smoking. The lower rate of decline, and perhaps leveling, in the most recent classes may reflect the impact of greatly increased promotion and advertising of cigarettes since the ban on electronic media advertising went into effect in 1971.[7] Given the generally negative climate toward smoking, why is there not a general period effect? The data suggest that cigarette smoking is very resistant to change; once it reaches the daily level, the behavior is likely to continue, and thus we see continuing differences between classes.

We noted that the age effects differed for the three smoking measures, and were not simple linear effects. In fact, as indicated in Table 1, the majority of age and year effects across all drugs are not linear. In all but one case, these represent some combination of linear changes and intervals with no change (e.g., a linear age effect through age 21 and constant thereafter.) The one exception is for methaqualone (Quaaludes), where the year effect is mixed. The general lack of simplicity is not surprising, given the volatility of substance use in recent years, and the considerable developmental changes that individuals go through between the age of 18 and 28. These relatively complex results are more evident now than they were in the earlier reported analyses, due to the continued volatility of substance use, the considerable amount of developmental changes, and also to the simple fact that there are more data points, particularly for the older age groups, which helps to make clearer what effects seem most likely to be operating.

Alcohol

The strongest effects for the various alcohol use measures are age effects, as we found also in the earlier report. These strong age effects are understandable, given that most respondents are below the minimum drinking age at ages 18–20 and all are at or above the minimum age thereafter. However, the age effects are not identical across measures, and they certainly do not reflect a sudden increase in drinking

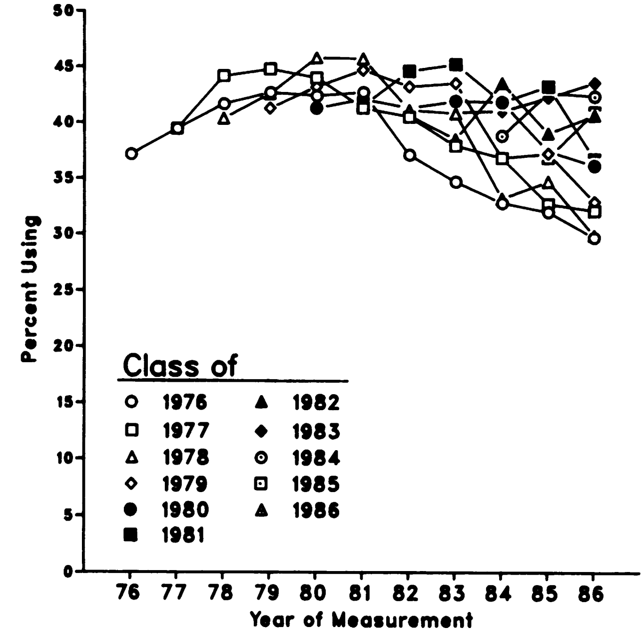

FIGURE 2—Alcohol: Two-Week Prevalence (five or more drinks in a row)

behavior at age 21, when most respondents reach the legal minimum age. For all three measures (monthly prevalence, daily prevalence, and occasions of heavy use), the age effects reflect linear increases per year through age 21; the monthly and daily use show no further change thereafter, whereas the prevalence of occasions of heavy drinking declines (Figure 2). For the monthly measure, the increase through age 21 is 3.1 per cent for each year of age, with a corresponding increase of 0.5 per cent for daily use. For the measure of occasions of heavy drinking, the age effect similarly reflects an increase through age 21, but then shows a linear decline (1.8% per year of age in both measures). The earlier analyses had not been so clear in showing age 21 as a transition point, and we stated in the 1984 report that a few more years of data would help to show just where a peak in frequent heavy drinking occurs. It appears now that the peak is right around age 21, which is fairly consistent with results of another longitudinal study that found that periods of highest use of alcohol occurred between ages 18 and 20.[8]

In addition to the age effects, there are now some modest secular trends evident for the monthly and "heavy" alcohol use measures, trends that had not been clear in the earlier report. Both have shown linear declines of 0.5 to 0.6 per cent per year since 1979. Monthly use was essentially constant prior to 1979, while occasions of heavy drinking had been increasing. (Annual use of alcohol is not included here because it was essentially invariant across year, age, and cohort, with prevalence rates at about 90 per cent.)

Marijuana

Unlike alcohol, the use of marijuana had shown a strong secular trend earlier, increasing from 1976 through 1979 and decreasing thereafter at approximately the same rate. This secular trend continues to be true through 1986. All three measures—annual, monthly, and daily—show "bilinear" effects, that is, a period of linear increases followed by a period of linear decreases (of equal size), and these effects describe the observed data fairly well. This strong secular trend was the most dominant effect in the earlier report, but

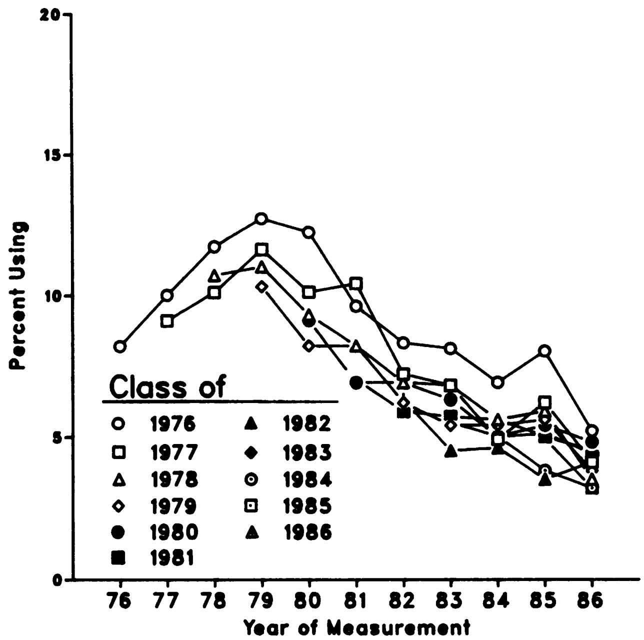

FIGURE 3—Marijuana: Daily Prevalence

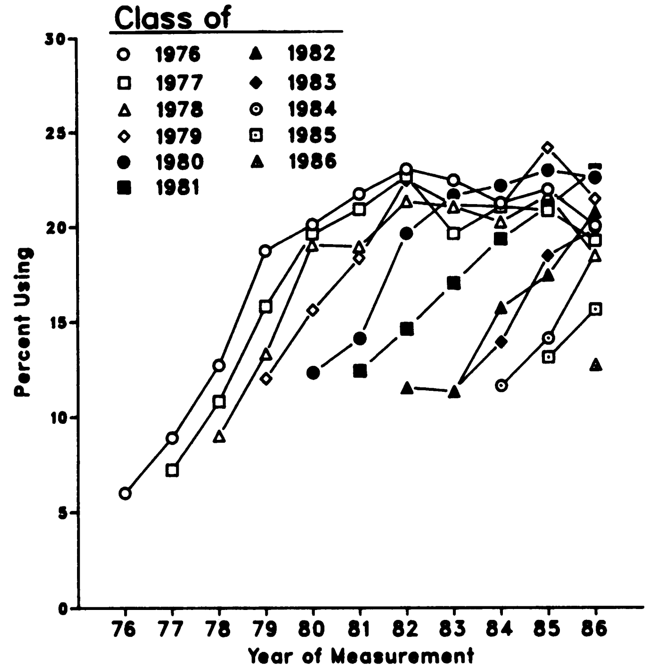

FIGURE 4—Cocaine: Annual Prevalence

there was a slight positive linear age or negative linear class effect with respect to daily use; the two effects were about equally likely, but we reported the age effect because of our prior assumptions that age effects were more likely than class effects. With the extended data, that effect now appears more likely to be a class effect, as we indicate in Table 1 (−0.2 per cent per class); a corresponding age effect fits the data less well, albeit only slightly so. On the other hand, both the annual and monthly use measures now show slight bilinear age effects, increasing through age 21 or 22 and declining thereafter, which is very similar to the age effect for the measure of heavy drinking. Kandel and Logan[8] had reported a maturational trend in marijuana use, with a decline beginning around age 22; our earlier data were somewhat ambiguous, due in part to few cases in the over-22 age group. The present extended data set suggest that there is indeed a negative age effect after about age 21 or 22, for annual and monthly marijuana use. As indicated earlier, however, the measure of daily use of marijuana does not show a similar peaking at around age 21–22 (controlling for the strong secular trend) as seen in Figure 3. It continues to be true that the secular trend is clearly the strongest factor in accounting for changes in all measures of marijuana use.

Illicit Drugs other than Marijuana

- Annual *cocaine* use shows a complex pattern of use (Figure 4). Two effects are clearly present: an age effect and a period effect. The age effect reflects linear increases through age 21 (or 22), and constant thereafter;*** the period effect reflects linear increases from 1976 through about 1980, and constant thereafter. Based on the earlier data, we reported a similar age effect (peaking around age 21 or 22), but we were unable to report whether the secular trend of an increase in cocaine use had stopped or was continuing; the new data reported here make it clear that in fact a plateau was reached about 1980. The age effect for cocaine is quite strong—on average, the data show an increase of 2.9 per cent in annual prevalence per year as respondents went from age 18 and 21 or 22 (controlling for the secular trend that occurred between 1976 and 1980). These age-related changes are much stronger for cocaine than for any of the other illicit drugs, including marijuana. In fact, marijuana is the only other illicit drug that shows an age-related increase (for annual and monthly use). The other illicits that show age-related changes all decrease—amphetamines, barbiturates, LSD, and narcotics other than heroin.
- *Amphetamine* use increased dramatically between 1976 and 1981, and began to exhibit a possible reversal of that trend in 1982. Since then, there has continued to be a consistent decline, with a net average decrease of 2.7 per cent per year. (As we have discussed at length elsewhere,[4] part of the pre-1982 change is artifactual, having to do with misinterpretation of the questions. However, although part of the secular trends is artifactual, it is clear, based on revised questions, that considerable real change had also occurred.) In addition to the annual declines, an inspection of residuals indicated a small age effect, with a 0.7 per cent per year decline showing up after age 21.
- *Methaqualone,* one of the two types of sedatives under study, provided the one instance in model-fitting where linear or constant effects were inadequate. During the period from 1976 to 1980 there was substantial change, but it was not very regular; hence, a series of dummy variables was required to represent change in this period. (The earlier report had suggested a slight linear annual increase of .7 per cent, but the fit was not very good.) Since 1980, it is now clear that there have been steady declines of about 1.4 per cent

***A peak at either age 21 or 22 represents the data about equally well.

per year for all age groups. Legal production and distribution of methaqualone have been discontinued in this country, which may account for much of this decline, but there continues to be some illegally manufactured and imported quantities available.

- The use of *barbiturates,* the other type of sedative included in the study, had been declining throughout the period 1976–1982, at a rate of about 0.7 per cent per year. The more complete data show a similar linear trend across the entire span of 1976 to 1986 of 0.6 per cent per year. This represents a best-fit straight line, and does not mean that there has been a decline of exactly 0.6 per cent every year. But, coupled with one age-related change, this model explains almost all of the variance left unaccounted for by a constant. One additional feature—an average decrease of 1.9 per cent in the first year after high school—now appears to be involved.
- The earlier data for *LSD* had suggested very little variation by age, period, or class. With the additional data, some more complex changes emerge. There is some secular trend for LSD, similar to that for marijuana, increasing through 1979, and decreasing since then; for LSD, the annual change has been 0.9 per cent. There also appears to be a small age effect, with older ages successively slightly less likely (by 0.2 per cent) to have used LSD in the prior year. This small effect is highly statistically significant (nominally speaking); the probability level of the simpler model is less than .02, compared to .69 for the model that includes the age effect. Because a bilinear year effect has already been fitted, a class effect would work as well (actually, the class effect is trivially better, p = .74) but, as discussed in the earlier report, we believe that age effects are more likely than class effects. Moreover, the age effect is much more consistent with the other findings illustrated in Table 1. In any case, it is now clear that the major effect in LSD use is a fairly strong secular trend, increasing through 1979, and decreasing since then.
- *Psychedelics other than LSD* continue to reflect a simple pattern; they show a linear secular trend down, at the rate of 0.6 per cent per year. The earlier data indicated an annual decline of 0.5 per cent.
- *Tranquilizers, heroin, and narcotics other than heroin* show no change in their patterns between 1976–1982 and 1976–1986. *Tranquilizers* have shown a secular decline of 0.6 per cent per year. In this case, however, the model does not fit the data as well as for most drugs. The fitted model has a nominal probability of .546, and only two-thirds of the error variance is accounted for. The residuals from this model indicate that either a positive linear age effect or a negative class effect would improve the fit but, as indicated above, there is no way to choose between these two alternatives. Although we have generally preferred to give priority to an age effect, that alternative is less attractive here because none of the other psychotherapeutic drugs show positive age effects. Therefore, no age or class effect is shown. In any case, the estimated value of the excluded parameter value is quite small (0.2 per cent) relative to the estimated year parameter (0.7 per cent when an age or class effect is included, and 0.6 per cent otherwise).
- A constant 0.2 per cent "explains" the *heroin* data very well, therefore no attempt was made to fit any more complex model.†
- Finally, like heroin, *narcotics other than heroin* show no secular trend. (These two have been the only classes of illicit drugs not showing secular trends.) There does appear to be an age-linked decline, of about 0.3 per cent per year. As with tranquilizers, there is considerable variance left unaccounted for, but there does not appear to be any simple pattern to the observed data.

In summary, the data presented above display quite an impressive variety of change patterns observed among the different drugs in the relatively short interval between 1976 and 1986. Several kinds of *period* effects were evident. Monthly alcohol use was constant through 1979, decreasing thereafter. Cocaine use increased through 1980, with no change thereafter. Linear decreases occurred for barbiturates, psychedelics other than LSD, and tranquilizers. A bilinear period effect, first increasing and then decreasing, was observed for occasions of heavy drinking, marijuana, amphetamines, and LSD. Quaaludes also increased and then decreased, although the increase was not linear in form.

Effects of *age* also were complex. Increases in the early years after high school were seen for all measures of cigarette use. The different patterns indicated there was not much increase in the proportion who were active smokers in the years after high school but, among those who smoked, a higher proportion became frequent smokers. Monthly and daily use of alcohol and annual prevalence of cocaine increased linearly with age through age 21 and were constant thereafter. A measure of occasions of heavy drinking showed a similar increase through age 21, but declined thereafter. Annual and monthly marijuana prevalence followed a similar pattern, peaking at age 21 or 22 and declining thereafter. Amphetamine use also declined with age after 21, but did not increase during the post-high school years. Annual use of LSD and narcotics other than heroin showed simple linear age decreases.

Clear *class* effects appeared for cigarette use, with successive classes smoking less at all levels. Similarly, daily marijuana use seems to decline with successive classes.

Discussion

As Robins stated in an editorial commenting on the earlier article, this study "presents evidence that the drug epidemic is not a single epidemic but a composite of epidemics."[9] Results presented here demonstrate that the drug scene continues to be a mosaic of different phenomena. Some substances are waning in popularity, others are not. Some drugs seem to show a "maturing" out; but others show more complex patterns. As discussed in the earlier report,[1] we do not ascribe causal roles in changing behavior to the variables age, period, or class. Instead, they reflect the impacts of more fundamental underlying causes. Nevertheless, it can be highly useful to distinguish the circumstances where one or another factor seems to be involved or not to be. Whether a behavioral change is associated with age as opposed to historical period,

†The non-variation for a measure is applicable to the table as a whole, including both senior-year and follow-up data. For senior-year only data, because of the much larger numbers of cases and the consequently smaller sampling errors, subtle shifts can be reliably discerned. Thus, although heroin use shows little overall change in the data presented here, there is a slight downward trend evident in the senior-year data for the period of 1975 to 1979.[4]

for example, can be highly relevant to furthering understanding, as well as to targeting prevention activities.

An extensive discussion of causal factors is beyond the scope of this report, but we can briefly comment on some of the factors that may be involved. With respect to the strong secular trends observed for marijuana, we have interpreted these as having been caused in large part by changes in attitudes toward marijuana.[10,11] In particular, it appears that an increase in perceived risk of harm to the user from regular marijuana use led directly to a decline in that behavior. With respect to the smaller maturational trends in marijuana use, we have ascribed these to being due at least in part to the impacts of role transitions. In particular, leaving the parental home to live alone or with others (but not a spouse) seems to lead to an increase in use of marijuana, whereas marriage seems to lead to a decrease.[12] The age distributions in these role transitions would therefore lead to an increase in marijuana use in the first few years after high school followed by a later downturn (which is the observed pattern). The measure of occasions of heavy drinking follows a similar pattern, and the interpretation would be similar to that for marijuana. The secular trend reflected in the linear decline in use of tranquilizers, barbiturates, and amphetamines may be due to a very different phenomenon: as we have reported elsewhere, there has been a recent decline in physicians' prescriptions of such drugs to adolescents, and that may well have contributed to the decline.[5]

Although the drug problem among American young people has shown signs of improving in recent years, it remains an important public health issue. Alcohol and tobacco continue to be used by substantial proportions of young Americans, and marijuana and cocaine still have disturbingly high rates of use. Thus, there remains the need for careful monitoring of drug use patterns and for further investigation of the underlying causal factors. The cohort-sequential design can continue to play an important role in helping to inform the search for such causal factors.

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Call for Proposals: Mental Health Services Program for Youth

The nation's largest health care philanthropy will offer up to $20.4 million in grants over the next five years to improve services for young people with serious mental illness. Under its new Mental Health Services Program for Youth, the Princeton-based Robert Wood Johnson Foundation will award grants to state-community partnerships that serve young people with mental disorders ranging from autism and hyperactivity to depression and anorexia nervosa.

Under the first phase of the initiative, the foundation will award up to 12 one-year grants of up to $100,000 each. Based on the strength of the plans developed under these grants, the foundation will award as many as eight four-year implementation grants for amounts up to $2.4 million each. The four-year grants will be used for the management and actual delivery of services as well as the development of a financing strategy to ensure that services continue.

Agencies in the 50 states, the District of Columbia and Puerto Rico are eligible to apply for funding under the national initiative. All proposed projects must involve state-community partnerships. The communities to be served under the initiative will generally range in size from 300,000 to 500,000 people. For rural areas, counties or regions may be combined to form the population to be served by the project. Potential applicants are asked to send a letter of interest of no more than two single-spaced pages by October 3, 1988 to: Mary Jane England, MD, Vice President, Medical Services, Prudential Insurance Company, 56 North Livingston Ave., Roseland, NJ 07068. Include: identification of a project director and a state liaison designated by the governor, as well as the names of state and community agencies that will participate in developing the project.