Seasonality of Substance Use:
National Household Survey on Drug Abuse 1992-96

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By Lynn X. Huang, Sam Schildhaus, and Doug Wright

I. Introduction

This study uses information from the National Household Survey on Drug Abuse (NHSDA) to determine whether the prevalence of substance use varies during the course of the year. In 1992, the NHSDA switched to continual administration of interviews throughout the year; specifically, the yearly sample was divided into four nationally representative samples, providing estimates on a quarterly basis. This paper examines seasonality in the quarterly estimates of substance use using the 1992–1996 NHSDA.

Establishing whether seasonal variation in substance use exists is important because this may be one of the reasons why the NHSDA results differ from those of surveys conducted at a specific time of year. For example, the Monitoring the Future survey (MTF) interviews samples of eighth-, tenth-, and twelfth-graders in the spring. In addition to seasonality, differences between the results of the NHSDA and the MTF may be due to differences in the mode of data collection, the sample, the place of administration, and questionnaire wording. If the differences between the two sets of data could be reconciled, this would provide a better understanding of the drug problem in the United States. Another reason that this analysis is important is to gain a better understanding of the epidemiology of drug use. If there were seasonality of drug use, this might lead to a modified approach to prevention programs.

We examined the 1992–1996 NHSDA for the following past-month-use variables: any illicit drug, any illicit drug except marijuana, marijuana, marijuana only (persons who report using marijuana but no other drug), alcohol, cigarettes, and heavy use of alcohol (defined as five drinks per session on five or more days). We compared prevalence rates for these variables by quarter for three population groups: all respondents aged 12 and older, adults aged 18 and older, and adolescents aged 12-17.

II. Findings[1]

- There were no seasonal differences of past month substance use either among all persons aged 12 and older or among adults aged 18 and older for any of the drugs studied (any illicit drug, any illicit drug except marijuana, marijuana, marijuana only, alcohol, cigarettes, and heavy use of alcohol).

- Youth aged 12-17 displayed seasonal variations for past-month use of **alcohol** and **any illicit drug except marijuana**. Alcohol use was highest in the first quarter of the year and lowest in the fourth quarter. Use of any illicit drug except marijuana was higher in the first half of the year.

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[1] Tests for significance are based on the $\alpha = 0.05$ level.

- The above finding of seasonality in past month use of alcohol and of any illicit drug except marijuana could be due in part to response bias or nonresponse bias, but the size of these potential biases are difficult to measure in the NHSDA. (See Section V for further details.)

- Youth also reported statistically fewer contacts of being approached by drug dealers during the summer months. A more detailed review of past-month prevalence estimates of any illicit drug except marijuana confirmed that the prevalence was generally lowest in the summer.

- Seasonality in past-month use of **alcohol** and **any illicit drug except marijuana** was not due to changes in the demographic mix over the four quarters. In addition, once demographic differences were controlled for, past-month use of **marijuana only, any illicit drug,** and **heavy drinking** now revealed at least one quarter that was different than the "summer" quarter.

- Alcohol displayed patterns of seasonality similar to the national pattern for both males and females, white/non-Hispanics, and for two of the four Census regions. For any illicit drug except marijuana, only males showed significant seasonality, and it was similar to the national pattern.

III. Methods

We conducted a simple analysis using weighted means by quarter across the five years for each substance-use variable.[2] The sample sizes per year ranged from about 18,000 to 29,000 persons age 12 and older; the total sample size for the five years was approximately 109,000. The sample size for youth age 12-17 over the same period was approximately 28,000; and the sample size per quarter was about 7,000 youth. We examined whether any quarterly differences were statistically significant (using chi-square tests of independence) and subsequently used t-tests to see which pairs of quarters were significantly different.

To separate the effect of demographic characteristics from the seasonal effect, we ran logistic regressions for each past-month substance-use variable, using the four quarters as the variables of interest, and with basic demographic characteristics as explanatory variables (i.e., age, race/ ethnicity, region, survey year). If the quarterly differences were still statistically significant, then this would indicate that the NHSDA data displayed seasonal variation that was not due to variations in demographic characteristics over time.

Multiple factors can lead to seasonal variation of substance use in the NHSDA data. We were interested in seasonal variation resulting from true behavior variation. Given that reporting bias or sampling variability might also contribute to the appearance of seasonality, we considered these factors in the analysis as well.

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[2] Since we only had 20 data points for the five years, we decided not to conduct traditional time-series analysis such as spectral analysis or Box Jenkins methods. James D. Hamilton. *Time Series Analysis.* Princeton, New Jersey: Princeton University Press. 1994.

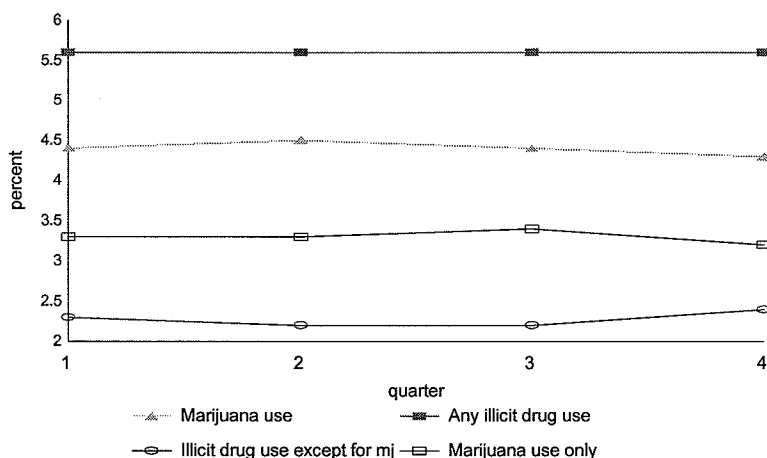## IV. Seasonal Variation in Past-Month Substance Use

The seasonality of past-month substance use was examined in the total NHSDA sample (ages 12 and older), as well as among adults (aged 18 and older) and adolescents (aged 12 to 17).[3] Adolescents could have different patterns of substance use than adults due to the shift from school to vacation in the summer.

No statistically significant differences were found for the total sample age 12 and older (Table 1). For all variables, overall tests failed to reject the null hypothesis of independence between past-month substance use and quarters because of the similarity of prevalence across the four quarters.[4] Figure 1 shows a plot of the quarterly data, excluding cigarette and alcohol use.

Figure 1.
Seasonal Prevalence of Past-month Illicit Drug Use For Persons 12 and Older, by Drug

The results for adults aged 18 and older (Table 2) are similar to those for persons aged 12 and older. In retrospect, the similarity of the results for adults aged 18 and older with all persons aged 12 and older is logical since adults represent 90 percent of the population aged 12 and older in the NHSDA. Figure 2 plots past-month prevalence for adults.

Figure 2.
Seasonal Prevalence of Past-Month Illicit Drug Use for Persons 18 and Older, by Drug

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[3] Further division of the ages into other categories was possible given sufficient sample sizes and assumptions about segmentation of substance use, but we did not explore them here, choosing instead to focus on adults and adolescents. Future explorations of these data might focus on, for example, young adolescents (aged 12 to 15), young adults (aged 18 to 21), or the elderly.

[4] We obtained weighted means of rates of substance use and conducted overall tests of seasonality, and pair-wise (quarter to quarter) tests of significance if the overall seasonality tests were significant. The statistical software package SUDAAN 7.5 was used to obtain all statistics, including population estimates, and standard errors adjusted for data collected using a complex sample design.

For adolescents aged 12 to 17 (Table 3), weighted means of all illicit drug variables appeared to drop in the third quarter. Overall Chi-square tests failed to reject the null hypothesis of independence for all substances except for past-month use of alcohol and any illicit drug except marijuana. Figure 3 plots the quarterly data of the seven variables for adolescents aged 12-17.
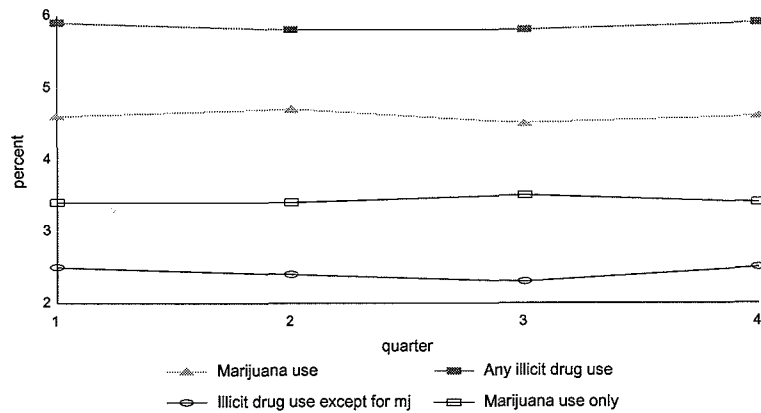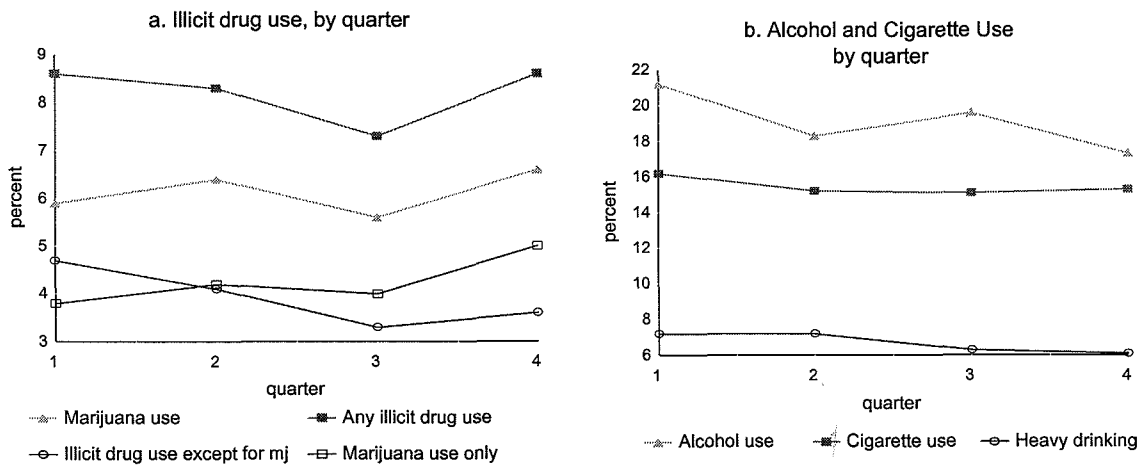

Figure 3.
Seasonal Prevalence of Past-Month Substance Use Among Adolescents, by Drug

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cohol and any illicit drug except marijuana, demonstrated overall seasonal variations among adolescents aged 12-17. Reported past-month use of any illicit drug except marijuana was higher in Quarter 1 relative to Quarter 3 and Quarter 4. Alcohol use was higher in Quarter 1 than in Quarters 2 and 4, and Quarter 3 was also higher than Quarter 4.

The patterns of seasonality displayed by alcohol and any illicit drug except marijuana appeared to be different, with a decrease in the third quarter for any illicit drug except marijuana and an increase in the third quarter for alcohol use.

V. Real or Spurious Seasonal Patterns?

The prior section indicates that statistically significant seasonal patterns exist among youth aged 12-17 for two variables: past month use of alcohol and past month use of any illicit drug except marijuana. The appearance of seasonal patterns, however, could be due to response bias, non-response bias, or could be an artifact of the analytic technique involving the summation of quarterly data across five years. For example, the reporting of quarterly data could be affected by poor recall or intentionally wrong answers. However, this would seem unlikely to induce seasonality since it would imply that the pattern of poor recall or intentionally incorrect answers would have to vary by quarter. It is also plausible that non-response among individuals varies seasonally and that non-response is correlated with drug use. This might occur in youth if drug users were less likely to be at home for the interview in the summer than in other seasons.
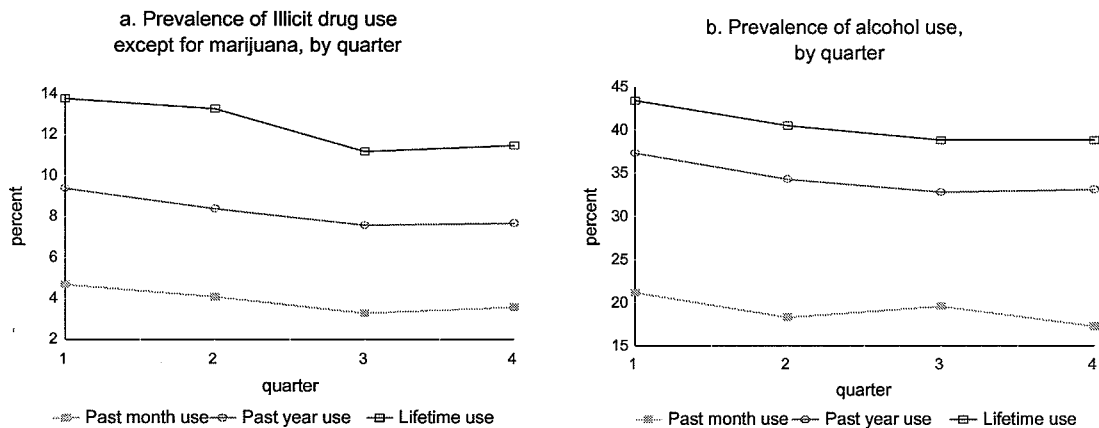
We analyzed whether past-year or lifetime substance use among adolescents aged 12-17 displayed seasonality similar to the past-month findings. This might imply the existence of measurement error since, past-year or lifetime substance use should reflect an average over all four seasons and thus should not display any quarterly seasonality. If the past year and lifetime results were to show similar seasonal variation to the usage patterns we have already described, then the observed past-month patterns might be a result of response or non-response biases.

Past-Year and Lifetime Use of Alcohol and Any Illicit Drug Except Marijuana

Figure 4 (next page) presents a graphical comparison of the seasonality of past-month use versus past-year and lifetime use of alcohol or use of any illicit drug except marijuana, with the weighted means of these three measures plotted by quarter. The first chart in Figure 4 presents the usage rate of any illicit drug except marijuana in the past month, past year, and lifetime - by quarter. The three measures appear to reflect the same direction of variations across quarters. The second chart presents results for alcohol use. The seasonal pattern of past-month alcohol use appears somewhat different from those of past-year and lifetime alcohol use. In particular, reported past-month alcohol use in Quarter 1 was not statistically different from Quarter 3, while reported past-year and lifetime alcohol use were statistically different for those two quarters.

- For both variables (use of alcohol and use of any illicit drug except marijuana), past-year and lifetime use also displayed statistically significant seasonal variations (Table 4).[5]

Figure 4.
Patterns of Seasonality
by Measures of Past-Month, Past-Year, and Lifetime Use Among Adolescents

a. Prevalence of Illicit drug use except for marijuana, by quarter

b. Prevalence of alcohol use, by quarter

Thus, for use of any illicit drug except marijuana, the past-month, past-year, and lifetime use all reveal statistically significant seasonality, and the pattern of seasonality appears similar in all three measures. These similarities raise the question of whether the seasonality of past-month use of any illicit drug except marijuana is in error (not due to true seasonal differences), or whether the findings of past year and lifetime seasonality are in error.

The latter could occur, for example, if former users (those who used in their lifetime or past year but not in the past month) had a greater tendency to deny ever using drugs than current users. Under this scenario, youth who were no longer current users in the summer would deny that they had used the drug in the past year or in their lifetime. Other research supports this possibility. Based on the National Longitudinal Survey of Youth (NLSY), Mench and Kandel (1988) estimated that 9 percent of those who reported lifetime marijuana use in 1980 denied lifetime use 4 years later.[6] Johnson, Gerstein, and Rasinski (1998) using NHSDA data from 1982-1995 indicated that, "Detailed cohort analysis suggest ... intentional concealment of early marijuana

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[5] Table 4 presents the weighted means of four variables: (1) past-year use of any illicit drug except marijuana, (2) lifetime use of any illicit drug except marijuana, (3) past-year alcohol use, and (4) lifetime alcohol use. Overall chi-square tests of seasonality were conducted, as well as pair-wise t-tests of significance when overall seasonality was statistically significant.

[6] Mench and Kandel, "Underreporting of Substance Use in a National Longitudinal Youth Cohort: Individual and Interviewer Effects," *Public Opinion Quarterly* (1987).

use that increases with aging." [7] Further research will be needed to explore this possible explanation.

The "Year Effect"

The above analysis combined NHSDA data from 1992 through 1996 and analyzed seasonal patterns of substance use without considering the year effect. If seasonal patterns were different from year to year, then the observed seasonal patterns from the pooled data could be random noise that resulted from averaging over all five years. It is also possible that the turning points of the upswings and downswings in the long-term trends might have occurred at different quarters over the years, potentially obscuring a quarterly pattern.

The seasonal changes in alcohol use and any illicit drug use except marijuana are presented separately by year in Figures 5a and 5b (next page), respectively. Seasonal changes in any illicit drug except marijuana in 1992, 1995, and 1996 fit the pattern obtained from the pooled data, in which the prevalence decreased in the third quarter. In 1992, the prevalence decreased sharply across the first three quarters and then increased in the fourth quarter. This might reflect a turning point in the long-term trend of illicit drug use among adolescents aged 12-17. The variable displayed a different pattern in 1993, decreasing in the second quarter while increasing in the third quarter and then decreasing again in the fourth quarter. In 1994, the usage rate of any illicit drug except marijuana increased continuously but mildly from Quarter 2 to Quarter 4 after a decrease from Quarter 1 to Quarter 2.

Seasonal changes in past-month alcohol use among adolescents aged 12-17 were similar in two of the years, 1995 and 1996. The rate of alcohol use was highest in the first quarter, decreased in the second quarter, increased in the third quarter and then declined in the last quarter. The seasonal changes in the last three quarters of 1993 were similar to those in 1995 and 1996. In 1992 and 1994, alcohol use dropped continuously from Quarter 1 to Quarter 4.

We conclude that, although there appears to be some noise in certain years, the seasonal usage patterns of alcohol and any illicit drug except marijuana among adolescents aged 12-17 remained strong. With only a limited number of data points[8], we cannot determine whether the long-term trends and the timing of upturns and downturns might have obscured the seasonal patterns for the variables considered.
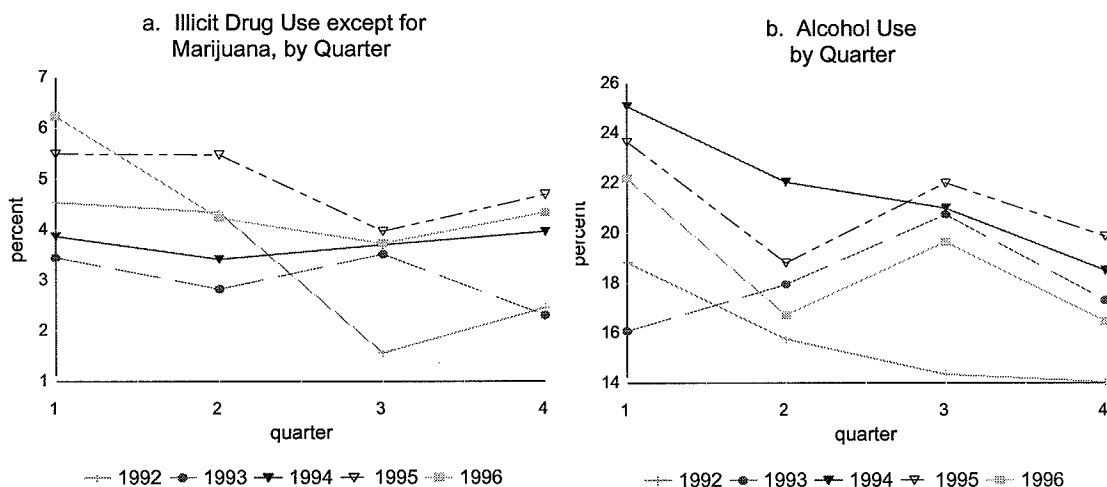
VI. Exploring the Seasonal Variation

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[7] Johnson, Gerstein, and Rasinski, "Adjusting Survey Estimates for Response Bias: An Application to Trends in Alcohol and Marijuana Use," *Public Opinion Quarterly* (1998).

[8] Nelson, C. R., 1973. Applied Time Series Analysis for Managerial Forecasting. Chicago: Holden-Day.

This section offers some possible explanations for the estimated seasonal variation that might

Figure 5.
Seasonal Prevalence of Past-Month Substance-Use Among Adolescents, by Year

a. Illicit Drug Use except for Marijuana, by Quarter

b. Alcohol Use by Quarter

lend additional credibility to the seasonal variation discussed in previous sections. A number of factors could lead to seasonal changes in substance-use behavior among adolescents—for example, seasonal changes in the availability of the substance (the supply side) or seasonal changes in the availability of leisure time (the demand side). Economic theories suggest that reduced access to illicit drugs could reduce demand, while increased availability of leisure could increase demand (since leisure and substance use are complementary goods[9]).

Any Illicit Drug Except Marijuana

During the summer season, students might have more leisure time, which could lead to increases in substance use, holding other factors constant.[10] On the other hand, the school might provide a more efficient marketplace for access to drugs. If the school provides easier access to drugs, then youth might be expected to have less access to drugs during the summer. The impact of the possibly reduced access might outweigh the effect of more leisure time in the summer and lead to lower prevalence rates in the summer. Since the NHSDA collects data on the "availability" of drugs, we were able to explore the impact of any seasonal changes in drug availability on changes in use.

Since the summer school vacation typically runs from the middle of June to the beginning of September for most youth, whereas the "summer" quarter is from June 1 to August 31, we attempted to break down the quarterly use into periods that more closely match the public school summer vacation. This is possible because the NHSDA collects data throughout the year and

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[9] Becker, G. S. *Accounting for Tastes.* Cambridge, MA: Harvard University Press, 1998.

[10] Since the NHSDA is a household study, it includes in its sample of youth both enrolled students and dropouts. We are focusing here on enrolled students because they constitute approximately 97-99 percent of all persons 12-17, and, therefore, drive the results for this age group.

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records the day and month of field interview contact with the respondent.[11] The results are presented in Table 5, where we have divided June and July into half-months in order to make the periods more closely correspond to the school calendar.[12]

The data collection period from June 1-15 covers youth responding to the question about past-month use from May 1-May 30 through May 15-June 15, respectively. Most students are in school during that period. The prevalence rate for the 6 weeks ending on June 15 is 4.0 percent (i.e., an average across the three two-week periods: 4.3 percent, 4.3 percent, and 3.4 percent).

The data collection period from June 16 through July 15 represents a *transitional* period from being in school most of the past month (May 16-June 15) to being out of school most of the past month (June 15-July 14). The prevalence rate during that transition period is 3.0 percent.

The data collection period from July 16 through August 31 covers the past month reference period of June 16-July 15 through July 31-August 30, a period when most youth are *out* of school most days. The prevalence rate for that period is 3.2 percent.

Similarly, data collected during the month of September (prevalence rate is 3.2 percent) reflect a *transition* period (August 1-September 30), and October data collection reflects drug use during September and October, a period in which youth are *in* school most days (prevalence rate of 4.0 percent).

- To reiterate: past-month use of any illicit drug except marijuana **is lower during the period that most students are on summer vacation (3.2 percent)**, similarly **lower during the two transition periods from school to summer and summer to school (3.0 and 3.2 percent, respectively)**, and **higher during the periods just before school lets out (4.0 percent) and just after students return from vacation (4.0 percent)**.

Next, we examined whether the availability of illicit drugs was lower during summer. Availability was measured by being approached by someone selling drugs in the past 30 days.[13] Table 6:A lists, by quarter, the percentage who reported being approached by drug dealers in the past 30 days.[14]

- Fewer adolescents aged 12-17 surveyed in Quarter 3 reported being approached by drug dealers in the past month relative to other quarters.

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[11] It should be noted that the NHSDA does not collect data randomly by month. It usually collects data more intensively in the first two months of a quarter and collects in the third month the remaining sample and those who cannot be reached in the first two months.

[12] Although not a significant variable, we have included past-month marijuana use in the table.

[13] This variable was only available in 1992–1994 and 1996.

[14] Results from overall chi-square tests of independence are reported, as well as pair-wise t-tests when the overall chi-square test rejected the null hypothesis.

The drop in use of any illicit drug except marijuana during the summer in conjunction with the reduced availability provides some evidence of a possible relationship between the two variables.

Table 6:B reports the same variable by month. The monthly percentage who reported "being approached by someone selling illicit drugs in the past 30 days" has a correlation coefficient of 0.43 with the rate of past-month use of any illicit drug except marijuana. With only 12 observations, the correlation was not statistically significant.

Alcohol

Alcohol use was higher among adolescents aged 12-17 in Quarters 1 and 3 (Table 3). The lowest months were in October and November (Table 5), while the highest months occurred during December and January. Higher use during December and January may be due to the December holidays and the winter recess during that period. Since alcohol is a legal product for adults, lack of availability is probably less important for alcohol than for illicit drugs. In Quarter 3, July represented another fairly high month, but August and September were not as high.

VII. Seasonal Variation by Region, Sex, and Race/Ethnicity

NHSDA reports show that prevalence of substance use varies among demographic subgroups.[15] Is the same seasonality that was observed at the national level observable among demographic subgroups? We focused on the 12-17 age group and the two substances for which we had observed seasonality, namely past-month any illicit drug use except marijuana and past-month alcohol use.

Unfortunately, given the larger sampling error for these subgroups coupled with the relatively small range of seasonal differences in prevalence, the tests of seasonality were usually not significant.

- For any illicit drug use except marijuana, none of the four regions and none of the racial/ethnic subgroups (white/non-Hispanic, black/non-Hispanic, Hispanic, or other/non-Hispanic) displayed significant seasonal differences. Males, however, did display significant seasonality and a pattern of t-tests similar to the national results. For alcohol, the Northeast and the West, males and females, and white/non-Hispanics showed significant seasonality. The patterns in each of these subgroups were similar to the national patterns.[16]

VIII. Logistic Regressions and Controlling for Demographic Characteristics

Since seasonality in substance use varied somewhat across demographic subgroups among adolescents, as described in Section VII, some of the seasonal variation observed in Section IV

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[15] *National Household Survey on Drug Use, Main Findings, 1996.* Office of Applied Studies, SAMHSA.

[16] In the interest of space, tables of results are not included here. They are available upon request.

might result from the changes in the demographic composition of the population. We examined the extent to which seasonal variation would still exist once we controlled for survey year and demographic factors (using logistic regression). In addition, we also examined the relationship between illicit drug use and availability.

We ran separate logistic regressions for the full set of dependent variables of interest — past-month use of marijuana, marijuana only, any illicit drug, any illicit drug except marijuana, alcohol, cigarettes, and heavy drinking — to see if other variables might display seasonality once we controlled for year of survey and other demographic characteristics. The independent variables of interest were the four quarters, with Quarter 3, as the reference quarter since earlier analysis had indicated that the summer quarter was the low quarter for any illicit drug except marijuana and one of the high quarters for alcohol use. The quarter variables were intended to capture changes in substance use that were caused by seasonal changes. We controlled for survey year, age, sex, race/ethnicity, and region.

We ran regressions for the adolescent population (Table 7).[17] We reported the estimated parameters for the quarters and the corresponding odds ratios. The odds ratio is defined as the ratio of $p/(1-p)$, where p is the probability of using a substance.[18] The odds ratio is the ratio of one odds relative to another. We also reported the Cox and Snell R.[19]

- For adolescents aged 12-17, where we had earlier observed seasonal differences in alcohol and any illicit drug except marijuana, there was still significant seasonality after controlling for demographic differences. *In addition*, after controlling for demographic differences, marijuana only, any illicit drug, and heavy drinking also revealed at least one quarter that was significantly different than Quarter 3 (the "summer" quarter).

Youth were 1.3 times more likely to engage in past-month use of marijuana only in Quarter 4 than in Quarter 3. Youth were 1.2 times more likely to use any illicit drug in Quarter 1 relative to Quarter 3. Youth were 1.4 times more likely to engage in heavy drinking in the past-month in Quarter 1 than in Quarter 3.[20]

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[17] We focus on adolescents in this section, since we only found seasonal variations in some substances (Section I) and different seasonal patterns among demographic subgroups among adolescents (Section IV). As regressions show the relationship between the response variable and the explanatory variable, holding other affecting factors constant, while cross-tabulations show the relationship without controlling for other affecting factors, we ran similar regressions for persons ages 12 and older and 18 and older. There were no seasonal variations in substance use in these two populations, which is consistent with the results reported Section I.

[18] $p=prob(Y=1)= e^{\beta'X}/(1+e^{\beta'X})$, where β is the vector of estimated parameters and X the vector of explanatory variables.

[19] For more information about the Cox and Snell R^2, refer to Cox and Snell (1989) and SUDAAN Manual, version 7.50.

[20] We tested the sensitivity of our results using a sub-sample of the full sample. We dropped the first and last three of the 20 quarters from the analysis and re-ran the logistic regressions. The results from this sub-sample were basically the same as those from the full sample.

With only 20 quarterly observations, we were concerned whether our results might be driven by a few outliers. We inspected the quarterly residuals from logit regressions for each substance-use variable and found that the quarterly residuals were within narrow ranges and there were no obvious outliers. This reinforced our results and suggested that our logistic model adequately captured the data in the NHSDA.

We ran a similar regression using the same independent variables on two variables that could be considered measures of the availability of illicit drugs for adolescents aged 12-17, treating them as dependent variables (Table 8.A): (1) being approached by someone selling illicit drugs in the past 30 days and (2) perceived difficulty in getting marijuana. Adolescents were statistically more likely to report being approached by drug dealers in the past 30 days in Quarters 1, 2, and 4 relative to Quarter 3. There was, however, no significant seasonal variation in the percentage of adolescents who regarded obtaining marijuana as being "difficult."

Finally, we regressed past-month use of marijuana, marijuana only, any illicit drug use, and any illicit drug except marijuana on the two availability variables among adolescents, with the other explanatory variables included (Table 8.B). The effect of the availability of illicit drugs was as expected—a negative effect of reported difficulty obtaining marijuana, and a positive effect of reports of being approached by drug dealers in the past month. Adolescents aged 12-17 who regarded obtaining marijuana as difficult were 0.42 times as likely to use any illicit drug except marijuana as those who did not believe it would be difficult. Furthermore, adolescents who reported being approached by drug dealers in the past month were six (6) times as likely to use any illicit drug except marijuana as those who did not report this. After controlling for the availability of illicit drugs, the quarterly effect remains significant only for monthly use of any illicit drug except marijuana in Quarter 1 (compared with Quarter 3), suggesting little seasonality of these substances once "availability" is controlled for.

Our analysis in the previous sections suggests that the NHSDA data displayed some seasonality in adolescent use of alcohol and any illicit drug except marijuana. The logistic regression analysis in this section (once we controlled for year of survey and any demographic differences across quarters) confirmed the seasonality in adolescent alcohol use and in any illicit drug except marijuana, and, *in addition*, uncovered seasonality in marijuana only, any illicit drug, and heavy drinking, which was not apparent earlier. Again, the same caveats that were mentioned earlier, namely factors such as reporting bias or non-response error (e.g., a low response rate during the summer among adolescents aged 12-17 who use illicit drugs might lead to the observed drop in adolescent drug use), apply to these findings as well.

Also, the estimates of the effect of illicit drug availability on illicit drug use could be subject to a number of estimation biases. Since economic theories suggest that the demand for, and the availability of, illicit drugs could effect each other simultaneously, our use of a single equation to reflect the relationship (rather than two simultaneous equations in which a given variable is a dependent variable in one equation and an independent variable in another) could bias our findings.

IX. Conclusions, Policy Implications, and Future Research

Using the 1992–1996 NHSDA, we examined the seasonal variation in past-month use of various substances among respondents aged 12 and older, adults aged 18 and older, and adolescents aged 12 to 17. We found no seasonal change in substance use among adults, but we detected some seasonal patterns among adolescents aged 12-17 in past-month use of alcohol and any illicit drug except marijuana.

These findings may have some policy-relevance. First, data collected during different time periods could yield different estimates of drug prevalence for adolescents; therefore, indications of the timing of upturns or downturns from surveys that are not based on year-round collection should be viewed with caution. Second, higher seasonal use of selected drugs tied to greater availability of drugs during the school year might have implications for prevention programs.

This study was a first examination of the seasonality of substance use in the NHSDA; additional research is needed on this subject. As the NHSDA gathers more quarterly data, more sophisticated time-series analysis can be applied. This area of investigation would also benefit from information on quarterly response rates (once they become available to researchers) and better statistical methods for comparing trends.

Table 1: Percentage Reporting Past-Month Substance Use
All Ages 12 and Older
by Quarter
NHSDA 1992–1996

Substance	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Overall Chi-square Test of Independence Between Substance Use and Quarters χ^2[p-value]
Marijuana	4.6	4.7	4.5	4.6	0.342 [0.952]
Any Illicit Drug	5.9	5.8	5.8	5.9	0.231 [0.972]
Any Illicit Drug Except Marijuana	2.5	2.4	2.3	2.5	1.580 [0.664]
Marijuana Only	3.4	3.4	3.5	3.4	0.374 [0.950]
Alcohol	52.2	49.9	50.8	50.8	4.888 [0.182]
Cigarettes Use	28.6	27.0	27.2	26.2	6.841 [0.079]
Heavy Drinking	5.2	5.3	5.7	5.3	2.700 [0.441]

Note1: Heavy drinking is defined as having 5 or more drinks per session on 5 or more days in the past 30 days.

Note2: The reported overall Chi-square test of independence between substance use and quarters is based on observed minus expected values, and is analogous to the Pearson chi-square for non-survey data. P-values are based on the F-statistics, computed from the Wald chi-square. The degrees of freedom are 3 for all chi-square statistics in the table. For more information, please refer to SUDAAN Manual 7.5.

Table 2: Percentage Reporting Past-Month Substance Use
Adults 18 and Older
By Quarter
NHSDA 1992–1996

Substance	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Overall Chi-square Test of Independence Between Substance Use and Quarters χ^2[p-value]
Marijuana	4.4	4.5	4.4	4.3	0.231 [0.972]
Any Illicit Drug	5.6	5.6	5.6	5.6	0.043 [0.998]
Any Illicit Drug Except Marijuana	2.3	2.2	2.2	2.4	0.855 [0.836]
Marijuana Only	3.3	3.3	3.4	3.2	0.917 [0.821]
Alcohol	55.7	53.6	54.4	54.7	3.596 [0.310]
Cigarettes	30.1	28.4	28.4	27.9	6.090 [0.109]
Heavy Drinking	5.5	5.7	6.2	5.8	3.509 [0.321]

Note1: Heavy drinking is defined as having 5 or more drinks per session on 5 or more days in the past 30 days..

Note2: The reported overall Chi-square test of independence between substance use and quarters is based on observed minus expected values, and is analogous to the Pearson chi-square for non-survey data. P-values are based on the F-statistics, computed for the Wald chi-square. The degrees of freedom are 3 for all chi-square statistics in the table. For more information, please refer to SUDAAN Manual 7.5.

Table 3: Percentage Reporting Past-Month Substance Use
Adolescents Age 12 to 17
By Quarter
NHSDA 1992–1996

Substance	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Overall Chi-square Test of Independence Between Substance Use and Quarters χ^2[p-value]
Marijuana	5.9	6.4	5.6	6.6	4.133 [0.249]
Any Illicit Drug	8.6	8.3	7.3	8.6	4.908 [0.181]
Any Illicit Drug Except Marijuana	4.7	4.1	3.3	3.6	10.687 [0.014]
Marijuana Only	3.8	4.2	4.0	5.0	5.906 [0.118]
Alcohol	21.2	18.3	19.6	17.3	24.09 [0.000]
Cigarettes	16.2	15.2	15.1	15.3	1.805 [0.614]
Heavy Drinking	7.2	7.2	6.3	6.1	5.883 [0.120]

If p-values for chi-square tests is smaller than and equal to 0.05,

Pair-wise T-tests. H_0: Substance use for two compared quarters is different.							
P-values	Q1 vs. Q2	Q1 vs. Q3	Q1 vs. Q4	Q2 vs. Q3	Q2 vs. Q4	Q3 vs. Q4	Q3 vs. Average of (Q1, Q2 and Q3)
Any illicit drug except marijuana	0.121	0.002	0.010	0.078	0.262	0.553	0.347
Alcohol	0.001	0.103	0.000	0.182	0.300	0.010	0.398

Note1: Heavy drinking is defined as having 5 or more drinks per session on 5 or more days in the past 30 days.

Note2: The reported overall Chi-square test of independence between substance use and quarters is based on observed minus expected values, and is analogous to the Pearson chi-square for non-survey data. P-values are based on the F-statistics, computed for the Wald chi-square. The degrees of freedom are 3 for all chi-square statistics in the table. For more information, please refer to SUDAAN Manual 7.5.

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Table 4. Percentage Reporting Past-Year and Lifetime of Substance Use
Adolescents Age 12 to 17
By Quarter
NHSDA 1992–1996

4:A. Past-Year and Lifetime Use of Any Illicit Drug Except Marijuana

Weighted Means by Quarter	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Overall Chi-square Test of Independence χ^2[p-value]
Past Year	9.4	8.4	7.6	7.7	8.66 [0.04]
Lifetime	13.8	13.3	11.2	11.5	15.54 [0.002]

Pair-wise T-tests. H_0: Substance use for two compared quarters is different.						
P-values from t-tests	Q1 vs. Q2	Q1 vs. Q3	Q1 vs. Q4	Q2 vs. Q3	Q2 vs. Q4	Q3 vs. Q4	Q3 vs. Average of (Q1, Q2 and Q3)
Past Year	0.117	0.010	0.011	0.168	0.215	0.857	0.092
Lifetime	0.414	0.002	0.005	0.009	0.023	0.741	0.014

4:B. Past-Year and Lifetime Alcohol Use

Weighted Means by Quarter	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Overall Chi-square Test of Independence χ^2[p-value]
Past Year	37.3	34.3	32.8	33.1	20.6 [0.00]
Lifetime	43.4	40.5	38.8	38.8	23.3 [0.00]

Pair-wise T-tests. H_0: Substance use for two compared quarters is different.						
P-values from t-tests	Q1 vs. Q2	Q1 vs. Q3	Q1 vs. Q4	Q2 vs. Q3	Q2 vs. Q4	Q3 vs. Q4	Q3 vs. Average of (Q1, Q2 and Q3)
Past Year	0.009	0.000	0.000	0.157	0.279	0.763	0.023
Lifetime	0.012	0.000	0.000	0.132	0.145	0.971	0.035

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Table 5. Percentage of Adolescents Reporting
Past-Month Use of Alcohol, marijuana, and Any Illicit Drug Except Marijuana
By Month
NHSDA 1992–1996

Month	Any Illicit Drug Except Marijuana	Marijuana	Alcohol
January (*n*=2,460)	4.5	6.0	23.3
February (*n*=2,803)	5.3	5.7	20.2
March (*n*=1,692)	4.2	6.0	20.2
April (*n*=3,320)	4.3	6.2	17.7
May (*n*=2,536)	4.3	6.7	19.3
June (*n*=1,091)	3.0	6.0	17.6
June 1-15 (*n*=712)	3.4	6.1	17.7
June 16-30 (*n*=379)	2.3	5.8	17.4
July (*n*=3,203)	3.6	6.0	20.5
July 1-15 (*n*=1430)	3.8	7.1	19.6
July 16-31 (*n*=1773)	3.4	5.2	21.1
August (*n*=2,617)	3.1	4.9	18.7
September (*n*=1,271)	3.2	5.8	19.3
October (*n*=3,410)	4.0	6.7	16.5
November (*n*=2,589)	3.1	6.3	16.5
December (*n*=1,071)	3.6	7.5	21.4

Table 6. Availability of Illicit Drugs
Adolescents Aged 12 to 17
NHSDA 1992–1994 and 1996

6:A. By Quarter

Variables	Percentage who were approached by individuals selling illicit drugs in the past 30 days
Quarter 1	10.8
Quarter 2	12.1
Quarter 3	9.5
Quarter 4	11.9
Overall Chi-square Test of Independence Between Substance Use and Quarters χ^2[p-value]	14.35 [0.003]

P-Values for Significance Tests

Contrasts	Q1 vs. Q2	Q1 vs. Q3	Q1 vs. Q4	Q2 vs. Q3	Q2 vs. Q4	Q3 vs. Q4	Q3 vs. Average of Q1, Q2 and Q4
Approached by person selling illicit drugs in the past 30 days	0.060	0.071	0.125	0.0005	0.785	0.003	0.001

Table 6 *(continued)*

6:B. By Month

Variables	Percentage who were approached by individuals selling illicit drugs in the past 30 days
January (*n*=2,001)	9.3
February (*n*=2,317)	11.1
March (*n*=1,434)	12.0
April (*n*=2,768)	11.9
May (*n*=2,117)	13.1
June (*n*=852)	10.4
July (*n*=2,717)	10.2
August (*n*=2,206)	8.0
September (*n*=1,071)	11.0
October (*n*=2,852)	11.9
November (*n*=2,221)	11.6
December (*n*=912)	12.8

Table 7. Coefficients and Odds Ratios of Quarter Variables
from Logistic Regressions of Past-month Substance Use
Adolescents Aged 12 to 17
NHSDA 1992–1996

Dependent Variables	Marijuana	Marijuana Only	Any Illicit Drug	Any Illicit Drug Except Marijuana	Alcohol	Cigarettes	Heavy Drinking
Independent Variables	Parameters from Logistic Regressions [Adjusted Odds Ratios]						
Quarter 1	0.064 [1.066]	-0.046 [0.955]	0.176* [1.192]	0.373** [1.452]	0.108 [1.115]	0.086 [1.090]	0.301** [1.351]
Quarter 2	0.132 [1.141]	0.047 [1.048]	0.127 [1.136]	0.103 [1.225]	-0.122 [0.886]	-0.024 [0.974]	0.226 [1.254]
Quarter 4	0.204 [1.226]	0.256** [1.291]	0.187 [1.206]	0.082 [1.085]	-0.168** [0.845]	0.015 [1.015]	-0.068 [0.934]
R^2 (Cox & Snell, 1989)	0.038	0.028	0.033	0.010	0.092	0.077	0.024

*$p<0.05$ from t-test $\beta=0$.
**$p<0.01$ from t-test $\beta=0$.

Note 1: Other explanatory variables in the models include survey year, age, race, ethnicity, gender, and region.
Note 2: The reference subgroup is the third quarter.
Note 3: The odds ratios for each independent variable measure the likelihood of, for example, using marijuana in the past 30 days for the subgroup relative to a reference subgroup. For example, the odds ratio of 1.452 for the first quarter use of illicit drug use except marijuana means that, after controlling for the effects of age, race/ethnicity, sex, region, and survey year, the likelihood of using illicit drug except marijuana is 1.452 times as high in the first quarter as in the third quarter.
Note 4: The Cox and Snell R^2 is a measure of the fit of the model, defined as $1-[L(0)/L(B^\wedge)]^{2/N}$, where $L(0)$ is the likelihood of the intercept-only model, $L(B^\wedge)$ is the likelihood of the full model, and N is the estimated population size. For further information, please refer to SUDAAN Manual 7.5, and Cox and Snell (1989).

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Table 8. Coefficients and Odds Ratios of Quarter Variables
from Logistic Regressions of Past-month Illicit Drug Use and Availability of Illicit Drugs
Adolescents Aged 12 to 17
NHSDA 1992–1996

8:A. Availability of Illicit Drugs

Dependent Variables	Percentage Who Regarded Getting Marijuana "Difficult"	Percentage Who Reported Being Approached by Individuals Selling Drugs in the Past 30 Days
Independent Variables	Parameters from Logistic Regressions [Adjusted Odds Ratios]	
Quarter 1	−0.033 [0.968]	0.133* [1.147]
Quarter 2	−0.033 [0.968]	0.280** [1.323]
Quarter 4	-0.009 [0.991]	0.269** [1.309]
R^2 (Cox & Snell, 1989)	0.145	0.093

*p<0.05 from t-test β=0.
**p<0.01 from t-test β=0.

Note 1: Other explanatory variables in the models include survey year, age, race, ethnicity, gender, and region.

Note 2: The reference subgroup is the third quarter.

Note 3: The odds ratios for each independent variable measure the likelihood of, for example, being approached by drug dealers in the past couple of months, for a sub-group relative to a reference subgroup. For example, the odds ratio of 1.147 for the first quarter in the model of being approached by drug dealers means that, after controlling for the effects of age, race/ethnicity, sex, region, and survey year, the likelihood of being approached by drug dealers is 1.147 times as high in the first quarter as in the third quarter.

Note 4: The Cox and Snell R^2 is a measure of the fit of the model, defined as $1-[L(0)/L(B^\wedge)]^{2/N}$, where $L(0)$ is the likelihood of the intercept-only model, $L(B^\wedge)$ is the likelihood of the full model, and N is the estimated population size. For further information, please refer to SUDAAN Manual 7.5, and Cox and Snell (1989).

Table 8 *(continued)*
8:B. Past-Month Use of Marijuana, Marijuana Only, Any Illicit Drug, and Any Illicit Drug Except Marijuana
With Illicit Drug Availability as Independent Variable

Independent Variables	Dependent Variable			
	Past-Month Marijuana	Past-Month Marijuana Only	Past-Month Any Illicit Drug	Past-Month Any Illicit Drug Except Marijuana
Regarded obtaining marijuana "difficult"	−1.662** [0.190]	−1.793** [0.166]	-1.251** [0.286]	−0.860** [0.423]
Reported being approached by drug dealers in past month	1.914** [6.782]	1.450** [4.264]	1.779** [5.922]	1.798** [6.039]
Quarter 1	−0.038 [0.963]	−0.132 [0.876]	0.132 [1.142]	0.347** [1.415]
Quarter 2	−0.006 [0.994]	0.011 [1.011]	0.038 [1.038]	0.064 [1.066]
Quarter 4	0.010 [1.010]	0.149 [1.160]	0.061 [1.063]	-0.060 [0.942]
R^2 (Cox & Snell, 1989)	0.100	0.060	0.098	0.042

*$p<0.05$ from t-test $\beta=0$.
**$p<0.01$ from t-test $\beta=0$.
Note 1: Other explanatory variables in the models include survey year, age, race, ethnicity, gender, and region.
Note 2: The reference subgroup is the third quarter.
Note 3: The odds ratios for each independent variable measure the likelihood of, for example, using marijuana in the past 30 days for the subgroup relative to a reference subgroup. For example, the odds ratio of 1.415 for the first quarter use of illicit drug use except for marijuana means that, after controlling for the effects of illicit drug availability, age, race/ethnicity, sex, region, and survey year, the likelihood of using illicit drug except marijuana is 1.415 times as high in the first quarter as in the third quarter.
Note 4: The Cox and Snell R^2 is a measure of the fit of the model, defined as $1-[L(0)/L(B^\wedge)]^{2/N}$, where $L(0)$ is the likelihood of the intercept-only model, $L(B^\wedge)$ is the likelihood of the full model, and N is the estimated population size. For further information, please refer to SUDAAN Manual 7.5, and Cox and Snell (1989).