Teenage Indulgence in Cigarettes, Alcohol and Marijuana: Evidence of a "Gateway" Effect

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ABSTRACT

Adolescents face the temptation to engage in many risky behaviors, which may potentially alter the rest of their lives. In this paper, we investigate the inter-temporal complementarity among three risky behaviors—smoking, drinking and marijuana usage—by examining the possible existence of a "gateway" effect in these three behaviors. Basically, a gateway effect exists when consumption of one substance increases the likelihood of subsequent initiation of consumption of other substances. Using data from the *NLSY97,* we empirically test for the gateway effect using hazard rate analysis. By tracking the same person over time to see if initiation of consumption of either / both of two substances subsequently increases the hazard of initiating consumption of the third, we attempt to adjust for unobserved heterogeneity, which typically confounds gateway effect investigation in a cross-sectional framework. We find evidence of a gateway effect for marijuana use, in that initiation of smoking and /or alcohol consumption makes the same person significantly more likely to subsequently experiment with marijuana. Gateway effects are also observed for smoking and drinking, where prior experimentation with either one thereafter increases an individual's risk of experimentation with the other. Notably, we find evidence of a *reverse* gateway effect of marijuana consumption on subsequent initiation of consumption of smoking or drinking, suggesting that among the three substances, marijuana is the "final" drug of choice.

1. Introduction

In his introductory chapter, Gruber (2001) states "The simple fact that we can explain so little of the time series trends over the past decade highlights the importance of future investigations of risky behavior." He also writes that directions for future research should include i) investigating how these risk-taking decisions fit together for more than two behaviors and ii) disentangling the roles of the youth, her parents and her peers in driving risky behavior . This research attempts to increase our knowledge about factors influencing risky behaviors by investigating their inter-temporal relationship with each other while controlling for the effect of individual, parental and neighborhood characteristics.

Several empirical studies in the health sciences find evidence of a consistent pattern of 'sequencing' in consumption of addictive substances (Kandel, 1975; Ellickson et al, 1992; Kandel & Yamaguchi, 1993). Initiation of alcohol and cigarette consumption is typically followed by commencement of marijuana use, which is then followed by ingestion of other 'harder' drugs. The prevalence of these patterns has led to the 'gateway' hypothesis, whereby it is conjectured that certain addictive substances serve as 'gates' through which consumers move to other addictive substances.

Using data from the *National Longitudinal Survey of Youth 1997*, we present an empirical analysis for the gateway effect by employing the Cox proportional hazards model. In doing so, we attempt to control for both the effect of economic and demographic characteristics and of unobserved heterogeneity that typically confounds cross sectional studies.

We start with a brief literature review and adaptation of previous theoretical models in the next section. The methodology and data are described in Section 3; the empirical analysis is presented in Section 4, followed by conclusions in Section 5.

2. Literature Review and Conceptual Framework

The economic literature has concerned itself extensively with contemporaneous correlation between consumption of different addictive substances. For example, DiNardo & Lemieux (1992), Model (1993), Chaloupka & Laixuthai (1997), Pacula (1998a) and Saafer & Chaloupka (1998) consider contemporaneous correlation between alcohol and marijuana; Farrelly, Bray, Zarkin, Wendling & Pacula (1999) and Dee (1999) consider contemporaneous correlation between alcohol and cigarettes. However, to our knowledge, only two empirical studies explicitly consider intertemporal correlation in the consumption of such substances among young adults (Pacula, 1997; 1998), and no study specifically considers whether consumption of one substance increases the likelihood of subsequent *initiation* of consumption of other substances (what may be considered a true 'gateway effect'). Pacula's (1997; 1998) work is a considerable advancement in the research on inter-temporal correlation in substance consumption, and she does so by investigating the effects of prices in a prior period on current period's consumption. Using a simple example of the demand theory, it may be posited that if prior period's prices of substance A negatively (positively) affect current period's consumption of substance B, then the substances are inter-temporal complements (substitutes). Pacula tests this hypothesis by using the 1983-84 waves of the NLSY79 (respondents were 20-27 years old in those waves), and considering the impact of prior year's state-level prices for cigarettes and marijuana on current year's consumption of alcohol and marijuana for both those years. However, interpretation of the results for the gateway effect is problematic, because last year's and current prices are strongly correlated. For example, in Pacula (1998), past cigarette taxes are found to significantly affect current consumption of alcohol and marijuana. However, since current cigarette taxes are not included in the model, it is hard to say whether this shows a true gateway effect between cigarettes and the other substances, or merely a contemporary

relationship, with last year's cigarette taxes just serving as proxies for this year's cigarette taxes. It should also be kept in mind that, while cross-sectional analysis using past year's consumption of substances may give evidence of inter-temporal correlation in consumption, they are less useful in testing the gateway effect insofar as *initiation* of consumption goes. While last year's consumption of substance A might affect this year's consumption of substance B, this gives no indication that initiation of consumption of substance A actually preceded initiation of consumption of substance B. To obtain this information, one requires that models that utilize information regarding the order in which the respondent *began* to consume different substances over his/her lifetime. This study extends the model developed by Pacula (1997) and attempts to address the issue in the context of initiation of use of addictive substances by adolescents.[1]

Pacula (1997) provides a simple intertemporal model of multiple substance use that adds another dimension to the original models of habit formation (rational addiction) of Becker and Murphy (1988). Whereas Becker and Murphy's model is based on intertemporal consumption of a single substance, Pacula extends the model to the use of multiple substances. The utility function is assumed to be separable in general consumption (of a composite good C_t whose price is normalized to 1) and in consumption of addictive substances. The model considers two addictive substances, A_t and B_t, and S_t represents the 'consumption capital stock' – namely the user's experience with past consumption of these same substances. The utility function to be maximized is:

$$\Sigma_{t=1}^{T} R^t [U(C_t) + b_t (Z_t).V (A_t, B_t, S_t)] \text{ where } S_t = (A_{t-1}, B_{t-1}), \qquad (1)$$

subject to the standard lifetime budget constraint. The variable b_t is a function of observable factors (Z_t) that influence the individual's marginal utility from consuming addictive substances,

[1] Along parallel lines, DeSimone (1998) has considered the 'gateway effect' for hard drugs using methods similar to

and R is the discount factor for the future. The sub-utility functions, U and V, follow the standard characteristics in that $U'>0$, $U''<0$, V_A , V_B >0, V_{AA} , V_{BB} <0. In keeping with the original rational addiction model, $V_S \leq 0$. This indicates that a higher stock of past consumption capital of addictive substances lowers present utility or well-being (or that an increase in current consumption capital will reduce future well-being).

In context of studying the gateway effect, we are interested in the *initiation* rather than the continuance of substance consumption. It can be shown that an individual will initiate consumption of a drug in period t if the marginal utility of consuming that drug, evaluated at zero consumption, is greater than the marginal cost ($P_{A,t}$) :

$$(U')^{-1} . \{ b_t (Z_t). V_{A,t} + b_t (Z_t). \Sigma_{k=1}^{T-t} R^j V_{S,t+j} .S_{A,t} \}|_{A=0, T=t} - P_{A,t} >0. \quad (2)$$

The term $\Sigma_{k=1}^{T-t} R^j V_{S,t+j} .S_{A,t}$ is the *negative* effect on future utility/well-being of increasing the consumption capital stock of substance A in period t. The extent to which this effect will determine the initiation of consumption of A depends to a large extent on the magnitude of R. Previous empirical tests of the rational addiction model (Becker, Grossman and Murphy, 1991; Chaloupka, 1991) provide evidence that adolescents generally discount the future far more than adults do and behave myopically when making decisions about consumption of substances like alcohol and cigarettes. This indicates that adolescents discount the future at a sufficiently high rate (that is, R is sufficiently low) to reduce the entire second term in equation (2) to a negligible magnitude. Hence, we may simply rewrite the equation of interest as being:

$$(U')^{-1} . \{ b_t (Z_t). V_{A,t} \}|_{A=0, T=t} - P_{A,t} >0. \quad (3)$$

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those used by Pacula. His study concludes that, among adults in their late 20s and early 30s, consumption of marijuana substantially increases the probability of initiation of cocaine consumption within the next 4 years.

The presence of a gateway effect exists if the instantaneous marginal utility from beginning to consume A, that is $\{V_{A,t}\}|_{A=0}$, is positively impacted by past consumption of the other addictive substance. Thus, the condition for a gateway effect to exist is

$$(\partial^2 V_t/\partial A_t \partial S_t).(\partial S_t/\partial B_{t-1})|_{A=0} > 0. \quad (3)$$

Note that it is also possible for a *counter* gateway effect to exist if

$$(\partial^2 V_t/\partial A_t \partial S_t).(\partial S_t/\partial B_{t-1})|_{A=0} < 0. \quad (4)$$

For example, it could be speculated that an individual with a consumption capital stock of a substance that provides a stronger 'rush', like marijuana, may gain less marginal utility from initiating consumption of a substance that provides a weaker 'rush', like cigarettes.

The above model implies that the hazard rate, i.e. the probability of indulging in substance A in time period t conditional on not having indulged in it until time period t is a function of both the observable factors (Z_t) and whether the individual has B_t in the stock of past consumption capital. i.e.

$$h_A(t) = Prob\,(A_t > 0 \,|\, Z_t, S_t(B_t); A_k = 0, k = 1, 2, \ldots t\text{-}1) \quad (5)$$

3. Empirical Methodology and Data Description

We estimate the gateway effect by using hazard rate analysis, i.e. relating the risk of indulgence in any one addictive substance to the age of the teenager along with other individual specific characteristics. The relevant time frame is from the individual's birth year to the year of the survey (in 1997). In each model, individuals 'exit' when they initiate consumption of that particular substance, and those who have never used that substance by the time of the survey are treated as 'censored'. Thus, the existence of a gateway effect is investigated by testing whether starting to consume *either or both of the other two substances* (that is, having positive amounts

of either or both of the other two substances in the stock of consumption capital) increases the hazard of initiating consumption of the primary substance.

We use the Cox's semi-parametric proportional hazards model to estimate the relative rate of failure (hazard function) as a function of the independent variables. Allison (1995) discusses the advantages of using the Cox proportional hazard model, and states that it has become the overwhelmingly favored method of doing regression analysis of survival data. Reasons include the facts that the model does not make any assumptions regarding the underlying hazard rate function, can deal with censored observations and allows for time varying covariates.

Following Cox (1972), we operationalize Equation 5 above for the j^{th} individual's hazard rate $h_{Aj}(t)$ as a function of the explanatory variables as follows:

$$h_{Aj}(t) = h_A(t; x_j) = h_{A0}(t)\exp(x'_{Aj}(t)\beta_A) \qquad (6)$$

where $h_{A0}(t)$ is the baseline hazard function for the A^{th} substance consumption, $x_{Aj}(t)$ is a vector of possibly time varying explanatory variables for the j^{th} individual, and β_A is the vector of unknown regression parameters to be estimated. Note that $x_{Aj}(t)$ consists of both the observable individual characteristics Z_j (t) and whether or not the individual has initiated use of the other substances prior to time period t ($S_j(t)$). Parameter estimation is accomplished using the partial likelihood method. Along with the coefficients estimates, the *marginal effect* of a variable of interest is given by the risk ratio. A risk ratio greater than one (positive β) implies an increase in the hazard rate due to the explanatory variable, while a risk ratio less than one (negative β) implies a decrease in the hazard rate function.

The main obstacle to attempting to test for a true 'gateway' effect, particularly in a cross sectional framework, is the issue of individual heterogeneity. Briefly, this implies that the individual's unobserved propensities for consuming each different addictive substance may be

strongly correlated. This is also termed the "bad seed" model that suggests that certain youths are predisposed towards risky behaviors whereas the remainder is not. This implies that the positive effect of past consumption of substance B on current consumption of substance A in a cross-sectional framework might reflect an *associational* rather than a causal relationship. Hence, it cannot be inferred that it was the past consumption of substance B that *directly increased* the likelihood of current consumption of substance A. In our study, the time dimension in the data and the nature of the proportional hazards framework partially alleviate this problem, since the *same* individuals are being observed over time, and their behavior is tracked *before* and *after* their indulgence in any of the other two activities. Thus, the time varying nature of key variables (indulgence in the other two substances) allows us to capture the differential effect of substance indulgence for the *same individuals.* We further attempt to address this problem with two different techniques. First, in the main models, we control for several individual specific characteristics (demographic and economic) that are likely to affect the probability of *all* substance consumption. Second, as described in greater detail in the next section, we test the robustness of our results by using sub-samples of individuals who presumably have similar unobserved propensities.

Our study uses the first round of data from *The National Longitudinal Survey of Youth, 97* (NLSY97), the latest survey started by the *National Longitudinal Survey program* (sponsored and directed by the *Bureau of Labor Statistics*). The data consist of a sample of 6,748 respondents who are representative of the U.S. population aged 12-16 years on Dec. 31, 1996, and a supplemental over-sample of 2236 Hispanic and black people of the same age group. A self-administered part of the survey asks respondents questions about use of three substances, alcohol, cigarettes, and marijuana. The information provided includes whether respondents had

ever consumed cigarettes, alcohol, and/or marijuana, and if so, their age at time of first consumption of each substance.

Definitions and descriptive statistics of the key individual characteristics are reported in Table 1. Thirty nine percent of all respondents reported smoking cigarettes, 43 percent claimed to have drunk alcohol, and twenty percent reported experimenting with marijuana. Table 1 also gives personal, neighborhood and family characteristics that may affect the individual's propensity to initiate substance use. These include race, gender and indicators of familial stability (whether the respondent lives with both natural/adoptive parents and the total number of living situations the respondent was in since birth.) Additional variables include economic situation indicators such as family income level and if the respondent lived through any spells of acute 'hard times' (defined as living in a homeless shelter or living in residences without basic amenities like electricity and water), and the respondent's experiences of neighborhood quality instrumented by whether the respondent has ever seen someone shot with a gun.

Table 2 provides the distribution of the number of substances the respondent reported ever using, as well as the order of use (in case of multiple substances). More than half the respondents indicated experimenting with at least one of the three substances, with 1661 respondents reporting usage of all three substances. The general pattern seems to be that initiation of cigarette use predates initiation of alcohol use, and initiation of cigarette or alcohol use predates initiation of marijuana use.

4. Empirical Results

The empirical analysis investigating the gateway effect is conducted for each of the three undesirable activities—smoking, drinking and marijuana use. Before discussing the results, we

briefly report on the creation of time varying covariates used in the analysis and additional time specific controls. Our primary interest—the gateway effect—is tested by investigating whether the risk of initiating consumption of one of these substances is increased due to initiation of either of the other two substances. Accordingly, we create time varying values for the variables "Smoke" "Drink" and "Marijuana Use" in the following manner: The respondent is tracked from their time of birth to age at 1997. The variables Smoke, Drink and Marijuana Use take values of 0 for each age prior to the respondent's initiation of the respective substance, and 1 thereafter. For respondents that have never used a particular substance, the relevant variable has a value of zero for every observed age. Additional time varying variables include hard times experience and living with natural or adoptive parents. Data on household income were available only for 1997 and as a result, the dummy variables for rich and poor households are time invariant. We believe that the error in assuming no change of status in household income over the respondent's lifetime is small. Furthermore, only data on the *total number* of living situations from birth to survey year is available. Hence this, too, is time invariant, but provides an instrument for the degree of instability experienced by the respondent while growing up.

Additionally, we recognize that the environment faced by different respondents at a particular age differs by their year of birth. Environmental differentials include differences in country-level prices of substances,[2] cultural norms and attitudes regarding substance use and the extent of law enforcement. We control for these differences by including birth cohort dummies.[3] A test of the underlying hazard rate function revealed that while there are significant differences in the levels of the hazard rate functions, they have the same shape. Thus, while the assumption

[2] We are unable to control for any state level prices since we do not know which states the respondents resided in at different ages prior to the survey year.
[3] There are 4 birth cohort dummies, indicating birth in year 1981, 1982, 1983 or 1984.

of proportionality of hazard rates is not violated for birth cohorts, there is a clear need for controlling for differences in birth cohorts by including dummy variables for year of birth.

Tables 3 through 5 report the results from the proportional hazards regression for marijuana use, cigarettes and alcohol respectively. We first report on the control characteristics before turning to the main variables of interest for the gateway effect. We find that instruments for an unstable family life and for economic hardship affect initiation of consumption of the substances in most cases. Adolescents residing with both parents are significantly less likely to initiate consumption of any of the three substances, while an increase in the number of different living arrangements or seeing someone shot ever in their life (an instrument for neighborhood quality) causes an increase in the initiation of consumption of all three substances. A steady decline in the initiation of the consumption of all three substances is seen over the birth cohorts. This finding is consistent with the long-term downward linear trend of usage for all three substances over most of 1976 – 1996.[4] The presence of hard times during an individual's lifetime is seen to increase the initiation of smoking, but not drinking or marijuana use. Interestingly enough, the dummy for rich households is also seen to have the same effect. The absence of a father figure increases the likelihood of experimenting with alcohol, but not cigarette or marijuana use. Ethnicity and gender matter in initiation of substance use. African Americans are less likely to indulge in any of the three substances relative to white adolescents, as are Hispanics for both smoking and drinking. While this may seem contrary to popular perception, this corresponds to results of Pacula (1998) and Chatterji (1999) for adolescents. It also corresponds to results of Caetano & Clark (forthcoming) who find higher rates of abstinence

[4] That there has been a nationwide trend in decline of consumption in tobacco from 1980-1994 is evidenced by reports from the Center for Disease Control and Prevention. Evidence of decline in alcohol use between 1984-1995 is provided by Caetano and Clark (forthcoming), and evidence in decline of marijuana use from 1980-1992 is

from alcohol consumption among black and Hispanic adults than white adults of both genders. Male adolescents are more likely than female to experiment with marijuana, but there is no significant difference in their propensity to experiment with either smoking or drinking.

Turning to our hypothesis of primary interest, we see clear evidence of a gateway effect for marijuana use (Table 3). Initiation of smoking makes the same person five times more likely to subsequently experiment with marijuana, while initiation of alcohol makes them almost three times more likely to do the same. Thus, both smoking and drinking positively affect the risk of experimenting with marijuana. Gateway effects are also observed for smoking and drinking. Prior experimentation with either alcohol or cigarettes cause an individual to be three times more at risk of initiation of the other substance (Tables 4 and 5). Note that in testing for the gateway effect, we are paying close attention to the chronology of the initiation of indulgence in substances. For example, a person who experiments with marijuana *before* smoking or drinking would have zeros for the time varying covariates of smoking and drinking for all ages, and a person who, say, smoked at age 12 and experimented with marijuana at age 15 would have zero for smoking until age 12, and 1 thereafter until age 15 in the regression for marijuana use. In light of this fact, the identical coefficients of smoking in the equation for drinking, and of drinking in the equation for smoking are remarkable. The results indicate a strong *inter-temporal* complementarity between the two substances.

Particularly interesting is the evidence of a *reverse gateway effect* that marijuana has on both smoking and drinking. If an adolescent happens to experiment with marijuana before initiating use of either cigarettes or alcohol, then they are *less* likely to subsequently experiment with either of those substances. Indulgence in marijuana causes a person to have a twenty two

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provided by Pacula et al (2000). However, consumption of each substance followed different paths that did not all continuously fall over that period. See Figure 4 in the introductory chapter of Gruber (2001) for the details.

percent lower probability of smoking cigarettes, and a twenty three percent lower probability of drinking alcohol. This buttresses the notion that, among cigarettes, alcohol and marijuana, the last is the "final" drug, and after experiencing the stronger 'rush' provided by marijuana, the individual derives less marginal utility from the consumption of a substance that provides a weaker 'rush' (e.g., cigarettes or alcohol).[5]

Our results are robust to alternative specifications and to the choice of sample. While we do not report tables for the extensive additional analyses here, they are available on request. Briefly, we find similar evidence of gateway effects when we re-estimate hazard regressions for each substance after including prior initiation of consumption of either *one* of the other substances. More importantly, the results are largely unchanged when, for each substance, the sample is restricted to only those individuals who are observed to indulge in that particular substance (the assumption being that these individuals would have the same underlying propensities, and hence the sample would represent a homogenous group of people). The fact that even *within* these sub-groups, the risk of initiation of that substance changes following the initiation of the other two substances, appears to strongly indicate the presence of a true gateway effect. Finally, the results are largely unchanged when we restrict our sample to those individuals who are known to *continue* indulgence in the 'gateway' substances and have not merely had a sporadic experience with any one of the substances.[6]

[5] We do not, by any means, assert that cigarettes or alcohol are either less addictive or less hazardous to health than marijuana. However, the fact that the former are only illegal for youth, whereas the latter is illegal for all might lend marijuana an aura of 'being illicit' that makes it more satisfying to risk-seekers than the other two drugs.

[6] This was possible by restricting the sample to those respondents that reported current use of the respective substance, for both the substance under investigation and the "gateway" substances.

5. Conclusions

This research attempts to increase our knowledge about factors influencing risky behaviors by investigating the effects of individual, familial and environmental characteristics along with the inter-temporal impact of indulgence in other risky behaviors. Our results are consistent with prior literature on the effects of ethnicity, race, gender, familial income and structure of parental family on indulgence in cigarette, alcohol and marijuana use. In addition, we incorporate the effect of additional factors such as experiences of acute economic hardship, instability of living situations while growing up, and neighborhood quality.

The existence of gateway effects is strikingly clear among the three behaviors of smoking, drinking and marijuana usage. Particularly interesting is the evidence of a pattern of sequencing, whereby consumption of the 'weaker' substances (cigarettes and alcohol) tends to lead to an initiation of consumption of the stronger (marijuana). On the other hand, *starting* with marijuana reduces the tendency to initiate consumption of substances lower in the sequence. These results are evident even after the probability of initiation is estimated while controlling for various family, neighborhood and other socio economic factors. The documentation of the forward and reverse gateway effects among the three substances and furnishing of strong evidence for inter-temporal relationships between the substances reinforces the idea that consumption of any one substance does not occur in a vacuum.

Our results thus have forceful implications for policies geared towards deterrence of use of undesirable substances such as cigarettes, alcohol and marijuana. The evidence of the existence of a gateway effect bodes well for the effectiveness of policies aimed at curtailing cigarette and alcohol consumption, including those that improve teenage awareness of the risks of indulgence in any one of the substances, and policies that actively discourage experimentation

either through education or through higher prices. That is, policies designed to curb each of alcohol and tobacco use may have the added positive externality of curbing the other as well as curbing marijuana consumption. Conversely, while policies for curbing marijuana may be beneficial in themselves, they are less likely to have the positive externalities of curbing alcohol and tobacco usage. Of course, there remains the possibility that marijuana may serve as a gateway to still 'stronger' substances like heroin or cocaine. The findings of DeSimone (1998) support this being the case for adults, and investigating whether it is also true for adolescents should provide an interesting direction for future research.

Table 1. Descriptive Statistics

Variable Definition[1]	Variable Name	N	Mean	Std Dev	Min.	Max.
Substance Usage						
Respondent ever smoked cigarettes?	**Eversm**	8991	0.393	0.488	0	1
Respondent ever drank alcohol?	**Everdr**	8982	0.429	0.495	0	1
Respondent ever used marijuana?	**Evermj**	8981	0.201	0.401	0	1
Personal Characteristics						
Age as of 1997	**Age**	8984	14.408	1.405	12	18
African-American	**Black**	8984	0.266	0.442	0	1
Hispanic Origin	**Hisp**	8959	0.212	0.409	0	1
Male	**Male**	8984	0.512	0.500	0	1
Neighborhood Characteristics						
Respondent ever lived in acute hard times?	**Hard Times**	8969	0.053	0.225	0	1
Respondent seen someone shot?	**Shot**	8833	0.110	0.313	0	1
Family Characteristics						
Total number of living arrangements ever[2]	**Numres**	7869	1.543	1.096	1	21
Household Income ≤ poverty level	**Poorhh**	8984	0.164	0.370	0	1
Household Income > 5 times poverty level	**Richhh**	8984	0.092	0.289	0	1
Biological father never identified	**No Father**	8984	0.047	0.211	0	1
Lives with both natural/adoptive parents-age 2	**Twoparent2**	8984	0.408	0.491	0	1
Lives with both natural/adoptive parents-age 6	**Twoparent6**	8984	0.405	0.491	0	1
Lives with both natural/adoptive parents-age 12	**Twoparent12**	8984	0.404	0.491	0	1

[1]Variable = 1 if either the answer is "yes" or the statement is true

[2] Missing values (approximately 100 observations) filled in with modal value of 1

Table 2. Distribution of Number of Substances Consumed

Group	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Used no substance	4173	46.5	4173	46.5%
Only smoke	769	8.6	4942	55.1%
Only drink	1083	12.1	6025	67.2%
Only marijuana	36	0.4	6061	67.6%
Smoke & drink, drink last	802	8.9	6863	76.5%
Smoke & drink, smoke last	342	3.8	7205	80.3%
Smoke and marijuana, marijuana last	133	1.5	7338	81.8%
Smoke and marijuana, smoke last	15	0.2	7353	82.0%
Drink and marijuana, marijuana last	129	1.4	7482	83.4%
Drink and marijuana, drink last	26	0.3	7508	83.7%
All three, marijuana last	546	6.1	8054	89.8%
All three, drink last	434	4.8	8488	94.6%
All three, smoke last	481	5.4	8969	100%

Table 3: Proportional Hazards Regression Results for Marijuana Use

Variable	Parameter Estimate	Standard Error	Chi-Square	Pr > Chi.Sq.	Risk Ratios
Smoking	1.67	0.084	395.59	0.0001	5.32
Drinking	1.07	0.078	187.04	0.0001	2.92
Two parents	-0.44	0.059	55.97	0.0001	0.65
Hard Times	0.35	0.228	2.39	0.1219	1.42
No Father	-0.14	0.124	1.19	0.2756	0.87
Numres	0.05	0.019	8.53	0.0035	1.06
Shot	0.53	0.070	57.89	0.0001	1.71
Poorhh	-0.06	0.072	0.75	0.3874	0.94
Richhh	0.06	0.089	0.39	0.5346	1.06
Hisp	0.02	0.069	0.10	0.7503	1.02
Black	-0.21	0.070	9.10	0.0026	0.81
Male	0.11	0.052	4.15	0.0416	1.11
YOB81	-0.30	0.068	20.24	0.0001	0.74
YOB82	-0.78	0.078	101.28	0.0001	0.46
YOB83	-1.20	0.097	151.57	0.0001	0.30
YOB84	-1.75	0.136	165.02	0.0001	0.17
Observations	8945				
Percent Censored	83.35				
Test of Overall Model:					
Likelihood ratio			1494.35	0.0001	
Wald			1322.37	0.0001	

Table 4: Proportional Hazards Regression Results for Cigarette Smoking

Variable	Parameter Estimate	Standard Error	Chi-Square	Pr > Chi.Sq.	Risk Ratios
Marijuana Use	-0.24	0.059	17.36	0.0001	0.78
Drinking	1.12	0.049	513.49	0.0001	3.05
Two parents	-0.41	0.041	103.51	0.0001	0.66
Hard Times	0.59	0.168	12.19	0.0005	1.80
No Father	-0.01	0.087	0.01	0.9346	0.99
Numres	0.06	0.013	24.35	0.0001	1.07
Shot	0.50	0.055	84.82	0.0001	1.66
Poorhh	-0.04	0.052	0.47	0.4927	0.97
Richhh	-0.13	0.063	3.94	0.0472	0.88
Hisp	-0.34	0.050	47.26	0.0001	0.71
Black	-0.77	0.052	220.26	0.0001	0.46
Male	0.03	0.037	0.69	0.4052	1.03
YOB81	-0.06	0.052	1.27	0.2593	0.94
YOB82	-0.09	0.057	2.73	0.0983	0.91
YOB83	-0.22	0.065	10.95	0.0009	0.81
YOB84	-0.28	0.078	12.77	0.0004	0.76
Observations	8945				
Percent Censored	66.64				
Test of Overall Model:					
Likelihood ratio			982.58	0.0001	
Wald			1040.48	0.0001	

Table 5: Proportional Hazards Regression Results for Drinking Alcohol

Variable	Parameter Estimate	Standard Error	Chi-Square	Pr > Chi.Sq.	Risk Ratios
Marijuana Use	-0.27	0.054	24.31	0.0001	0.77
Smoking	1.12	0.048	556.37	0.0001	3.07
Two parents	-0.21	0.039	29.80	0.0001	0.81
Hard Times	-0.19	0.211	0.78	0.376	0.83
No Father	-0.24	0.090	7.21	0.0072	0.79
Numres	0.03	0.015	3.43	0.0642	1.03
Shot	0.47	0.054	75.01	0.0001	1.59
Poorhh	-0.09	0.051	3.42	0.0642	0.91
Richhh	0.09	0.057	2.49	0.1146	1.10
Hisp	-0.14	0.048	8.47	0.0036	0.87
Black	-0.43	0.049	79.44	0.0001	0.65
Male	0.04	0.035	1.63	0.202	1.05
YOB81	-0.12	0.049	6.17	0.013	0.89
YOB82	-0.13	0.055	5.90	0.0151	0.87
YOB83	-0.23	0.065	12.83	0.0003	0.79
YOB84	-0.29	0.079	13.69	0.0002	0.75
Observations	8944				
Percent Censored	63.56				
Test of Overall Model:					
Likelihood ratio			858.40	0.0001	
Wald			902.79	0.0001	

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