

Parental and Peer Influences on the Risk of Adolescent Drug Use

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Using a probability sample of 4,230 adolescents from grades 7–12, we used negative binomial regression to estimate the effects of peer and six family variables on the risk of adolescent drug use. Peer drug use had relatively strong effects of adolescent drug use. Parental drug attitudes, sibling drug use, and adult drug use had significant direct effects net of peer influences. In addition, they had significant indirect effects that were mediated by peer drug use. The influences of parental monitoring, attachment to mother, and attachment to father were statistically significant but relatively small. The findings applied to alcohol, binge drinking, cigarettes, marijuana, and other illicit drugs.

Editors' Strategic Implications: The authors interpret their findings as being more consistent with social learning than social control theory. This research, although cross-sectional and limited to adolescents' self-reports, contributes to a growing literature on the direct and indirect influences of parents on their teens' substance use rates. It speaks to the need for school- and community-based prevention efforts to focus on families as well as peers.

KEY WORDS: adolescent drug use; peers and drug use; family and drug use.

An ongoing issue in the study of adolescent drug use is the rival effects of peer versus parental influences. On the one hand, theory and research indicate that parental influences have significant impacts on the risk of adolescent drug use (Etz, Robertson, & Ashery, 1998; Hawkins, Catalano, & Miller, 1992; Kandel, 1996; Pe-traitis, Flay, & Miller, 1995; Svensson, 2000). On the other hand, there is evidence that parental influences are small and insignificant after peer influences are taken into account (Aseltine, 1995; Bahr, Maughan, Marcos, & Li, 1998; Hoffmann &

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Su, 1998; Peiser & Heaven, 1996). There is a need to resolve these conflicting findings and better understand the social forces that may influence the development of adolescent drug use. This is an important issue because many drug prevention programs are school-based and focus on peer influences (Gorman, 1996).

The purpose of this research is to examine peer and family characteristics as predictors of adolescent drug use. We extend previous research in a three ways. First, we examine a more complete set of family variables than has been studied in previous research. Second, we explore the direct and indirect effects of six family characteristics on the risk of adolescent drug use. This enables us to estimate how family characteristics may be mediated by peer influences. Third, we study five different types of drug use rather than focusing on only one or two drugs. We turn now to a brief review of relevant theories that explain how families and peers may influence the risk of adolescent drug use.

Social Learning Theory

Theoretically, family and peer relationships are important for adolescent drug use because both are primary groups where attitudes and behaviors are learned. According to social learning theory, an individual learns to take drugs in small, informal groups (Akers & Sellers, 2004; Bahr, Maughan, Marcos, & Li, 1998; Petraitis, Flay, & Miller, 1995). It is in these intimate settings that people are taught, through imitation and reinforcement, to hold attitudes that are favorable or unfavorable to drug use (Reed & Rountree, 1997). Within families where alcohol is used, adolescents may observe alcohol use, acquire favorable attitudes toward alcohol use, and begin using alcohol themselves (Wills, Mariani, & Filer, 1996). Similarly, if their friends drink alcohol, adolescents are likely to receive positive social reinforcement from their friends for drinking (Petraitis, Flay, & Miller, 1995).

Many social learning theorists focus on peers because of the significance adolescents place on friends as adolescents mature and gain autonomy from their parents. However, families also appear to be important for learning attitudes and behaviors about alcohol and other drugs. In Sutherland's differential association theory (Sutherland, Cressey, & Luckenbill, 1992), for example, learning takes place according to the frequency, duration, intensity, and priority of social interactions. Adolescents are likely to acquire attitudes favorable to drug use if they associate frequently with others who use drugs and have favorable attitudes toward drug use. If those interactions occur over a long period of time, internalization of pro-drug attitudes and behaviors is more likely than if the duration of interactions is over a short period of time. Learning is more likely to occur when interactions are intense as opposed to casual and superficial. Intense interactions tend to occur in primary groups such as families or close friends. Adolescents are likely to listen to and give priority to individuals who they admire and look up to.

If those individuals have attitudes favorable to drug use and use drugs themselves, adolescents are likely to imitate and internalize those attitudes and behaviors.

Although peer interactions may be powerful influences since they are often frequent, intense, and given high priority by youths, families also are likely to be important influences on the learning of drug use attitudes and behavior. One's family is the first social group many individuals belong to and it is usually a significant group where individuals have frequent and intense interactions over a long period of time.

Social Control Theory

The premise of social control theory is that deviance is normal and conformity, rather than deviation, must be explained (Akers & Sellers, 2004; Hirschi, 1969). Implicit in this theory is the understanding that all adolescents have impulses toward deviance and would act on these desires if not for pro-social controls provided through families and other social institutions (Hirschi, 1969). In the context of adolescent drug use, social control theorists maintain that when adolescents are close to their parents, they feel obligated to act in non-deviant ways that please their parents (Rankin & Kern, 1994; Wright & Cullen, 2001). Hence, they are likely to refrain from drug use if their parents are opposed to their drug use. When they are not close to their parents, however, adolescents may not feel as constrained to conform to the desires of their parents and they are more likely to experiment with drugs.

In a similar way, monitoring by parents may influence drug use among adolescents. When monitoring is high, teens may feel constrained to act in pro-social ways because they believe their parents are watching them and expect them to conform. When monitoring is low and adolescents do not perceive that their parents are supervising their activities closely, adolescents are likely to let their own preferences guide their behavior. When this happens, adolescents may act on their impulses to experiment with drugs (Vitaro, Brendgen, & Tremblay, 2000). Of course, parental attachment and monitoring are not likely to constrain adolescent drug use if parental attitudes and behavior are tolerant of adolescent alcohol use. In explaining adolescent drug use, many social control theorists focus on parents because it is parents who are likely to constrain the deviance of their children.

RESEARCH OBJECTIVES

In both social learning and social control theories, adolescent relationships with their parents and peers are critical in predicting whether adolescents will choose to use drugs. According to social learning theory, adolescents whose family members and friends use drugs are likely to model those behaviors and use drugs

themselves. From social control theory, we would expect that drug use is less frequent among adolescents who are close to their parents and perceive that their parents monitor their behavior closely.

Although there has been much research on these two theories, there are conflicting data regarding how well family characteristics predict adolescent drug use. Our objectives in this study are to extend existing research in three ways. First, based on social learning and control theories, we examine six family variables to determine their relative strength in predicting adolescent drug use. From social learning theory, we examine parental drug attitudes, sibling drug use, and adult drug use. From social control theory we examine attachment to mother, attachment to father, and parental monitoring. Previous researchers have not examined all of these variables simultaneously although all are important according to these two theories.

Second, we explore the extent to which peers may mediate family characteristics. In some existing research, parental and peer characteristics have been compared to see which has the strongest direct association with adolescent drug use (Hoffmann, 1993). Newcomb (1992) referred to this approach as a tug-of-war between pro- and anti-drug forces, the winner of which was assumed to have the greater influence on an adolescent's choice to use drugs. Researchers using this direct approach have found consistently that peers have stronger associations with adolescent drug use than family variables (Bahr, Maughan, Marcos, & Li, 1998; Brook, Brook, & Richter, 2001; Hoffmann, 1993; Seydlitz, 1993; Wills, Mariani, & Filer, 1996). However, direct comparisons of peer versus family variables ignore the possibility that peers may mediate family variables.

The diagram in Fig. 1 illustrates the limitation of existing research. Some researchers have examined how family variables predict adolescent drug use without taking into account peer variables (path *b* in Fig. 1). Others have examined peer and family variables simultaneously and have found that peers are relatively strong predictors of adolescent drug use (path *a* in Fig. 1) while the family variables are relatively weak predictors of adolescent drug use (path *b* in Fig. 1). Some have concluded from these results that family variables are relatively weak net of peer influences. However, such a finding does not demonstrate that the family variables are weak but only that their influences are antecedent to and mediated by peers (path *c*, Fig. 1). In this study, we test the model in Fig. 1 to (1) estimate how well the family variables predict adolescent drug use net of peer influences, and (2) determine the extent to which the different family variables are mediated by peers (paths *c* and *a* in Fig. 1).

The third objective of our research is to estimate the relative predictive power of family and peers across five different categories of drugs: (1) alcohol use, (2) binge drinking, (3) cigarette use, (4) marijuana use, and (5) other illicit drug use. Examining these drug categories separately is important to determine whether the influence of family characteristics varies across the different drugs. To illustrate,

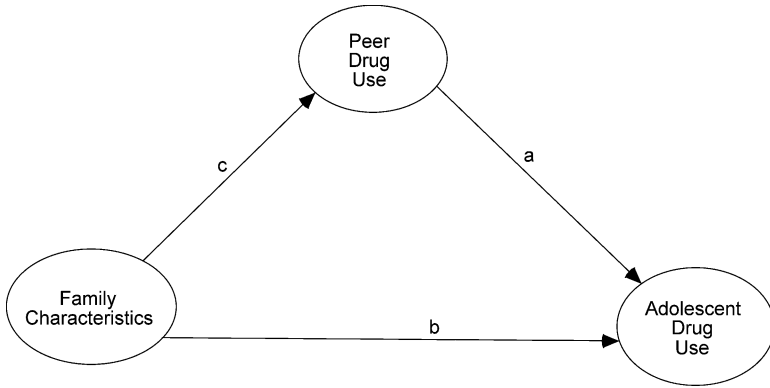


Fig. 1. Hypothetical model of adolescent drug use.

since alcohol is legal for adult family members, attitudes and behavior for alcohol might be different than for marijuana. Alcohol is widely used by adults while possession of marijuana is a criminal offense in most states.

PREVIOUS THEORY AND RESEARCH

Before reporting our results, we summarize existing research on how peer and family characteristics may influence adolescent drug use. From social learning theory, we examine peer drug use along with parental drug attitudes, sibling drug use, and drug use by significant adults. Attachment to mother, attachment to father, and parental monitoring are the family variables derived from social control theory. Age and gender are included as control variables.

Peer Drug Use

Consistent with social learning theory, numerous researchers have documented the powerful influence of peers on adolescent drug use (Brook, Brook, & Richter, 2001; Hawkins, Catalano, & Miller, 1992; Reed & Rountree, 1997; Thornberry & Krohn, 1997; Trost, Langan & Kellar-Guenther, 1999). When adolescents associate with peers who use drugs, they are much more likely to initiate drug use (Elliott, Huizinga, & Ageton, 1985; Huizinga, Loeber, & Thornberry, 1995; Kaplan, Martin, & Robbins, 1984). Peers usually introduce one to a drug and encourage its use and adolescents rarely use drugs if none of their friends use drugs (Khavari, 1993; Moon, Hecht, Jackson, & Spellers, 1999). Of course, there are also selection effects. Adolescents who use drugs tend to choose friends who

use drugs. Longitudinal data indicate that socialization and selection effects are about equal in strength (Kandel, 1980).

Parental Drug Attitudes

We define parental drug attitudes as how wrong parents feel it is for their adolescent to use various drugs. Existing research indicates that parental attitudes toward drug use influence the likelihood that adolescents will use drugs. For example, Brook, Whiteman, Gordon, and Cohen (1986) found that maternal tolerance of tobacco use had a positive association with adolescent drug use. According to Barnes and Welte (1986), when parents disapprove of drinking, students are less likely to drink and if they drink, they consume less alcohol. McDermott (1984) reported that parental drug attitudes, as perceived by the adolescent, have stronger effects on adolescent drug use than does parental drug use. Andrews, Hops, Ary, Tildesley, and Harris (1993) observed that both parental attitudes and behavior influenced adolescent substance use.

Sibling Drug Use

Needle, McCubbin, Wilson, Reineck, Lazar, & Mederer, (1986) observed that researchers have given little attention to the possible influence of siblings on adolescent drug use. Yet, siblings are likely to be an important way adolescents are introduced to and learn about drugs. Younger siblings often observe and model the behavior of older siblings. If the older siblings use drugs, they provide a model for adolescents to emulate. On the other hand, when an older sibling does not use drugs, younger siblings have a drug-free model to follow. Needle, McCubbin, Wilson, Reineck, Lazar, & Mederer, (1986) reported that siblings have a significant influence on adolescent drug use. More recently, a number of researchers have confirmed that siblings are an important socializing influence on the drug use of adolescents (Brook, Brook, & Whiteman, 1999; Rohde, Lewinsohn, Brown, Gau, & Kahler, 2003; Stillwell, Hunt, Taylor, & Griffiths, 1999; Stormshak, Comeau, & Shepard, 2004; Windle, 2000).

Adult Drug Use

Adults who associate with adolescents are likely to influence the attitudes and behaviors of the adolescents. If adolescents see their parents or other significant adults using drugs or if the attitudes of the adults are tolerant of drug use, adolescents may be inclined to experiment with drugs, acquire accepting attitudes toward drug use, and choose friends who use drugs. Often parents are significant adults for adolescents but other relatives, teachers, neighbors, and employers may

also influence adolescent drug use. It is probable that adolescents acquire attitudes favorable or unfavorable to drug use through their interactions with parents and other adults. We discovered no research on how adults other than parents may influence the risk of adolescent drug use. However, there is a substantial amount of research demonstrating that parental drug use is positively associated with drug use among adolescents (Andrews, Hops, Ary, Tildesley, & Harris, 1993; Hawkins, Catalano, & Miller, 1992; Miller, Alberts, Hecht, Trost, & Krizek, 2000).

Attachment to Parents

Social control theorists maintain that delinquent behavior, including drug use, is linked to the bond that an individual maintains with society (Hirschi, 1969). One of the critical bonds identified by Hirschi (1969) is attachment to parents. Attachment is the amount of connection or closeness adolescents feel toward their parents (Barber, 1997). Hirschi (1969) assumed that attachment to parents helps adolescents accept conventional values and tends to deter them from associating with delinquents. Consistent with social control theory, there is evidence that a close and affectionate relationship between parents and children inhibits drug use directly and indirectly by influencing peer selection (Bahr, Maughan, Marcos, & Li, 1998; Brook, Whiteman, Gordon, & Brook, 1990; Hoffmann, 1993, 1995; Sokol-Katz, Dunham, & Zimmerman, 1997; Stice & Barrera, 1995). On the other hand, Hoffmann and Su (1998) found that family relationships had no direct impact on drug use after controlling for other effects in their model. A few other researchers (Bahr, Marcos, & Maughan, 1995; Kandel, 1980; Simcha-Fagan, Gersten, & Langner, 1986) have found weak associations between parent-adolescent attachment and adolescent drug use.

Since mother-adolescent attachment may be qualitatively different from father-adolescent attachment, we chose to conceptualize attachment into two major types, attachment to father and attachment to mother. This conceptualization is consistent with recent research by Dorius, Bahr, Hoffmann, and Harmon (2004). Using structural equation modeling, they confirmed that attachment to mother is distinct from attachment to father.

Parental Monitoring

Parental monitoring is the extent to which parents watch and supervise their children (Bahr, Maughan, Marcos, & Li, 1998; Hirschi, 1969). Social control theorists assume that parental monitoring has a negative association with delinquent behavior (Akers & Sellers, 2004; Hirschi, 1969). Consistent with this assumption, a number of researchers have reported that a lack of parental monitoring is associated with children's initiation into drug use

(Kandel & Andrews, 1987; Larzelere & Patterson, 1990; Penning & Barnes, 1982; Svensson, 2000). If parents usually know what their children are doing and who they are with, their children will be less likely to associate with drug-using friends, and consequently less likely to use drugs (Bahr, Maughan, Marcos, & Li, 1998; Flannery, Williams, & Vazsonyi, 1999; Larzelere & Patterson, 1990). We expect that parental monitoring will have a negative association with the likelihood of adolescents associating with drug-using peers.

Control Variables

Because age and gender are associated with adolescent drug use, each of these variables was included as a control variable. Age was included because drug use tends to increase with age (Hoffmann & Johnson, 1998). The exposure of adolescents to drugs is a developmental process that changes over time as relationships with parents and peers evolve (Catalano, Kosterman, Hawkins, Newcomb, & Abbott, 1996). Gender is important because drug use is more prevalent among boys than girls (Hoffmann & Johnson, 1998). These control variables are related not only to drug use but also to some of our independent variables. Therefore, it is essential to include them in our analyses in order to specify our models correctly.

METHOD

Sample

The data were from a probability sample collected in an intermountain state in 1997 from 4,230 students in grades 7–12. The final sample was 82 percent of the total number of students enrolled in the sample classrooms at the time of the survey. The sample was similar to the state population on major demographic characteristics. Compared to the state population of students in grades 7–12, our sample had a slight over-representation of girls, minorities, and junior high students. The sample ranged in age from 12 to 19 with a median age of 15. About half (51%) of the respondents were girls and 72.6 percent lived with both of their parents. Forty-two percent said their father had graduated from college and 35 percent reported that their mother had graduated from college. In terms of ethnicity, 88 percent indicated that they were White and not of Hispanic origin.

To help minimize the bias from dropouts, an over-sample of students from alternative schools was included in the sample. We used alternative students as a proxy for dropouts because teachers and school counselors indicate that students at alternative schools are similar to dropouts, and many students who eventually drop out of public school attend alternative schools for a period of time.

Each school district had an alternative school to provide educational opportunities for students that were not able or not allowed to continue in traditional

classrooms. Students assigned to alternative schools had a behavioral, legal, or academic problem that precluded their attendance in the traditional classroom. Most students in the alternative school had low grades or were failing in the traditional classroom and many were involved in legal difficulties such as drug use, truancy, and petty crime. Each student in an alternative school was assessed by a counselor and had an individual educational plan set up. They were required to attend at least weekly to bring in assignments and attend some type of group meeting.

The alternative school students who completed the questionnaire were 5.3 percent of the total respondents, which is slightly larger than the dropout rate reported by school officials. The rates of alcohol, cigarette, and marijuana use would have been about 2 percent lower if the alternative students had not been included in the sample. This is consistent with the estimates of Johnston, O'Malley, and Bachman (1999) concerning the impact of dropout students on rates of drug use. By including alternative school students, we have minimized sampling bias common in school surveys.

Measurement of Variables

We focus on five dependent variables: alcohol, binge drinking, cigarettes, marijuana, and illicit drug use during the past thirty days. For alcohol, cigarette, and marijuana use the students were asked how frequently they used each of those substances during the past thirty days. Each item had seven response categories ranging from "0 occasions" to "40 or more times."

To measure binge drinking, the students were asked how often during the past two weeks they had five or more alcoholic drinks in a row. There were six response categories, ranging from "None" (0) to "10 or more times" (6).

As shown in Table I, the mean score for binge drinking during the past two weeks was .23 while the mean score for alcohol use during the past month was .38. The percentage of students who admitted drinking any alcohol during the past month was 19.6 percent while the percentage who said they binge drank during the past two weeks was 10.7 percent. Thus, about half of those who currently drink alcohol said they participated in binge drinking at least once during the past month.

Finally, to measure illicit drug use, we summed the total number of six illicit drugs that the respondent reported using during the past 30 days. The six drugs were amphetamines, sedatives, hallucinogens, cocaine, inhalants, and heroin. The response to each drug was dichotomized into "0" for no use and "1" if they had used the drug during the past month. The responses to the six illicit drugs were summed resulting in a scale with a range of "0" (no use of any of the six drugs) to "6" (had used all six drugs during the past month). The items and descriptive

Table I. Measurement of Adolescent Drug Use

	Range	M	SD
Alcohol Use			
Occasions of alcohol use during past 30 days	0–6	0.384	0.961
Binge Drinking			
Times in past 2 weeks had 5 or more alcoholic drinks in a row	0–5	0.230	0.771
Cigarette Use			
Frequency of smoking cigarettes during past 30 days	0–6	0.319	0.905
Marijuana Use			
Occasions of marijuana use during past 30 days	0–6	0.257	0.976
Illicit Drug Use			
Number of 6 illicit drugs used during past 30 days (amphetamines, sedatives, hallucinogens, cocaine, inhalants, heroin)	0–6	0.182	0.575

statistics for each drug are shown in Table I. Higher scores indicate higher levels of drug use.

Peer drug use was measured by four questions that asked about alcohol, cigarette, marijuana, and other illegal drug use by their four best friends. For each item there were five response categories ranging from “None” to “4.” We used each of the peer questions separately rather than combining them into a scale. For example, to predict alcohol use we used the peer item on alcohol use and to predict cigarette use we used the item on peer cigarette use.

Three questions were used to measure *parental drug attitudes*. Each adolescent was asked how wrong their parents felt it would be for them to (1) drink beer, wine, or hard liquor, (2) smoke cigarettes, and (3) smoke marijuana. Each question had four response categories ranging from “very wrong” to “not wrong at all.” For each item, a higher score indicated more tolerance or acceptance of adolescent drug use by their parents. In the analysis, we used each of the three parental attitude questions separately, i.e., parental attitude toward marijuana was used to predict marijuana use and so on.

Sibling drug use was determined from three questions. The students were asked if any of their brothers or sisters have ever drunk alcohol, smoked cigarettes, or smoked marijuana. The responses were “no,” “yes,” or “I don’t have any brothers or sisters.” Those without a sibling were coded “0” since they had no sibling who used a substance. One of the issues in the measurement of sibling influence is whether or not the sibling is older or younger. We assumed that the major influence is younger siblings modeling older siblings. Therefore, we computed three dichotomous measures of sibling use which were coded as “1” for adolescents who had an older sibling and a sibling who used alcohol (cigarettes or marijuana), and “0” for all who did not meet both of these criteria. In the analysis, we used each of the sibling variables separately. For example, sibling cigarette use was used to predict respondent cigarette use, and so on.

We assessed *adult drug use* by creating a two-item scale. The students were asked how many adults they knew personally who, in the past year, (1) had gotten drunk or high, and how many (2) had used marijuana, crack, cocaine, or other drugs. Each of these two items had five response categories ranging from 0 (“None”) to 4 (“5 or more adults”). The two-item scale ranged from 0 to 8 and had an alpha score of .81. A higher score indicated that they knew more adults who use drugs. A limitation of this scale is that it asked about adults they knew and did not differentiate between their parents and other adults. It is possible that for many of the adolescents the adults are their parents, although they could also be other relatives, neighbors, employers, or teachers. The mean on this scale is 2.72, which indicates that for many of the adolescents they are referring to at least one adult in addition to their parents.

As noted above, parental attachment was separated into *attachment to mother* and *attachment to father* because Dorius et al. (2004) confirmed that these two concepts are distinct conceptually and empirically. Each type of attachment had three indicators: (1) “Do you feel very close to your mother (father)?” (2) “Do you share your thoughts and feelings with your mother (father)?” (3) “Do you enjoy spending time with your mother (father)?” These items had the same four response categories ranging from “Definitely Not True for You” (0) to “Definitely True for You” (3). Thus, each scale has a range of 0 to 9; higher scores indicate higher attachment. The alpha scores for attachment to mother and attachment to father were .86 and .89, respectively.

We used the following three questions as indicators of *parental monitoring*: (1) “If you drank some beer or wine or liquor without your parents’ permission, would you be caught by your parents?” (2) “If you carried a handgun without your parents’ permission, would you be caught by your parents?” (3) “If you skipped school, would you be caught by your parents?” Each of the three items had four response categories: “Definitely Not True for You” (0), “Mostly Not True for You” (1), “Mostly True for You” (2), and “Definitely True for You” (3). The scale scores for monitoring ranged from 0 to 9 with a higher score indicating higher parental monitoring.

The range, mean, and standard deviation of each of the independent variables are given in Table II. In addition, for each multi-item scale the alpha coefficient is listed.

Analysis

Our dependent variables are counts of the frequency of drug use during the past 30 days and range from 0 to 6. The distributions are skewed with high proportions of the responses being “0,” indicating no use during the past month. For example, 80 percent of the adolescents did not use any alcohol during the past month and 91 percent did not use marijuana. In addition, the distributions are “over

Table II. Measurement of Independent Variables

Independent Variables	Questions and Scales	Range	M	SD	Alpha
Peer Drug Use	During past year, number of best friends who used alcohol	0–4	1.167	1.523	
	smoked cigarettes	0–4	0.969	1.415	
	used marijuana?	0–4	0.697	1.267	
	used other illegal drugs	0–4	0.316	0.877	
Parental Drug Attitudes	How wrong do your parents think it is for you to drink beer, wine, or hard liquor regularly?	0–3	0.220	0.579	
	smoke cigarettes?	0–3	0.198	0.564	
	smoke marijuana?	0–3	0.095	0.398	
Older Sibling Drug Use	Have an older sibling who has used alcohol	0–1	0.383	0.486	
	smoked cigarettes	0–1	0.343	0.475	
	used marijuana	0–1	0.217	0.412	
Adult Drug Use	Two item scale	0–8	2.722	2.760	0.81
	Number of adults you know personally who, in the past year, have . . . used marijuana, crack, cocaine, or other drugs? gotten drunk or high?				
Attachment to Mother	Three item scale:	0–9	6.689	2.258	0.86
	Feels close to mother Shares thoughts and feelings with mother Enjoys spending time with mother				
Attachment to Father	Three item scale:	0–9	5.832	2.613	0.89
	Feels close to father Shares thoughts and feelings with father Enjoys spending time with father				
Parental Monitoring	Three item scale:	0–9	5.640	2.641	0.78
	Would you be caught by your parents if you drank alcohol without their permission?				
	carried a handgun without their permission? skipped school?				

dispersed” because their variances are greater than their means. An appropriate statistical technique for this type of distribution is negative binomial regression, a generalization of Poisson regression (Allison, 1999; Hoffmann, 2003). Unlike the assumption of regular Poisson regression, negative binomial regression takes into account the fact that the expected variances exceed the means. We estimated negative binomial regression models for binge drinking and for alcohol, cigarette,

marijuana, and illicit drug use. Using this statistical technique enables us to preserve the distributions of the dependent variables while adjusting for the bias of the standard errors common in analyses of rare events like drug use.

Interpretations of negative binomial regression coefficients are similar to logistic regression coefficients because both use a log transformation as their link functions, to use the terminology of generalized linear models. The regression coefficients are interpreted as “incidence rate ratios” (IRR) similar to odds ratios in logistic regression (Hoffmann, 2003). To illustrate, an incidence rate ratio for sibling alcohol use of 1.50 indicates that those students who have an older sibling who has used alcohol are 50 percent more likely to report a one unit increase in alcohol use than students who did not have an older sibling who has used alcohol.

The respondents were instructed to leave a question blank if it did not apply to them. Non-response rates varied from 0.3 percent on age to 6.5 percent on attachment to father. However, since different respondents tended to skip different items, the total number of missing cases in this analysis was 15.2 percent, and the final usable sample included 4,230 cases.

Because the amount of missing data was relatively small, we chose to use listwise deletion in the analysis. In analyses using listwise deletion with known populations, Allison (2002) found that logistic regression yields consistent estimates of the slope coefficients and their standard errors. He also reported that with regression analysis, listwise deletion is more robust to violations of the assumption that data are missing at random than are other methods of handling missing data. Since in our analysis the missing data are dispersed across different cases and variables, they appear to be missing at random.

RESULTS

For each drug category, we ran two regression equations. First, we ran a regression equation with the six family characteristics and the control variables. Second, we ran the same equation with peer drug use added to the model. As noted earlier, our purpose was to determine whether and by how much family variables diminish in strength when peer drug use is added. For the family variables, the difference between their coefficients in regressions one and two is an estimate of how much of the influence of the family characteristics is mediated by peer drug use. The coefficients for the family variables in equation two are estimates of their direct effects independent of any peer influences.

Alcohol Use

The initial regression results for alcohol use are shown in column 1 of Table III (model 1). The family variables all have significant associations with adolescent

Table III. Negative Binomial Regressions of Family and Peer Variables on Frequency of Alcohol Use and Binge Drinking

Independent Variables	Alcohol		Binge Drinking	
	Model 1	Model 2	Model 1	Model 2
Peer alcohol use		1.77***		1.90***
Parents tolerant of alcohol use	1.80***	1.38***	1.85***	1.39***
Older sibling has used alcohol	1.71***	1.29***	1.84***	1.29*
Know adults who use alcohol or drugs	1.26***	1.12***	1.34***	1.18***
Attachment to mother	.96*	0.97	0.97	0.99
Attachment to father	.94***	.96**	.94**	.95*
Parental monitoring	.88***	.92***	.89***	.93**
Age	1.05*	0.99	1.12**	1.05
Gender	1.29***	1.25***	1.51***	1.44***

* $p < .05$; ** $p < .01$; *** $p < .001$.

alcohol use. Parental attitudes and sibling use are particularly important risk factors. For each unit increase in parental tolerance of alcohol use, the frequency of adolescent alcohol use increases by 80 percent. Those with an older sibling who has used alcohol are 71 percent more likely to report a one unit increase in alcohol use during the past month than adolescents without an older sibling who has used alcohol.

When peer alcohol use is added to the equation, all of the coefficients for the family variables decrease, as expected (see Model 2 in Table III). For example, the incidence rate ratio for parental attitudes decreases from 1.80 in Model 1 to 1.38 in Model 2. Thus, according to Model 2, a one-unit increase in parental attitudes results in a 38 percent increase in adolescent alcohol use, net of peer influences.

Attachment to mother has a relatively small association with adolescent alcohol use. Attachment to father and parental monitoring tend to suppress adolescent alcohol use. Their influences are mediated partially by peers but each still has a modest effect independent of peers (see Table III).

Age is only weakly associated with adolescent alcohol use and this becomes negligible after peers are entered into the equation. The frequency of alcohol use is about 25 percent higher for boys than girls, net of the other variables.

Binge Drinking

Perhaps a greater health risk for adolescents than frequency of alcohol use is binge drinking. We asked the students how many times during the last two weeks that they had five or more alcoholic drinks in a row. Eleven percent of the students reported doing this at least once during the past two weeks.

Our findings are similar to those for frequency of alcohol use, as shown in Table III. Peer alcohol use is the strongest predictor of adolescent binge drinking.

As the number of close friends who drink increases, the risk of binge drinking almost doubles. The most important family variable is parental attitudes followed by having a sibling who drinks. The three variables from social control theory are much less important although the effect of parental monitoring is moderately strong in size.

The sizes of the incidence rate ratios indicate that about half of the influences of parental attitudes, sibling use, and adult use are mediated by peers. Net of peers, each has a significant direct effect on the risk of adolescent binge drinking. Attachment to mother is not associated with binge drinking. Attachment to father and parental monitoring tend to suppress binge drinking only slightly. Age is not related to binge drinking net of the other variables. Boys are much more likely to binge drink than girls.

Cigarette Use

In recent years the proportion of U.S. adolescents who smoke cigarettes has decreased substantially. Nevertheless, adolescent cigarette use continues to be a major health concern. More than half of adolescents have tried cigarettes by twelfth grade and about one-fourth of twelfth graders are current smokers (Johnston, O'Malley, Bachman, & Schulenberg, 2004).

Our results on risk factors for cigarette use are shown in Table IV. All six of the family variables have significant associations with adolescent cigarette smoking. Parental attitudes and siblings who smoke are the most important family variables. Each of these variables doubles the risk of adolescent cigarette smoking.

After peers are entered into the equation, the coefficients for the family variables decrease substantially. The number of close friends who smoke is the strongest predictor of adolescent smoking and it appears to be a mediating variable

Table IV. Negative Binomial Regressions of Family and Peer Variables on Frequency of Cigarette Smoking

Independent Variables	Cigarette Use	
	Model 1	Model 2
Peer cigarette use		2.07***
Parents tolerant of cigarette use	2.11***	1.40***
Older sibling has smoked cigarettes	2.16***	1.51***
Know adults who use alcohol or drugs	1.26***	1.11***
Attachment to mother	.91***	.93***
Attachment to father	.94***	.97*
Parental monitoring	.93***	0.98
Age	1.13***	1.09***
Gender	1.18	1.05

p* < .05; *p* < .01; ****p* < .001.

for the family characteristics. However, even net of peers, the family variables are important, particularly parental attitudes and sibling use. Sibling smoking is associated with a 50 percent unit increase in the risk of smoking. As parental attitudes increase by a point (become more tolerant of cigarette use), the unit increase in cigarette use increases by 40 percent. Attachment to mother, attachment to father, and parental monitoring tend to decrease the risk of adolescent smoking and these effects are partially mediated by peers. Gender is not associated with adolescent smoking net of peers while the risk of smoking increases with age.

Marijuana Use

The most commonly used illegal drug is marijuana. In 2003, 21 percent of high school seniors tried marijuana during the past month (Johnston, O'Malley, Bachman, & Schulenberg, 2004). Our results for marijuana are shown in Table V. All of the family variables have significant coefficients. When peer effects are added in Model 2, the family coefficients become considerably smaller, again indicating that peers mediate some of the impact of the family variables.

The most important family variable is having a sibling who has used marijuana, which is associated with a 50 percent unit increase in marijuana use. Other important risk factors are tolerant parental attitudes and knowing adults who use. Attachment to father is not significant while attachment to mother has a modest but significant coefficient. Parental monitoring appears to be more important for marijuana use than for alcohol or cigarettes. Net of peers, parental monitoring is associated with a 10 percent unit decrease in marijuana use. Age is not related to marijuana use net of the other variables. Males are much more likely to use marijuana than females.

Table V. Negative Binomial Regressions of Family and Peer Variables on Frequency of Marijuana Use and Number of Illicit Drugs Used

Independent Variables	Marijuana Use		Illicit Use	
	Model 1	Model 2	Model 1	Model 2
Peer marijuana use		2.35***		
Peer use of other illegal drugs				1.61***
Parents tolerant of marijuana use	2.18***	1.33***	1.43***	1.11
Older sibling has smoked marijuana	2.83***	1.58***	1.35**	1.09
Know adults who use alcohol or drugs	1.46***	1.25***	1.28***	1.21***
Attachment to mother	.95*	.95*	.94**	.94**
Attachment to father	0.96	0.98	.96*	0.97
Parental monitoring	.84***	.90***	.83***	.86***
Age	1.04	1.00	.81***	.79***
Gender	1.62***	1.50***	0.93	0.96

* $p < .05$; ** $p < .01$; *** $p < .001$.

Illicit Drug Use

As mentioned earlier, illicit drug use was measured by the number of six illicit drugs, other than marijuana, that adolescents used during the past month. Twelve percent of the students admitted using at least one of the six illicit drugs during the past month.

Our regression results (see Table V) are similar to those for the other drugs. Parental attitudes and sibling use are again the two most important family variables. However, the coefficients for these two variables become negligible when peer influences are included. Thus, their impacts appear to be mediated completely by peers. Parental monitoring is important net of peer influences. The incidence rate ratio of .86 indicates that as parental monitoring increases, the number of illicit drugs one uses decreases by 14 percent. Attachment to mother has a modest suppressant effect while attachment to father has only a slight impact.

DISCUSSION

One of the ongoing issues in the study of adolescent drug use is the strength of peer and family influences. Drug prevention programs have tended to focus on school programs that target peers (Gorman, 1997). However, there is increasing evidence that peer influences have been overestimated (Bauman & Ennett, 1996; Gorman, 1998; Kandel, 1996). One of the purposes of this research was to address this question by including a more complete set of family characteristics than has been included in previous research (parental attitudes toward drug use, sibling use, adult use, attachment to mother, attachment to father, and parental monitoring). These six variables were examined across five different drug categories. After including the family and attitudinal variables, peer drug use had stronger effects than any of the other variables. However, the results showed that the family variables had significant impacts on adolescent drug use as well.

Several key findings stand out. First, the effects of the family variables appeared to be partially mediated by peers. The amount of their influence that was mediated through peers tended to be about 50 percent.

Second, several family variables had significant effects independent of peer influences. Tolerant parental drug attitudes and sibling use were particularly important, with the incidence of each type of use increasing by about 30 to 50 percent for each unit increase in these variables. These data indicate that the family variables have significant, direct influences on adolescent drug use separate from any peer influences. The cumulative impact of the six family variables is important even though peer influences had the strongest impact of any individual variable.

Third, the data are more consistent with social learning than social control theory. Although attachment to mother and father and parental monitoring had

significant effects for most drugs, their coefficients were much smaller than the coefficients for the social learning variables. The most important of the three social control variables was parental monitoring. It was strongest for marijuana use and illicit drug use but weak for cigarette use.

Our findings confirm that peers had a strong influence on adolescent decisions to use drugs. In addition, the family variables had significant effects net of peer influences and the cumulative impact of the six family variables was substantial. This confirms that the indirect effects of the family variables are important in estimating the complex social forces that may influence adolescent decisions to use drugs.

It is well established that peers have a strong influence on adolescent decisions to use drugs. An important practical question is how family characteristics might influence the choice of peers. We found that when parents were tolerant of drug use, adolescents were more likely to have friends who use drugs. In addition, there was a negative association between parental monitoring and having friends who use drugs, and those who were attached to their parents were somewhat less likely to have friends who used drugs. These data imply that the family variables may be an important influence on the choice of peers.

Study Limitations

There were several limitations to our study. First, since the data were cross-sectional, we were unable to verify the hypothesized temporal ordering of the variables. The analysis shows the extent to which adolescent drug use was associated with the family variables, net of peer influences. Our data provide no information on temporal ordering. We acknowledge that there may be reciprocal influences among some of the variables. For example, associating with drug-using adults may affect peer selection, but the reverse is also possible. Hoffmann and Su (1998) found that previous drug use may affect later peer selection and family attachment. Longitudinal data are needed to capture these reciprocal relationships.

A second limitation was that the adolescents provided all of the information. Adolescent reports of parental monitoring and attitudes may not reflect the actual behavior and attitudes of parents, and adolescent reports of peer behavior may not reflect actual peer behavior. However, as noted by Gray and Steinberg (1999), parental reports of monitoring are not necessarily more accurate than adolescent reports of parental monitoring. Furthermore, adolescent perceptions of parental behavior appear to be as important in adolescent development as the actual behavior of the parents (Gray & Steinberg, 1999). Similarly, although adolescent perceptions of peer behavior may not be accurate (Aseltine, 1995), adolescents respond to their perceptions of their peers rather than to the actual behaviors of their peers.

Third, a direct measure of parental drug use was not available. Our measure of adult drug use may partially capture parental use. In addition, parental drug use might affect adolescent drug use indirectly by influencing adolescent drug attitudes and their choice of peers (Andrews, Hops, Ary, Tildesley, and Harris 1993; Hoffmann & Su, 1998; McDermott, 1984). Without a direct measure of parental drug use, the effect of parental drug attitudes might have been overestimated.

Fourth, peer influences may have been overestimated because of our inability to account for temporal order selection effects (Aseltine, 1995; Hoffmann & Su, 1998). Kandel (1996) estimated that peer influence is inflated by a factor of at least two when the temporal influence of parents on peer selection is not taken into account. Despite this limitation, the overall pattern of our relationships is consistent with our theoretical model.

Fifth, the prevalence of all types of drug use was relatively low in this sample compared with national data. To illustrate, in their national sample of eighth, tenth, and twelfth graders, Johnston, O'Malley, & Bachman, (1999) reported that 16.6 percent of the students had used marijuana during the past month, compared with 10.8 percent among the eighth, tenth, and twelfth graders in our sample. An important question is whether the results would be different among adolescents with higher usage rates. Given previous results that are consistent with our findings (Catalano, Kosterman, Hawkins, Newcomb, & Abbott, 1996; Kandel, 1996; Larzelere & Patterson, 1990; Svensson, 2000), we would predict similar results among different types of samples in other geographical regions. We see no theoretical reason why the family variables would operate differently in different regions of the country or where adolescent usage rates may be higher. However, that is an empirical question for future research.

Contributions of Study

A significant contribution of our study is that we used a large probability sample that included measures of six family variables as well as number of close friends who use drugs. The inclusion of six different family characteristics was particularly important given the conflicting findings in previous research regarding the relative influence of peer and family characteristics. Finally, we used negative binomial regression to estimate indirect influences. Modeling indirect effects is critical in understanding the complex social forces that may influence adolescent decisions to use drugs.

Implications for Prevention and Intervention

These findings have a number of implications for strengthening prevention programs. First, our model indicates that prevention should be multifaceted and

not focus on only one component such as peers. Gorman (1996, 1998) questioned the usefulness of many school-based and community-based programs that focus on the idea that peer pressure is the primary cause of adolescent drug use. It appears that drug prevention programs should place more emphasis on myriad influences from parents, siblings, and other adults.

Second, parental attitudes appear to be a critical variable that has direct and indirect influences on adolescent drug use. Given this finding, perhaps prevention programs should assess and attempt to influence the attitudes of parents and adolescents toward drug use. If parents or adolescents can acquire attitudes unfavorable to drug use, this may be an important countervailing force against peer pressure to use drugs. Our findings on the importance of parental attitudes are consistent with the suggestion of Graham (1996) that prevention programs should include attitudinal as well as behavioral training.

Third, although monitoring and attachment had only modest effects, their cumulative impact was important. When parents ask what they can do to help minimize the risk of drug use among their children, these variables should be discussed. Parental monitoring was particularly important for illicit drug use. Furthermore, communities could help parents by offering classes that teach parenting skills. There is evidence that training in parenting skills can help parents learn to enhance protective factors and avoid practices that increase the risk of adolescent problem behaviors (Catalano, Kosterman, Haggerty, Hawkins, & Spoth, 1998).

Fourth, too often practitioners and researchers have ignored antisocial influences other than from peers. Our findings indicate that families and other adults may also produce significant antisocial influences. In addition, in certain contexts peers could be a pro-social influence as demonstrated by the research by Osgood, Wilson, O'Malley, Bachman, & Johnston (1996).

Adolescent decisions to use or refrain from drugs are influenced by a variety of social forces. Although each individual family variable may have only a small impact, we found that the constellation of family variables has a significant influence on adolescent decisions to use drugs. That constellation includes parental attitudes, parental monitoring, adolescent-parent bonding, and sibling drug use. Although peer influences remain powerful, it does not appear to be valid to dismiss family variables as insignificant. Taken together, these family variables are associated with adolescent drug use net of peers and may influence adolescent choice of friends.

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