

Peer Network, Sensation Seeking, and Drug Use among Junior and Senior High School Students¹

Ronald E. Rice

School of Communication, Information and Library Studies, Rutgers University, USA

Lewis Donohew

Center for Prevention Research, University of Kentucky, USA

Richard Clayton

Center for Prevention Research, University of Kentucky, USA

This study argues that both individual and social factors are strong influences on use of drugs by adolescents and teenagers, and, further, that these factors may interact. Thus, both individual and social factors offer avenues for targeting prime at-risk groups and designing messages and programs to reach them. The primary individual factors explored here are prior drug use, attitudes toward drug use, closeness toward family, susceptibility to peer pressure, and sensation-seeking, and the social factors explored are the attitudes, behaviors, and sensation-seeking of respondents' named friends/peers. In particular, peers' own responses are used instead of respondents' estimated or perceived peers' drug attitudes, behaviors and sensation-seeking. These factors are included in a model that is tested over three cohorts of an average of 1900 junior- and high-school students, each measured at three successive grades. Both one's own sensation-seeking, and peer influence (their drug use, and their sensation-seeking), along with one's own prior drug use, are the main predictors of specific drug use at the end of the periods.

INTRODUCTION

Before we can develop a comprehensive theory of drug use prevention that guides our interventions, much more needs to be known about the relationships among the various motivating forces leading to drug use. Although the mass media offer the most effective means of reaching large audiences and school-based programs offer the most parsimonious means of repeated instruction, unfortunately, neither the mass media nor interpersonal approaches have a history of consistent success.

¹ We appreciate comments on a previous version of this paper from Dr. Kathryn Greene and anonymous reviewers. This research was supported by grants DA-04887-05 and DA-05312 from the National Institute on Drug Abuse. See Donohew, Hoyle, Clayton, Skinner, Colon, and Rice (1999), and Palmgreen, Donohew and Harrington (2001) for more details on the nature of these projects.

For example, though Project DARE (Drug Abuse Resistance Education) has received considerable press and research fanfare, overall analyses do not find that this traditional form of prevention has much effect. Ennet and Rosenbaum's (1994) longitudinal evaluation of Project DARE in 36 schools (1,334 adolescents) in Illinois found only a limited effect of DARE's impact on student drug use immediately following the intervention, and none for either continued or emerging impact on drug use 1 or 2 yrs after. Of relevance to the current study, DARE had no effect on social variables (there, peer resistance skills). More generally, Ennett and Tobler (1994) meta-analyzed eight methodologically rigorous DARE evaluations, finding that for all outcomes, the DARE effect size means were considerably smaller than those of programs emphasizing social and general competencies and using interactive teaching strategies. Similarly, Hallfors and Godette (2002) report that 82% of 81 school districts in 11 states were recently using the DARE program, even though research shows small short-term and no long-term effects on prevention.

This study analyzes influences in drug use in a cohort of sixth through eleventh graders. While it includes some of the more familiar influences identified by health communication and drug use research, this study has four particularly innovative components. First, it emphasizes the influence of peer attitudes and behavior at the respondent's ego-network level. Second, it emphasizes the influence of the need for sensation-seeking at the individual level. Third, it uses peer measures rather than respondents' perceptions of peer attitudes and behavior. Fourth, it tests a model of influence both across time and across cohorts of grade-school students. Panel studies of adolescents have concentrated on the relation of social psychological variables (e.g., self-esteem, distress) and peer influences to drug use (Kandel, 1985; Kandel, Smirch-Fagan, Davies, 1986; Kaplan, Johnson, and Bailey, 1987; Kaplan, Martin, and Robbins, 1984). However, few if any studies consider individual and network variables in combination with peer measures simultaneously, permitting a more valid assessment of their contributions individually and together over an extended period of time.

REVIEW OF RELEVANT RESEARCH

Drug Use

Drug use, even of cigarettes and alcohol, is not common among sixth graders, but increases substantially in immediately following years (Clayton *et al.*, 1988). And the climate of opinion toward cigarette smoking has been changing recently, which Flay (1987) attributed in part to continued reports in the media over a period of years. However, while drug use such as marijuana had been declining through 1992, it has been rising in past years, along with more positive attitudes by high school students toward such use (Cappella *et al.*, 2001). Use of these drugs, whether early or later in life, is still a matter of great societal and individual concern. Considerable research and funding has been devoted recently to reducing American youth's attitudes toward and use of drugs, such as the 5-year National Youth Anti-Drug media campaign (Cappella *et al.*, 2001).

Peer Influence

Certainly socialization forces from family, school, and church influence adolescents' attitudes toward the use of drugs (Elliott, Huizinga and Ageton, 1985; Massey and Krohn, 1986; Oetting *et al.*, 1991). Research provides considerable support for the importance of peer networks in influencing many behaviors and attitudes (Friedkin, 1998; Friedkin and Cook, 1990; Rice, 1993), including use of alcohol, cigarettes, and other drugs (Flay *et al.*, 1983; Kandel, 1985).

Drug use among high school students was more strongly associated with drug use among peers than with any other variable in Kandel's study (1985) and social support for drug use was the strongest six-month predictor of drug use in Sadava's study of college students (1973). Wister and Avison (1982) also found that peer group pressure among college students is an important correlate of marijuana use. Just over 1,000 students completed a survey concerning their, and their friends', beer drinking behaviors, in their 6th grade and again in their 7th grade in Ennett and Bauman's study (1991). Peer drinking indirectly influenced adolescent drinking by shaping adolescents' norms on drinking, drinking preferences, and expected consequences of drinking related to friends and problem behavior. Parental alcohol use and peer attitude toward alcohol had primarily direct influence on adolescent beer drinking.

A fair amount of research on peer influences has focused on tobacco use. From a network analysis of 461 9th graders, Ennett and Bauman (1994a) identified 87 adolescent friendship cliques. While smokers tended to be in cliques with smokers, most cliques were comprised entirely or mostly of nonsmokers, implying that friendship cliques may contribute more to the maintenance of nonsmoking than to the onset and maintenance of smoking. Ennett and Bauman's (1993) study of 1,092 9th graders in five schools in one school system asked the students to name their three best friends. At four of the schools, being a current smoker was significantly more likely for isolates than for clique members and liaisons. These effects were not explained by demographic variables or by the number of friends who smoke. Their related analysis (Ennett and Bauman, 1994b) of students ($n=926$) in five schools at two time periods concluded that influence and selection contributed about equally to peer group smoking homogeneity, but, as most smokers were not peer group members, selection provided more of an explanation than influence for why isolates smoke. An innovative analysis of 719 matched pairs of parent (usually mother) and child suggests that parents' former smoking is associated with adolescents' current smoking, and family influences were family disunion and parents' awareness of their child's activities (Bailey and Ennett, 1993).

Research shows consistent support for the relationship between one's own, and one's peers', delinquency. This is particularly likely as adolescents move from middle school to high school, where they are confronted with larger and more heterogeneous sets of students, so their own identity and being known become more salient and even difficult. Thus individuals become especially susceptible to peer influence, and groups work hard to strengthen peer cohesion and maintain group norms. However, adolescents belong to multiple friendship groups with varying cohesion and openness, so the total number of delinquent friends is an insufficient conceptual and empirical factor. Indeed, different delinquent groups tend to specialize in their delinquencies, group structures affect delinquent behaviors, and, counter to social control theory, there are generally few differences in friendship relations compared to delinquent and nondelinquent groups (Giordano, Cernkovich and Pugh, 1986; Kandel and Davies, 1991).

As most prior studies of student/peer influences on drug use represent peer attitudes and behavior by the respondent's estimation or perception of those attitudes and behavior, instead of the peers' own reported attitudes and behaviors, one important question is the extent to which these results are confounded by overestimates or common-method bias. We will return to that important methodological question.

Peer Influence Mechanisms

Social Control or Social Learning. There seem to be two major schools of thought on how peer networks influence adolescents' drug use. One may be called the social control model. This

perspective argues that drug users experience less social control than non-users, due to personal isolation or weak personal ties, and thus are more disinhibited toward drug use, and tend to associate with other drug users who have also experienced less social control (Gottfredson and Hirshi, 1990). Oetting and Beauvais (1987) argue that adolescents in general are embedded in clusters of similar peers, members of which all influence each other. As an example of weakened social control, adolescent smokers are less likely to have values centered around family, school or church (Jessor and Jessor, 1977) and thus are more likely to try deviant behavior and associate with deviant peers who model such behaviors (Massy and Krohn, 1986). Members of a 'punk' gang with weaker bonds to school, family and a home, were more likely to hold delinquent attitudes and to be more integrated into the gang (Baron and Tindall, 1993).

A social control perspective would predict weaker links, less multiplex ties, less support, more conflict, less group cohesion, less attraction to the group, and smaller groups. That is, there is less social control exerting influence on an individual's attitudes and behavior. Thus this model implies that similar patterns of drug use are due largely to selective association; that is, that one becomes associated with people who have similar drug attitudes or behaviors, due to similar social control contexts, and this largely explains the later similarity in drug usage or attitudes. That is, there is less influence toward drug use or attitudes, than common habits that drew the peer network together in the first place.

The other school of thought may be called the social learning model. This perspective argues that drug users' networks may be just as densely knit as nonusers', but present different role models, social behavior and values. Members develop or reinforce attitudes and behavior through social learning and conformity to group norms (Kandel and Davies, 1996; Skog, 1986). This model argues that one may develop friendships based on similarities, but that later similarity in drug usage or attitude comes about through role modeling, social learning and converging norms. Reference group theory, for example, suggests that salient groups serve individuals as a frame of reference for purposes of self evaluation and that individuals will often imitate the behavior of reference group members to improve their own self-concept. Analysis of a three-wave panel study of junior high school students conducted by Kaplan, Martin, and Robbins (1984) also found support for the viewpoint that drug use is a consequence of interaction with and an attempt to imitate the behaviors of peer group members.

These two distinctions imply that selective association must be separated out first in order to accurately assess any peer influence. For instance, Urberg, Cheng and Shy (1991) calculated the difference between the respondent's smoking and the named best friend's "actual" smoking as the peer influence variable, to remove the effect of selective association (Epstein, 1983; this measure was uncorrelated with the perceived proportion of friends who smoked). Cohen (1983) argued that similarity among peers fosters stability in attitudes and behavior. Davis (1963) also argued that similarity toward each other or toward a third person or object creates tensions toward cognitive and social balance – that is, transitivity. Thus if peers are similar in their smoking behavior, then stability of that behavior is likely, but if they are different, then there exists a pressure for the adolescent to change behavior. Thus if this difference is positive, social learning theory would predict an increase for one's smoking from one year to the next year. Indeed, Urberg *et al.* (1991) found significant changes in this difference score. This peer influence variable was stronger for 8th graders than 11th graders, and for boys than girls. However, the perceived proportion of friends who smoke was a stronger influence for 11th than 8th graders. The correlation between the respondent's smoking and friend's smoking was .09 for 8th graders, and .47 for 11th graders. This

implies smoking is not, for 8th graders, a criterion, or at least not one salient enough, for selecting friends. The high 11th grade correlation is due to both selective association and cumulative peer influence. The authors also concluded that the influence process was not different for changing non-smokers to smokers versus ongoing smokers (contradicting propositions by Flay *et al.*, 1983, and Leventhal and Clearly, 1980).

Krosnick and Judd (1982) found that perceived friends' smoking was a stronger influence for 8th graders than 5th graders, and Ary, Biglan, Gallison, Wiessman, and Severson (1983) found a stronger influence for higher grades (9th, 10th) but only for initial non-smokers. Other researchers have also found that early adolescents are likely to be more influenced by their peers (Berndt, 1979; Brittain, 1963), although some (Chassin, Presson, Sherman, Montello, and McGrew, 1986) find little grade influence once the effect of selective association was removed. Epstein (1983) argues that older adolescents may be more influenced by personality or behavior similarity. Both Cohen (1977) and Kandel (1978) found about equal influences of selective association and peer influence on similarity in smoking behavior, whereas Urberg *et al.* (1991) found the peer influence difference score explained approximately three times more variance in later smoking than did the perceived proportion of friends who smoked. These results imply a social learning effect in the earlier grades and a social control effect later on.

Haynie's (2001) research into delinquency extends social control theory (whereby bonding constrains natural tendencies toward antisocial behavior) (Hirschi, 1969) with differential association theory (Warr and Stafford, 1991), into a more general theory. Not only are some group members more susceptible to peer influence depending on their location in a network, but some networks have greater social control based on their structural characteristics. In this way, both nondelinquency, and delinquency (in the present study, drug use and nonuse), can conceivably be fostered through group influence. Social control through a strong group norm is not necessarily antithetical to delinquent behavior or drug use. Haynie (2001) shows that there are both direct influences (on delinquent peers) but also moderating influences of network structure. Respondents' delinquency was predicted by race, gender, middle of the age range, one-parent family, public assistance, involvement with friends, but lower friend attachment, lower parent attachment, lower school attachment, more friends' delinquency, and greater popularity. The strongest influence was peers' reported delinquency, but each additional friendship nomination received increased delinquency by 2%. A simple social control model does not explain this set of predictors. Further, the influence of peers' delinquency was significantly greater in networks with delinquent peers, that were dense, more centralized, and had more in-degrees popularity. There was a significant influence of an adolescent's friends' delinquency on the adolescent's delinquency, but this relationship was stronger in cohesive networks (see also Agnew, 1991). Haynie (2001) concludes that it is not that more cohesive, centralized or popular groups have stronger norms against delinquency, but that the influence of delinquent or nondelinquent peers is greater in such groups. So the results support both social control (social bonds constrain behavior) and differential association/social learning (network context and social norms influence behavior) (Sutherland and Cressey, 1974).

Source of Peer Influence. Another distinction has to do with the origin of the network influence. Is it due primarily to one's best friend or to a more generalized, subjectively perceived peer group? Admittedly, the inclusion of one or more named best friends creates some practical research problems: data collection is more difficult, the best friend may not have the most influence, and smokers are more likely to be out of grade or out of school than non-smokers. Other questions remain. Does the primary influence derive from an individual's whole contact network (such as

several best friends, or a clique of densely interconnected people), or from the “social crowd” with which one does, or wants to, identify (such as structurally equivalent others, all of whom do not necessarily communicate with other, but are seen as joint members of a particular “social crowd”; Urberg, 1992)? Best friends may be more influential than other friends for drinking and smoking (Lanes, Banks, and Keller, 1972), while the whole peer group, including influential leader, may be more influential than a single best friend (Kandel, Kessler, and Margulies, 1978), and the “social crowd” can influence one’s drug use.

There are of course different ways of conceptualizing a peer or group norm. Friedkin and Cook (1990; see also Friedkin, 1998) conclude from simulations and empirical analyses that the best model involves: (a) the strength of group social influence is negatively related to the strength of exogenous conditions affecting group member opinions, and (b) social influence is a fixed resource so each individual can distribute the same amount of influence, although differently to each other group member. This leads to the conclusion that a reasonable, though still artifactual, conceptualization of “group norm” is the mean of the attitudes of an individual’s group peers.

Rice (1993) discusses several conceptual and operational distinctions necessary to determine the exact nature of those significant others or of the influence group. One is whether the referenced others are generalized or specific -- that is, whether the ‘group’ or ‘friend’ or ‘salient other’ is a general category whose specific members are not identified, or whether the group or its constituents are specified. For example, ‘your friends’ or ‘the artist crowd’ is a generalized group, whereas ‘the three best friends that you named above’ is a specified group. The second is whether the attitudes or usage of those others is estimated or ‘actual.’ For example, asking a respondent what is the best friend’s attitude toward, or usage of, alcohol involves an estimation, whereas identifying the best friend and then obtaining the best friend’s attitude or usage represents an ‘actual’ response (even if misremembered by that friend). So, for instance a common measure of peer influence is to ask a respondent what is the general attitude toward drugs of his friends; this is a ‘generalized estimate.’

We know two things about such generalized estimates. First, in matters such as friends’ smoking, estimates (whether for general or specified others) are generally over-estimates (Sherman *et al.*, 1983; Urberg *et al.*, 1990). This over-estimation leads to a ‘false consensus,’ a particular kind of ‘social projection’ of one’s own attitudes onto a putative other (individual or group). Consequently, second, one’s own generalized estimates are much more highly correlated with the respondent’s attitude toward use than are the specified others’ actual attitudes (Rice, 1993). Urberg *et al.* (1990) tested a structural equation model of role modeling, direct pressure, and indirect normative pressure on adolescents’ smoking. They found the false consensus effect of over-estimating (perceived) friends’ smoking: there was a higher influence of perceived friend’s smoking on self smoking than of friend’s actual smoking (similar to Rice and Aydin’s results, 1991).

We should note that under most social influence models, the actor is assumed to have consciously selected his or her normative referents, and is most influenced by the subjectively perceived norms of those referents. But some situations would make identification, much less recall, difficult, leading to a greater susceptibility to social exchange considerations (even implicit, unrecognized ones) than to willingness to comply with subjective norms of the actor’s social network, or to subjective norms of the actor’s emotionally close/supportive others (Richard, Bell and Montoya, 2000). Richard *et al.*’s study of female cocaine smokers found that these women have low power to influence condom use by their sexual partners, are therefore more dependent, and are thus more influenced by those who provide various social and resource exchanges than by subjective or social support norms. For

those women who also experienced low self-efficacy, none of the three sources of norms was influential, as they had little material or psychological power.

Sensation-Seeking

The problem of persuading persons to engage in or avoid specific behaviors has been a subject of research for many years. Early experimental research dealt with such questions as the level of fear appeals in getting people to brush their teeth (Janis and Feshbach, 1953), and early survey research considered the effectiveness of mass media in persuading individuals to vote for particular candidates (Berelson, Lazarsfeld, and McPhee, 1954; Lazarsfeld, Berelson and Gaudet, 1948). For many years, research on persuasion was influenced by findings from these and similar studies, which led to communication models that assumed a high level of rationality on the part of the receivers (Festinger, 1964), a relatively weak role for mass media, and the assumption that individuals could, for the most part, only be influenced by salient other persons or groups.

A modification of these views emerged from later studies. From the perspective of the individual, the 'rational' model of human behavior has given way to more complex models of human beings as information processors, guided both by cognitive (Lazarus, 1982) and affective (Zajonc, 1980) forces. Depending on the nature of the stimulus message and how much it directly involves the subject, it may generate considerable excitement or it may be largely ignored as the subject moves on to something providing more stimulating, even simply -- and without being aware of it -- shifting to stimulation supplied from his or her own thought stream; i.e., daydreaming (Palmgreen, 1976). The level of arousal needed varies across individuals (Zuckerman, 1978) and affects the kinds of stimuli to which individuals will likely attend (Christ and Medoff, 1984; Donohew, Finn, and Christ, 1988).

One indicator of arousal need is sensation-seeking. Need for sensation -- which has been found to be associated with preferences for novel, complex and ambiguous stimuli (e.g., Zuckerman, 1978) -- has been measured both as a personality trait (Pearson, 1970, 1971; Zuckerman, 1978, 1983; Zuckerman, Kolin, Price, and Zoob, 1964) and as part of a more general activation theory of information exposure (Donohew, Finn, and Christ, 1988).

A number of studies have linked sensation seeking with biochemical measures, including Monoamine Oxidase (MAO), an enzyme which regulates the levels of monoamine neurotransmitters in brain neurons. Lower levels of platelet MAO tend to be associated with higher levels of sensation seeking (e.g., Murphy, Belmaker, Buchsbaum, Martin, Ciaranello, and Wyatt, 1977). The disinhibition subscale of the Sensation-Seeking Scale (SSS) is positively associated among males with levels of testosterone and estrogens. Although there is evidence of high heritability of the trait (Fulker, Eysenck, and Zuckerman, 1980), the environment also is thought to account for at least a third of its variance (Zuckerman, 1978).

Studies consistently indicate significantly greater likelihood for high-sensation seekers, at both the junior and senior high school age levels, to use marijuana or have higher levels on an omnibus combined measure including marijuana, alcohol, cocaine and other substances (Segal and Singer, 1976; Zuckerman, 1978). Positive relationships were found between alcohol use and sensation-seeking (Earleywine and Finn, 1991) and between alcohol use and the disinhibition subscale in college student populations (Schwarz, Burkhart, and Green, 1978) but not among alcoholic populations (Kish, 1970). Individuals with higher needs for sensation begin using drugs earlier and are much more likely than lower-sensation seekers to become regular users (Bares, Labouvier, and

White, undated; Schwarz, Burkart, and Green, 1978; Segal, Huba, and Singer, 1980; Zuckerman, 1983; Zuckerman, 1978). This may be due to both the experience of risk or illegality associated with drug use (one form of novelty), as well as neurological stimulation from use of the drug itself (Segal *et al.*, 1980).

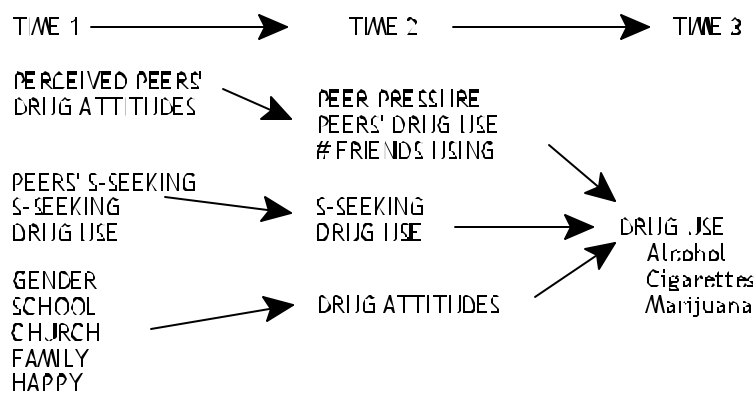
Persons with high need for sensation also tend to tolerate or even require stronger messages for attracting and holding their attention (Donohew, 1982; Donohew *et al.*, 1980; Donohew, Finn, and Christ, 1988). Individual differences in need for sensation and, to a lesser extent, in prior drug use, play a major role in responses to drug use prevention messages about marijuana, including exposure preferences, physiological responses and changes in attitude and behavioral intentions (Donohew, Helm, Cook, and Shatzer, 1987). Thus the concept of sensation seeking offers an avenue for targeting prime at-risk groups and designing messages and programs to reach them (Clayton, Cattarello, and Waldon, 1991).

Sensation-seeking and Peer Influence

If need for sensation is such a powerful motivating force for drug use, how does one account for the demonstrated effects of environmental forces, such as peer influence? Sensation seeking and peer influence are not necessarily contradictory explanations. It is plausible that individuals with high sensation seeking needs will tend to have similar interests and be members of the same peer group. It also is plausible that both individual and social forces are operating in a two-way causal fashion, in effect 'causing' each other in a reinforcing spiral. Individuals with high need for sensation may be likely to become drug users unless external sources of influence, such as peer group and family (sources of social control), intervene to influence them to abstain or divert their attention to other sources of stimulation. And individuals with lower needs for sensation may be unlikely to become drug users unless they are pressured into doing so by peers or strongly influenced by family.

MODEL

The prior discussions lead to the general overall model. In the study reported below, other, more general influences, such as gender and school and family influences, were controlled for statistically. The model was analyzed for differences in drug (alcohol, cigarettes or marijuana) use for each cohort.



Taking into account the prior research and conceptualizations, Figure One presents a summary model of influences, intervening variables and outcomes over time. At some initial time period Y1, church norms, school norms and parental norms create positive pressure against drug use at Y2,

which decreases drug use at Y3. Gender influences drug use and drug attitudes. Peer sensation-seeking at Y1 is associated with one's drug use at Y1, and peer drug use and one's drug attitudes at Y2. Peer sensation-seeking and one's drug use at Y1 influence one's drug attitudes at Y2, which, along with peer drug use at Y2, influence one's drug use at Y2. One's drug use at Y1 and Y2, peer drug use at Y2, and one's drug attitudes at Y2, all influence one's drug use at Y3.

Table 1. Sample Sizes, Response Rates, and Cohort/Year Samples

Used Drug in Past Year or Month		Cohort 1 (1988) N Pct.		Cohort 2 (1989) N Pct.		Cohort 3 (1990) N Pct.	
		Year 8 th grade		7 th grade		6 th grade	
Year:	Cigarette	1620 ^a	78.2 ^b	1890	82.1	2173	89.8
	Alcohol	1609 ^c	29.9 ^d	1879	24.9	2153	14.0
	Marijuana	1604	38.8	1875	24.6	2147	13.9
Month:	Cigarette	1609	11.6	1880	5.5	2148	2.0
	Alcohol	1607	16.7	1877	11.8	2158	5.7
	Marijuana	1607	17.4	1881	10.1	2144	5.3
		9 th grade		8 th grade		7 th grade	
Year:	Cigarette	1346	65.0	1542	67.0	1906	78.7
	Alcohol	1332	34.5	1529	29.1	1899	21.3
	Marijuana	1328	51.1	1525	38.4	1898	20.8
Month:	Cigarette	1329	15.7	1527	9.4	1899	3.1
	Alcohol	1330	20.8	1531	16.0	1900	10.6
	Marijuana	1327	27.1	1529	20.1	1899	7.9
		10 th grade		9 th grade		8 th grade	
Year:	Cigarette	1144	55.2	1452	63.0	1675	69.2
	Alcohol	1138	40.9	1442	41.4	1666	32.4
	Marijuana	1137	59.9	1443	55.4	1660	39.2
Month:	Cigarette	1139	21.3	1444	20.4	1664	9.4
	Alcohol	1139	25.3	1438	26.6	1663	16.9
	Marijuana	1138	34.0	1441	31.9	1665	19.6
		11 th grade		10 th grade		9 th grade	
Year:	Cigarette	1141	14.1	1448	13.0	1670	5.6
	Alcohol						
	Marijuana						

a: N of this particular sample; b: percent relative to initial cohort sample (from Clayton, Cattarello, Day, & Walden, 1991); c: N responding to this question; d: percent users relative to respondents to this question.

METHOD

Study Design

The sample comes from a NIDA study of adolescents involving survey evaluations of Project DARE, a primary prevention program taught to sixth graders in the Lexington, Kentucky, school system, whose attitudes and behaviors were tracked several years (Clayton, Cattarello, Day, and Waldon, 1991). The DARE longitudinal survey started with a sample size of approximately 2100; it is a replicated panel study. In 1987-1988, 23 schools were randomly assigned to receive DARE instructions, while eight schools were assigned to a no-treatment control condition. In the Fall of 1988, and in subsequent years, all 31 elementary schools received DARE instruction. The '87-'88 sixth graders were followed for four additional years. 1988-1989 sixth graders for three additional years, 1989-1990 sixth graders for two more years, 1990-1991 sixth graders for one more year, and 1991-1992 sixth graders for just that year. The present study added on an additional year of panel surveys, for 1992-1993.

Table One shows the initial sample sizes for each cohort, the remaining number and percent at each subsequent time period, and the cohort time periods used in the present study. Sample sizes all began with around 1900 to 2175 subjects, and by the fifth post-DARE survey the first cohort included around 1150 subjects.

The surveys were completed by mass self-administration at each of the junior high schools, taking about 45 minutes, with makeup sessions for those absent. The percentage of those refusing to fill out the questionnaire at any given time was very low. Approximately 15-20% of the students each year moved into a new school district. Some students dropped out at age 16 or 17. And a small percentage had difficulty completing the questionnaire due to mental incapacities or lack of time in the classroom setting. Every attempt was made to keep dropouts in the study because their rates of drug use are higher (Clayton and Voss, 1982). Students chronically absent or those who subsequently dropped out or moved were contacted by the study director at their home or by mail to complete the questionnaire. Overall response rate of those remaining in the relevant population was close to 99%. However, as the current focus is on peer influences, we included only those respondents who named at least one best friend (they were asked to name up to three), who was also in the data set (that is, in the school system and responded to the survey), at all of the three time periods. This means we are analyzing only from about a third to a half of the original respondents.

MEASURES

Sensation-seeking was computed as the mean of the 24-item scale developed by Zuckerman (1978). Family distance was computed as the mean of seven items concerning relations at home. Negative attitudes toward drugs were measured by four items concerning drug usage in general. Peer pressure was measured by nine items indicating how susceptible one is to pressure from friends and others. One's own drug use was measured by asking how many times in the last year one smoked cigarettes, drunk a full glass of alcohol, or smoked marijuana. Perceptions of friends' drug use were measured by asking for categories of number of one's friends who used each of the three drugs. Peer attitude toward each of the drugs was measured by how good/bad "most students in my grade" thought the drug was. The survey instrument included other demographic and situational measures – sex, how frequently one went to church, how well the student was doing in school, and how happy the person was at the time.

Respondents were asked to name three friends in one's same grade. If those named alters also completed a questionnaire, their sensation and drug use scores were added to the respondent's data record for that time period. One's peer measures were computed by taking the mean of the named peers' sensation-seeking or drug use (for each of the three drugs). For a small number of cases, the 2nd or 3rd-named peers did not report their sensation-seeking and/or drug use. The method used here is similar to that used by Donohew *et al.* (1999), Krohn (1986), Haynie (2001), Rice and Aydin (1991) and others. A broad survey collects information on nearly all members of a social system. Each actor names alters with whom they interact. Data exists for both the actors and alters, so alter data can be integrated into actor records. Thus alter attitudes and behaviors can be tested, after being weighted by extent of interaction with the actor, and averaged, for influences on actor attitude and behavior, distinct from actor's perceptions (estimations and projections and generalizations) of each alter's attitudes and behaviors (Rice, 1993). Perceptions of others' norms or behaviors may be potent predictors, largely because of common method bias and pressures toward cognitive consistency, but they are poor levers for social change or communication messages when incorrect. For example, Valente *et al.* (1997), in their study of the social influence on and awareness of network

partners' use of contraceptive methods among 9 voluntary associations of Cameroonian women, when comparing a respondent's report of their partner's use, and a network partner's report of their own use of contraceptive methods, found that only about 31% were correct, 28% were incorrect, and the rest said they did not know. But whether they were correct or incorrect, perceiving that the other used a method, whether correct or not, was a significant predictor of the respondent's using a contraceptive method.

Table One provides descriptive statistics on drug usage by cohort and year. Table Two provides the wording of the questions for separate items and constituting scales. Table Three provides descriptive statistics for the items and scales across the nine datasets (three cohorts, three time periods).

Analysis Procedures

Most of the analyses used various combinations of waves of the panel data. Panel analysis researchers have generally rejected change scores and cross-lagged correlation approaches and moved to regression methods (Bohrenstedt, 1969; Markus, 1979). These researchers and others (Kessler and Greenberg, 1981) note that care must be taken because of the imprecise measurement of ostensibly 'perfect' indicators repeated over time, and they point to the advantages of latent structure equations. However, Heise (1970), recognizing the possibility that ordinary least squares (OLS) regression techniques underestimate parameters in panel models, points out that OLS has computational efficiency in assessing the initial examination of models using multiple analysis of variance, and multiple regression as a step in developing testable latent structure models for future research. Thus the results of these analyses are preliminary.

RESULTS

Sensation-Seeking and Drug Use Over Time

Respondents' and mean peers' reported use of alcohol, cigarettes and marijuana all increased significantly at each time period in each cohort, except for cohort three (C3) respondents' and mean peers' use of marijuana between Y1 and Y2. The percentage of the study's respondents who indicated they had ever used cigarettes ranged from 16% to 41%, alcohol from 16% to 60%, and marijuana from 6% to 21%. Except for some 6th graders, any use of alcohol is greater than any use of cigarettes. Respondents' and mean peers' sensation seeking also increased significantly across each time period (for respondents, from a low of 2.88 for C3Y1 to a high of 3.36 for C1Y3; for peers, from a low of 2.90 in C3Y1 to a high of 3.45 in C2Y3). While it may well be the case that respondents who stay in the study across all three time periods may have higher or lower drug use on sensation seeking than those who drop out, these comparisons used paired t-tests, so that the differences are not biased by this possibly confounding factor. Note too, that although we have not conducted significance tests, it does appear that the cohort differences, when aligned with the same years, mirror the time period differences: as the respondents get older, in general their drug use and sensation-seeking levels rise.

Correlations of Self and Peer Sensation-Seeking Over Time

Respondents' mean sensation seeking was strongly correlated across time, and for C1 and C3 is weaker across Y1-Y3 than either Y1-Y2 or Y2-Y3, as would be expected. However, for C3, it is stronger between Y2-Y3 ($r=.88$, all correlations $p<.05$) and Y1-Y3 ($.85$) than Y1-Y2 ($.67$). Mean peer sensation seeking is significantly, but weakly, correlated across time periods (around $r=.3$), as would be expected, insofar as different peers may be named at each time period. Finally, respondents'

Table 2. Wording of Items on Survey, with Reliabilities of Scales

Sensation-seeking (SS): (1=I agree strongly; to 5=I disagree strongly; * reversed) I like to jump off high diving boards.* Someday I would like to try sky-diving or parachute jumping.* I would like to learn how to scuba dive.* Climbing a steep mountain would be too scary for me. I would like to try to water-ski.* I like to do dangerous things.* I like to try all kinds of new things, even if they scare me or I know it's something I shouldn't do.* I like loud music.* A lot of drinking is what it takes to make a party fun.* I like quiet parties. I like to be with people who party a lot.* I like to watch love scenes in movies or on TV.* I would like to take a trip without having to make any plans ahead of time.* I would like to visit a strange city all by myself, even if I might get lost doing it.* I have -- or would like to have -- some unusual or different people for friends.* People should dye their hair purple, if they want to.* I like to test myself every now and then by doing something a little risky.* People should dress neatly and follow the rules for good style. I think it's funny when people do things just to shock or upset others.* I would get bored looking at someone's home videos or travel slides.* I get restless if I have to stay around home.* I like people who are boring more than I like people who are rude. I like watching a TV show/movie where I can tell what will happen. I would rather be with people I know than meet new people. Mean reliability over nine cohort/time periods: .78. five dimensions emerged in every cohort/time except Y1 Cohort 1 (which showed six).	Peer Pressure (PP): (1=definitely not; to 5=definitely would; except * 1=I agree strongly; to 5=I disagree strongly -- reversed) If a friend dares you to tear a page out of a school library book, would you do it? If your friends are going to the movies and you have to study for a test, would you go to the movies anyway? If your best friend is skipping school, would you skip too? If you are at a party where your friends are drinking alcohol would you feel left out if you are not drinking alcohol? If a friend offers you a drink of alcohol, would you drink it? If a friend dares you to smoke a cigarette and your parents don't want to you smoke, would you smoke it? If a friend asks you to smoke marijuana with them, would you do it? If my best friend offered me a drug, I would take it.* If I was at a party and a lot of people there were drinking alcohol and using drugs, I probably would too.* Mean reliability over nine cohort/time periods: .89
Family Distance (FD): (1=yes, most of the time; to 5=no, never) Do you get along well with your mother or guardian? Do you get along well with your father or guardian? Do you and your parents have fun together? Are you happy at home? Do you get a lot of attention at home? Do your parents understand you? Do you feel close to your family? Mean reliability over nine cohort/time periods: .89	Sex: (1=male; 2=female) School: (1=very well; to 5=not well at all) How well are you doing in school? Church: (1=never; to 4=once a week) How often do you go to church? Happy: (1=very happy to 4=not at all) How happy are you? Cigs: How many cigarettes have you smoked in the past year: (1=none; 2=less than one cigarette; 3=1-5 cigarettes; 4=6-10 cigarettes [1 1/2 pack to 1 pack]; 6=21-30 cigarettes [1 to 1 1/2 packs]; 7=31 or more cigarettes [over 1 1/2 packs]) Alc: In the past year, how many times have you drunk a full glass of alcohol (beer, wine, liquor)? (1=0 times; 2=1-2; 3=3-5; 4=6-9; 5=10-19; 6=20-39; 7=40 or more) Mari: In the past year, how many times have you smoked marijuana (Grass, Pot, Hash)? (1=0 times; 2=1-2; 3=3-5; 4=6-9; 5=10-19; 6=20-39; 7=40 or more) About how many of your friends: (1=none; 2=1-2; 3=some; 4=most; 5=all) smoke cigarettes? get drunk at least once a week? smoke marijuana? Most students in my grade think that: (1=a very bad thing; 5=a very good thing) cigarettes are drinking is marijuana is Named Friends (NF): On the lines below, please PRINT the first and last names of 3 of your friends in this town who are in the same grade as you in school (the friends you name can go to a different school but need to be in the same grade as you). (First name/Last name/Friend's school)

Negative Drug Attitude (NDA): (1=I agree strongly; to 5=I disagree strongly)

It's OK to try drugs once or twice just to see what they are like.

It's OK for people to use drugs if drugs make them feel better.

There is really nothing wrong with using most drugs.

Kids who use drugs have more friends.

When you are under a lot of stress, it helpful to drink alcohol or take drugs.

Drugs help you have more fun.

Kids who take drugs are more grown-up.

Mean reliability over nine cohort/time periods: .87

Table 3. Descriptive Statistics of Scales and Drug Usage Across Cohort/Year Periods

Cohort/Year	C1Y1		C1Y2		C1Y3		C2Y1		C2Y2		C2Y3		C3Y1		C3Y2		C3Y3	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Sex	1.6	0.5	1.6	0.5	1.6	0.5	1.6	0.5	1.6	0.5	1.6	0.5	2.6	0.5	2.6	0.5	1.6	0.5
School	1.8	0.7	2.0	0.7	1.9	0.7	1.8	0.6	1.8	0.7	2.0	0.7	1.7	0.6	1.8	0.7	1.9	0.7
Church	3.1	1.1	3.0	1.1	2.9	1.1	3.0	1.1	2.9	1.4	2.8	1.2	3.0	1.1	3.0	1.1	2.9	1.2
Happy	1.8	0.6	1.8	0.6	1.8	0.6	1.7	0.6	1.8	0.6	1.8	0.6	1.8	0.6	1.8	0.6	1.8	0.6
Sensation-seeking	0.5	0.5	3.1	0.5	3.3	0.6	3.0	0.5	3.2	0.6	3.4	0.6	2.9	0.5	3.0	0.6	3.1	0.5
Family distance	0.7	0.9	2.0	1.0	2.1	1.0	1.8	0.9	2.0	0.9	2.1	1.0	1.7	0.7	1.8	0.9	2.0	1.0
Negative drug attitude	1.1	0.5	4.5	0.8	4.3	0.9	4.7	0.5	4.6	0.7	4.3	0.9	4.8	0.4	4.8	0.5	4.6	0.8
Peer pressure	0.6	0.8	2.3	0.9	2.5	1.0	1.8	0.7	2.1	0.9	2.5	1.0	1.5	0.6	1.7	0.7	2.2	0.9
In last year																		
cigarettes	1.6	1.3	1.8	1.6	2.5	2.2	1.5	1.2	1.8	1.7	2.3	2.1	1.2	0.8	1.4	1.1	1.9	1.7
drinks	1.5	1.0	2.0	1.6	2.6	1.9	1.3	0.9	1.8	1.3	2.3	1.7	1.2	0.6	1.3	0.8	1.8	1.4
marijuana	1.0	0.4	1.2	0.8	1.5	1.3	1.1	0.4	1.2	0.7	1.4	1.2	1.0	0.3	1.0	0.3	1.2	0.8
Most students think these are bad:																		
cigarettes	2.6	1.0	2.8	0.9	2.8	0.9	2.3	0.9	2.4	1.0	3.0	0.9	1.7	0.8	2.1	0.9	2.5	0.9
drinking	2.5	1.0	3.0	0.9	3.1	1.0	2.2	0.9	2.5	1.0	3.2	1.0	1.6	0.8	2.0	0.9	2.6	0.9
marijuana	1.9	1.0	2.1	1.1	2.4	1.1	1.6	0.9	1.8	1.0	2.4	1.1	1.2	0.5	1.5	0.8	1.7	0.9
# Friends who																		
smoke cigs	1.9	0.9	2.2	1.0	2.4	1.1	1.8	0.9	2.1	1.0	2.5	1.1	1.5	0.7	1.6	0.9	2.1	1.0
get drunk	1.5	0.8	1.9	1.0	2.3	1.1	1.3	0.6	1.6	0.9	2.2	1.1	1.1	0.5	1.3	0.6	1.7	0.9
smoke marj	1.4	0.7	1.5	0.8	1.9	1.0	1.2	0.6	1.4	0.7	1.8	1.0	1.1	0.4	1.2	0.5	1.3	0.7
# Respondents who name																		
1st peer	423		417		385		478		470		429		829		799		727	
2nd peer	426		368		363		483		444		421		801		728		698	
3rd peer	394		371		339		464		429		360		771		676		647	
Approx. # respondents	500		500		510		590		585		590		920		915		915	

sensation seeking and mean peer sensation seeking are even more weakly, yet still significantly, correlated (around .2). Only for C3 is there any indication of a cross-lagged relationship. There, the correlation between respondents' sensation seeking at Y1 and mean peers' sensation seeking at Y3 ($r=.15$, still $p<.05$) is only half as strong as the correlation between peer sensation seeking at T1 and respondents' sensation seeking at one time to respondents' sensation seeking later on. Note that the similarity of sensation-seeking across time is slightly greater among one's peers (around .3) than it is between oneself and one's peers (around $r=.2$).

Correlations of Respondents' Estimations of Friends' Drug Use and Friends' Reported Drug Use

As discussed earlier, respondents' estimates of peers' drug use is usually the measure of choice in similar surveys. Here, we can conduct a general comparison between these two indicators. However, note that these measures are not the same. Respondents reported how many of their friends used each of the drugs in the past year, while peers' responses indicated how frequently they themselves used each of the drugs in the past year. Further, peer nominations were limited to a maximum of three, and we do not include respondents who did not name peers. And, of course, even the peer responses are subjective reported/recalled indicators of actual drug use. So these two measures must, of course, be only approximately related.

The correlations, though mostly significant, are quite weak, from marijuana use C3Y2 ($r=.03$, n.s.) to marijuana use C2Y3 ($r=.23$, $p<.01$). Estimations of cigarette use are a non-significant $r=.05$ for C1, all three time periods, but rise to between .16 and .20 for C3, all three time periods.

We might speculate that correlations would be greater either for the most frequent drug use (here, generally alcohol), because it would be easier to estimate overall usage, or for the least frequent drug use, because users would stand out so much or would be known only by one's closest peers (here, marijuana). So the first conclusion is that the inconsistent correlation patterns do not support such a general relationship.

The second conclusion is that respondents' estimated of peers' drug use is highly inaccurate (at most sharing only 4% of variance). So we would not want to rely on respondents' estimates of the number of their friends who use drugs as a reliable surrogate for the frequency of drug use by their peers. However, perceptions of others' behaviors, even if (or possibly especially if) inaccurate, may be a potent influence on one's own use of drugs. Indeed, some "peer norm" campaigns to reduce college drinking explicitly target the inflated perceptions of the extent to which one's peers engage in excessive drinking (Lederman *et al.*, 2001).

Multivariate Analysis of Variance Results

A focused, but simplifying, approach to testing for relationships of drug use, respondents' sensation-seeking, mean peer sensation-seeking and mean peer drug use is to dichotomize all these and test for main and interaction effects among these categories on respondents' drug use, all within the same time period. For these analyses we dichotomized the respondents' sensation seeking averaged across the three time periods at the median and categorized respondents into 'high'-sensation seekers and 'low'-sensation seekers in order to equalize the sample sizes of this main predictor. The other variables were categorized at the mean, within each time period, except the dependent variable, respondents' frequency of drug use (for alcohol, cigarettes, marijuana). Table Four summarizes the significant main and interaction effects.

Table 4. Significant MANOVA Influences on Respondent's Reported Yearly Use of Alcohol, Cigarettes, and Marijuana

Cohort	Y1		Y2		Y3	
Drug Use	Var.	F	Var.	F	Var.	F
----- Cohort 1 (N=from 448 to 501) -----						
Alcohol	SS	16.7	SS	13.0	SS	11.7
	pSS	7.1	pAlc	7.9	pAlc	13.0
Cigarette	SS	2.6	SS	10.5	SS	24.0
	pSS	7.3	pCig	25.0	pCig	27.0
	pCig	16.0				
	SS * pCig	6.6				
Marijuana	SS	5.0	Ss	7.0	SS	11.0
	p SS	3.4	pMj	39.0	pMj	30.0
	SS * pSS	5.0	ss * pMj	3.5	pSS * pMj	3.1
	SS * pMj	3.0				
	pSS * pMj	4.7				
	SS * pSS * pMj	3.1				
----- Cohort 2 (N=from 558 to 582) -----						
Alcohol	SS	25.0	SS	21.0	SS	39.0
	pAlc	9.0	pAlc	22.0	pAlc	37.0
					SS * pAlc	10.0
Cigarette	SS	27.0	SS	13.5	SS	44.0
	pCig	19.0	pCig	2.8	pCig	49.0
					SS * pCig	13.5
Marijuana	SS	7.4	SS	10.3	SS	38.8
	pSS	6.8	pMj	4.2	pMj	36.3
	SS * pSS	7.3	SS * pMj	5.3	SS * pSS	6.1
					SS * pMj	21.1
					SS * pSS * pCig	9.7
----- Cohort 3 (N=from 876 to 908) -----						
Alcohol	SS	61.7	SS	66.1	SS	72.3
	pAlc	12.5	pSS * pAlc	3.4	pAlc	20.5
	SS * pAlc	7.0			SS * pAlc	5.0
					pSS * pAlc	5.0
Cigarette	SS	48.2	SS	5.1	SS	49.9
	pSS	5.0	pCig	20.2	pCig	42.8
	pCig	30.8	SS * pCig	5.9	SS * pSS	4.1
	SS * pCig	10.8				
	pSS * pCig	5.1				
Marijuana	SS	2.9	---	---	SS	11.3
					pSS	4.2
					pMj	16.1
					pSS * pMj	5.0

All F-ratios significant at $p < .05$ or less.

SS = mean of respondent's sensation-seeking scale across three time periods

pSS = mean of named peers' sensation-seeking scale within time period

pAlc = mean of named peers' yearly use of alcohol

pCig = mean of named peers' yearly use of cigarettes

pMj = mean of named peers' yearly use of marijuana

In every cohort/time period, respondents' own sensation seeking was a significant main influence on all three kinds of drug use (except for marijuana, C3Y2). F-ratios for this influence increased considerably for each cohort (except for marijuana in C3), but not as clearly across time. In general, mean peers' sensation seeking was a significant influence in Y2, but disappeared in the subsequent time periods. However, mean peers' use of the corresponding drug was a significant main influence in nearly every Y2 and Y3 sample. That is, peers' behavior becomes a clearer influence over time than peers' sensation seeking. As we have seen, sensation seeking increases over time, and peers' sensation seeking in Y1 may influence respondents' sensation seeking in Y3, implying that the influence of peers' sensation seeking occurs early on by generating similarity of associations. Then, as respondent and peer sensation seeking are more similar, peers' behavior (drug use) becomes the discriminating influence.

Note, however, that there are numerous interaction effects as well. The primary one seems to be between peer sensation seeking and peer drug use. The combination of peers with slightly similar sensation seeking levels and greater use of drugs may heighten both the social control (through similar peers) and the social learning (through greater exposure to drug use) processes. For example, in C1Y2, the highest mean level of respondent's alcohol use in the past year occurred under conditions of (a) high peer sensation seeking and (b) peer alcohol use in past year, both for respondents with low sensation seeking (mean respondent alcohol use in past year = 1.41, $p < .05$, compared to 1.14 for those with peers with low sensation seeking and no alcohol use) and with high sensation seeking (mean respondent alcohol use in past year = 2.04, $p < .05$, compared to 1.52 for those with peers with low sensation seeking and no alcohol use).

An interaction between respondents' sensation seeking and mean peers' sensation seeking occurs twice in Y2 (marijuana, C1; cigarette, C2) and twice in Y3 (marijuana, C2; cigarette, C3), implying, perhaps, that cigarettes and marijuana are seen as more risky or adventurous, and thus more likely when respondent and peers both have high sensation seeking, than alcohol, which is the more frequently used drug.

Multiple Regression Results

MANOVA restricts us unduly in this study because of the false dichotomization of mean scales and the limited number of variables that can be managed. A more straightforward approach is to regress relevant prior variables, entered in chronological sequence, on use by each of the three cohorts of each of the three drugs at Y3. Because some of the independent variables are the same across each of the three drug analyses, and because the drug use variables are likely to be intercorrelated themselves, these are not, therefore, independent analyses. They might be thought of as three overlapping perspectives on the same phenomenon. Finally, this approach does not consider the intervening or endogenous relations suggested in Figure One. However, it is relatively straightforward, does take into account the longitudinal nature of the data and, because of the large sample sizes, allows the use of a good number of predictors.

Table Five provides the results from the nine regressions (one each for yearly frequency use of alcohol, cigarettes and marijuana, for each cohort).

Alcohol and cigarette use (adjusted R-squares from .21 to .46) were predicted somewhat better than marijuana use (from .11 to .33), but the percentage of marijuana users was so low throughout that there would be little variance in that dependent variable. Predictability was also greater for C1 and C2 (from .31 to .46) than for C3 (from .11 to .36).

Table 5. Regressions of Reported Yearly Drug Use Y3 on Prior Influences Y2 and Y1

Ind. Variables	Alcohol	Cigarettes	Marijuana
----- Cohort 1 -----			
Y2: Drug Use/Year	0.38 ***	0.33 **	0.32 ***
Peers' Use/Year	0.05	0.04	0.12 **
Neg. Drug Att.	0.03	0.00	-.03
Sensation-seeking	0.02	0.11 **	0.05
Est. # Friends Use	0.02	0.10 **	0.07
Peer Pressure (Hi=more)	0.23 ***	0.16 **	0.16 **
Y1: Drug Use/Year	0.14 **	0.16 ***	0.05
Peers' SS	0.05	0.02	0.10
Est. Friends' Drug Att	0.05	-.04	-.03
Sex (Hi=F)	0.00	0.03	-.03
School (Hi=poor)	0.03	-.02	-.02
Church (Hi=freq)	-.03	0.02	-.02
Home (Hi-distant)	0.00	-.02	-.03
Happy (Hi=not)	0.04	0.03	0.04
Adj. R-sq	0.46	0.44	0.33
d.f., F-ratio	14/444=29 ***	14/488=27 ***	14/440=17 ***
----- Cohort 2 -----			
Y2: Drug Use/Year	0.40 ***	0.45 ***	0.23 ***
Peers' Use/Year	0.13 ***	0.06	0.15 **
Neg. Drug Att.	0.08	0.05	-.10 *
Sensation-seeking	0.11 **	0.00	0.01
Est. # Friends Use	0.05	0.03	0.07
Peer Pressure (Hi=more)	0.09	0.18 **	0.16 **
Y1: Drug Use/Year	0.13 **	0.15 ***	0.07
Peers' SS	-.03	0.01	-.04
Est. Friends' Drug Att	0.00	0.00	0.07
Sex (Hi=F)	0.05	0.05	-.02
School (Hi=poor)	0.05	0.06	0.01
Church (Hi=freq)	-.03	0.02	-.06
Home (Hi-distant)	-.03	-.01	0.02
Happy (Hi=not)	-.03	-.02	-.08
Adj. R-sq	0.37	0.46	0.31
d.f., F-ratio	14/517=24 ***	14/517=33 ***	14/511=18 ***
----- Cohort 3 -----			
Y2: Drug Use/Year	0.35 ***	0.31 ***	0.12 **
Peers' Use/Year	0.00	0.00	0.09 **
Neg. Drug Att.	0.02	0.03	0.00
Sensation-seeking	0.11 **	0.11 **	0.07
Est. # Friends Use	0.12 **	0.08 *	0.07
Peer Pressure (Hi=more)	0.08	0.00	0.13 **
Y1: Drug Use/Year	0.15 ***	0.09 *	-.08 *
Peers' SS	-.01	0.00	0.03
Est. Friends' Drug Att	-.03	0.00	0.10 ***
Sex (Hi=F)	-.03	0.01	0.00
School (Hi=poor)	0.03	0.09 **	0.03
Church (Hi=freq)	-.07 *	-.03	-.05
Home (Hi=distant)	0.04	0.02	0.09 *
Happy (Hi=not)	0.01	0.03	-.02
Adj. R-sq	0.36	0.21	0.11
d.f., F-ratio	14/821=34 ***	14/830=17 ***	14/820=9 ***

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

Significant predictors of alcohol use were respondents' alcohol use at Y1 and at Y2, greater sensation seeking at Y2, greater susceptibility to peer pressure at Y2, and, for C3, greater estimated number of friends using the drug at Y2 and slightly less attendance at church at Y1.

Significant predictors of cigarette use were respondents' cigarette use at Y1 and Y2, peer pressure at Y2, respondents' sensation seeking at Y2, estimated number of friends who smoke at Y2, and, for C3, doing worse at school at Y1.

Significant predictors of marijuana use were respondents' marijuana use at Y2 (except for C1) and Y1 (except for C2), peer pressure at Y2, mean peers' sensation seeking at Y1 (for C1) and, for C3, distant home relations at Y1.

Identifiability and Number of Friends, Drug Use, and Sensation Seeking

Finally, the present data allow us to assess whether social control or social learning seems to be the more plausible explanation. The social control explanation would argue for smaller or even isolated networks, and thus greater disinhibition, and eventual association with other isolates with similar drug disinhibition. The social learning explanation would argue for equivalent sized networks between users and nonusers, but networks with different norms and attitudes concerning drug use.

The prior results show that predictors of one's own use of a specific drug include using that drug at prior time periods (all three drugs), use of the drug by one's peers at the immediate time period (alcohol and cigarettes), one's own sensation-seeking (alcohol and cigarettes), general susceptibility to peer pressure at the prior time period (alcohol and marijuana), doing worse at school at Y1 (cigarettes), and peers' sensation-seeking at Y1 (marijuana). This is not a clear-cut argument for either social control or social learning. To the extent that one's own use and sensation-seeking are primary predictors – that is, one's social network plays no role -- a social control explanation is somewhat justified. However, to the extent that susceptibility to peer pressure, and use of a drug by one's peers, contributes – that is, one's social network does play a role – a social learning explanation is somewhat justified.

We can provide some analysis of the specific role of the size and nature of one's network. From the responses to the request to name up to three friends in one's grade anywhere in the school system, two ego network characteristics can be computed. The first characteristic is the number of friends named regardless of whether they are in the school district ("any") versus those who also exist in the dataset for that same grade ("identified"). For example, someone could name three friends (any=3), but only one of them is identifiable (identified=1). The second characteristic is whether they named none, or any (i.e., from one to three), identifiable friends.

Using Y1 as an example, there is a generally consistent difference between the ego network size of unidentified and identified friends, and between none versus any identified friends, though the results are stronger for C1. Generally, the greater the number of any friends named, the slightly less the use of most drugs (from $r=.00$ for marijuana C2 to $-.07$, $p<.01$ for marijuana C3). The greater the number of identified friends named, the use of drugs is noticeably less (from $r=-.05$, $p<.01$ for marijuana C3 to $-.16$, $p<.01$ for cigarette C1). The correlations are generally twice as strong between "any" and "identified" for C1 and C2, but become about equal by C3. The possible explanation here is that teenagers who have friends outside of the common school social network (i.e., the same grade in schools in the district) are somewhat less inoculated by belonging to a network, and may be slightly more likely to look outside the shared network for excitement and risk.

Consider, for example, the high school girl with a college boyfriend, or a high school student who spends time with dropouts.

Focusing just on identified friends, there is a consistently higher level of alcohol, cigarette and marijuana use for those who named no identifiable friends compared to those who named from one to three identifiable friends. Again, the relationship wanes from C1 (means of 2.2 vs. 1.8, 2.4 vs. 1.9, 1.6 vs. 1.2, respectively; all $p < .005$) to C3 (mean cigarette use 1.5 vs. 1.3, and mean marijuana use 1.1 vs 1.0, $p < .05$). The possible explanation here is a mix of social control with social learning at a larger societal level.

Also for Y1, respondent's sensation-seeking is generally unrelated to number of either any or identified friends, except $r = -.07$, $p < .01$ for C3 identified friends.

DISCUSSION

Summary

Self-reported use of drugs of all kinds -- both in terms of its frequency and the number of subjects reporting any use at all -- increases significantly across each yearly time period.

(Generalized) estimates of number of friends who use particular drugs are only very weakly correlated with (specified, or named) peers' own reports of their frequency of drug use. Although these are not measuring exactly the same thing, and thus we should not expect them to be highly correlated, it may well be that prior studies using self-reported estimates of generalized peers' drug usage and attitudes suffered from the poor validity of such estimates of generalized others' behavior trying to represent actual behavior of specified others (Rice, 1993).

Focusing just on self and peer sensation-seeking and drug use, one's own sensation-seeking and peers' drug use seem to be the primary influences on one's drug use within a given time period. Peers' sensation-seeking seems to be a significant influence primarily in earlier periods, then waning.

The combined, longitudinal multiple regression analyses help us understand both the independent influence of the factors as well as the time-order nature of their influence. Alcohol use is most strongly predicted, with the three cohort regressions explaining 46%, 37% and 36%, respectively. Cigarette use is next most strongly predicted, with explained variances of 44%, 46% and 21%. And marijuana use is least well predicted, with explained variances of 33%, 31% and, for cohort 3, 11%. All of the equations are significant at the $p < .001$ level.

In almost every case, one's prior use of a drug is the best predictor of one's current use. The use of a drug even two years earlier has an independent effect from use the prior year, indicating either (or both) a long latency of drug use norms or the likelihood that, once overcome, hesitations about further drug use are considerably reduced.

Peers' use of a drug the prior year seems to be a consistent influence only on marijuana use across all three cohorts, and for alcohol use in the first cohort. This behavioral influence might be identifiable only for marijuana because of the likely greater need to have friends who use it, than for the other drugs. This could be due to the very low percentage of students who actually use mari-

juana, and the greater difficulty in obtaining and affording it. That is, marijuana is, for practical and cultural reasons, inherently a more 'social' drug in the sense that it is typically used within a more intimate social setting rather than more publicly as are smoking and alcohol, so peer influence would be more salient and powerful. Consistent with this specified peer pressure is the occasional influence of generalized susceptibility to peer pressure, a predictor of greater alcohol and cigarette use (C1), cigarettes and marijuana (C2), and marijuana (C3). So one does not need specific peer role models using drugs, necessarily; instead, a general susceptibility to peer modeling, along with some of the other influences, may be enough to influence later drug use.

One's own sensation-seeking at Y2 is a weak independent predictor of drug use at Y3 (for cigarettes, C1; alcohol, C2; and both for C3), and not at all for marijuana use. Again, this may be due to the very low frequencies and thus variance of marijuana use, but it also may be that, to the extent that it is a more 'social' drug, it does not satisfy the purpose of general individual sensation-seeking. Finally, early home, school and church experiences do not seem to play much of an independent role in predicting drug use several years later. Only in C3, slight effects exist for less church attendance (alcohol), poor school performance (cigarettes), and distant home relations (marijuana). In each case, no more than 1% of the variance was explained.

The results overall seem to provide support for both a social control explanation – because of higher drug use among those with no friends, and those with friends outside the common student social network – and for a social learning explanation – because of susceptibility to generalized peer pressure, friends who smoked cigarettes or marijuana the prior year, and possibly a general social trend away from alcohol and cigarette use over the time period of the three cohorts. However, the influences, especially peer influences, differ across these three drugs.

Concerning the ambiguity in causal direction between socialization (social control) and selection (differential association), Haynie (2001) argues that adolescents seldom have much choice in selecting groups, which offer limited opportunities to join, and which control acceptance. Thus peer networks seem to be the primary causal factor – that is, social control and social learning instead of selection. While Haynie's cross-sectional data cannot test for self-selection into delinquent peer networks based on prior dispositions or attitudes (rather than delinquency being caused by influence of peers in the group), he notes that even initial selection may be influenced both by attraction to similar peers as well other structural forces affecting exposure to and acceptance by various groups, and that friendship groups change frequently, making exact tests highly difficult. Valente *et al.*'s (1997) study of the social influence on and awareness of network partners' use of any, or specific, contraceptive methods, among 9 voluntary associations of Cameroonian women, argued against the selectivity process as an alternative explanation of their results. The two main results, that a respondent reporting that a network partner encouraged them to use "any" or a specific method was more likely to use any contraceptive method, and that women who use the same contraceptive method interacted in the network, both imply that discussion facilitates usage (i.e., social control and social learning), and not the other way around (i.e., selection).

Qualifications

Our present analyses emphasized the influence of peers' attitudes and behaviors on respondents' attitudes and behaviors. Thus we analyzed only those respondents who named at least one peer (out of a requested three) at each of the three time periods (within each cohort). Note that the social control model proposes that those with best friends are less likely to be delinquent or isolated, whereas the social learning model argues that number of links is not the influence, but the content

of those relations is. Therefore, when we exclude all those respondents who do not name at least one peer at each time period, the social control model implies that we are removing precisely those who are most at risk, and perhaps most of interest to research attempting to change positive attitudes toward, and use of, drugs. Indeed, as noted above in the analysis of year 1 data, those not naming any friends were more likely to use any of these drugs, except alcohol by C3. However, missing data on any of the peer variables was not associated with drug use, nor was missing data at one time period associated with missing peer responses at other time periods.

We should also note that while excessive use of any of these drugs is harmful, some are more socially acceptable than others, depending on the context and the age of the user. For example, cigarettes and alcohol are illegal on the basis of the user's age, while marijuana is generally illegal regardless of age. So legality, risk, harm and abuse are all important distinctions not assessed here. Also, while we did not analyze cross-influences here, some drug use may be gateways to other drug use (such as smoking and drinking leading to marijuana use) so a full model would be much more complex than Figure One portrays.

Another concern that inevitably arises in this type of research is the honesty and accuracy of respondent self-reports, especially concerning reports of illegal activities, such as drug use. However, in each cohort and each wave respondents were assured that their results were confidential and that no one who knew them or was in a position of authority has access to any identifying information.

Future studies might also include other indicators of social influence on adolescent and teenage drug use. Feld (1981) proposes that friendship ties are not just based in loosely connected social circles of relationships (especially transitive relations), but are also strongly influenced by both individual characteristics and other social structures around which individuals organize their social relations – what he calls “foci,” or structures that “focus” relations, as suggested by Homan's social elements of activity, interaction and sentiments. That is, shared relations to foci create positive sentiments indirectly through positively valued interaction. Groups result from foci organizing more or less exclusive social interactions. These foci may be persons, places, social positions, activities, groups, etc., and not primarily direct similarities among individuals. However, these foci generate more social interaction only if they somehow constrain interactions. For example, larger and more general foci are less constraining on time, effort and emotion, so are less the basis for group formation. Further, if several foci are themselves more compatible, then they foster more social interactions. (Feld emphasizes that relations among individuals in this social context is largely due to the shared foci, not an individual drive toward psychological balance.) Conversely, for those involved in more foci, their social contacts are less likely to themselves interact, leading to less dense personal networks. So the driving forces in group interaction, and thus similar behaviors and attitudes, are the number, diversity and constraints of foci. For the present study, these might include obvious social categories salient to high school students (gender, race, school activities such as clubs or athletics, income, etc.) Feld does note, however, that because focus theory emphasizes structure over individual cognitive balance, it is probably more appropriate to use in studying entities (such as corporations or scientific projects) than individuals.

Another generalization of social control theory to explain delinquency and deviant behavior is developed and tested by Osgood *et al.* (1996). Similar to Haynie's argument, they argue that number of friends and the nature of one's group is not by itself the explanatory factor. Rather, “unstructured socializing with peers in the absence of authority figures presents opportunities for deviance”, as these will be easier and more rewarding, there will be less social control, and more

time for deviant behavior (p. 635), in accord with Cohen and Felson's (1979) routine activity perspective. They analyzed five waves of data for a national sample of 1,700 16-18 year olds. The more time the teenagers spent in unstructured socializing activities (riding around in a car for fun, getting together with friends informally, going to parties, or spending evenings out for fun and recreation), the more criminal behavior (10 items), heavy alcohol use, use of marijuana and other drugs, and dangerous driving, over time, and the stronger the associations between age, gender and SES with these deviant behaviors. Further, deviant behaviors were not associated with either in-home or out-of-home activities, as long as they were structured. Even the traditional influence of age, gender, and grades on deviance significantly declined once structured activities were controlled for. Interestingly, greater parental education was associated with greater student deviancy, largely through providing more opportunities for unstructured socializing.

Their activity measures, over-time research design and statistical analyses preclude an alternative interpretation of selection (i.e., deciding to engage in deviance causes a selection of one of the unstructured activities). Thus Osgood *et al.* (1996) conclude that such relationships are moderated both by unstructured time (opportunity) and by an absence of an authority figure (less social control). This approach also explains why having more friends is not necessarily a damper on deviant behavior – having friends in a context of unstructured routine activities, without an authority figure (a public role such as a sales clerk or teacher, but also including a group leader representing socially conforming values), can make deviance easier to accomplish and more rewarding, and provide a setting for the filling the symbolic role of bravery, toughness, etc. Nonetheless, as an aside, they do acknowledge that “The magnitude of these relationships between routine activities and deviance is exceeded only for measures of other deviant behaviors, attitudes about deviance, and the deviant behavior of one's peers” (pp. 651-652). Thus even their focus on unstructured informal activities does not reject a direct influence of one's peers, as the current study argues. However, including measures of unstructured time in activities not involving authority figures would be a valuable way to expand the scope of the present model.

There are also many more kinds of analyses, both more subtle as well as more statistically elegant, that could be applied to these and similar data. For example, the final nine regressions could be reduced to three by combining data within cohort, allowing for statistical testing of specific and overall cohort effects. The different conceptualizations of social influence by Feld (1981), Haynie (2001), and Osgood *et al.* (1996) call for including additional direct and moderating individual and social influences.

CONCLUSION

The main focus of this study was the influence of one's own behaviors, attitudes and sensation-seeking, and one's peers' behaviors, attitudes and sensation-seeking, on respondents' drug usage. Clearly, both nature and nurture, individual and social factors play a role in influencing one's drug use. However, the nature of that influence depends somewhat on the nature of the analyses, the time period, the length of the influence, the particular cohort, and the specific drug. From a network theory perspective, it does seem clear that studies that rely on respondents' estimates of generalized others' attitudes and behaviors, rather than on their named peers' own report of their attitudes and behavior, are prone to problems of validity, reliability and common method bias. Both theory and empirical evidence, such as this study, emphasize the need to include actual peer responses as predictors. This study also emphasizes the need for large-scale, longitudinal studies into the individual and network influences on different kinds of drug use among adolescents.

REFERENCES

- Agnew, R. 1991. The interactive effects of peer variables on delinquency. *Criminology*, 29(1): 47-72.
- Ary, D., Biglan, A., Gallison, C., Wiessman, W., and Severson, H. 1983. Longitudinal prediction of the onset and change of adolescentsmoking. In W.F. Forbes, R.C. Frecker, and D. Nostbakken (Eds.), *Proceedings of the fifth world conference on smoking and health*. Winnipeg: Canadian Council on Smoking and Health.
- Bailey, S.L., and S.T. Ennett. 1993. Potential mediators, moderators, or independent effects in the relationship between parents' former and current cigarette use and their children's cigarette use. *Addictive Behaviors*, 18(6): 601-621.
- Baron, S., and D. Tindall. 1993. Network structure and delinquent attitudes within a juvenile gang. *Social Networks*, 15(3): 255-274.
- Berelson, B., P. Lazarsfeld, and W. McFhee. 1954. *Voting: A study of opinion formation in a presidential campaign*. Chicago: University of Chicago Press.
- Berndt, T. 1979. Developmental changes in conformity to peers and parents. *Developmental Psychology*, 15: 608-616.
- Bohrenstedt, G.W. 1969. Observations on the measurement of change. In E.F. Borgatta (Ed.), *Sociological methodology 1969*. San Francisco: Jossey-Bass.
- Brittain, C. 1963. Adolescent choices and parent-peer cross-pressures. *American Sociological Review*, 28: 385-391.
- Cappella, J., M. Fishbein, R. Hornik, R.K. Ahern, and S. Sayeed. 2001. Using theory to select messages in antidrug media campaigns: Reasoned action and media planning. In R.E. Rice and C.K. Atkin (Eds.) *Public communication campaigns, 3rd ed.* (pp. 214-230.) Thousand Oaks, CA: Sage.
- Chassin, L., C. Presson, S. Sherman, D. Montello, and J. McGrew. 1986. Changes in peer and parent influence during adolescence: Longitudinal versus cross-sectional perspectives on smoking initiation. *Developmental Psychology*, 22: 327-334.
- Christ, W.G., and N. J. Medoff. 1984. Affective state and the selective exposure to and use of television. *Journal of Broadcasting*, 28: 51-63.
- Clayton, R.R., H.L Voss, L. LoSciuto, Robbins, W.F. Skinner, S.S. and Martin. 1988. *The national survey on drug abuse: Main findings*. Rockville, MD: NIDA.
- Clayton, R., A. Cattarello, and K.P. Waldon. 1991. Sensation seeking as a potential mediating variable for school based prevention intervention: A two-year follow-up of DARE. *Health Communication*, 3(4): 229-239.
- Clayton, R., A. Cattarello, L.E. Day, and K. Waldon. 1991. Persuasive communication and drug prevention: An evaluation of the DARE program. In L. Donohew, H.E. Sypher, and W.J. Bukoski (Eds.), *Persuasive communication and drug abuse prevention*. pp. 295-313. Hillsdale, NJ: Erlbaum.
- Cohen, J. 1977. Sources of peer group homogeneity. *Sociology of Education*, 50: 227-241.
- Cohen, J. 1983. Commentary: The relationship between friendship selection and peer influence. In J.L. Epstein and N. Karweit (Eds.), *Friends in school: Patterns of selection and influence*. NY: Academic Press.

- Cohen, L. and M. Felson. 1979. Social change and crime rate trends: A routine activity approach. *American Sociological Review*, 44: 588-608.
- Davis, J. 1963. Structural balance, mechanical solidarity, and interpersonal relations. *American Journal of Sociology*, 68(4): 444-462.
- Donohew, L. 1982. Newswriting styles: What arouses the reader? *Newspaper Research Journal*, 3, 3-6.
- Donohew, L., S. Finn, and W. Christ. 1988. The nature of news revisited: The roles of affect, schemas, and cognition. In L. Donohew, H. Sypher, and T. Higgins (Eds.), *Communication, social cognition, and affect*. 195-218. Hillsdale, NJ: Erlbaum.
- Donohew, L., D. Helm, P. Cook, and M. Shatzer. 1990. Sensation seeking, marijuana use and responses to prevention messages: Implications for public health campaigns. In R.R. Watson (Ed.) *Drug and alcohol abuse reviews* (pp. 73-93.) Clifton, NJ: Humana Press.
- Donohew, L., R. Hoyle, R. Clayton, W. Skinner, S. Rice and R.E. Colon. 1999. Sensation seeking and drug use by adolescents and their friends: Models for marijuana and alcohol. *Journal of Studies on Alcohol*, 60(5): 622-631.
- Earleywine, M., and P. Finn. 1991. Sensation seeking explains the relation between behavioral disinhibition and alcohol consumption. *Addictive Behaviors*, 16(3/4): 123-128.
- Elliott, D., D. Huizinga, and S. Ageton. 1985. *Explaining delinquency and drug use*. Thousand Oaks, CA: Sage.
- Ennett, S.T., and K.E. Bauman. 1991. Mediators in the relationship between parental and peer characteristics and beer drinking by early adolescents. *Journal of Applied Social Psychology*, 21(20): 1699-1711.
- Ennett, S.T., and K.E. Bauman. 1993. Peer group structure and adolescent cigarette smoking: A social network analysis. *Journal of Health and Social Behavior*, 34(3): 226-236.
- Ennett, S.T., and K.E. Bauman. 1994a. Variability in cigarette smoking within and between adolescent friendship cliques. *Addictive Behaviors*, 19(3): 295-305.
- Ennett, S.T., and K.E. Bauman. 1994b. The contribution of influence and selection to adolescent peer group homogeneity: The case of adolescent cigarette smoking. *Journal of Personality and Social Psychology*, 67(4): 653-663.
- Ennett, S.T., and D.P. Rosenbaum. 1994. Long-term evaluation of Drug Abuse Resistance Education. *Addictive Behaviors*, 19(2): 113-125.
- Ennett, S.T., and N.S. Tobler. 1994. How effective is drug abuse resistance education? A meta-analysis of Project DARE outcome evaluations. *American Journal of Public Health*, 84(9): 1394-1401.
- Epstein, J. 1983. The selection of friends on achievement and affective outcomes. In J. Epstein and N. Karweith (Eds.), *Friends in school: Patterns of selection and influence*. NY: Academic Press.
- Feld, S. 1981. The focused organization of social ties. *American Journal of Sociology*, 86(5): 1015-1035.
- Flay, B. 1987. Mass media and smoking cessation: A critical review. *American Journal of Public Health*, 22: 153-160.
- Flay, B., J. d'Avernas, J. Best, Ryan and M.K. Kersell. 1983. Cigarette smoking: Why young people do it and ways of preventing it. In P. McGrath and P. Firestone (Eds.), *Pediatric and adolescent behavioral medicine*. NY: Springer-Verlag.

- Friedkin, N. and K. Cook. 1990. Peer group influence. *Sociological Methods and Research*, 19(1): 122-143.
- Friedkin, N. 1998. *A structural theory of social influence*. Cambridge, UK: Cambridge University Press.
- Fulker, D.W., S.G. Eysenck, and M. Zuckerman. 1980. A genetic and environmental analysis of sensation seeking. *Journal of Research in Personality*, 14: 261-281.
- Giordano, P., S. Cernkovich, and M. Pugh. 1986. Friendships and delinquency. *American Journal of Sociology*, 91: 1170-1202.
- Gottfredson, M. and T. Hirshi. 1990. *A general theory of crime*. Stanford, CA: Stanford U. Press.
- Hallfors, D. and D. Godette. 2002. Will the "Principles of Effectiveness" improve prevention practice? Early findings from a diffusion study. *Health Education Research*, 17(4): 461-470.
- Haynie, D. 2001. Delinquent peers revisited: Does network structure matter? *American Journal of Sociology*, 106(4): 1013-1057.
- Heise, D.R. 1970. Causal inference from panel data. In E.F. Borgatta (Ed.), *Sociological methodology 1970*. San Francisco: Jossey-Bass.
- Hirschi, T. 1969. *Causes of delinquency*. Berkeley: University of California Press.
- Janis, I., and S. Feshbach. 1953. Effects of fear-arousing communications. *Journal of Abnormal and Social Psychology*, 48: 78-92.
- Jessor, R. and S. Jessor. 1977. *Problem behavior and psycho-social development: A longitudinal study of youth*. NY: Academic Press.
- Kandel, D. 1978. Homophily, selection, and socialization in adolescent friendships. *American Journal of Sociology*, 84: 427-436.
- Kandel, D. 1985. On processes of peer influences in adolescent drug use: A developmental perspective. *Advances in Alcohol and Substance Abuse*, 4: 139-163.
- Kandel, D. and M. Davies. 1991. Friendship networks, intimacy, and illicit drug use in young adulthood: A comparison of two competing theories. *Criminology*, 29(3): 441-470.
- Kandel, D., and M. Davies. 1996. High school students who use crack and other drugs. *Archives of General Psychiatry*, 53(1): 71-81.
- Kandel, D., R. Kessler, and R. Margulies. 1978. Antecedents of adolescent initiation into stages of drug use: A developmental analysis. *Journal of Youth and Adolescence*, 7: 13-40.
- Kandel, D., O. Simcha-Fagan, and M. Davies. 1986. Risk factors for delinquency and illicit drug use from adolescence to young adulthood. *Journal of Drug Issues*, 16(1): 67-90.
- Kaplan, H.B. 1980. *Deviant behavior in defense of self*. New York: Academic Press.
- Kaplan, H.B., R.J. Johnson, and C.A. Bailey. 1987. Deviant peers and deviant behavior: Further elaboration of a model. *Social Psychology Quarterly*, 50(30): 277-284.
- Kaplan, H.B., S.S. Martin, and C. Robbins. 1984. Pathways to adolescent drug use: Self-derogation, peer influence, weakening of social controls, and early substance use. *Journal of Health and Social Behavior*, 25: 270-289.
- Kessler, R.C., and D.F. Greenberg. 1981. *Linear panel analysis: Models of quantitative change*. New York: Academic Press.

- Krohn, M. 1986. The web of conformity: A network approach to the explanation of delinquent behavior. *Social Problems*, 33: 601-613.
- Krosnick, J. and C. Judd. 1982. Transitions in social influence at adolescence: Who induces cigarette smoking? *Developmental Psychology*, 18: 359-368.
- Lazarsfeld, P., B. Berelson, and H. Gaudet. 1948. *The people's choice*. New York: Columbia University Press.
- Lazarus, R. S. 1982. Thoughts on the relations between emotion and cognition. *American Psychologist*, 37: 1010-1024.
- Lederman, L., L. Stewart, S. Barr, R. Powell, L. Laitman, and F. Goodhart. 2001. RU Sure? Using communication theory to reduce dangerous drinking on a college campus. In R. E. Rice and C. K. Atkin (Eds.), *Public communication campaigns, 3rd ed.* 295-299. Thousand Oaks, CA: Sage.
- Markus, G.B. 1979. Analyzing panel data. *Sage University Paper Series on Quantitative Applications in the Social Sciences*, 07-018. Beverly Hills: Sage Publications.
- Massy, J., and M. Krohn. 1986. A longitudinal examination of an integrated social process model of deviant behavior. *Social Forces*, 65: 106-133.
- Murphy, D.L., R.H. Belmaker, M.S. Buchsbaum, N.F. Martin, R. Ciaranello, and R.J. Wyatt. 1977. Biogenic amine related enzymes and personality variations in normals. *Psychological Medicine*, 7: 149-157.
- Oetting, E., and F. Beauvais. 1987. Peer cluster theory, socialization characteristics, and adolescent drug use: A path analysis. *Journal of Counseling Psychology*, 34: 205-213.
- Oetting, E., S. Spooner, F. Beauvais, and J. Banning. 1991. Prevention, peer clusters, and the paths to drug abuse. In L. Donohew, H. Sypher, and W. Bukoski (Eds.), *Persuasive communication and drug abuse prevention*. 239-261. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Osgood, D.W., J. Wilson, P. O'Malley, J. Bachman, and L. Johnston. 1996. Routine activities and individual deviant behavior. *American Sociological Review*, 61: 635-655.
- Palmgreen, P., L. Donohew, and N. Harrington. 2001. Sensation seeking in antidrug campaign and message design. In R.E. Rice and C.K. Atkin (Eds.) *Public communication campaigns, 3rd ed.* 300-304. Thousand Oaks, CA: Sage.
- Palmgreen, P. 1976. A daydream model of communication. *Journalism Monographs*, 20: 1-31.
- Rice, R.E. (1993). Using network concepts to clarify sources and mechanisms of social influence. In W. Richards, Jr. and G. Barnett (Eds.) *Progress in communication sciences: Advances in communication network analysis*. 43-52. Norwood, NJ: Ablex.
- Rice, R.E. and C. Aydin. (1991). Attitudes towards new organizational technology: Network proximity as a mechanism for social information processing. *Administrative Science Quarterly*, 36: 219-244.
- Richard, A., D. Bell, I. Montoya. 2000. Normative influence on condom use in the personal networks of female cocaine smokers. *AIDS Education and Prevention*, 12(4): 357-374.
- Sadava, S.W. 1973. Patterns of college student drug use: A longitudinal social learning study. *Psychological Reports*, 33: 75-86.
- Schwarz, R.M., B.R. Burkhart, and B. Green. 1978. Turning on or turning off: Sensation seeking or tension reduction as motivational determinants of alcohol use. *Journal of Consulting and Clinical Psychology*, 46: 1144-1145.

- Segal, B., and J.L. Singer. 1976. Daydreaming, drug and alcohol use in college students: A factor analytic study. *Addictive Behaviors*, 1: 227-235.
- Segal, B., G.J. Huba, and J.L. Singer. 1980. *Drugs, daydreaming and personality: A study of college youth*. Hillsdale, NJ: Erlbaum.
- Sherman, S., C. Presson, L. Chassin, B. Corty, and R. Oshavsky. 1983. The false consensus effect in estimates of smoking prevalence: Underlying mechanisms. *Personality and Social Psychology Bulletin*, 9: 197-208.
- Skog, O. 1986. The long waves of alcohol consumption: A social network perspective on cultural change. *Social Networks*, 8(1): 1-32.
- Sutherland, E. and D. Cressey. 1974. *Criminology*, 9th ed. Philadelphia, PA: J.B. Lippincott.
- Urberg, K. 1992. Locus of peer influences: Social crowd and best friend. *Journal of Youth and Adolescence*, 21(4): 439-405.
- Urberg, K., C. Cheng, and S. Shyu. 1991. Grade changes in peer influence on adolescent cigarette smoking: A comparison of two measures. *Addictive Behaviors*, 16(1/2): 20-28.
- Urberg, K., S. Shyu, and J. Liang. 1990. Peer influence in adolescent cigarette smoking. *Addictive Behaviors*, 15(3): 247-256.
- Valente, T., S. Watkins, M. Jato, A. van der Straten, and L-P. Tsitsol. 1997. Social network associations with contraceptive use among Cameroonian women in voluntary associations. *Social Science and Medicine*, 45(5): 677-687.
- Warr, M. and M. Stafford. 1991. The influence of delinquent peers: What they think or what they do? *Criminology*, 29(4): 851-866.
- Wister, A.V., and W.R. Avison. 1982. "Friendly persuasion": A social network analysis of sex differences in marijuana use. *The International Journal of the Addictions*, 17: 523-541.
- Zajonc, R.B. 1980. Feeling and thinking: Preferences need no inferences. *American Psychologist*, 35: 151-175.
- Zuckerman, M. 1978. *Sensation seeking: Beyond the optimal level of arousal*. Hillsdale, NJ: Erlbaum.
- Zuckerman, M. 1983. *Biological bases of sensation seeking, impulsivity and anxiety*. Hillsdale, NJ: Erlbaum.
- Zuckerman, M., E.A. Kolin, L. Price, and I. Zoob. 1964. Development of a sensation-seeking scale. *Journal of Consulting Psychology*, 28: 477-482.