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SIBLING INFLUENCE ON ADOLESCENT ALCOHOL, CIGARETTE,  
AND MARIJUANA USE

by

Benjamin Guild Gibbs

A thesis submitted to the faculty of

Brigham Young University

in partial fulfillment of requirements for the degree of

Master of Science

Department of Sociology

Brigham Young University

June 2005

BRIGHAM YOUNG UNIVERSITY

GRADUATE COMMITTEE APPROVAL

of a thesis submitted by

Benjamin Guild Gibbs

This thesis has been read by each member of the following graduate committee and by majority vote has been found to be satisfactory.

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As chair of the candidate's graduate committee, I have read the thesis of Benjamin Guild Gibbs in its final form and have found that (1) its format, citations, and bibliographical style are consistent and acceptable and fulfill university and department style requirements; (2) its illustrative materials including figures, tables, and charts are in place; and (3) the final manuscript is satisfactory to the graduate committee and is ready for submission to the university library.

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## ABSTRACT

### SIBLING INFLUENCE ON ADOLESCENT ALCOHOL, CIGARETTE, AND MARIJUANA DRUG USE

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Department of Sociology

Master of Science

The purpose of this study is to estimate the association between sibling drug use and adolescent alcohol, cigarette, and marijuana use. Research is conducted using survey data from a probability sample of 4,987 adolescents in grades 9–12 in Utah. To account for the limited frequency of drug use among respondents, Poisson regression is used to estimate models for each type of drug. In support of current literature, findings indicate that having a sibling who uses drugs increases the frequency of drug use substantially, even when peer influences are taken into account. Significant sibling associations with adolescent drug use found in this study support the assumptions of social learning theory. Findings suggest that sibling influence is largely due to social learning, as older sibling influences are demonstratively more significant than younger sibling influences.

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## INTRODUCTION

A major social problem in the United States is the prevalence of drug use among adolescents. According to a national survey of high school seniors, 25 percent reported cigarette use during the past month, 48 percent said they had used alcohol, and 20 percent had used marijuana (National Institutes of Health, 2004). Substance use in adolescence is associated with a variety of problems including low academic achievement, early sexual initiation, non-marital pregnancy, poor interpersonal relationships, and marital disruption in adulthood (Brook & Brook, 1990; Johnson & Kaplan, 1990; Newcomb & Bentler, 1988).

There has been extensive research and theorizing about factors that influence adolescents to use drugs (Hawkins, Catalano, & Miller, 1992; Petraitis, Flay, & Miller, 1995). Two of the most important variables that influence the risk of adolescent drug use are peers and parents. Siblings are another potentially significant influence but until recently, few studies have examined sibling influence on adolescent drug use.

Siblings affect on adolescent drug use has been explained by two competing theories: social learning theory and the behavioral genetic perspective. Social learning theory emphasizes the importance of observing and modeling behaviors, attitudes, and emotional reactions of others (Bandura, 1977). From this perspective, siblings model drug use and express attitudes favorable of drug use. The behavioral genetic perspective emphasizes genetic similarity between individuals (Swendsen, Conway, Rounsaville, & Merikangas, 2002). From this perspective, the association between sibling drug use and adolescent drug use is genetic.

There is evidence that both perspectives may have some validity. On the one

hand, researchers have found that older siblings are more influential than younger siblings in affecting adolescent drug use. This finding supports the modeling or socialization process. If the association were purely genetic, then younger siblings would be just as influential as older siblings in affecting adolescent drug use.

On the other hand, behavioral genetic researchers have found that almost fifty percent of personality traits are explained by genetic factors (Bouchard, McGue, Hur, Horn, & 1998; Reiman & De Raad, 1998). For some researchers, the association between family factors and adolescent drug use is attributed to genetic affects (Merikangus, Rounsaville, & Prusoff, 1992). No known study of sibling drug use on adolescent drug use has tested for the validity of these perspectives. Additional research is needed to distinguish between the social and the genetic aspects of sibling drug use on adolescent drug use.

Testing the social learning theory and the genetic perspective may clarify the role of peer influence on adolescent drug use. In research on peer effects, two alternative explanations, socialization and selection, have emerged to explain the high correlation between peer and adolescent drug use. The first, socialization, is derived from social learning theory. Peers socialize and teach adolescents to use drugs. The second, selection, refers to the adolescent's selection of peers who reflect similar interests, such as drug use. Although socialization is arguably one explanation for sibling influence, the selection argument is less applicable: siblings are not selected. Therefore, finding that sibling influence is significant and not the result of genetic similarity challenges the selection argument for peers. If adolescents are equally influenced by siblings (whom are not selected) and peers (who can be), this would support the socialization perspective.

Aside from the theoretical argument, sibling research has several limitations. First, previous studies have examined either alcohol, marijuana, or cigarette use of siblings (or some pairing of the three, see Duncan, 1996). Hundleby and Mercer state that, “the influence of family and friends will depend upon the particular drug in question” (1987, p. 153). Hence, the comparative analysis of each drug should reveal unique effects. To date, no known study has isolated both sibling and peer use by these drug categories.

Second, most studies have relatively small sample sizes, limiting the number of factors that can be analyzed (Hoffmann & Johnson, 1998). Family structure and religiosity, for example, have been identified as relevant factors contributing to adolescent drug use and should be included in analyses of drug use.

And third, most models of drug use (i.e. ordinal least squares regression, structural equation modeling) are based on the assumption that a larger number of respondents report some drug use rather than no drug use, yet most adolescents do not use drugs. Without accounting for the high number of non-drug users, results are subject to bias (Hoffmann, 2004). Although Poisson regression transforms skewed distributions to look more like normal distributions, few studies use this methodology (Stormshak, Comeau, & Shepard, 2004).

The purpose of this study is to determine the strength of the association between sibling and adolescent drug use, controlling for other relevant variables including peer and parental influences. Specifically, this study addresses the socialization, genetic, and selection debate, as well as limitations in current sibling research.

## LITERATURE REVIEW

Theorists find that although adolescent drug use generally occurs through a process of social learning, peer and parent influences are distinct (Kandel, 1996). Specifically, parents, through strong bonds and attachments, tend to restrict drug use, while reinforcing pro-socialization and peers often display and reinforce anti-social behavior.

### *Parent Influence*

Theorists have suggested that parents influence adolescent drug use in two ways. First, by attitudes and behavior, parents teach adolescents to avoid drug use. Adolescents will tend to model the behaviors they observe in their parents and other family members, according to social learning theory (Bandura, 1977).

Second, parents are viewed as barriers which help constrain adolescents from drug use (Warr, 1993). According to this perspective, adolescents form attachments and bonds to their parents which inhibit their impulses to experiment with drugs (Akers & Sellers, 2004). This theoretical perspective is referred to as social control theory (Hirschi, 1969). The stronger the bonds between parent and adolescent, the less likely adolescents are to use drugs. A number of researchers have observed that adolescent drug use decreases when parent-adolescent bonds increase (Hundelby & Mercer, 1987; Melby, Conger, & Lorenz, 1993; Patterson, DeBaryshe, & Ramsey, 1989).

### *Peer Influence*

Consistent with social learning theory, numerous researchers have documented the influence of peers on adolescent drug use (Brook, Brook, & Richter, 2001; Hawkins et al., 1992; Petraitis et al., 1995; Thornberry & Krohn, 1997). Adolescents who associate

with drug using peers are much more likely to initiate drug use (Elliott, Huizinga, & Ageton, 1985; Huizinga, Loeber, & Thornberry, 1995). Peers often introduce and encourage adolescent drug use, which may explain why adolescents rarely use drugs if none of their friends use drugs (Khavari, 1993; Moon, Hecht, Jackson, & Spellers, 1999).

One limitation of these findings is the issue of “selection”. That is, rather than peers influencing adolescent drug use, adolescents who use drugs choose friends who also use drugs. There is debate about how much of the association between peer and adolescent drug use is due to socialization and how much is due to selection (Kandel, 1996). Some longitudinal data indicate that socialization and selection effects are about equal in strength (Ennett & Bauman, 1994; Kandel, 1980). One possible test of selection could be conducted by comparing siblings and peers. Siblings are a unique comparison group because adolescents can learn from both siblings and peers yet they can select their peers but not their siblings.

### *Sibling Influence*

Only recently have researchers examined the relationship between sibling and adolescent drug use. Reviewing the literature, Stormshak et al. (2004) concluded that, “parents and peers predict the development and maintenance of later antisocial behavior; however, research on siblings has been more limited.” (p. 635–636). Brook and her colleagues (Brook, Whiteman, Gordon, & Brenden, 1983) stated in their study of sibling influence on adolescent drug use that “while the importance of examining the impact of significant others on the adolescent’s use of drugs has been recognized, attention has been primarily focused on relations with mothers, fathers, and peers” (p. 84). Despite the small number of sibling drug studies, siblings have been identified for some time as a

potential area of research. In 1964 Irish stated in an article titled, “Sibling interaction: a neglected aspect in family life research,” that “the influences of brothers and/or sisters upon each other during adolescence need recognition and examination...” (p. 288).

While sibling research developed in the family literature in the 1970s, research specifically analyzing sibling influence on adolescent drug use did not emerge until the 1980s (Brook & Brook, 1990). Interest in sibling effects on drug use continued to receive marginal attention. Researchers (Duncan, Duncan, & Hops, 1996) echoed what Needle et al. (1986) proclaimed a decade prior, “investigations of the role of siblings on adolescent substance use have been neglected” (p. 159).

There are several possible explanations for the limited number of sibling drug use studies. Conceptualizing siblings as a unique influence aside from other familial factors is relatively new. For example, some studies have relegated siblings into family categories that minimize or ignore sibling effects (Warr, 1993; Hundleby & Mercers, 1987). Recent adolescent drug studies—instead of using the construct of *family*—have begun to identify parents and siblings as unique factors (Bank, Burraston, & Snyder, 2004; Brook, Brook, & Whitman, 1999).

Another explanation for the relative lack of sibling drug studies may be a technical one; national surveys of adolescents do not ask questions regarding sibling drug use. The 1997 National Survey of Adolescent Males, for example, only asked for the number of male and female siblings and whether the sibling was the oldest, youngest, or a middle child. The survey did not ask about sibling drug use (Sonenstein, Pleck, Ku, & Turner, 2000). Without national data on sibling drug use, sibling research is limited to regional studies with relatively small sample sizes.

In 1999, Brook et al. concluded that “there is now a growing recognition that sibling effects need to be included in order to obtain a more representative view of family life” (p. 452). Similarly, researchers (Slomkowski, Rende, Conger, Simons, & Conger, 2001) have found that “the neglect of sibling effects on delinquency, relative to parental and peer influences, is being challenged by an emerging literature suggesting that siblings exert a detectable, pronounced, and unique influence on the development of antisocial behavior in childhood and adolescence” (p. 271). To date, several characteristics of sibling relationships have been identified.

Researchers know that siblings share formative years together, which often become enduring relationships (Brook et al., 1983). Children typically spend more time with siblings than with parents in early and middle childhood (McHale & Crouter, 1996; see Brook et al., 1983; Bank & Kahn, 1982) and rely on siblings for intimacy, companionship, and emotional support (Blyth & Foster Clark, 1987). Siblings provide social support regarding school and family problems (Tucker, McHale, & Crouter, 2001) and influence their sibling’s social-emotional and cognitive development (Brown & Dunn, 1992; Howe, 1991). Although this rate of sibling interaction decreases over time as children enter adolescence (Buhrmester, 1992; Buhrmester & Furman, 1990; Raffaelli & Larson, 1987), Yeh and Lempers (2004) noted that “these decreases do not necessarily indicate that sibling relationships in adolescence become less important” (p. 134).

Several studies have analyzed the influence of sibling drug use on other siblings (Slomkowski et al., 2001; Brook et al., 1983). Some studies include peer drug use (Stormshak et al., 2004), parental drug use and attitudes towards drug use (Brook et al., 1999; Duncan et al., 1996; McGue, Sharma, & Benson, 1996; Brook, Whiteman, Gordon,

& Cohen, 1986), or both (Windle, 2000; Melby et al., 1993; Rowe & Gulley, 1992; Conger, Rand, & Reuter, 1991; Needle et al., 1986). Most studies conclude like Branje et al. (Branje, Van Kieshout, Van Aken, & Haselager, 2004) that “siblings seem to exert a unique, independent influence on each other during adolescence, even when parental and peer influences are controlled” (p. 1386). Likewise, McCoy, Brody, & Stoneman (1994) stated that siblings provide “children and adolescents with experiences that are different from those they have with both parents and peers” (p. 400, see Azmitia & Hesser, 1993; Brody, Stoneman, & MacKinnon, 1982; Whiting & Whiting, 1975).

Siblings, on the one hand, resemble parents by inculcating family values. In other words, they have an interest in the overall well being of the family. In addition, older siblings may feel a sense of responsibility towards younger siblings. On the other hand, siblings do not always embrace parental beliefs and attitudes, especially towards drug use. In this instance, siblings may act more like peers by displaying and reinforcing antisocial behavior (Slomkowski et al., 2001, p. 273; Bank, Patterson, & Reid, 1996). Although sibling bonds may help constrain adolescent drug use, most sibling research confirms the importance of siblings as a socializing influence for or against drug use.

#### *Socialization vs. Genetic Effect*

With few exceptions, researchers find that older sibling drug use is more influential on adolescent drug use than younger sibling drug use. Researchers have found that older siblings influence adolescent’s anti-social behaviors (Fagan & Najman, 2003; Lewin, Hops, Davis, & Dishion, 1993; Klein & Patterson, 1986; Alexander & Parsons, 1977). Specifically, older sibling influences have been associated with adolescent drug use (Needle et al., 1986) sexual activity (Widmer, 1997), and educational achievement



(Hauser & Wong, 1989; Benin & Johnson, 1984). Tucker et al. (2001) found that both older and younger siblings view older siblings as a source of support about non-familial issues such as social and scholastic activities. Most researchers interpret the association between older sibling use and adolescent drug use as evidence supporting the socialization process (Brook et al. 1999).

Some scholars, however, have argued that the similarities found between siblings support the behavior genetic perspective (Merikangus et al., 1992). Yet, McGue et al. (1996) found no difference between nonbiological siblings. Likewise, studies that find correlations between older sibling use and adolescent drug use rather than between younger sibling use and adolescent drug use seem to suggest that learning is a better predictor of deviance than genetic disposition (see Duncan et al., 1996).

### *Current Study*

In this study I examine the unique role of siblings on adolescent cigarette, alcohol, and marijuana use. The purpose is to compare the relevance of social learning and genetic explanations of sibling influence. In the analysis, I eliminate several limitations in the existing literature. First, studies that focus on sibling influence on adolescent outcomes have examined parent, sibling, and peer variables independently. Of the studies that combine at least two of the above factors, a number of articles concentrate primarily on middle- to late-childhood (Shortt, Capaldi, Dishion, Bank, & Owen, 2003; Lockwood, Kitzmann, & Cohen, 2001; Updegraff & Obeidallah, 1999; Abramovitch, Corter, Pepler, & Stanhope, 1986). No known study on sibling drug use has included the affects of sibling cigarette, alcohol, and marijuana use simultaneously. Studies often combine cigarette, alcohol, and marijuana use into one sibling drug

variable. For example, Stormshak et al. (2004) combined sibling cigarette and alcohol use, Windle (2000) combined alcohol, marijuana, and other illegal substances, while Melby et al. (1993) only analyzed the influence of sibling tobacco use.

Second, several variables, like family structure, religiosity, and family drug abuse, have rarely been analyzed (see Branje et al., 2004; Yeh & Lempers, 2004; Slomkowski et al., 2001; Windle, 2000; Updegraff & Obeidallah, 1999; Melby et al., 1993). Although several studies have shown family structure to be associated with drug use (Gil, Vega, & Biafora, 1998; Hoffmann, 1995; Hoffmann & Johnson, 1998; Thomas, Farrell, & Barnes, 1996), many sibling drug use studies focus on adolescents who have both a father and mother at home (Slomkowski et al., 2001), possibly due to the restrictions of smaller sample sizes (Hoffmann & Johnson, 1998; for examples see Branje et al., 2004; Stormshak et al., 2004; Yeh & Lempers, 2004; Slomkowski et al., 2001; Windle, 2000; Updegraff & Obeidallah, 1999; Melby et al., 1993).

Religious belief has been found to influence rates of adolescent drug use (Wills, Gibbons, Gerrard, Murry, & Brody, 2003; Brook & Brook, 1990); sexual activity (Wills et al., 2003); and peer affiliations (Bahr, Maughan, Marcos, & Li, 1998). Drug abuse by extended family members has also been associated with adolescent drug use (Vega, Zimmermann, Warheit, Apospori, & Gil, 1993; Clayton, 1992; Smart, Chibucos, & Didier, 1990; López, Redondo, & Martin, 1989). Therefore this study will extend the analysis beyond siblings, peers, and parents to include family structure, religiosity, and family drug abuse.

Third, only one known study accounts for the non-normal distribution of drug-use frequencies (Stormshak et al., 2004). Standard analyses (e.g., ordinary least squares,

structural equation modeling) assume that the dependant variable is normally distributed<sup>1</sup>. Therefore, to transform the dependent variable into a normally distributed variable, different analyses should be used (i.e., Poisson regression, see Hoffmann, 2004) or tests should be utilized to interpret findings (i.e., Sattora-Bentler test, see Stromshak et al., 2004).

For example, although Windle (2000) utilized structural equation modeling to analyze mediation effects, there is no evidence that the non-normal distribution of drug outcomes is transformed to meet the assumption of normally distributed dependent variables required in structural equation modeling (Kline, 2005). Likewise, Melby et al. (1993) utilizes structural equation modeling; however, they do not account for the non-normal distribution of the drug use measurement. It may be possible that these studies have accounted for this issue without reporting dependent variable transformations or alternative analyses and tests. Even so, the distinct distribution of drug use variables should be reported clearly and with well-defined methods to account for the non-normal distributions.

To summarize, this study advances current research by: (1) testing the accuracy of social learning theory and the genetic perspective in explaining the influence of sibling drug use on adolescence, (2) analyzing both sibling and peer cigarette, alcohol, and marijuana use simultaneously with parental attitudes toward drug use, (3) utilizing a large, representative data set (which allows the inclusion of variables such as family structure, religiosity, and family drug abuse), and (4) accounting for non-normal data

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<sup>1</sup> In other words, for the question “how many days have smoked marijuana at least once in the past thirty days,” most responses should be fifteen days, with some answering less than fifteen and some more than fifteen. It is more likely, however, that most respondents will indicate “0” days, therefore making the

using Poisson regression.

### **Expected Findings**

This study is based on three hypotheses. Each hypothesis is consistent with the assumptions of social learning theory. The first hypothesis asserts that sibling influence is a pronounced and independent influence on adolescent drug use, even when controlling for the affects of peers and parents.

The second hypothesis asserts that parent, peer, religious, and other family factors are associated with adolescent drug use. This suggests that each factor is uniquely associated with adolescent drug use.

The third hypothesis asserts that *only* older siblings influence adolescent drug use. This hypothesis is more consistent with social learning theory than the genetic explanation for two reasons: siblings are not selected and genetics would not predict a difference between older and younger adolescents.

Therefore, support for each hypothesis will reveal the importance of sibling influence, the importance of parent, peer and other factors, and lend support for the role of socialization over genetic effects in adolescent drug use.

Hypothesis 1. Sibling alcohol, cigarette, and marijuana use are associated with adolescent alcohol, cigarette, and marijuana use.

Hypothesis 2. Peer and parent factors are associated with adolescent drug use as well as family structure, religiosity, and family drug abuse.

Hypothesis 3. Older sibling alcohol, cigarette, and marijuana use are associated with adolescent alcohol, cigarette, and marijuana use. Younger sibling alcohol, cigarette, and marijuana use are *not* associated with adolescent alcohol, cigarette, and marijuana use.

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distribution of answers non-normal.

## Sample

The data are from a probability sample collected throughout the state of Utah in 1997 from 4,987 students in grades 7–12. To help minimize the bias from dropouts, an over-sample of students from alternative schools was included. Alternative schools are schools created to meet the needs of at-risk students who would otherwise drop out. Alternative students are used as a proxy for dropouts because teachers and school counselors indicate that students at alternative schools are similar to dropouts, and many students who eventually drop out of public school attend alternative schools for a period of time. The alternative school students who completed the questionnaire are 5.3 percent of the total respondents, which is slightly larger than the dropout rate reported by school officials. The rates of alcohol, cigarette, and marijuana use would be about 2 percent lower if the alternative students were not included in the sample. This is consistent with the estimates of Johnston, O'Malley, & Bachman (1998) concerning the impact of dropout students on rates of drug use. By including alternative school students, sampling bias common in school surveys should be minimized. Of the following data analyses, sample weights are included to adjust for the differential sampling across schools.

Descriptive statistics are reported in table 1. The final sample is 82 percent of the total number of students enrolled in the sample classrooms at the time of the survey. The sample is similar to the state population on major demographic characteristics but has a slight over-representation of females, minorities, and junior high students. The sample age ranges from twelve to nineteen with a median of fifteen years of age. About half (51 percent) of the respondents are female and 72.6 percent live with both biological parents. Forty-two percent say their father graduated from college and 35 percent report that their

mother graduated from college. In terms of ethnicity, 88 percent indicate that they are white and not of Hispanic origin. Although religious affiliation was not asked, a majority of residents in Utah are associated with the Church of Jesus Christ of Latter-day Saints.

Less than one fourth (23 percent) of the respondents do not have an older sibling. Thirty percent of the respondents have at least one “best friend” who has smoked in the past year, over half with at least one best friend who has used alcohol, and almost 30 percent of respondents with at least one best friend who has used marijuana in the past year. Forty-eight percent of respondents reported that at least one sibling was involved in some form of drug use. Of all respondents, there were 240 cases (23 percent) of those who reported being the oldest and having a younger sibling who used at least one drug. Among respondents who were the youngest child, 63 percent reported that at least one older sibling used drugs.

## **Measures**

This analysis focuses primarily on the associations between sibling and peer drug use and parental attitudes toward drug use on adolescent cigarette, alcohol, and marijuana use in the past thirty days. Reports of peer and respondent drug use were restricted by time. For example, drug use for siblings was derived from a question asking whether or not a sibling has used drugs. It follows that most respondents would report drug use of their sibling during the sibling’s lifetime. Drug use for peers, however, was limited to the number of peers using drugs in the past year. Self-reported use was restricted to thirty days. Although sibling use could not be restricted to the past year, reports of peer use and self-reported were intentionally restricted.

I do this for two reasons. First, this is a cross-sectional data set. By limiting the

respondent to drug use in the past thirty days, findings are based on measures of current drug use. If this analysis were to use the respondent's drug use in the past year or lifetime, longitudinal data may be more appropriate to account for changes over the course of a year or lifetime which may be influenced by the increasing or decreasing influence of siblings, peers, and parents.

Second, analyzing the influence of peer drug use in the past year provides a sufficient amount of time that could conceivably affect the respondent. Lifetime use would be too general; whereas drug use in the past thirty days could be too recent to theoretically influence the respondent's drug use. The question regarding sibling use did not specify a time frame for using. Sibling lifetime drug use may be an appropriate measure considering the plausible effect siblings have over the adolescent's lifetime verses the limited time period adolescents have known their peers. Therefore, the dependent variables are based on the respondent use of alcohol, cigarettes, and marijuana in the past month; the drug use variables for peers are based on drug use in the past year; and sibling drug use is over the lifetime of the sibling.

All respondents were asked how often they had used each of these three drugs during the past thirty days. Respondents could choose from seven response categories, ranging from 0 to 40 or more occasions, to reflect intervals of drug use. The measure of sibling use was determined by three questions. First, the students were asked if any of their brothers or sisters had ever drunk alcohol, smoked cigarettes, or smoked marijuana. The responses were "no", "yes", or "I don't have any brothers or sisters". The percentage of students with at least one sibling was 97 percent.

Second, respondents were asked "How many brothers and sisters, including

stepbrothers and stepsisters, do you have that are older than you?" The third question asked "How many brothers and sisters, including stepbrothers and stepsisters, do you have that are younger than you?" According to the theoretical assumption that the influence of sibling drug use is the result of modeling, only respondents with at least one older sibling were included in the analysis. Initial analyses were run comparing all respondents with at least one sibling *regardless of age* with those who had at least one *older* sibling. Of the respondents with at least one older sibling, the coefficients for the sibling drug use variables were considerably larger, therefore respondents with no older siblings were dropped from the data set.

To measure peer drug use, respondents were asked how many of their best friends had used alcohol, cigarettes, and marijuana during the past year. For each item there were five response categories ranging from "None" to "4." In the analysis, a higher score indicated more friends who used each of the drugs.

Parental drug attitudes are defined as how wrong parents feel it is for their adolescent to use various drugs. Although actual parent drug use measures were not available, parental attitudes have been found to predict adolescent drug use (Ennett, Bauman, Foshee, Pemberton, & Hicks, 2001; Kandel 1996; Andrews, Hope, Ary, Tildesley, & Harris, 1993; McDermott, 1984). Students in the survey were asked: "How wrong do your parents feel it would be for you to (1) drink beer, wine, or hard liquor regularly, (2) smoke cigarettes, and (3) smoke marijuana?" For each item there were four response categories ranging from "very wrong" to "not wrong at all." Again, a higher score indicated more tolerance or acceptance of adolescent drug use by their parents.

Family structure was coded into four dummy variables: (a) lives with both



biological parents, (b) lives with one parent in a single-parent home, (c) lives with one parent and a step-parent, or (d) other family type. The “lives with both biological parents” variable is used as the reference category. Therefore, interpretations of other family arrangements are based on the comparison with two biological parents at home.

To measure religiosity, the following question was asked: “How important is religion in your life?” Respondents were given the following answer choices: “Not important”; “Somewhat important”; “Pretty important”; and “Very important.” These items are common indicators of religiosity that has been used in other studies (Wills et al., 2003; Bahr et al., 1998; Litchfield, Thomas, & Li, 1997; Brody, Stoneman, & Flor, 1996). Cochran (1992) and others (Gorsuch & McFarland, 1972) have found that a single-item on the importance of religion appears to be reasonably valid.

To determine the extent of drug abuse in the “family” (however defined by the respondent), this question was asked: “Has anyone in your family ever had a severe alcohol or drug problem?” The students responses could only be “no” or “yes”. Although there is undoubtedly some overlap with family drug abuse and sibling drug use, tests for multi-collinearity indicate that parental and sibling measures were within an acceptable range of independence to be used as variables.

Two control variables are considered as well, age and gender. Drug use tends to increase with age and is more prevalent among males than females (Hoffmann & Johnson, 1998). Some studies, however, report that the effect of age (Catalano et al., 1996) and gender (Branje et al. 2004; Stormshak et al. 2004; Slomkowski et al., 2001; Duncan 1996; Pepler, Abramovitch, & Corter, 1981; Abramovitch, Corter, & Pepler, 1980) are only indirectly related to adolescent drug use (see Branje et al., 2004). Age

ranged from twelve to nineteen years of age. Gender was coded “0” for female, and “1” for male.

Respondents were instructed to leave a question blank if it did not apply. Nonresponse varies, for example, from 0.3 percent on age to 3.0 percent for sibling marijuana use. For sibling drug use (cigarette, alcohol, and marijuana) the total number of missing cases in the regression equation is 12 percent, since different respondents tend to skip different items. Due to the low percentage of nonresponse for each drug use category compared with a larger total percentage dropped from the analysis, nonresponse appears to be random. In analyses using listwise deletion with known populations, Allison (2002, p. 7) finds that generally with regression analysis, listwise deletion more closely resembles random missing data than most other missing data methods. Therefore, listwise deletion is used in this analysis.

### **Procedure**

The dependent variables are counts of the frequency of drug use during the past month. The distributions are skewed with high proportions of the responses reporting 0, indicating no use during the past month. Poisson regression accounts for the variation in use and essentially preserves data. The data distributions are “extradispersed”, or in other words, the variance of the dependent variable is larger than its mean score. This type of distribution requires the use of extradispersed Poisson regression (Hoffmann, 2004). Extradispersed Poisson regression adjusts the model for variance unequal to means. I estimated extradispersed Poisson regression models for alcohol, cigarette, and marijuana use. Using this alternative modeling strategy allows for the preservation of the distributions of the dependant variables while accounting for the bias in the standard

errors common in rare events like drug use.

Interpretations of extradispersed Poisson regression coefficients are similar to logistic regression coefficients in that both use log-linear modeling. Poisson regression coefficients are interpreted much like odds ratios in logistic regression (Hoffmann, 2004). For example, if the coefficient for female drug use is .08, it may be transformed by first exponentiating, then subtracting one and multiplying by 100. The final number, 9, would be interpreted as follows; females are estimated to be 9 percent *more likely* to use drugs *more often* than males, controlling for all other variables in the model. For continuous variables, the interpretations are slightly different. If, for parental attitudes of drug use, the exponentiated coefficient were 1.43, then an increase in a favorable parental attitude of drug use is associated with a 43 percent increase in the occasions an adolescent uses drugs.

### **Estimation**

Table 2 summarizes the findings for associations of sibling drug use, number of peers that use drugs, parental attitudes towards drug use, family structure, religiosity, family history of drug abuse, age, and gender on adolescent cigarette, alcohol and marijuana use. The analysis of adolescent *cigarette* use, for example, includes sibling *cigarette* use, number of peers who smoke *cigarettes*, and parental attitudes towards *cigarette* smoking are used. Likewise for alcohol and marijuana use, the sibling, peer, and parent variables reflect the same drug type. Therefore, table 2 tests hypothesis 1: sibling drug use corresponds with respondent drug use and hypothesis 2: peer and parent factors will also be associated with adolescent drug use.

Table 3 is the same analysis except two subpopulations from the sample are

selected: the oldest children and the youngest children. Although many respondents were not the oldest or youngest child in their family, this analysis is conducted to determine the influence of younger sibling drug use on the oldest sibling and older sibling drug use on younger siblings. This estimation technique is to determine if genetic factors are significant. According hypothesis 3, if older sibling influences are significant and younger sibling influences are not, then the genetic assumption of sibling influence is unsupported.

## **Results**

As expected in the first hypothesis, sibling alcohol, cigarette, and marijuana use are associated with alcohol, cigarette, and marijuana use (see table 2). Respondents with a sibling who smoked cigarettes have a frequency of cigarette use more than double that of respondents who do not have a sibling who smokes. The association between sibling and adolescent alcohol use is even stronger. Having a sibling who drinks alcohol increases the occasions of adolescent alcohol by almost three times. Finally, respondents with a sibling who has smoked marijuana have a frequency of marijuana use more than double that of respondents who do not have a sibling who has consumed alcohol. These findings suggest that sibling influence is a pronounced and independent influence on adolescent drug use, even when controlling for the affects of peers and parents.

The second hypothesis states that peer and parent factors are associated with adolescent drug use as well as family structure, religiosity, and family drug abuse. Results show partial support for this hypothesis. The number of peers who use cigarettes, alcohol, and marijuana is strongly associated with adolescent cigarette, alcohol, and marijuana use. As the number of close friends who smoke cigarettes in the past year

increases, the frequency of adolescent smoking doubles<sup>2</sup>. As the number of close friends who have consumed alcohol in the past year increases, the increase in occasions of respondent alcohol use almost doubles. The association between peer marijuana use and adolescent marijuana was the strongest. An increase in the number of peers that smoke marijuana increases the frequency of respondent marijuana use by more than two and one half times.

The expectation that an association between parental attitudes towards drugs and adolescent drug use was supported for cigarette and alcohol use, but not for marijuana use. As parental tolerance of cigarette use increases, the frequency of adolescent cigarettes use increases by 22 percent. If parental attitudes are more tolerant of alcohol use, the frequency of consuming alcohol increases by 22 percent. Surprisingly, parental attitude toward marijuana use is not associated with adolescent marijuana use.

As expected, religiosity is associated with adolescent drug use. An increase in religious convictions is associated with a 31 percent decrease in the adolescent's frequency of cigarette use. Likewise, the frequency of adolescent alcohol use is associated with a 25 percent decrease as the level of religiosity increases. As religiosity increases, the occasions of adolescent marijuana use decreases by 22 percent.

Age and family drug abuse variables are only associated with adolescent cigarette use. Each one-year increase in age is associated with an 8 percent increase in the

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<sup>2</sup>Note that the coefficients between peer and sibling variables can not be compared, as they measure different influences. The peer variable measures the effect of the increase in the number of peers who use drugs whereas the sibling effect is measured by a dummy variable ("0" = no siblings who use drugs and "1" = one or more siblings who use drugs). The interpretation is therefore different. An increase in the number of peers who use drugs increases the number of occasions the respondent is expected to use a certain drug by some percentage. Having a sibling who uses drugs is associated with an increase in the occasions of adolescent drug use.

frequency of adolescent cigarette use. Having a family member with a drug problem increased the adolescent's frequency of cigarette use by 28 percent. Somewhat surprisingly, gender and family structure are not associated with adolescent cigarette, alcohol, or marijuana use.

Therefore, the hypothesis that parent, peer, religious, and other family factors are associated with adolescent drug use is strongly supported for peer and religious influences, partially supported for parent, age, and history of family drug abuse, and is not supported for gender and family structure.

The third hypothesis asserts that *only older* siblings influence adolescent drug use. Table 3 separates respondents who are the oldest child in the family and respondents who are the youngest child in the family. Because oldest children only have younger siblings and youngest siblings only have older siblings, table 3 tests the influence of first younger siblings (under the oldest child category) and second tests the influence of older siblings (under the youngest child category). It is expected that oldest children *will not* be influenced by younger sibling drug use and the youngest children *will* be influenced by older sibling drug use.

Results support these two claims. With cigarette use, having a younger sibling who smokes cigarettes *is not* associated with adolescent cigarette use. Having an older sibling who smokes cigarettes *is* strongly associated with adolescent cigarette use.

For alcohol use, there is a slight association with younger sibling alcohol use and the oldest child's use but, compared with the strong influence of older sibling alcohol use on the youngest child's alcohol use, this association is moderate.

As expected, the association between younger sibling marijuana use and marijuana

use of the oldest child is not significant. Once more, older sibling drug use is significant. Older sibling marijuana use is associated with marijuana use of the youngest child.

## **Discussion**

### *Socialization, Genetic Effect, and Selection*

By demonstrating a difference between the influence of younger and older siblings, the genetic explanation is not supported. It appears that social learning theory explains the role of older siblings on adolescent drug use as a result of modeling and socialization. Furthermore, the role of socialization may extend to the peer socialization vs. selection debate. If siblings, who are not selected, model drug behavior, then perhaps peers also model behavior and are not selected by the adolescent. This conclusion is tentative.

Selection can occur with siblings and peers. The adolescent can select the quality of their sibling relationships; how much time they spend together, what type of activities they do, etc. Likewise, adolescents can select the quality of their peer relationship. These findings suggest, however, that the role of social learning may be much greater than the role of selection.

### *Importance of Older Siblings*

Older sibling drug use is strongly associated with adolescent drug use for cigarette, alcohol, and marijuana use. These findings are consistent with sibling research (Stormshak et al., 2004; Windle, 2000; Brook et al. 1999; Duncan et al., 1996; Ary, Tildesley, Hops, & Andrews, 1993; Rowe & Gulley, 1992; Brook et al., 1986; Needle et al., 1986; Brook et al. 1983). In addition, the influence of older siblings varies by cigarette, alcohol, and marijuana use, a finding not yet established in the literature.

Of the three drug types, sibling alcohol use has the strongest association with

adolescent alcohol use. Although there is no clear interpretation of this finding, alcohol use may be less stigmatizing than cigarette or marijuana use and therefore easier to use in the presence of siblings. Future research should explore why older sibling alcohol use is more strongly associated with adolescent drug use than cigarette and marijuana use.

### *Importance of Peers and Parents*

Consistent with most studies of adolescent drug use, the number of peers who use drugs has a large affect on adolescent drug use (Windle, 2000; Brook, Gordon, Brook, & Brook, 1993). Some researchers argue that the significance of peer associations with adolescent drug use may be overstated due to the inability to account for temporal order of selection effects (Hoffmann & Su, 1998; Kandel, 1996; Aseltine, 1995). According to the results of this study, selection may not be as salient a factor as previously argued. If sibling influence is primarily a socialization process then peer influence may also be primarily social.

This conclusion is uncertain. It is based on the assumption that siblings are a similar to peers in terms of influence and different in terms of selection, yet research has shown that peer relationships are often unstable and fluid (see Cairns, Leung, Buchanan, & Cairns, 1995) whereas sibling relationships are often enduring (Stormshak et al., 2004). The difference in length and depth of peer and sibling relationships may affect how peer and siblings influence adolescent drug use. Future research exploring how siblings and peers influence adolescent drug use would add further insight into these findings.

There are interesting differences by drug type. Comparing several drug types, peer marijuana use has a stronger association with adolescent marijuana use than sibling



cigarette or alcohol use on adolescent cigarette or alcohol use. Future research should explore peer marijuana use to determine what unique factors contribute to higher associations between adolescent marijuana use and peer marijuana use than the other drugs.

The coefficients for parental attitudes are not as large as sibling and peer drug use but support research on parental attitudes towards drug use (Aseltine, 1995; Andrews et al., 1993). Parents are an important factor, even if moderately.

### *Importance of Religiosity*

Religiosity proved to be significantly associated with adolescent drug use for each drug type, which supports past research. Religiosity is a consistent predictor of adolescent drug use and should continue to be analyzed as an important role in the etiology of drug use. The role of religion in the lives of adolescence on drug use may support social control theories where religion constrains and limits anti-social behavior. One limitation to this conclusion, however, is the choice of the individual to identify the role of religion as meaningful. Therefore, understanding the theoretical explanations for why religion is a significant factor is better suited for longitudinal analysis.

### *Limitations*

There are several limitations to this study. First, only several questions were asked about the respondent's siblings. A direct measure of which sibling was identified as the drug user in terms of age, birth order and gender was not available. Brook et al. (1999) found that sibling status variables (number of siblings in the family, spacing between siblings, older brother's age, the ordinal position of the younger brother) were unrelated to the younger brother's drug use (see Abramovitch et al., 1980; Pepler et al.,

1981). Therefore, the exclusion of these variables may not have largely affected the analysis. Brook et al. suggested that, “in terms of drug use, modeling may be of more importance than the relationship between siblings” (p. 460, Brook et al., 1999).

Some sibling studies have focused on sibling warmth and sibling conflict as factors in adolescent deviance. Although these measures are not available in the data, Stormshak et al. (2004) found that sibling warmth and conflict are not significant.

Second, data were gathered from self-reports. A second study of peers and parents would be useful for validating respondent perceptions of the attitudes and behaviors of their parents and peers. Some researchers suggest that self-reports, however, have been found to be more valid than parent reports (Moretti, Fine, Haley, & Marriage, 1985; Brown, 1999; Sourander, Helstelae, & Helenius, 1999). Branje, 2004 concludes that adolescent self-reports are a viable source for information. Still bias exists. Aseltine’s studies show that youths’ perceptions of their friends’ attitudes and behavior are not necessarily accurate which may consist of projections of their own values onto others (1995; see Fisher & Bauman, 1988; Elliot & Voss, 1974). Therefore, the conclusions drawn from this study should be interpreted with these limitations in mind.

Third, the data are cross-sectional. As Hudleby and Mercer state, “influence as causation is difficult to demonstrate” (1987, p. 151). Longitudinal data are required to further analyze the socialization vs. selection relationship to sibling, peer, and parent influences. As Brook and Brook (1990) conclude:

cross-sectional studies of drug use are designed to explore the influence of various factors on drug use at a given point in time. Because of this, cross-sectional studies are limited with regard to causal inferences. They can suggest

trends for future investigations, and they are of importance in making certain epidemiologically-based policy decisions. They can also permit a more in-depth look at particular factors than is possible with longitudinal studies. (p. 120)

Therefore, this study provides an examination of sibling effects in one point in time. Longitudinal analysis is needed to examine causal and mediating relationships. As Bauman and Ennett (1999) warn: “with a cross-sectional research design, data are gathered once. It is the design most often used to study adolescent drug use, but it is inadequate for studying peer influence because selection effects cannot be controlled” (p. 189). These findings should encourage further investigation into, rather than confirm the role of sibling drug use on adolescent cigarette, alcohol, and marijuana use of adolescents.

Finally, these findings are limited in generalizability (Duncan, 1996). This sample, although diverse in terms of drug use and other key variables, is predominantly white and come from religious backgrounds; predominantly associated with the Church of Jesus Christ of Latter-day Saints. Although representative of the region of study, caution should be used when applying these results to minority and urban populations.

### *Implications*

Many drug prevention programs are school-based and focus on peer influences (Gorman, 1996). Although these programs have undergone some criticisms, policies that remain school-oriented may still effectively assist adolescents in pro-social behavior by identifying factors beyond peer influence. Many prevention programs only focus on the role of peers and with only moderate success (Stormshak et al., 2004; Windle, 2000; Bauman & Ennett, 1996, Duncan et al., 1996). Adolescents should “undergo a broad,

ecological, family-based assessment that targets family management strategies, as well as sibling relationship qualities” (Shormshak et al., 2004, p. 647). Adapting multiple factors that lead to drug use into these programs may create more effective, long term outcomes. Duncan’s study (1999) on sibling effects concludes that “considerable effort in prevention work has focused on...the child in the school setting...successful interventions to reduce substance use of older siblings might be an important preventative measure of substance use in younger siblings” (p. 164).

These findings suggest that identifying older siblings with drug use problems may lead to prevention of younger siblings modeling drug use behavior. School based drug programs designed to reduce the risk of drug use should consider training students how to respond to sibling drug use. Evidence from this study indicates that the relationship with sibling drug use is primarily a result of modeling or learning. Siblings may also model pro-social behavior. Students at risk of drug use may benefit from an engaged older brother or sister who avoid drug use.

Table I. Descriptive Statistics

Description	Frequency	Range	Mean	SD
<b>Dependent Variables</b>				
Alcohol use during past month (at least once)	19%	(0, 6)	0.380	0.961
Cigarette use during past month (at least once)	15%	(0, 6)	0.320	0.905
Marijuana use during past month (at least once)	9%	(0, 6)	0.260	0.976
<b>Independent Variables</b>				
Sibling drinks alcohol	51%	(0, 1)	0.3833	0.486
Sibling smokes cigarettes	45%	(0, 1)	0.343	0.475
Sibling smokes marijuana	29%	(0, 1)	0.217	0.412
Friends drink alcohol [at least one]	[56%]	(0, 4)	1.170	1.522
Friends smoke cigarettes [at least one]	[41%]	(0, 4)	0.970	1.415
Friends use marijuana [at least one]	[30%]	(0, 4)	0.700	1.267
<b>Control Variables</b>				
Parental tolerance of child's alcohol use [very wrong]	[86%]	(0, 3)	0.220	0.579
Parental tolerance of child's cigarette use [very wrong]	[88%]	(0, 3)	0.200	0.564
Parental tolerance of child's marijuana use [very wrong]	[94%]	(0, 3)	0.090	0.398
Religiosity [very important]	[52%]	(0, 3)	2.120	1.035
Family member with alcohol or drug problem	27%	(0, 1)	0.270	0.445
Age		(12, 19)	15.125	1.725
Gender (0 = female; 1 = male)		(0, 1)	0.490	0.500
Live with both parents	71%	(0, 1)	0.718	0.450
Single-parent family	13%	(0, 1)	0.127	0.332
Stepfamily	12%	(0, 1)	0.120	0.325
Other family arrangement	4%	(0, 1)	0.036	0.186

**Table II.** Estimated Association of Sibling and Peer influence on Cigarette, Alcohol and Marijuana Use in past 30 days Among Adolescents. *School Survey of Alcohol and Drug Nonuse and Use, 1997*

Explanatory Variable	Cigarette Use	Alcohol Use	Marijuana Use
Sibling drug use	2.17***	2.78***	2.24***
Number of peers who use drugs	2.00***	1.82***	2.66***
Parental attitude towards drug use	1.22**	1.22**	1.14
Age	1.08*	0.97	0.95
Male	0.93	1.13	1.24
Religiosity	0.69***	0.75***	0.78**
Family history of drug abuse	1.28*	1.13	0.89
Family Structure			
Single parent	0.93	0.91	1.22
Step parent	0.89	0.91	0.99
Other arrangement	1.20	0.73	0.57
Intercept	-4.06	-2.43	-2.94
n size	3307	3303	3286

\*\*\*P<.001

\*\*P<.01

\*P<.05

**Table III.** Estimated Associations of Sibling Drug Use on Cigarette, Alcohol and Marijuana Use in past 30 days Among Adolescents by Oldest and Youngest Child. *School Survey of Alcohol and Drug Nonuse and Use, 1997*

Explanatory Variable	Cigarette Use		Alcohol Use		Marijuana Use	
	Oldest	Youngest	Oldest	Youngest	Oldest	Youngest
Sibling drug use	1.10	2.95***	1.57*	4.04***	1.04	1.96*
Number of peers who use drugs	2.08***	1.92***	1.74***	1.92***	2.83***	3.01***
Parental attitude towards drug use	1.66***	1.15	1.16	1.38**	1.65**	1.43**
Age	1.12	1.12*	1.07	0.97	1.03	1.03
Male	1.21	0.97	1.24	1.21	1.71*	0.96
Religiosity	0.74***	0.61***	0.71***	0.84*	0.79*	0.80
Family history of drug abuse	0.80	1.00	1.33	1.06	1.15	0.76
Family Structure						
Single parent	1.53	1.13	1.27	1.26	1.10	1.30
Step parent	0.88	0.90	1.04	1.53	1.02	1.32
Other arrangement	3.23***	1.39	1.99	0.70	0.70	0.50
Intercept	-4.47	-4.58	-3.14	-3.30	-4.30	-4.54
n size	973	1024	976	1027	972	1016

\*\*\*P<.001

\*\*P<.01

\*P<.05

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