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Alcohol and Substance Use in Adolescence and Young Adulthood: The Role of Siblings

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Abstract

Interpersonal relationships both within and outside the family have been a central part of alcohol and substance use research. Many studies have focused on the role of parents and peers; fewer studies have focused on siblings. This paper examined siblings' roles in ATOD use patterns and trajectories in the context of familial and non-familial factors across time. First, intraclass correlations (ICCs) were used to examine the degree to which older siblings' ATOD use was associated with younger siblings' ATOD use. Second, hierarchical regression analyses were conducted to examine the degree to which individual, parent, sibling and peer factors over time were associated with adolescents' and young adults' ATOD use. It should be noted that developmentally proximal predictors were utilized in these models and within-family replication was also examined. Results demonstrate strong associations between older and younger siblings' ATOD use. Moreover, the developmentally proximal sibling variables were predictive of younger sibling ATOD use in the context of other variables across all substances. Study findings are discussed in terms of identifying promising and potentially malleable points of intervention for future investigators.

Keywords

Siblings; Substance use; Adolescents; Young adults and Longitudinal

Substance misuse often comes with enormous costs both in terms of dollars as well as personal misery and family disruption. Investigations have examined the correlates of alcohol and substance use in the direct social environment as well as the characteristics that advance and reduce the risk of future substance use problems. Interpersonal relationships with individuals both within and outside of the family have been central to this research.

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Many studies have concentrated on the influence of parents and peers; yet, fewer studies have focused on siblings as sources of influence. Moreover, the influence of parents, siblings and peers on adolescents' and young adults' alcohol, tobacco and other drug (ATOD) use has rarely been examined simultaneously. This is salient given that 80% of individuals in the United States have at least one sibling (Noller, 2005), and children are more likely to grow up with a sibling than a father (McHale, Kim, & Whiteman, 2006). Given the enduring nature of the sibling relationship, siblings are potentially noteworthy agents of influence and change. A deeper understanding of siblings' influence, especially in the context of the parents and peers, will potentially lead to improved prevention and intervention programs.

Familial and non-familial sources, particularly parents and peers, have been extensively examined in the literature with regard to individuals' ATOD use. Some studies (Adrados, 1995; Johnson & Pandina, 1991) have indicated that parental influence is the strongest precursor of adolescent substance use among family variables. Parental attitudes and parent modeling of alcohol use have shown to be strongly linked to alcohol use of their children (Ary, Tidesley, Hops, & Andrews, 1993; Van der Vost et al., 2005). Studies (Engles et al., 1999; Windle, 2000; Wood et al., 2004) have demonstrated that parental alcohol use is associated with adolescent and young adult drinking. Cohen & Rice (1997) found that adolescents who have heavy drinking parents were more likely to drink heavily as well. In addition, similar associations have also been found between parents and their children for tobacco use (e.g., Tjora et al., 2011). Having parents who smoke doubles the risk of adolescent smoking (Bahr, Hoffman, & Yang, 2005). Kelly and colleagues (2011) also found parental smoking to be significantly associated with adolescents' smoking using multilevel models. In contrast, other investigations (e.g., Boyle et al., 2001) have not found a direct association between parental drinking and adolescent drinking. Other within-family factors such as family connectedness, family conflict, and parental education have also been examined in relation to adolescents' substance use. For example, parental involvement has shown to be associated with lower rates of tobacco and marijuana use (Johnson et al., 1990), and emotional support has shown to be associated with less marijuana use (Zimmerman, Salem, & Maton, 1995). Family conflict, on the other hand, has shown to be predictive of adolescent substance use (Brook, Brook, Gordon, Whiteman, & Cohen, 1990). The link between parental education and adolescent substance use has been inconsistent. Thus, parents do seem to play a role; however, that role varies by context.

Numerous studies have also focused on influences outside the family, namely peers. These investigations have examined adolescents' perceptions of the number of drinking peers, the associations between peers' (often the best friend's) alcohol use and adolescents' alcohol use, the association between peers' and adolescent smoking (e.g., Ali & Dwyer, 2009; Colder et al., 2001) as well as between peers' and adolescents' use of other substances (e.g., Garnier & Stein, 2002). In general, friends' drinking has been shown to predict adolescents' alcohol use in cross-sectional studies (Graham et al., 1991; Ary et al., 1993; Webster et al., 1994, Urberg et al., 1997; Engels et al., 1999; Windle, 2000; Wood et al., 2001; Andrews et al., 2002; Bot et al., 2005) and longitudinal studies, but this influence tends to decrease with age (Andrews et al., 2002; Engels et al., 1999; Poelen et al., 2007). Moreover, Jaccard and colleagues (2005) conclude that close friends are less relevant in affecting adolescent drinking behavior

than is often assumed, suggesting that it is peer selection rather than peer influence that contributes to similarities between peers and adolescents. Whether peer effects are inflated or not, numerous studies have demonstrated strong links between peers' and adolescents' alcohol use (Andrews et al., 2002, Petraitis et al., 1995, Sieving et al., 2000) and studies have shown the association between peers' and adolescents' use of other substances. Kelly et al. (2010) demonstrated that adolescent smoking is significantly related to the number of friends who also smoke. In addition, Moodley, Matjila and Moosa (2012) found that both older sibling illicit drug use and number of illicit drug users among their five closest friends were associated with cannabis use among a sample of students. Moodley et al. explain these finding saying that the students may be selecting friends with similar risk-taking behaviors. This is consistent with older studies.

Snyder, Bank and Burraston (2005) tested a sibling and peer mechanism. To predict poor adjustment among younger brothers and sisters at age 17, a SEM format was used with early ineffective parenting and sibling conflict (10 years earlier), older sibling deviant peer associations (5 years earlier) and concurrent "hanging out" with older siblings and peers as predictor constructs. Early sibling conflict predicted "hanging out" with older siblings and peers who engaged in antisocial activities. "Hanging out" was also predicted by higher levels of deviant peer associations of older siblings. These findings provide support for an older sibling/deviant peer mechanism of transmission of antisocial behavior and placing younger siblings at risk (Snyder et al., 2005).

Even though a vast body of research exists on parental and peer influence on individuals' ATOD use, a smaller number of studies have examined the impact of siblings specifically. Sibling relationships are frequently overlooked particularly in adolescence and early adulthood (Conger & Little, 2010) and little systematic research has examined sibling substance use and its role in adolescents' and young adults' use. This is particularly interesting because siblings can be thought of as a special subset of peers (Clayton & Lacy, 1982) and are among the longest lasting relationships that most people have (Cafarro & Conn-Cafarro, 2005). Moreover, siblings serve as important contexts for individual development (East & Khoo, 2005; Patterson, 1986). Healthy sibling relationships provide companionship, support, and guidance which are associated with healthier outcomes later in life (Dunn, 2005). In fact, a quality sibling relationship is the best predictor of positive adjustment among older adults (Waldinger, et al., 2007). The sibling relationship, however, has also been associated with a host of problems. A recent article (Feinberg et al., 2012) compared the sibling relationship to the third, electrically charged rail on a subway track. The comparison suggests that sibling relationships are intense and powerful, and may drive development in constructive ways, but may also present problems. Sibling relationship quality, therefore, serves as a context for substance use (Widom, Wiler, & Lottler, 1999).

Sibling similarities have been examined for risk and deviant behaviors such as alcohol and drug use (e.g., Ary et al., 1993; Brook et al., 1983; Boyle et al., 2001; Fagan & Najman, 2005; Windle, 2005) and aggression (e.g., Bank, Patterson, & Reid, 1996). Sibling resemblance has been found in regards to endorsement, expectancies, behavior, practices, and consequences in a number of behavior domains. Researchers seem to think that siblings operate and influence one another during adolescence and young adulthood much like

friends, through modeling, facilitation, and encouragement. Sibling research efforts thus far have clearly established the link between older and younger sibling substance use (e.g., Brook, Brook, & Whiteman, 1999; Griffin et al., 2002). Studies (Craig & Brown, 1975; Needle et al., 1986) have demonstrated that adolescents with substance using older siblings begin using substances at younger age than adolescents with non-substance using older siblings. Investigations that have measured both parental and sibling influence have established that older siblings exert a unique effect on younger siblings (Brook, Whiteman, Gordon, & Brook, 1990). More recent studies (e.g., Fagan & Najman, 2005; Rende et al., 2005; Trim, Leuthe, & Chassin, 2006) have revealed significant older sibling influences, controlling for parent and peer factors, such as membership in a shared peer group and parental alcoholism. Older siblings provide vicarious learning experiences for their younger siblings (e.g., D'Amico & Fromme, 1997), and the sibling relationship is one mechanism through which younger siblings learn about ATOD use and behaviors.

Pomery and colleagues (2005) have delineated the best supported hypotheses at this time: (1) older sibling models/younger sibling emulates substance abusing behavior, (2) older sibling makes substances available to younger siblings, and (3) older siblings influence younger siblings' peer selection. It is noteworthy that all three of the mechanisms can operate concurrently, further strengthening an older sibling's influence on a younger one. Earlier work by Conger and Reuter (1996) and Oregon Youth Study (OYS) data (Snyder, Bank, & Burraston, 2005) support this third mechanism with adolescents. The older sibling-younger sibling mentor-like model of influence has been referred to as vertical cultural transmission (Rowe, 1994). It is important to note that matched gender and closeness in age between siblings have both been shown to be important in alcohol-use concordance (McGue, Sharma, & Benson, 1996; Rowe & Gulley, 1992) as well as concordance for other substances.

These modeling processes are grounded in social learning theory and Patterson's coercion theory (Patterson, 1982). Feinberg and colleagues (2012) recently published theoretical framework also combines and extends previous work with siblings (e.g., Patterson, 1982; Snyder et al. 2005). This model delineates the pathways that lead to substance use and conduct problems among siblings and incorporates the developmental processes that link sibling relations to family processes and behaviors. In sum, research suggests that parents, peers and siblings play a role in adolescents' and young adults' alcohol and substance use. This study aims to examine the factors within and beyond families across development that are linked to substance use among siblings.

The Present Study

The primary goal of this paper is to extend programmatic studies of sibling and family processes and examine the ways in which siblings influence alcohol and substance use patterns and trajectories in the context of other familial and non-familial factors across time including parents and peers. The OYS is a groundbreaking, intergenerational research project that currently includes data gathered through multiple methods from multiple informants (Patterson & Bank, 1986; Bank & Patterson, 1992). In OYS, the frequency and quantity data for alcohol, tobacco and other drugs have been collected as well as regular

reports from parents and peers across nearly three decades. Additionally, data were collected at two points in time (which will be referred to as Sibling Wave 1 and Sibling Wave 2- S1 & S2) from the older brothers and sisters and the younger brothers and sisters of the focal OYS males. This paper will examine powerful parent, sibling and peers predictors of alcohol and substance use over time to assess which factors are most strongly related to ATOD use in adolescence and young adulthood. This study will allow us to examine the role of siblings in the context of familial and extra-familial processes in accounting for alcohol and substance use patterns during adolescence and young adulthood. The study findings are discussed in terms of identifying promising and potentially malleable points of intervention for future investigators.

There are two primary research questions. First, to what degree is older siblings' ATOD use associated with their younger siblings' ATOD use? Intraclass correlations (ICCs) are utilized to examine the association between OYS men and their younger siblings closest in age and between OYS men and their older siblings closest in age for five different substance categories (beer, hard alcohol, max alcohol, tobacco, and marijuana). Both sibling comparisons (i.e., OYS men with younger siblings and OYS men with older siblings) reflect substance use at the same developmental stage and therefore, are conducted using data collected when the two siblings were approximately the same age; we refer to this comparison method as developmentally proximal. This within-family replication allows for a larger sample size and lets us examine these relationships at two developmental periods (i.e., adolescence and young adulthood). In addition, these associations are examined separately for same-sex and mixed-sex sibling dyads. We hypothesize that older and younger siblings' ATOD use would be strongly linked and that the association would be stronger for OYS men and their younger siblings as compared to OYS men and their older siblings. We also expect that the association would be stronger for same sex versus mixed sex sibling dyads.

Second, to what degree are individual, parent, sibling, and peer factors across time associated with adolescents' and young adults' ATOD use? Hierarchical regressions will be used to examine which factors best predict younger siblings' substance use and OYS men's substance use. The blocks for each analysis are set up in a similar fashion. The first block contains the older sibling's developmentally proximal substance use (e.g., beer, tobacco, hard alcohol). The second block contains the individual's gender, and other early predictors including parent drug use and negative sibling interaction in early childhood (wave 1/3). The third block contains the older siblings' deviant peer association at a mid-level point (i.e., wave 5; between S1 and S2) as well as age. We expect that many of these factors are significant predictors of younger siblings' ATOD use. We hypothesize that gender and parent drug use would be associated with ATOD use as other studies have demonstrated. We also expect that developmentally proximal use by older sibling would be significantly associated with younger siblings ATOD use even in the context of other individual, parent, and peer variables.

Methods

Participants

Oregon Youth Study (OYS) Sample Characteristics in 1984 at wave 1—

Participants for the OYS were drawn from two adjacent cities, Eugene and Springfield, Oregon. The 1980 Census showed Eugene and Springfield to have populations of 105,387 and 41,621 respectively. The racial background for both cities was, and remains, predominantly white (90%). Participants were selected based on their enrollment in schools from the Eugene and Springfield metropolitan area with high rates of juvenile crime and on who were thought to be at higher risk for poor social adjustment. Two hundred and seventy-seven families with a 4th grade boy in targeted schools (identified as the focal male/OYS male) were identified and eligible for inclusion in the study, 206 (74%) agreed to participate. Compared to non-participants, the enrolled boys were slightly more problematic based on teacher ratings of academic skills and psychological adjustment (Capaldi & Patterson, 1987). In the first year (1984), one-third of the families were headed by two biological parents, one-third by one biological and one step-parent (predominantly step-fathers), and one-third by a single biological parent (almost all mothers). A large proportion of the families were low income; one fifth of the families reported no employed parent in the home, one-third reported that they received financial assistance from the state. The average family income in the fifth year of the study (1988-89) was around \$20,000 a year. Participants were evaluated on multiple contextual variables that include income, SES, family size and family structure. Parents' characteristics such as ATOD use and parenting practices such as discipline as well as a range of child and adult behaviors encompassing critical areas of child and adolescent adjustment (e.g., negative sibling interactions, ATOD use, deviant peer associations) were assessed. Data have been collected on an annual basis from the focal males over the past 27 years. A full description of the recruitment procedures can be found in Capaldi and Patterson (1987).

OYS Sibling Sample Characteristics—The 206 OYS families included 310 siblings (older and younger brothers and sisters of the OYS focal men) at study inception between the ages of two and 20 years. Siblings who participated in the home observations of family interaction in the first three years of the study, Sibling wave 1 (S1) were then recruited for the Sibling wave 2 (S2) assessment in 1994 (waves 10 and 11 for the OYS focal males). Data used for these analyses were based on a subset of 194 (63%) older and younger siblings within 5 years of the age of OYS focal males and for whom substance use data were available ($n = 88$ brothers and $n = 106$ sisters). Siblings who were under the age of two or older than age 20 years were excluded from the study. At the time of the second wave of data collection (S2), 102 younger sisters ($M=17.27$ years) and brothers ($M=17.26$ years) and 92 older sisters ($M=24.41$) and brothers ($M=24.22$) participated and had substance use data (see Table 1). At S2, these three sibling groups (older brothers and sisters of OYS men, the OYS men, and younger brothers and sisters of OYS men) came from 163 families.

Measures

In order to determine how older siblings impact ATOD use of their younger siblings in the context of other factors, we focused on variables related to different developmental periods

in the lives of the younger siblings. These developmental periods reflect 1) developmentally proximal factors, 2) early life factors, 3) mid-level factors. ATOD use was measured by frequency of five substance outcomes. Sum scores reflected substance use status (e.g., abstainer, heavy user).

Developmentally proximal predictors—Sibling modeling of substance use was measured by variables we describe as “developmentally proximal”. The sibling closest in age to his or her OYS brother in both the older and younger sibling groups was matched to the assessment wave in which the OYS focal brother was the same age (developmentally proximal). In this way, the data were developmentally similar for each sibling dyad even though the older sibling data always preceded the younger sibling data in time (i.e., on average, siblings were four years apart in age). The developmentally proximal variables also served as a proxy for age difference; therefore age and age difference were not included in these models. It was hypothesized that older siblings' substance using behaviors would be mirrored, at least to some degree, by that of their younger sibling when they reached that same age (in adolescence or young adulthood). These variables were constructed separately for each of the five substances (beer, hard alcohol, max alcohol, tobacco, and marijuana).

Early Predictors—Data related to early life factors were collected during the first wave of the larger study. These variables included: a) *gender*; we hypothesized that siblings of the same gender would be more likely to emulate their older sibling; b) *negative sibling interaction*, data for this variable were gathered from in-home observations of sibling conflict bouts that were coded, scored and given a value representative of the general tone of interactions between siblings. (These conflict bouts reflect microsocial conflict in the family and are initiated by reciprocated aversive behavior and offset by the absence of aversive behavior by parties to the conflict for a period of 18 seconds or more which reflect contagion and escalation in aggressive interchange, Snyder et al., 1994); and d) *parental drug use*, measured by computing parents' substance use history, including assessments of tobacco, alcohol, cannabis, and other drug use in terms of frequency and volume (OYS Parent Interview Assessment; Capaldi & Patterson, 1991).

Mid-level predictor—The mid-level factor included in the models was the influence of older siblings' deviant peers. This variable was measured by assessing older siblings' association with peers who were known to participate in antisocial behaviors. It was hypothesized that higher levels of deviant peer association among older siblings (approximately mid-way between S1 & S2 at wave 5; 1988-1989; when OYS brothers were adolescents) would predict higher levels of substance use for younger siblings (at S2; 1994). This hypothesis is based on the idea that younger siblings would tend to associate with the friends of their older siblings, particularly for those siblings who had a strong influence on their younger brother or sister. Older sibling (i.e., OYS male) deviant peer association was a composite variable that consisted of a mean of teacher report and parent report. Teacher report is the mean of two scores from the teacher questionnaire. The first score contains 4 items (e.g., “How often does this student associate with kids who misbehave in school”) and the second score is a single item from the teacher CBCL (e.g., “Hangs around with kids who

get in trouble”). Parent report of OYS boys association with deviant peers is defined by a single item from the parent CBCL (e.g., “hangs around with children who get in trouble”).

Substance use outcomes—The dependent variables were frequency and status summary scores of ATOD use. Separate summary scores measured five outcomes: beer, hard alcohol, max alcohol, tobacco and marijuana use. Older and younger siblings reported on their own use at S2. Frequency of use was categorized into nine response choices ranging from no use during the past year to using two or three times daily or more. Summary scores were tabulated by collapsing some frequency categories to create a summary of substance use that ranged from “abstainer” to “daily-heavy” use. All continuous independent variables in the models were standardized.

Results

Three sibling groups were represented within these OYS families: older brothers and sisters of the OYS focal men, the OYS focal men, and the younger brothers and sisters of the OYS focal men. Intraclass correlations (ICCs) were calculated between OYS men and their younger brothers and sisters, and between OYS men and their older brothers and sisters. In addition, ICCs were also calculated for same and mixed sex dyads.

As expected, the results demonstrated strong ICCs between OYS focal men and their younger brothers and sisters closest in age in regards to all substances: beer, hard alcohol, maximum alcohol use, tobacco, and marijuana use ($r^2=.19$ to $.42$, $p < .05$ in all cases; see Table 2). These ICCs are quite large and should be interpreted as variances (as compared to Pearson correlations). In a parallel fashion, ICCs were also calculated between older siblings closest in age and their younger OYS brothers (i.e., OYS focal men; see Table 3). Significant findings emerged for beer ($r^2=.20$, $p < .05$) and maximum alcohol use ($r^2=.18$, $p < .05$). As hypothesized, these ICCs were not as strong as those between OYS focal men and their younger siblings. The older siblings and matched OYS focal men's data were collected in early adulthood (ages 21-31, mean age 25) whereas the younger siblings data were collected during adolescence (ages 12-20, mean age 17). Alcohol use among this older sibling age group is normative and legal; however, significant sibling associations—even for men and women who had not lived in the same household for a decade or longer—continued to emerge.

To better understand sibling-pair composition and the role of gender, ICCs were also conducted separately for same-sex and mixed-sex dyads for each set (See Tables 2 & 3). Findings with regard to the OYS focal men and their younger sisters revealed that congruence on only hard alcohol and maximum alcohol were significant ($r^2=.46$, $p < .01$; $r^2=.23$, $p < .05$ respectively); in comparison, OYS focal men and their younger brothers showed significant ICCs regarding use of beer, maximum alcohol, tobacco, and marijuana ($r^2=.35-.42$, $p < .01$). ICCs conducted to assess congruence between OYS focal men and their older siblings revealed significant findings only for older sisters' beer use ($r^2=.24$, $p < .05$).

To examine parent (e.g., parent drug use), sibling (e.g., developmentally proximal substance use, and negative sibling interaction), and sibling peer influence (e.g., older sibling's deviant

peer association) variables simultaneously, multivariate hierarchical regression analyses were conducted to predict substance use of the younger siblings of the OYS focal males. Independent variables were entered in three blocks with developmentally proximal variables first, the early level predictor variables second, and the mid-level predictors in the third block. Separate regressions were conducted for the five outcomes of interest: beer, hard alcohol, max alcohol, tobacco, and marijuana (see Table 4).

Results of the analyses suggest that the developmentally proximal factors were significantly predictive of substance use among all five outcomes in Step 1 (β s ranged from .23-.32 across substances) and these developmentally proximal factors explained between 4-10% of the variance in younger sibling substance use at that initial step. Moreover, after adding additional variables to the models in Steps 2 and 3, these developmentally proximal variables continued to account for a significant amount variance in younger sibling substance use across all five substance outcomes (β s ranged from .22-.30). Some early and mid-level predictor variables contributed significantly to these models as well. As hypothesized, gender was significantly associated with younger siblings' beer use, maximum alcohol use and tobacco use with boys being more likely to use. Parent drug use in the early years was also significantly associated with their children's beer use and maximum alcohol use in adolescence. Interestingly, negative sibling interaction in the early years and older OYS brothers' deviant peer association during adolescence were not significantly associated with younger siblings' substance use for any of the five substance use outcomes. Negative sibling interaction was focused on the OYS focal male meaning that this variable captured negative sibling interaction between the OYS male and one or more of his sibling(s) in the home at that time. Similar regression analyses were conducted predicting the OYS focal men's ATOD use utilizing their older siblings' maximum use as the developmentally proximal variables. These analyses were not completely similar because we only had reports of older siblings' maximum use and only for four of the five outcomes. We did not have comparable measures between older siblings and their OYS brothers for marijuana use. None of the four models were statistically significant. Zero-order correlations, however, did suggest that the developmentally proximal use of the older siblings was associated with the OYS males' use in the cases of beer ($r=.20, p<.05$) and max alcohol ($r=.17, p<.05$). This was not case, however, for hard alcohol ($r=.11, ns$) or tobacco ($r=.09, ns$).

Nevertheless, it is noteworthy that significant sibling influences on alcohol and substance use patterns of younger siblings emerged in the context of demographic, parent and sibling peer variables. It is also interesting that some associations in the adult age category (i.e., between older siblings and their younger OYS brothers) were statistically significantly associated.

Discussion

The current study used longitudinal data across a ten-year interval to examine the degree to which parent drug use, older siblings' deviant peer association, and sibling modeling predict younger siblings' individual alcohol, tobacco and substance use. Within-family replication of ICCs and hierarchical regression analyses allowed examination of ATOD associations between older and younger siblings at two developmental periods, adolescence and early

adulthood. The results of this study were, for the most part, consistent with our hypotheses. The ICCs revealed strong congruence between older and younger siblings' ATOD use and these associations were, as hypothesized, stronger for siblings during adolescence (i.e., between the OYS men and their younger brothers and sisters) than during early adulthood (i.e., between older brothers and sisters and their younger OYS brothers). Many of the ICCs were stronger for same-sex than mixed-sex siblings, as hypothesized. With the exception of hard alcohol use, the ICCs for same sex dyads were much stronger than for mixed sex dyads among OYS men and their younger siblings. This pattern, however, did not replicate for OYS men and their older siblings. Thus, it may be that differences in siblings' gender composition play a weaker role as individuals move into adulthood. Sample sizes were also smaller when same- versus mixed-sex dyads were examined (especially for analyses utilizing data from older brothers and sisters), thus reducing statistical power. Future studies should continue to examine same versus mixed gender comparisons.

The hierarchical regression results shed further light on the role of siblings in the context of other relationship variables. Peers and parents have largely been the focal sources of influence in ATOD research, but previous work has shown siblings to have a unique influence on substance use (Brook, Whiteman, Gordon, & Brook, 1990). The results of this study also demonstrated that siblings do matter. Even when controlling for individual, parent and extra-familial factors, older siblings' developmentally proximal use was significantly associated with all younger sibling substance use outcomes. Moreover, gender and parent drug use were significantly associated with younger sibling use for two of the five substance outcomes even in the context of these other variables. As anticipated and similar to other studies, boys and men use alcohol and other substances more frequently than do girls and women (e.g., McGue et al., 1992). In addition, parents' early drug use was also associated with beer and maximum alcohol use similar to what other studies have found (Engels et al., 1999). These results demonstrate that multiple family relationships (including siblings) distributed across development affect individuals' risk for ATOD use.

These findings are directly linked to theory. Results suggest that adolescents and young adults engage in ATOD behaviors similar to those of their older siblings. Moreover, early experiences and exposure (e.g., parents' substance use) and demographic characteristics (e.g., gender) also play a role in this process. Consistent with Patterson's (1982) and Feinberg et al.'s (2012) theoretical models, individuals within the family (i.e., parents and siblings) as well as outside the family (e.g., peers) may model (e.g., parents and older siblings), facilitate (e.g., older siblings or peers), and encourage (e.g., older siblings and peers) emerging ATOD behaviors. Furthermore, the current data support Snyder et al.'s (2005) demonstrated linkage between older siblings' deviant peers and younger siblings' ATOD behavior.

Though previous studies have shown family conflict to be predictive of ATOD use (Brook, Brook, Gordon, Whiteman, & Cohen, 1990), including negative sibling interaction during childhood (e.g., Bank, Burraston, & Snyder, 2005), negative interaction did not predict ATOD use in the context of other family variables. While this variable has shown to predict antisocial behavior years later in this sample (i.e., Bank et al., 1996), it did not predict younger sibling substance use in adolescence in this study. One explanation for this could be

that the younger siblings may not have participated in the observational task during the early waves of the study because of their age. In addition, older siblings' deviant peer association did not predict younger siblings' ATOD use in these analyses. It should be noted that this variable only captured the association of the older sibling with deviant peers and not whether the younger sibling actually spent time with those antisocial peers. Future studies should carefully measure the degree to which younger siblings associate with older siblings' antisocial peers as these contacts are more likely to predict younger siblings' antisocial behavior and ATOD use (Snyder, Bank, and Burraston, 2005). Furthermore, this study looked at congruence between sibling substance uses using isomorphic substance use category in isolation (e.g., older sib developmentally proximal beer use predicting younger sib beer use). Perhaps this isomorphic substance use approach could be complemented by other multi-substance approaches of sibling congruence and influence.

Strengths and Limitations

This study has many strengths, perhaps the most important of which is the examination of siblings as a source of ATOD influence in the context of parent, peer, gender, and sibling relationship variables. In addition, this study examined these factors over a 10-year time period predicting outcomes in two developmental phases, adolescence and young adulthood. The use of developmentally proximal sibling comparisons was also novel, focusing on siblings' substance use at specific developmental stages. It should be noted that this method of comparison focuses on key developmental intervals rather than concurrent experiences or influences. Therefore, the current analyses are limited in that concurrent sibling contexts of home, neighborhood, and peer environments are not examined. In a similar way, the older siblings' peer data, rather than concurrent younger siblings' peer data, were used as a predictor.

Additional limitations were the lack of similar variables for all sibling groups, so precisely parallel analyses were not always possible. For example, we only had maximum frequency ATOD variables for older siblings of the OYS focal men. In addition, there were a smaller number of older brothers and sisters, which reduced statistical power for those analyses. Given the sample size and our interest in testing multiple individual, parent, sibling, and peer variables, we were only able to include a limited number of independent variables in the regression models. For this reason, we decided not to test interactions which may prove to be fruitful in future work with samples of sufficient size to power such analyses. We also did not look at sibling relationship quality which may moderate role older sibling influence on younger sibling substance use.

Conclusion and Implications

These findings indicate that siblings matter, and that sibling influence has implications for developmental science and future intervention research. The sibling dyad is an important context for risk and resilience. The relationship between older and younger sibling substance use is consistent and moderately strong. Moreover, this association often remains significant when controlling for other family and peer factors. Similar to other studies (e.g., Fagan & Najam, 2005), this study suggests that siblings are powerful role models and co-conspirators. Many questions remain in regards to the specific role siblings play and the

mechanisms involved in their brothers' and sisters' ATOD use across the life course. Future studies should continue to examine siblings as sources of influence within an ecological framework, exploring the ways in which siblings fit within individuals' social networks and how sibling relationships grow and change in adolescence and early adulthood.

The results also indicate that prevention and intervention efforts aimed at reducing or eliminating alcohol and substance use should address sibling influence. These efforts “should include components designed to enhance a positive sibling influence through appropriate modeling” (Ary et al., 1993, p. 874). As others have suggested (e.g., Windle, 2000), intervention practices should be multifaceted or multileveled in orientation rather than focusing on a single element. Especially in families with more than one child, prevention and intervention efforts may be enhanced by taking a family focus (i.e., including siblings). Feinberg and colleagues (2012) have indicated that siblings may serve as a non-stigmatizing point of intervention. As lifelong companions, siblings are potentially useful change agents and resources that have been underutilized in intervention programs. Sibling focused programs have been developed (e.g., Bank et al., 2002; Kennedy & Kramer, 2008; Feinberg et al., 2012) and some sibling programs are successfully serving higher risk populations including siblings in foster care (McBeath et al., 2014; Linares et al., 2014). Future investigations should continue to examine the many ways in which siblings exert influence as well as to incorporate these findings in the development of prevention and intervention programs aimed at reducing ATOD use.

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Table 1
Sibling Age by Gender and Sibling Order

	M (SD)
OYS Males with Older Siblings (<i>n</i> =92)	20.85 (.77)
Older Brothers of OYS Males (<i>n</i> =41)	24.22 (1.30)
Older Sisters of OYS Males (<i>n</i> =51)	24.41 (1.64)
OYS Males with Younger Siblings (<i>n</i> =102)	20.07 (.84)
Younger Brothers of OYS Males (<i>n</i> =47)	17.26 (2.28)
Younger Sisters of OYS Males (<i>n</i> =55)	17.27 (2.10)

Table 2
Intraclass Correlations Between Older Siblings and OYS Males

	Total (<i>n</i> =92)	Same Gender (<i>n</i> =41)	Mixed Gender (<i>n</i> =51)
Beer	.20*	.13	.24*
Wine	.23*	.48**	-.02
Hard Alcohol	.10	.01	.15
Alcohol	.18*	.16	.18
Tobacco	.08	.15	.04

Note:

**
 $p < .01$.

*
 $p < .05$.

†
 $p < .10$.

Table 3
Intraclass Correlations Between Younger Siblings and OYS Males

	Total (<i>n</i> =102)	Same Gender (<i>n</i> =47)	Mixed Gender (<i>n</i> =55)
Beer	.20*	.35**	.05
Wine	.07	.09	.05
Hard Alcohol	.34**	.20 [†]	.46**
Alcohol	.31**	.38**	.23*
Tobacco	.28**	.39**	.19 [†]
Marijuana	.23**	.42**	.10

Note:

**
 $p < .01$.

*
 $p < .05$.

[†]
 $p < .10$.

Table 4
Hierarchical Regressions Predicting Younger Siblings' ATOD Use

Variable	Beer (n=99)		Hard Alcohol (n=99)		Maximum Alcohol Use (n= 99)		Tobacco (n=99)		Marijuana (n=98)	
	R ²	β	R ²	β	R ²	β	R ²	β	R ²	β
Step 1	.04*		.10**		.08**		.09**		.05*	
Older Sibling's Developmentally Proximal Use	.23*	.23**	.33**	.33**	.29**	.29**	.31**	.31**	.25*	.25*
Step 2	.07**		-.004*		.06**		.04**		.01*	
Older Sibling's Developmentally Proximal Use	.21*	.21*	.30**	.30**	.24*	.24*	.28**	.28**	.23*	.23*
Sibling Gender	-.23*	-.23*	-.001	-.001	-.17†	-.17†	-.21*	-.21*	-.08	-.08
Negative Sibling Interaction	-.06	-.06	-.02	-.02	-.04	-.04	.05	.05	.10	.10
Parent Drug Use	.21*	.21*	.16	.16	.24*	.24*	.15	.15	.14	.14
Step 3	.01**		-.005*		.00**		-.01**		-.0008†	
Older Sibling's Developmentally Proximal Use	.22*	.22*	.31**	.31**	.25*	.25*	.26*	.26*	.25*	.25*
Sibling Gender	-.22*	-.22*	.01	.01	-.16	-.16	-.21*	-.21*	-.08	-.08
Negative Sibling Interaction	-.03	-.03	-.003	-.003	-.01	-.01	.04	.04	.11	.11
Parent Drug Use	.26*	.26*	.18†	.18†	.28**	.28**	.13	.13	.16	.16
Deviant Peer Association	-.14	-.14	-.06	-.06	-.10	-.10	.05	.05	-.06	-.06
Total Adjusted R ²	.12**		.08*		.14**		.12**		.06†	

Note:

*** p<.01.

* p<.05.

† p<.10