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Similarities and Differences in Adolescent Siblings' Alcohol-Related Attitudes, Use, and Delinquency: Evidence for Convergent and Divergent Influence Processes

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Abstract

A growing body of research indicates that siblings influence each other's risky and deviant behaviors during adolescence. Guided by research and theory on sibling similarities and differences, this study examined the operation and implications of three different influence processes--social learning, shared friends, and sibling differentiation--during adolescence. Participants included one parent and two adolescent siblings (earlier born age: M = 17.17 years, SD = 0.94; later born age: M = 14.52 years, SD = 1.27) from 326 families. Data were collected via telephone interviews. Using reports from both older and younger siblings, two-stage cluster analyses revealed three influence profiles: mutual modeling and shared friends, younger sibling admiration, and differentiation. Additional analyses revealed that mutual modeling and shared friends as well as younger sibling admiration were linked to similarities in brothers' and sisters' health-risk behaviors and attitudes, whereas differentiation processes were associated with divergence in siblings' characteristics. The discussion focuses on refining the study of sibling influence, with particular attention paid to the operation and implications of both convergent and divergent influence processes.

Keywords

adolescence; alcohol use; delinquency; modeling; sibling differentiation; siblings; social learning

Introduction

A small, but growing body of literature highlights similarities between adolescent siblings in a variety of health-related domains including alcohol and other substance use (e.g., Low,

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Author Contributions

SDW conceived of the study, participated in its design and coordination and drafted the manuscript; ACJ participated in the design and coordination of the study, performed the statistical analysis, interpretation of the data, and helped draft the manuscript; JLM aided in the interpretation of the data and helped draft the manuscript. All authors have read and approved the final manuscript.

Shortt, & Snyder, 2012; Slomkowski, Rende, Novak, & Kim, 2005; Windle, 2000), risky and delinquent behaviors (e.g., Bank, Patterson, & Reid, 1996; Rowe & Gulley, 1992; Slomkowski, Rende, Conger, Simons, & Conger, 2001), and sexual attitudes and behaviors (e.g., East, 1998; McHale, Bissell, & Kim, 2009). Importantly, results from genetically informed investigations reveal that concordance between siblings in these areas is not simply the result of shared genetics and shared parenting (e.g., McGue et al., 1996; Kendler, Ohlsson, Sundquist, & Sundquist, 2013; Slomkowski et al., 2005); similarities also arise from social influence processes. Unfortunately, the social influence processes linking siblings' attitudes and behaviors are not well understood because they rarely are assessed directly and instead are inferred post hoc. The present study addresses this gap by investigating the role of three different social influence processes--social learning, shared friends, and sibling differentiation--in explaining sibling similarities and differences in youths' alcohol-related attitudes, alcohol use, and other risky and delinquent behaviors. Importantly, we study the operation and implications of these influence processes during adolescence, a critical period for the onset and development of both alcohol and other substance use (e.g., Brown et al., 2008; Windle et al., 2008) and deviancy (e.g., Moffitt, 1993; Patterson, DeBaryshe, & Ramsey, 1989).

Mechanisms Underlying Sibling Similarities

Social learning processes such as modeling and imitation are the most common explanations posited to explain sibling similarities. In short, social learning theories hold that, in addition to learning through their own behaviors and actions, individuals form ideas about and learn new behaviors through the observation of others (Bandura, 1977). Within the family context, older siblings have been proposed to be especially powerful models from which younger siblings can learn from because they typically possess the characteristics of effective socialization agents such as status, nurturance, and similarity. Instead of directly assessing social learning processes, many investigators have used constructs such as sibling warmth, closeness, and nurturance between siblings as well as similarities in characteristics such as age and gender as proxies for modeling and imitation. For example, research documents that similarities between siblings in domains such as substance use as well as sexual behaviors and attitudes are greater when siblings share close and warm relationships (e.g., McHale et al., 2009; Slomkowski et al., 2005). Other work documents stronger associations between the characteristics of siblings who are close in age as well as the same gender (e.g., Kendler et al., 2013; Rowe & Gulley, 1992; Slomkowski et al., 2001).

Building on this work, researchers have begun to provide stronger tests of social learning principles by assessing processes such as modeling and identification directly. A number of studies by Whiteman and colleagues (2007a; 2007b; 2010; 2013), for example, highlight that social learning processes predicted sibling similarities in domains such as youths' interest and extracurricular activities, social competencies, attitudes about substance use, and patterns of alcohol use. Importantly, in several of these studies, social learning processes were associated with sibling similarities above and beyond the effects of sibling warmth and closeness, gender composition of the sibling dyad (i.e., same- versus mixed-gender), and age spacing--variables that have been used as proxies for modeling in previous work.

In addition to social learning processes like modeling, past research highlights that siblings can influence each other directly through gatekeeping behaviors and introduction to deviant peer networks (McGue et al., 1996; Needle et al., 1986; Windle, 2000). Consistent with these notions, a number of studies indicate that shared peer networks often underlie similarities between siblings' alcohol and other substance use patterns. Conger and Rueter (1996) as well as Windle (2000) found that older sibling alcohol use was linked indirectly to younger sibling use through peer alcohol use. Rende, Slomkowski, Lloyd-Richardson, and Niaura (2005) reported that associations between siblings' smoking and drinking behaviors

were stronger when they shared friends. Finally, Low and colleagues (2012) found evidence for modeling of substance use behaviors as well as socialization of substance use through affiliation with deviant peers. Given that patterns of socialization regarding substance use and other risk behaviors are multidimensional and complex, it important that research consider these processes simultaneously and examine whether they operate independently or in concert with one another.

Mechanisms Underlying Sibling Differences

Despite the growing literature on sibling similarities in adolescents' risky and deviant behaviors, classic behavioral genetic research noted marked differences between siblings' characteristics and behaviors (e.g., Dunn & Plomin, 1990; Plomin & Daniels, 1987). Behavioral geneticists have suggested that differences between siblings may emerge through nonshared genes and environments (e.g., different peers, parents' differential treatment of children), but they also may arise through siblings' conscious or unconscious differentiation from one another (Feinberg & Hetherington, 2000). Rooted in Adler's theory of individual psychology, which highlighted the role of the family system, including siblings, as central to personality development (Ansbacher & Ansbacher, 1956), sibling differentiation (or deidentification) refers to the tendency for siblings to learn from the experiences of brothers and sisters and to define themselves as different from one another. By choosing different niches and developing distinct personal qualities youth are thought to protect themselves from rivalry and resentment and in turn receive their share of parental love and attention (Feinberg & Hetherington, 2000; Schachter, Shore, Feldman-Rotman, Marquis, & Campbell, 1976). Toward the end of reducing competition and rivalry, differentiation processes are posited to operate more strongly when siblings are more objectively similar (e.g., close in age and the same gender; Schachter et al., 1976). Importantly, this postulation conflicts with social learning predictions suggesting that objective similarity between siblings increases salience of models and promotes imitation (hence similarity).

Although studied less frequently than social learning, results from a few studies highlight the operation of sibling differentiation dynamics across a range of outcomes. For example, foundational studies of personality and temperament characteristics by Schachter and colleagues (1976; 1978) documented that differentiation dynamics were more prevalent for siblings who were the same gender and more similar in age. More recently, research has found evidence for differentiation dynamics in domains ranging from gender role attitudes (McHale et al., 2001), adjustment (Feinberg & Hetherington, 2000), academics (Whiteman et al., 2007a), as well as social competence and risky attitudes and behaviors (Whiteman et al., 2007a; 2010). Although limited in scope, this work is important because it highlights that differentiation dynamics are relevant in adolescents' adjustment and health-risk attitudes. Furthermore, differentiation processes are critical to explore during adolescence when identity development becomes a salient task (McHale et al., 2001; McHale, Updegraff, & Whiteman, 2012).

Current Study

Taken as a whole, the literature on family influences on adolescents' health-risk attitudes and behaviors documents modest similarity between older and younger siblings' attitudes and behaviors. To the extent that convergent influence processes like social learning and shared friends operate in some sibling relationships and differentiation dynamics in others, conclusions about the strength of sibling influence based on extant data may be misleading. For example, if some sibling dyads are characterized by differentiation dynamics, rather than dynamics that serve to promote similarity, then the resulting estimates of sibling similarities would be deflated by these dyads' inclusion (i.e., the overall positive correlation observed between siblings whose relationships are characterized by convergent influence

processes would be deflated by the presence of a null or negative correlation for siblings whose relationship was characterized by processes that push for differentiation). To disentangle the contrasting effects of convergent and divergent sibling influence dynamics, researchers must directly measure both of these influence processes.

The objective of present study was to investigate the nature and implications of convergent and divergent sibling influence processes during adolescence. Accordingly, our first goal was to assess the operation and patterning of three sibling influence processes--social learning processes, shared friends, and differentiation--in adolescent-aged sibling dyads. Because previous work primarily has investigated these influence processes separately, we used a pattern analytic approach to discover the degree to which they operated independently or in concert with one another. Furthermore, by including both members of the sibling dyad in our analyses, we advanced previous work on sibling influence which only typically has examined how older siblings may influence their younger brothers and sisters. Our second goal was to connect reported patterns of influence to similarities and differences in siblings' health-risk attitudes and behaviors. We expected that siblings who reported greater modeling and shared friends would show the greatest degree of similarity; conversely, we expected those who endorsed higher levels of differentiation would be the least similar. Given that social learning and sibling differentiation theories offer contrasting postulations on the role of age spacing and gender constellation of the sibling dyad, we included these variables in our analyses; however, we made no formal hypotheses about their direction of effects. Importantly, to account for potential effects of siblings' shared environments, the present study controlled for parents' health-risk attitudes and behaviors.

Method

Participants

Participants included one parent and two adolescent siblings from 326 families (a total of 978 participants). On average, older siblings were 17.17 years old (*SD* = .94), younger siblings were 14.52 years old (*SD* = 1.27), and parents (87% mothers, 13% fathers; 98% were biological parents of the offspring) were 44.95 years old (*SD* = 5.54), respectively. The sibling dyads were almost equally divided by the gender constellation of the sibling dyad (95 sister-sister pairs, 72 sister-brother pairs, 87 brother-sister pairs, and 72 brother-brother pairs). Seventy-one percent of parents identified themselves as White (not Hispanic), 23% as African American, 4% as Latino, 1% as Asian, and 1% as multi-ethnicity. Seventy-seven percent of parents were currently married. Seventy-five percent of participating parents were employed and family socioeconomic circumstances varied from working to upper class as indexed by parent education (97% of parents were high school graduates; 58% of parents held bachelor's degrees) and household income (*Mdn* = $70,000; *M* = $77,964, *SD* = $72,806; *range* $0 to $980,000).

Procedures

Families with adolescent children were targeted in seven counties within one Midwestern US state. To increase the ethnic diversity of the sample, African American families were oversampled (23% of the current sample was African American as compared to a state average of 9%; U.S. Census Bureau, 2010). Potential families were identified via a purchased marketing list. Families were sent prenotification letters that described the study and included a telephone number, e-mail address, and a postage paid postcard to return if the family fit the study criteria and was interested in participating. Study criteria required that families have at least two adolescent-aged children, with the older adolescent being in the 11^{th} or 12^{th} grade and a younger sibling being in the 7^{th} grade or above. Given these grade criteria, twin siblings were not eligible to participate. A total of 6,854 addresses and phone

numbers of potentially eligible families were identified from the marketing lists; however, 3002 of these contained incorrect contact information. Of the remaining 3,852 families, 2,556 did not follow up with the study project and were not contacted via phone by project staff; an additional 511 families that were contacted did not meet our study criteria. Thus, a final pool of 785 eligible families was identified, 326 of which participated (a 42% response rate). This rate is comparable to the rate of 37% obtained in the National Survey of Families and Households in which three family members were recruited (Sweet and Bumpass, 1996; see also Booth, Johnson, and Granger, 2005).

Eligible and willing families were mailed consent and assent forms. Upon the return of these forms, telephone interviews were scheduled. After the interview was scheduled, a scales sheet (one page consisting of the Likert scales to be used during the interview) for each participant was mailed to the family. Research assistants trained in standardized interviewing procedures conducted the interviews. Interviews for youth and parents were conducted separately and steps were taken to ensure the privacy of each participant (e.g., answer questions in a room away from other family members). If lack of privacy was a concern for either the respondent or interviewer, interviews were rescheduled for a later date. Parent interviews lasted about 30 minutes and youth interviews lasted approximately 40 minutes. Following completion of the interviews, each participant received an honorarium of $35 for their participation (a total of $105 per family).

Measures

Demographic information—Family background information including household composition, parents' marital status, age, gender, and educational level for each family member was collected from parents. Gender constellation of the sibling dyad as well as age spacing between siblings (M = 2.65 years, SD = 1.07) were derived from these parent data.

Processes of sibling influence—*Social learning* and *differentiation* processes were indexed using an 18-item measure designed by Whiteman et al. (2010). Using a scale ranging from 1 (*never*) to 5 (*very often*), older and younger siblings responded to 8 items that assessed social learning processes (e.g., "My brother/sister provides a model for how I should act") and 10 items that indexed differentiation dynamics (e.g., "I want to be different from my brother/sister"). Scores were created by averaging items for each scale and total scores could range from 1 to 5 (older sibling social learning: M = 2.69, SD = .70, α = .81; younger sibling social learning: M = 3.30, SD = .71, α = .81; older sibling differentiation: M = 2.94, SD = .69, α = .82; younger sibling differentiation: M = 3.08, SD = .64, α = .80).

Siblings' shared friends—The extent to which siblings' shared friends was indexed via a measure developed by Trim and colleagues (2006). Specifically, each sibling rated "To what extent do you and your brother/sister currently have the same friends?" on a 5-point Likert scale ranging from 1 (*not at all*) to 5 (*very much*), with higher scores reflecting more common peers (M = 2.18, SD = 1.03 for older siblings, and M = 2.45, SD = 1.08 for younger siblings). Siblings' reports of shared friends were correlated (r = .48, $p < .001$).

Sibling intimacy—Intimacy in the sibling relationship was measured using an adapted version of Blyth, Hill, and Thiel's 8-item relational intimacy scale. Youth rated their experiences with their sibling on a scale ranging from 1 (*not at all*) to 5 (*very much*). An example item is: "How much do you go to your brother/sister for advice or support?" Intimacy scores were averaged across the eight items, with higher scores representing greater intimacy. Total scores could range from 1 to 5 (M = 3.22, SD = .68, α = .83 for older siblings; M = 3.27, SD = .68, α = .81 for younger siblings).

Risky and delinquent behaviors—Older and younger siblings reported on their participation in risky and delinquent behaviors in the past year using 16 items adapted from Eccles and Barber (1990) and Dishion, Patterson, Stoolmiller, and Skinner (1991). Items were rated on a 4-point scale ranging from 0 (*never*) to 3 (*often*), with higher values reflecting greater delinquency. Example items included, "How often have you damaged public or private property?" And, "How often have you lied about your age to buy or do things?" On average, both older (M = .51, SD = .39, α = .84) and younger (M = .47, SD = .42, α = .89) siblings reported relatively low levels of delinquent behavior. Siblings' similarity in delinquent behaviors was assessed via a difference score subtracting younger siblings' scores from older siblings' scores. The absolute value of the difference score was then calculated. Scores could range from 0 to 3, with scores closer to zero reflecting similarity (M = .36, SD = .33).

Attitudes about alcohol—Adolescents' and parents' attitudes about alcohol were measured with seven items created by Elliott, Huizinga, and Ageton (1985). Items were designed to assess attitudes toward alcohol use in general as opposed to the individual's own use (e.g., "drinking alcohol makes people happier"). Items rated on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), with higher scores reflecting more accepting attitudes toward alcohol use (M = 2.24, SD = .90, α = .90 for older siblings; M = 1.86, SD = .85, α = .91 for younger siblings; M = 2.23, SD = .83, α = .88 for parents). To assess similarities in siblings' attitudes about alcohol, difference scores were calculated by subtracting younger siblings' attitudes from older siblings' attitudes. The absolute value of the difference score was then calculated, which ranged from 0 (same attitude) to 4 (different attitudes). In general, siblings reported modest similarity in their attitudes about alcohol (M = .88, SD = .73).

Alcohol use—Older siblings', younger siblings', and parents' alcohol use was indexed via one question from the NIAAA's Task Force on Recommended Alcohol Questions (2003) that assessed frequency of alcohol use in the past 12 months. Specifically, on a scale ranging from 0 (*not at all*) to 5 (*several times a day*) participants responded to the following question: "During the last 12 months, how often did you usually have any kind of drink containing alcohol? By drink we mean a 12 ounce can or glass of beer or cooler, a 5 ounce glass of wine, or a drink containing one shot of liquor." Responses were then dichotomized to indicate whether the sibling had drunk alcohol in the past year or not (46% of older siblings, 19% of younger siblings, and 76% of parents reported drinking in the past year, respectively). A dummy code was then created to index similarity in siblings' alcohol use (0 = one sibling used alcohol in the past year and the other did not; 1 = either both used alcohol in the past year or both did not). Overall, more sibling pairs were similar in their alcohol use (64%) than were not (36%).

Results

Patterns of Sibling Influence

To address our first study goal, to understand the operation and patterning of various sibling influence processes (i.e., social learning, shared friends, and differentiation), we employed cluster analysis. Specifically, seven variables were subjected to cluster analysis: older and younger siblings' reports of modeling, shared friends, and differentiation as well as age-spacing of the sibling dyad. Following guidelines and suggestions on cluster analysis (Henry, Tolan, & Smith, 2005; Whiteman & Loken, 2006), a two-step method of clustering was used. In the first step, a hierarchical cluster analysis was conducted, using a cosine index of similarity with unweighted pair group mean averaging (or average) linkage. In the second step, a *k*-means method was used to determine whether the cluster structure found

with the hierarchical cluster technique was replicable. Previous research has documented the effectiveness of the *k*-means method for replication (e.g., Blashfield & Aldenerfer, 1988). All variables used in the cluster analysis were standardized with a mean of zero and a standard deviation of one in order to reduce bias towards variables with larger ranges (Henry, Tolan, & Smith, 2005).

On the basis of several stopping criteria--careful examination of the dendogram, cluster size, theoretical relevance and conceptual meaning, and the ability to replicate the solution--a three cluster solution was selected as the best characterization of the data. Crosstab examination between the hierarchical solution and the *k*-means solution suggested high correspondence between the two methods (χ^2 (df = 4) = 255.56, $p < .001$). The final cluster structure from the *k*-means analysis (see Figure 1) revealed evidence for a mutual modeling/shared friends group ($n = 135$), a differentiation group ($n = 83$), and an admiration group ($n = 108$).

To describe the nature of the three clusters, we calculated 95 percent confidence intervals to determine if the cluster pattern differed significantly from zero on each of the seven variables used in creating the clusters. Means were considered high if they were significantly greater than zero (the mean), low if they were significantly lower than zero, and average if they were not significantly different than zero. The mutual modeling/shared friends group was marked by high modeling as reported by both older and younger siblings, low differentiation by older siblings, average differentiation by younger siblings, high reports of shared friends from both older and younger siblings, and low age-spacing (i.e., closer in age). The differentiation group was marked by low modeling by both siblings, high differentiation by both siblings, low reports of shared friends by both siblings, and low age-spacing. The admiration group was characterized by average modeling from older siblings, high modeling by younger siblings, average differentiation by older siblings, low differentiation by younger siblings, low reports of shared friends by both siblings, and high age-spacing (i.e., more distant in age).

To further describe the cluster pattern, a series of one-way analyses of variances (ANOVAs) were conducted. In each instance cluster membership was used as a three-level independent variable and each item used to create the clusters as the dependent variables. As seen in Table 1, ANOVAs with Tukey follow-ups revealed that the mutual modeling/shared friends and differentiation groups differed significantly on every variable, except for age spacing. Siblings in the admiration cluster shared some characteristics of the other two groups, but were the furthest apart in age (see Table 1 for listing of all differences). Finally, inconsistent with the postulations of both social learning and differentiation theories, gender composition of the sibling dyad was not related to group membership, χ^2 ($df = 2$) = .73, *ns*.

Similarities and Differences in Siblings' Health Risk Attitudes and Behaviors

In order to address our second goal, to examine how convergent and divergent influence processes related to similarities in adolescent siblings' delinquent behaviors, attitudes about alcohol, and alcohol use, a series of 3 (influence group) × 2 (gender composition of the sibling dyad) analyses of covariance (ANCOVA) and binary logistic regression models were performed. Given their distributions, ANCOVA models were employed for differences in delinquent behaviors and attitudes about alcohol and binary logistic regression models for similarities and differences in alcohol use. Older and younger siblings' reports of sibling intimacy (centered at their means)--a variable that has been used as a proxy for sibling influence in previous research (e.g., Rowe & Gulley, 1992; Samek & Rueter, 2011; Slomkowski et al., 2005)--and gender (0 = female; 1 = male) were included as control variables in all analyses. Additionally, to capture the unique contribution of these processes and account for potential effects of siblings' shared environments, parents' attitudes about

alcohol and parents' alcohol use were included as control variables for models examining the corresponding dependent variable (no marker of parents' participation in risky or deviant behavior was collected). Two dummy codes were included in the binary logistic regression model to index influence group (reference group = admiration group; dum1: 1 = mutual modeling/shared friends group; dum2: 1= differentiation group). To examine whether the implications of different influence processes were moderated by gender composition of the sibling dyad (0 = same-gender; 1 = mixed-gender) interactions between influence group and gender composition were tested in all models.

The ANCOVA examining mean differences between groups in siblings' risky and delinquent behavior revealed a significant main effect of influence group, $F(2, 319) = 2.95$, $p < .05$. As seen in Table 2, Tukey's follow-ups indicated that siblings in the differentiation group were significantly less similar (or more different) than were siblings in the mutual modeling/shared friends and admiration groups. Siblings in the latter two groups were comparable in terms of their similarity.

With respect to attitudes about alcohol, the ANCOVA revealed a main effect of influence group, $F(2, 315) = 3.23$, $p < .05$. As seen in Table 2, Tukey's follow-ups indicated that siblings in the differentiation group were significantly less similar (or more different) in their attitudes about alcohol than were siblings in the mutual modeling/shared friends group. Siblings in the admiration group did not differ from those in either of the other two groups.

Finally, for alcohol use, the binary logistic regression yielded significant effects for both control variables and sibling influence group. With respect to the controls, a significant effect for parents' alcohol use indicated that siblings were less likely to be similar when their participating parent drank in the past year. Additionally, a main effect of older sibling gender indicated that youth were less likely to be similar in their patterns of use when dyads included an older brother (see Table 3). In Model 3, a significant influence group × gender composition interaction indicated that in same-gender siblings in the mutual modeling/shared friends group had the highest probability of similarity in alcohol use; in contrast, mixed-gender siblings in this same group shared the lowest probability of being similar (see Figure 2). In the differentiation group, same-gender siblings were the most different, whereas mixed-gender siblings were more similar. Finally, same- and mixed-gender siblings in the admiration group did not differ in their probabilities for being similar and their rates generally fell in between the other two groups.

Discussion

A growing number of studies document that siblings are important influences in the development of adolescents' risk behaviors, including alcohol and other substance use (e.g., Low et al., 2012; Slomkowski et al., 2005; Windle, 2000) and deviant and delinquent behaviors (e.g., Bank et al., 1996; Rowe & Gulley, 1992; Slomkowski et al., 2001). With some exceptions (e.g., e.g., Patterson, 1984; Whiteman et al., 2010; 2013), however, most work in this area has failed to actually measure the processes by which siblings influence each other and instead made inferences about their operation on the basis of correlations between siblings' behaviors. The purposes of the present study were to document the patterning and operation of three different sibling influence processes (two convergent and one divergent) and to examine how those influence processes were connected to similarities and differences in adolescent siblings' attitudes about alcohol, alcohol use, and other risky and deviant behaviors. In the following pages, we discuss our findings, address the strengths and limitations of the study, and suggest future directions for research on sibling influence on adolescents' behavior and adjustment.

Although rarely measured directly, most research on sibling influence posits social learning processes such as modeling and imitation as explanations for similarities between older and younger adolescent siblings' attitudes and behaviors (e.g., Slomkowski et al., 2001; 2005; Windle, 2000). With few exceptions (e.g., Pomery et al., 2005), most of this work assumes top-down or vertical socialization, in which older siblings serve as models whom younger siblings imitate. Consistent with these notions, cluster analyses revealed evidence of a group of dyads in which younger siblings clearly admired and wanted to be like their older siblings (admiration group), but the pattern was not true in reverse (i.e., these older siblings did not model their younger siblings). Importantly, siblings in these dyads reported not sharing many friends; as such it appears that social learning was the primary process of sibling influence in these dyads. Unlike the other two patterns of influence detected, older and younger siblings in these dyads were further apart in age, possibly reflecting how power and status increases the salience of older brothers and sisters as models, while also serving to diminish opportunities to share friends.

In addition to social learning, other work highlights the role of shared peer networks, finding that similarities between siblings may, in part, be the result of shared activities with common friends (e.g., Conger & Rueter, 1996; Low et al., 2012; Rende et al., 2005). The results of the present study indicate that these two convergent influence processes are not mutually exclusive and may in fact operate together in some dyads. Specifically, cluster analyses identified a mutual modeling/shared friends group that was characterized by close-in-age siblings who both endorsed modeling each other's behaviors as well as sharing friends. Given that this group of dyads is characterized by multiple pathways of influence, it seems likely that youth in this group would be the most similar to their brothers and sisters. Results, however, indicated that siblings in the younger sibling admiration and mutual modeling/shared friends groups showed equivalent levels of similarity in their attitudes about alcohol and participation in delinquent behaviors. With respect to alcohol use, an interaction between gender composition of the sibling dyad and influence group revealed that same-gender sibling dyads in the mutual modeling/shared friends group showed the greatest likelihood of similarity compared to siblings from any other group. Given that adolescents' alcohol use typically occurs in peer group settings in which there is pressure to consume (Bot, Engels, & Knibbe, 2005), the combination of salient sibling models and peer pressure may create an especially potent milieu regarding alcohol use. With some important exceptions, most work on adolescent risk behaviors has considered peers and siblings as separate sources of influence. The results of this study, however, suggest that future work would benefit from greater attention to the connections between and implications of sibling and peer influences processes.

Although discussed less frequently in the sibling literature, our analyses revealed evidence for a third type of sibling influence: Differentiation. Siblings in these dyads were close-in-age and reported high levels of trying to be different, low levels of trying to be like, and not sharing many friends. Importantly, siblings' differentiation efforts were linked to divergence in their attitudes about alcohol and participation in delinquent behaviors. Additionally, consistent with the notion that differentiation dynamics would be most prevalent for same-gender siblings, an interaction between the influence group and the gender composition of the sibling dyad for adolescents' alcohol use revealed that differentiation processes were linked to diverging patterns of alcohol use for same-gender siblings. For mixed-gender dyads, however, differentiation dynamics were linked to similarity in alcohol use. Given the differences in age, gender, and friendship circles between siblings in these dyads, it could be that other influence dynamics are more important predictors of alcohol use for these youth. Nevertheless, the identification of differentiation dynamics operating in approximately one-third of the sibling dyads in this study is critically important to understanding how brothers and sisters shape each other's development during adolescence. As mentioned earlier, most

work on sibling influences assumes positive, top-down associations, in which older brothers and sisters promote and evoke similarity on the part of their younger siblings. The recognition that differentiation dynamics also operate within sibling dyads suggests that most previous studies likely underestimated the degree to which sibling influence occurs during adolescence.

The present study was limited by several methodological shortcomings that may restrict our conclusions. First, because of our cross-sectional design, we were unable to disentangle whether the three different influence processes identified in the cluster analyses led to similarities and differences in siblings' attitudes or behaviors or vice versa. Longitudinal data are essential to explicate the implications of these influence processes as well as to identify how they unfold across adolescence. Second, because our sample was not genetically informed, we were unable to determine the extent to which similarities and differences in adolescents' attitudes and behaviors were influenced by shared genetics. This concern, however, is diminished given that previous behavior genetic research has found that siblings uniquely contribute to each other's risky and deviant behaviors above and beyond shared genetic and environmental factors (McGue et al., 1996; Kendler et al., 2013; Slomkowski et al., 2005). Third, measurements of several key constructs, including alcohol use, were limited to one item. Greater variability in youths' substance use behavior may have been detected if a broader range of questions were assessed. Additionally, given the developmental progression of alcohol use during adolescence (Schulenberg & Maggs, 2002), it is possible that similarities in our measure of alcohol use, specifically non-use, were enhanced because younger siblings had not initiated alcohol use. Again, longitudinal data are needed to better understand how sibling influence processes and siblings' behaviors interact to predict adolescents' risky and health-related behaviors over time. Fourth, our index of shared friends did not reflect the number or characteristics of friends that siblings had in common. Future work would benefit from greater attention to such factors given the important role of social networks in adolescents' substance use (e.g., Bot et al., 2005; Ennett et al., 2006). Finally, our measures relied on adolescents' self-reports. It is possible that associations between influence processes and siblings' attitudes and behaviors were inflated because of method variance problems (e.g., Lorenz et al., 1991). Our study, however, is one of the very few that has included and examined sibling influence processes for both older and younger siblings.

Conclusions

The present study adds to a growing body of work examining the ways in which brothers and sisters influence each others' risk behaviors during adolescence. Advancing previous work, we directly assessed the operation of multiple influence processes and discovered three distinct pathways of influence. Importantly, the associations between the different influence processes and sibling similarities were evident above and beyond the effect of other relational processes like sibling intimacy; thus, proxy variables used in previous work may be insufficient markers of sibling influence processes. Ultimately, the identification of the processes that drive sibling similarities and differences is critical to the development of effective family-based intervention strategies aimed at curbing adolescent risk behaviors including substance use. In fact, recent evidence highlights that sibling-based interventions may be especially promising for promoting child and adolescent health and well-being (e.g., Feinberg et al., 2013; Feinberg, Soli, & McHale, 2012). Our results, however, suggest that tailored intervention strategies may be the most effective given that convergent and divergent influence processes operate in different contexts and push towards different ends.

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References

Ansbacher, HL.; Ansbacher, RR. The individual psychology of Alfred Adler. New York: Basic Books; 1956.

Bandura, A. Social learning theory. Englewood Cliffs, NJ: Prentice Hall; 1977.

Bank, L.; Patterson, G.; Reid, J. Negative sibling interaction patterns as predictors of later adjustment problems in adolescent youth and adult males. In: Brody, GH., editor. Sibling relationships: Their causes and consequences. New York: Ablex; 1996. p. 197-229.

Blashfield, RK.; Aldenderfer, MS. The methods and problems of cluster analysis. In: Nesselroade, JR.; Cattell, RB., editors. Handbook of multivariate experimental psychology: Perspectives on individual differences. 2nd ed.. New York: Plenum Press; 1988. p. 447-473.

Blyth D, Hill J, Thiel K. Early adolescents' significant others: Grade and gender differences in perceived relationships with familial and nonfamilial adults and young people. Journal of Youth and Adolescence. 1982; 11:425–450. [PubMed: 24310956]

Booth A, Johnson DR, Granger DA. Testosterone, marital quality, and role overload. Journal of Marriage and Family. 2005; 67:483–498.

Bot SM, Engels RCME, Knibbe RA. The effects of alcohol expectancies on drinking behavior in peer groups: Observations in a naturalistic setting. Addiction. 2005; 100:1270–1279. [PubMed: 16128716]

Brown SA, McGue M, Maggs J, Schulenberg J, Hingson R, Swartzwelder S, Murphy S. A developmental perspective on alcohol and youths 16 to 20 years of age. Pediactics. 2008; 121(Supplement 4):S290–S310.

Conger, RD.; Rueter, MA. Siblings, parents, and peers: A longitudinal study of social influences in adolescent risk for alcohol use and abuse. In: Brody, GH., editor. Sibling relationships: Their causes and consequences. New York: Ablex; 1996. p. 1-30.

Dishion TJ, Patterson GR, Stoolmiller M, Skinner ML. Family, school, and behavioral antecedents to early adolescent involvement with antisocial peers. Developmental Psychology. 1991; 27:172–180.

Dunn, J.; Plomin, R. Separate lives: Why siblings are so different. New York: Basic Books; 1990.

East PL. Impact of adolescent childbearing on families and younger siblings: Effects that increase younger siblings' risk for early pregnancy. Applied Developmental Science. 1998; 2:62–74.

Eccles, J.; Barber, B. The risky behavior scale. University of Michigan; 1990. Unpublished manuscript

Elliott, D.; Huizinga, D.; Ageton, S. Explaining delinquency and drug use. Beverly Hills, CA: Sage; 1985.

Ennett ST, Bauman KE, Hussong A, Faris R, Foshee VA, Cai L. The peer context of adolescent substance use: Findings from a social network analysis. Journal of Research on Adolescence. 2006; 16:159–186.

Feinberg ME, Hetherington. Sibling differentiation in adolescence: Implications for behavioral genetic theory. Child Development. 2000; 71:1512–1524. [PubMed: 11194252]

Feinberg ME, Soli AR, McHale SM. The third rail of family systems: Sibling relations, mental and behavioral health, and intervention. Journal of Child and Family Clinical Psychology. 2012; 15:43–57.

Feinberg ME, Solmeyer AR, Hostetler ML, Sakuma K, Jones D, McHale SM. Siblings are special: Initial test of a new approach for preventing youth behavior problems. Journal of Adolescent Health. 2013 Advanced online publication.

Henry DB, Tolan PH, Gorman-Smith D. Cluster analysis in family psychology research. Journal of Family Psychology. 2005; 19:121–132. [PubMed: 15796658]

Kendler KS, Ohlsson H, Sundquist K, Sundquist J. Within-family environmental transmission of drug abuse: A Swedish national study. Archives of General Psychiatry. 2013 Advance online publication.

Lorenz FO, Conger RD, Simon RL, Whitbeck LB, Elder GH. Economic pressure and marital quality: An illustration of the method variance problem in the causal modeling of family processes. Journal of Marriage and the Family. 1991; 53:375–388.

Low S, Shortt JW, Snyder J. Sibling influences on adolescent substance use: The role of modeling, collusion, and conflict. Development and Psychopathology. 2012; 24:287–300. [PubMed: 22293010]

McGue M, Sharma A, Benson P. Parent and sibling influences on adolescent alcohol use and misuse: Evidence from a U.S. adoption cohort. Journal of Studies on Alcohol. 1996; 57:8–18. [PubMed: 8747496]

McHale SM, Bissell J, Kim J. Sibling relationship, family, and genetic factors in sibling similarity in sexual risk. Journal of Family Psychology. 2009; 23:562–572. [PubMed: 19685991]

McHale SM, Updegraff KA, Helms-Erikson H, Crouter AC. Sibling influences on gender development in middle childhood and early adolescence: A longitudinal study. Developmental Psychology. 2001; 37:115–215. [PubMed: 11206426]

McHale SM, Updegraff KA, Whiteman SD. Sibling relationships and influences in childhood and adolescence. Journal of Marriage and Family. 2012; 74:913–930. [PubMed: 24653527]

Moffitt TE. Adolescence-limited and life-course-persistent antisocial behavior: A developmental taxonomy. Psychological Review. 1993; 100:674–701. [PubMed: 8255953]

National Institute on Alcohol Abuse and Alcoholism Task Force on Recommended Alcohol Questions. Recommended sets of alcohol consumption questions. 2003. Retrieved from: http://www.niaaa.nih.gov/research/guidelines-and-resources/recommended-alcohol-questions

Needle R, McCubbinn H, Wilson M, Reineck R, Lazar A, Mederer H. Interpersonal influences in adolescent drug use: The role of older siblings, parents, and peers. International Journal of the Addictions. 1986; 21:739–766. [PubMed: 3781689]

Patterson, GR. Siblings: Fellow travelers in coercive family processes. In: Blanchard, RJ., editor. Advances in the study of aggression. New York: Academic; 1984. p. 174-214.

Patterson GR, DeBaryshe B, Ramsey E. A developmental perspective on antisocial behavior. American Psychologist. 1989; 44:329–335. [PubMed: 2653143]

Plomin R, Daniels D. Why are children in the same family so different from one another? Behavioural and Brain Sciences. 1987; 10:1–16.

Rende R, Slomkowski C, Lloyd-Richardson E, Niaura R. Sibling effects on substance use in adolescence: Social contagion and genetic relatedness. Journal of Family Psychology. 2005; 19:611–618. [PubMed: 16402876]

Rowe D, Gulley B. Sibling effects on substance abuse and delinquency. Criminology. 1992; 30:217–233.

Samek DR, Rueter MA. Consideration of elder sibling closeness in predicting younger sibling substance use: Social learning versus social bonding explanations. Journal of Family Psychology. 2011; 25:931–941. [PubMed: 21988080]

Schachter FF, Gilutz G, Shore E, Adler M. Sibling deidentification judged by mothers: Cross validation and developmental studies. Child Development. 1978; 49:543–546.

Schachter FF, Shore E, Feldman-Rotman S, Marquis RE, Campbell S. Sibling deidentification. Developmental Psychology. 1976; 12:418–427.

Schulenberg JE, Maggs JL. A developmental perspective on alcohol use and heavy drinking during adolescence and the transition to young adulthood. Journal of Studies on Alcohol. 2002; (Supplement No. 14):54–70.

Slomkowski C, Rende R, Conger KJ, Simons RL, Conger RD. Sisters, brothers, and delinquency: Evaluating social influence during early and middle adolescence. Child Development. 2001; 72:271–283. [PubMed: 11280484]

Slomkowski C, Rende R, Novak S, Lloyd-Richardson E, Niaura R. Sibling effects on smoking in adolescence: Evidence for social influence from a genetically informed design. Addiction. 2005; 100:430–438. [PubMed: 15784052]

Sweet, JA.; Bumpass, LL. Center for Demography and Ecology. University of Wisconsin-Madison; 1996. The National Survey of Families and Households –Waves 1 and 2: Data Description and Documentation. http://www.ssc.wisc.edu/nsfh/home.htm

Trim RS, Leuthe E, Chassin L. Sibling influence on alcohol use in a young adult,high-risk sample. Journal of Studies on Alcohol. 2006; 67:391–398. [PubMed: 16608148]

U.S. Census Bureau. State and county quick facts. Feb 10. 2012 from http://quickfacts.census.gov/qfd/states/18000.html

Whiteman SD, Bernard JM, McHale SM. The nature and correlates of sibling influence in two-parent African American families. Journal of Marriage and Family. 2010; 72:267–281. [PubMed: 20495684]

Whiteman SD, Jensen AC, Maggs JL. Similarities in adolescent siblings' substance use: Testing competing pathways of influence. Journal of Studies on Alcohol and Drugs. 2013; 74:104–113. [PubMed: 23200155]

Whiteman SD, Loken E. Comparing analytic techniques to classify dyadic relationships: An example using siblings. Journal of Marriage and Family. 2006; 68:1370–1382.

Whiteman SD, McHale SM, Crouter AC. Competing processes of sibling influence: Observational learning and sibling deidentification. Social Development. 2007a; 16:642–661.

Whiteman SD, McHale SM, Crouter AC. Explaining sibling similarities:Perceptions of sibling influences. Journal of Youth and Adolescence. 2007b; 36:963–972.

Windle M. Parental, sibling, and peer influences on adolescent substance use and alcohol problems. Applied Developmental Science. 2000; 4:98–110.

Windle M, Spear LP, Fuligni AJ, Angold A, Brown JD, Pine D, Dahl RE. Transitions into underage and problem drinking: Developmental processes and mechanisms between 10 and 15 years of age. Pediatrics. 2008; 121(Supplement 4):S273–S289. [PubMed: 18381494]

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Figure 1.
Profiles of Sibling Influence Processes for Final Three-Cluster Solution.

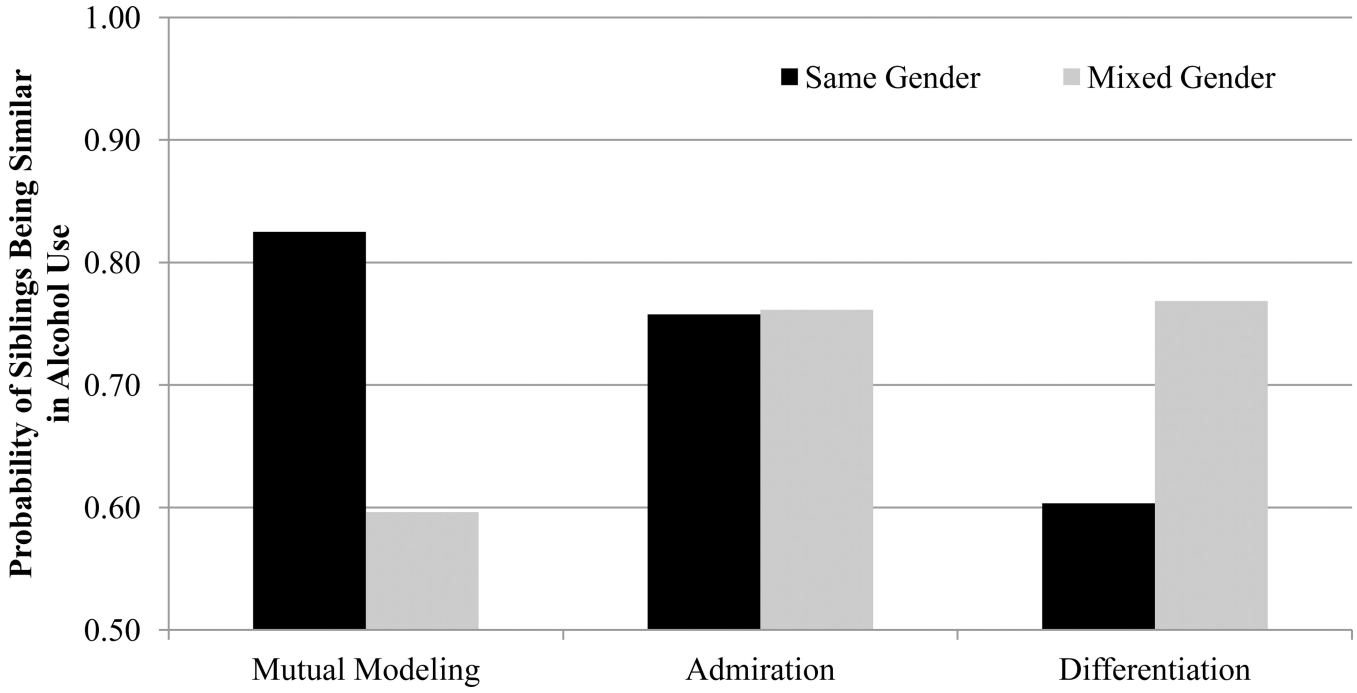

Figure 2.
Probability of Siblings being Similar in Alcohol Use Predicted by Sibling Influence Group.

Table 1

Unstandardized Means (and Standard Deviations) for Group Comparisons of Sibling Influence Variables for the K-Means Cluster Solutions

	Cluster		
	Mutual Modeling/ Shared Friends (N = 135)	**Differentiation (N = 83)**	**Younger Sibling Admiration (N = 108)**
Older Sibling Modeling	3.16[a] (.51)	2.09[b] (.59)	2.59[c] (.56)
Younger Sibling Modeling	3.55[a] (.58)	2.57[b] (.57)	3.54[a] (.55)
Older Sibling Differentiation	2.81[a] (.66)	3.20[b] (.73)	2.90[a] (.66)
Younger Sibling Differentiation	3.04[a] (.59)	3.51[b] (.59)	2.79[c] (.57)
Older Sibling Shared Friends	2.95[a] (.89)	1.66[b] (.77)	1.62[b] (.69)
Younger Sibling Shared Friends	3.22[a] (.95)	1.93[b] (.81)	1.90[b] (.80)
Age Spacing	2.23[a] (.79)	2.24[a] (.90)	3.48[b] (1.03)

Note: Across rows different superscripts indicate significant differences between clusters at $p < .05$ with Tukey adjustment.

Table 2

Means (and Standard Deviations) of Sibling Differences in Attitudes About Alcohol and Delinquent Behavior by Cluster Group (N = 326)

	Cluster		
	Mutual Modeling/ Shared Friends (N = 135)	**Differentiation (N = 83)**	**Younger Sibling Admiration (N = 108)**
Difference in Delinquent Behavior	0.32[a] (.35)	0.47[b] (.38)	0.35[a] (.34)
Difference in Attitudes About Alcohol	0.78[a] (.79)	1.08[b] (.83)	0.85[a] (.74)

Note: Across different rows superscripts indicate significant differences between clusters at $p < .05$ with Tukey adjustment.

Table 3

Summary of Logistic Regression Analysis for Variables Predicting Siblings' Similarities in Alcohol Use (N = 326)

	Model 1			Model 2			Model 3		
	B	**OR**	**95% CI**	**B**	**OR**	**95% CI**	**B**	**OR**	**95% CI**
Intercept	1.56***			1.74***			1.67***		
Parent Alc Use	−.69*	.50	.28 – .90	−.69*	.50	.29 – .90	−.76*	.47	.26 – .85
OS Gender	−.59*	.56	.35 – .89	−.59*	.55	.35 – .89	−.64**	.53	.33 – .86
YS Gender	−.09	.91	.57 – 1.47	−.07	.93	.58 – 1.51	−.06	.94	.58 – 1.54
OS Intimacy	.19	1.21	.81 – 1.80	.19	1.21	.79 – 1.85	.15	1.16	.75 – 1.79
YS Intimacy	.01	1.01	.68 – 1.50	−.07	.97	.64 – 1.47	−.04	.96	.63 – 1.48
GC	−.19	.83	.52 – 1.32	−.21	.81	.51 – 1.30	.05	1.06	.45 – 2.45
Dum1				−.22	.80	.45 – 1.43	.39	1.47	.63 – 3.42
Dum2				−.33	.72	.37 – 1.40	−.67	.51	.21 – 1.28
Dum1 X GC							−1.12*	.33	.11 – 1.00
Dum2 X GC							.75	2.12	.61 – 7.41
$\Delta\chi^2$		408.9			407.79			397.63**	
df		6			8			10	

Note: OR = Odds Ratio; 95% CI = 95% Confidence Interval. Parent Alc Use = Parents' Alcohol Use (0 = did not use in past year; 1 = used in past year); OS = Older Sibling (0 = female; 1 = male); YS = Younger Sibling (0 = female; 1 = male); GC = Sibling Dyad Gender Composition (0 = same gender; 1 = mixed gender); Dum1 = Cluster Solution Dummy Code 1 (0 = younger sibling admiration; 1 = mutual modeling/shared friends); Dum 2 = Cluster Solution Dummy Code 2 (0 = younger sibling admiration; 1= differentiation).

* $p < .05$.

** $p < .01$.

*** $p < .001$.