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Developmental Relations and Patterns of Change Between Alcohol Use and Number of Sexual Partners From Adolescence Through Adulthood

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Abstract

This study explored two unanswered questions regarding the role of alcohol use in sexual behavior. The first concerns whether alcohol use temporally precedes and predicts changes in sexual behavior assessed as the number of sexual partners, whether the reverse pattern holds, or whether the association reflects a common, external cause. Second, this study assessed whether associations between these behaviors change as adolescents transition to adulthood. These questions were addressed using a bivariate dual change latent difference score model. Drinking frequency and number of yearly sex partners were assessed eight times across a 13-year period in a sample of 553 individuals, beginning in the 9th grade (age: M = 15.11, SD = 0.43). In addition to an association between the individual growth trajectories of these behaviors, alcohol use was a leading indicator of changes in number of sex partners throughout adolescence, but the reverse pattern was not supported. Importantly, the predictive association could not be explained by individual differences in impulsivity, excitement seeking, conduct problems, hostility/aggression, conventional attitudes, gender, or divorce. Finally, in a developmentally meaningful pattern, alcohol use ceased to significantly predict changes in the number of sexual partners as adolescents transitioned to adulthood.

Keywords

Alcohol use; sexual behavior; developmental change; common causes; longitudinal study

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Alcohol use and sexual behavior are consistently reported to co-occur in both adolescent (Duncan, Strycker, & Duncan, 1999; Tubman, Windle, & Windle, 1996) and adult samples (Capaldi, Stoolmiller, Clark, & Owen, 2002; Cooper, 2002; Zuckerman & Kuhlman, 2000). Furthermore, alcohol use is found to predict the onset (Blinn-Pike, Berger, Hewett, & Oleson, 2004; Capaldi, Crosby, & Stoolmiller, 1996; Guo et al., 2005) and occurrence of sexual intercourse in adolescents (Whitbeck, Yoder, Hoyt, & Conger, 1999), as well as multiple recent sex partners in both adolescent (e.g., Tapert, Aarons, Sedlar, & Brown, 2001; Tubman et al., 1996) and adult samples (Graves, 1995). Additionally, a predictive relation has been found across these different developmental periods. For example, Wells, Horwood, and Fergusson (2004) reported that drinking patterns at age 16 positively predicted the number of sex partners during the period from 16–21 years of age and from 21–25 years. And, at least one study found some support that more frequent sexual activity predicted trajectories of heavy drinking from 16–25 years of age for females (Windle, Mun, & Windle, 2005).

Despite considerable research demonstrating an association between alcohol use and sexual behavior, two important questions remain unanswered. The first question concerns differential lead-lag relations between alcohol use and sexual behavior. Alcohol use may be the leading indicator, temporally preceding and predicting changes in sexual behaviors, such as the number of sexual partners. Or, sexual behavior could be the leading indicator, temporally preceding and predicting changes in alcohol use. Several theoretical frameworks point to differential lead-lag relations in one direction or the other consistent with causal explanations; however, the biggest threat to these claims is that a common cause, or "third variable," underlies such relations. According to the common cause perspective, alcohol use and sexual behaviors are related because they are manifestations of a shared antecedent that affects both behaviors, not because something specific about one of the variables (e.g., alcohol use) leads to changes in the other (e.g., sexual behavior). Although support exists for both of these perspectives, no study has evaluated comprehensively whether lead-lag relations exist after controlling for several shared causes.

The second question concerns developmental relations between alcohol use and sexual behaviors such as the number of sexual partners. No longitudinal study has included more than two or three assessments of alcohol use and sexual behavior spanning adolescence and adulthood. Therefore, it is not clear whether the association between drinking and sexual behavior changes in developmentally meaningful ways as adolescents become adults. The present analyses were designed to address these two questions, using data from a cohort of participants assessed over a 13-year period from adolescence into the adult years. Answers to these questions have implications for intervention research and practice and for advancing developmental theory.

Theoretical Frameworks

Causal Explanations—Alcohol's pharmacological effects on the brain alter cognition and behavior, resulting in hypothesized sexual disinhibition. Consistent with this view, experimental studies show that alcohol intake reduces inhibitions, increases impulsivity and risky social behavior, and impairs cognitive functioning (e.g., Poulos, Parker, & Lê, 1998). According to alcohol myopia theory (Josephs & Steele, 1990; Steele & Josephs, 1990), disinhibited behavior, such as sex with a new partner, arises because alcohol limits the capacity to engage in controlled, effortful processing and restricts attention to the most immediate (internal and external) cues. To the extent that sexual arousal is a powerful cue, alcohol use may reduce the efficacy of inhibitory cues that might normally occur. In support, one experimental study found that individuals administered alcohol reported lower perceived risk of sex with a new partner compared to individuals who received a placebo or water (Fromme, D'Amico, & Katz, 1999). Alcohol myopia theory has received considerable support from

experimental studies as an explanation of disinhibited behavior following alcohol use (e.g., Cooper & Orcutt, 1997; MacDonald, MacDonald, Zanna, & Fong, 2000).

Another explanation for the effect of alcohol use on sexual behavior is expectancy theory (Lang, 1985). According to this perspective, expectations or pre-existing beliefs individuals hold about the effects of alcohol use on behavior and specific social meanings surrounding alcohol use influence sexual behavior. In support of this view, adult men who thought they consumed alcohol but were given a placebo were more aroused sexually, rated females who used alcohol as more disinhibited, and showed a preference for sexual material if they held expectancies that alcohol enhances sexual feelings (e.g., enjoyment) (George, Stoner, Norris, Lopez, & Lehman, 2000). Other studies find that sex-related alcohol expectancies strengthen relations between alcohol use and sexual activity (e.g., Dermen, Cooper, & Agocha, 1998). Regardless of the cognitive or pharmacological mechanisms involved, considerable theoretical and empirical evidence is consistent with the hypothesis that alcohol use influences sexual behaviors.

It is also possible that sexual activity is a leading indicator of alcohol use. For example, engaging in sexual intercourse with a new partner may be a regrettable experience that leads to alcohol use to assuage the negative emotions. Having sex with a new partner may also bring individuals into new social networks and environments that promote alcohol use. In support, previous research indicates that associating with older peers is related to earlier and heavier alcohol use among adolescents (Stattin, Gustafson, & Magnusson, 1989), and an older deviant peer network may provide exposure to more experienced sexual partners. Though limited, there is at least some empirical evidence that sexual activity predicts alcohol involvement (Windle et al., 2005). The theoretical and empirical evidence for sexual behavior as a leading indicator of changes in alcohol use is not strong but does warrant investigation.

Common Causes—The common cause, or "third variable," hypothesis is the biggest threat to the proposition that alcohol use leads to changes in sexual behavior or vice versa. According to this perspective, any association between drinking and sexual activity is spurious, owing to some unobserved variable. A handful of personality, behavioral, and attitudinal variables have been linked to both alcohol use and sexual behavior. Notably, sensation-seeking and impulsivity are both associated with a disposition toward riskier behavior, including greater alcohol use and sexual activity (Arnett, 1996; Kahn, Kaplowitz, Goodman, & Emans, 2002; Newcomb & McGee, 1991; Zuckerman & Kuhlman, 2000). Thus, sensation seeking and/or impulsivity may explain the association between alcohol use and sexual behavior, although evidence for this possibility is mixed (Bryan & Stallings, 2002; Cooper, 2002; Cooper, Peirce, & Huselid, 1994).

In the behavioral domain, a large body of research has linked antisocial, hostile, and aggressive behavior to both alcohol use and sexual behaviors (e.g., Biglan et al., 1990; Capaldi et al., 1996; Tubman et al., 1996). Individuals who exhibit a variety of behavioral problems are also more likely to use alcohol and have more sexual partners. For example, conduct problems predict developmental trajectories of both alcohol use and sexual behaviors even into adulthood (Capaldi et al., 2002). However, even after controlling for conduct problems, Whitbeck et al. (1999) found that alcohol use still predicted sexual activity.

Jessor and colleagues (Jessor, Donovan, & Costa, 1991; Jessor & Jessor, 1977) proposed that problem behaviors (e.g., antisocial behavior, aggression, alcohol use, and more sexual partners) are positively related because they are part of a syndrome of problem behaviors that reflect a general tendency to reject conventional norms and values. If this were the case, conventional attitudes would not only be negatively related to such behaviors, but would account completely for any associations among them. Support for a "syndrome of problem behaviors" has come

from studies that find a single common factor accounts for covariation among multiple problem behaviors (e.g., Cooper, Wood, Orcutt, & Albino, 2003; Donovan & Jessor, 1985). However, other evidence from predictions of problem behavior theory is mixed (Basen-Engquist, Edmundson, & Parcel, 1996; Tildesley, Hops, Ary, & Andrews, 1995; Willoughby, Chalmers, & Busseri, 2004).

This brief review suggests that additional studies are needed to help discern whether alcohol use is a leading indicator of changes in sexual behaviors, such as having more sexual partners, sexual behavior is a leading indicator of changes in alcohol use, or the association is spurious, the result of some set of individual differences that account for a wide range of potentially risky or health damaging behaviors. Especially important, if common causes explain the association between alcohol use and number of sexual partners, then interventions targeting alcohol behaviors will not be effective in reducing the number of sexual partners or vice versa. Under these circumstances, interventions would need to focus on changing the personal traits or dispositions that underlie both drinking and sexual behaviors.

Developmental Change

There are several lines of evidence that point to common developmental changes in the relation between alcohol use and sexual behavior as adolescents transition to adulthood. On average, both behaviors increase most dramatically throughout adolescence, peak, and then decline slightly in adulthood (Capaldi et al., 2002; Maggs & Schulenberg, 2004). The similarity of these trajectories may result from the trajectory of one behavior being, at least in part, influenced by the trajectory of the other. For example, as alcohol use increases, sexual activity also increases; and as alcohol use levels off or declines, the trajectory of sexual behaviors may slow or decline.

As reviewed earlier, alcohol expectancies are found to play a role in explaining the effect of alcohol use on sexual behaviors. Therefore, if expectations about the effects of alcohol use on sexual behavior change across development, so too might the relation. In one study, Lundahl, Davis, Addesso, and Lukas (1997) found that participants under age 20 reported significantly greater alcohol-related expectations of positive effects and sexual enhancement than those over age 20. It is possible that these changes may account for changes in the predictive effect of alcohol use on changes in sexual behavior.

Additionally, it is possible that developmental changes in inhibition may underlie changes in the relation between alcohol use and sexual behavior as adolescents transition to adulthood. Fundamental changes in brain development occur from adolescence to adulthood, namely the development of frontal lobes and associated executive functions that underlie social and emotional behavior (Yurgelun-Todd, 2007). These changes may enhance decision-making, judgment, and behavior and inhibit impulsive behavior even under the influence of alcohol. There is also some evidence that adults may be less sensitive than adolescents to certain pharmacological effects of alcohol, such as social disinhibition (Spear & Varlinskaya, 2006). Whether this finding reflects maturation of the frontal lobe or not, such changes suggest that adults may be more inhibited while under the influence of alcohol than adolescents even when instigatory cues (e.g., sexual behavior) are high.

Other evidence suggests that as developmental contexts supporting these behaviors change, so might the association between them. During adolescence, alcohol use and sexual intercourse are proscribed behaviors and elicit social controls, whereas in adulthood these behaviors are more socially acceptable and normative. In support, McGee and Newcomb (1992) found that the problem behavior syndrome did not remain a cohesive or unified set of behaviors after adolescence, indicating that some behaviors were no longer reflective of a tendency to reject conventional norms and values. Furthermore, adolescents' relationships tend to be of short

duration (Feiring, 1996), providing more opportunities for multiple sex partners. As adolescents transition to adulthood they are more likely to enter into monogamous, committed relationships and marry. These developmental changes in relationship status may account for changes in the relation between alcohol use and sexual behavior, such as sex with a new partner. Therefore, as adolescents become adults the reasons for engaging in these behaviors and context surround such acts changes altering the relation between them.

In summary, some prior evidence suggests that the relation between alcohol use and sexual behavior may become weaker as adolescents transition to adulthood. Documenting these changes and understanding this process more fully is important both for the design of developmentally appropriate interventions and for advancing developmental theory.

The Present Study

The present investigation takes advantage of an ongoing study of adolescents grown to adulthood to attempt to answer the two questions posed earlier: (1) does alcohol use predict change in number of sex partners even after possible common causes of both behaviors are taken into account or does the number of sexual partners predict change in alcohol use, and (2) does the association between alcohol use and number of sex partners change in developmentally meaningful ways during the transition from adolescence to adulthood?

Alcohol use and number of sex partners per year were measured eight times over a 13-year period spanning mid-adolescence to young adulthood. Latent Difference Score (LDS; McArdle & Hamagami, 2001) models were used to model both alcohol use and number of sex partners and their lagged relations across the eight occasions. The dual change LDS model incorporates aspects of both growth (i.e., change in level) and occasion-to-occasion associations (quasi-simplex autoregression) in a single, overarching model. That is, this model allows for the estimation of latent trajectories of both behaviors and for time-varying effects of alcohol use on change in the number of sexual partners as well as effects from sexual behavior to change in alcohol use at the true score level (free of measurement error). In the interest of conserving space we do not provide the equations in the paper. However, these equations are available from the corresponding author.

A univariate version of the LDS model is depicted graphically in Figure 1 for manifest variable A, representing alcohol consumption, measured at four occasions (i.e., A_1 through A_4). In Figure 1, the triangle represents the unit constant that enables estimation of mean levels and intercepts. Circles represent latent variables and squares denote manifest variables. Single-headed arrows represent directed relations (e.g., factor loadings, regression weights) and curved, double-headed arrows denote undirected relations (e.g., variances, covariances). All omitted arrows assume path coefficient values are fixed to 0, and all unlabeled paths assume path coefficients fixed at 1.0.

At each of the t times of measurement, the manifest variable A_t (t = 1, …, 4) is decomposed into a latent true score a_t and a residual term ε_t representing measurement error–a standard latent variable decomposition. Then, for each time point after the first, latent status at time t, or a_t, is represented as an additive composition of latent status at the prior time of measurement, $a_{t\text{-}1}$, and change in status, Δa_t.

In the autoregressive portion of the model shown in Figure 1, each difference score (e.g., Δa_2) is regressed on the true score at the immediately preceding time of measurement (e.g., a_1) to achieve an estimate of time-specific change controlling for prior status. The resulting estimate is a change score, controlling for prior status through the autoproportion coefficient (e.g., $\beta_{\Delta 2.a1}$). The growth portion of the model is reflected in the intercept (I) or initial level of alcohol use at the first time of measurement, with a mean represented by the α_I parameter

and individual variance by the σ_i^2, and growth (G) in level of alcohol use across the four times of measurement. For the growth latent variable (G), one can (a) fix the mean parameter α_G to 1.0 and estimate the slope coefficients (e.g., $\beta_{\Delta 2.G}$) or (b) estimate the mean parameter α_G and fix the slope coefficients (e.g., $\beta_{\Delta 2.G}$) to 1.0, among other options.

The dynamics of the model are such that negative autoproportion coefficients decelerate positive growth whereas positive autoproportion coefficients accelerate positive growth, creating a dynamic, nonlinear function of the overall growth process of variable *a*, the true score manifestation of measured variable A. Of note, if the process generating the observed data is characterized only by linear growth processes, then the estimated autoproportion coefficients will be zero. Likewise, if autoproportion coefficients are fixed at zero, the model is reduced to a linear growth model.

Figure 2 depicts a bivariate dual-change LDS model for four times of measurement. The manifest variable time series at the top of the figure is denoted A for alcohol use, and the manifest variable time series at the bottom of the figure is denoted S for number of sexual partners. Due to space limitations, some representations were omitted from Figure 2, namely (a) covariances among residuals (e.g.,$\sigma_{\varepsilon S1,\, \varepsilon A1}$), (b) covariances among intercepts (I) and growth factors (G) of alcohol use and sex, and (c) residual variances of the difference scores, Δa and Δs.

Lagged effects between alcohol use and number of sexual partners across time are represented by cross-lagged coefficients, where change in number of sexual partners (Δs_t) is regressed on alcohol use at the previous point in time ($a_{t\text{-}1}$) and change in alcohol use (Δa_t) is regressed on number of sex partners at the previous time of measurement ($s_{t\text{-}1}$). Examination of cross-lagged associations from one wave to the next across the developmental periods of adolescence and adulthood will reveal whether alcohol use predicts change in number of sex partners across time and whether sexual behavior predicts change in alcohol use across time. Additionally, the relations between the individual trajectories of these behaviors are captured by covariances among the intercept and growth factors for each behavior (e.g.,$\sigma_{Ia,Is}$).

In the present study, we included several potential common causes – impulsiveness, excitement seeking, conduct problems, hostility/aggression, and conventional attitudes – in the LDS model. Covariates are generally entered into the model by regressing the intercepts (I_a and I_s) and slopes (G_a and G_s) for each outcome on the covariates (see Figure 2). It is also possible to regress all difference scores (e.g.,Δa and Δs) for alcohol use and number of sex partners on external covariates, Z – as implied by the labels $\beta_{All\Delta a,\, Z}$ and $\beta_{All\Delta s,\, Z}$ in Figure 2. In the present study we evaluated both possibilities.

We also controlled for gender and recent divorce. Gender must be taken into account when investigating these associations because males are consistently reported to have both more sexual partners (Graves, 1995; Tapert et al., 2001; Tubman et al., 1996) and higher levels of alcohol use than females (Graves, 1995; Naimi et al., 2003). Because the present study was based on data from two samples that differed on the presence of parental divorce, as described later, parental divorce was included as a covariate.

By controlling for each of these potential common causes or “third variables,” we evaluated whether the association between alcohol use and number of sexual partners was spurious. Specifically, if controlling for potential common causes reduced to nonsignificance coupling coefficients that had been statistically significant and relatively large, then the association between alcohol use and number of sex partners would be considered spurious.

Method

Sample and Procedures

This study used data from the Families Transitions Project (FTP), which is a longitudinal study of 556 9th grade adolescents and their families from two different overlapping projects. The first study, the Iowa Youth and Families Project (IYFP), began in 1989 and includes a cohort of 451 7th grade target adolescents from two-parent families. Lists of students were obtained from schools in eight counties in Central Iowa. Letters were sent to all eligible families describing the project. A family was eligible for participation if the target adolescent lived with both biological parents and had a sibling within 4 years of the target's age. Families were contacted by phone and asked to participate. Personal visits occurred when a family did not have a phone. Approximately 78% of the eligible families participated in the first wave of data collection.

The second study, the Iowa Single-Parent Project (ISPP), was initiated 2 years later in 1991 and included a sample of 207 8th and 9th grade adolescents from mother-headed households. Participants were identified through lists of students provided by schools in rural areas of Iowa. Mothers were contacted by telephone. Only 15% of families contacted met criteria for inclusion in the study. In addition to grade level, a family was eligible for participation if the target child had a close-aged sibling and the marital separation was permanent and occurred within the past 2 years. Only three of the eligible women refused to participate, yielding a response rate of 99%. The FTP included only those adolescents from the ISPP who were in the 9th grade in 1991 (n = 105) because they were from the same birth cohort as the IYFP target adolescents.

The IYFP and ISPP families were Caucasian and similar on a number of other demographic characteristics in 1991, including mothers' age (M = 39.8, IYFP; M = 38.3, ISPP), level of mothers' education (M = 13.4, IYFP; M = 13.4, ISPP), number of children (M = 3.1, IYFP; M = 3.1, ISPP), percentage of mothers employed (82.6%, IYFP; 80.3%, ISPP), and number of hours spent working outside the home (M = 31.5 hr, IYFP; M = 32.5 hr, ISPP). Mean annual income was different in the two samples ($39,116, IYFP; $24,281, ISPP). In the present study, we included divorce in 1991 as a covariate to control for any effects of this family history on the relations of interest.

The IYFP and ISPP followed the same procedures. At each wave of data collection during the adolescent years, trained interviewers visited each family at home twice a year for approximately 2 hours each visit. During the first visit, each family member completed questionnaires, some of which addressed the target's alcohol use, number of sexual intercourse partners, impulsiveness, excitement seeking, hostility/aggression, conduct problems, and conventional attitudes. During the second visit, the family members were videotaped as they engaged in structured interaction tasks. Data from the second visit were not used in the present investigation and are not discussed further. Beginning in 1995, after the completion of high school, the target subjects were contacted and interviewed at their place of residence.

Data for the present study were collected at eight times of measurement, either annually or biannually, over a 13-year period beginning in 1991 when target adolescents were in the 9th grade (average age in years reported to the nearest month: M = 15.11, SD = 0.43). Data collection occurred in 1991 (9th grade, M = 15 years), 1992 (10th grade, M = 16 years), 1994 (12th grade, M = 18 years), 1995 (M = 19 years), 1997 (M = 21 years), 1999 (M = 24 years), 2001 (M = 26 years), and 2003 (M = 28 years). A total of 553 adolescents were included in the present study, 448 adolescents (236 females and 212 males) from two-parent families and 105 adolescents (56 females and 49 males) from single-parent, mother-headed households at the start of the study. Three of the families from the two-parent study were dropped from these analyses because they were missing on all study variables. Complete data was available for

nearly 60% of the participants. As with any longitudinal data analysis, some participants left the study and did not return. Other participants were absent from one wave of data collection and subsequently reappeared. The covariance coverage, or proportion of nonmissing data, for all outcomes ranged from 80% to 94%.

Measures

Number of sex partners—At each wave of data collection, the target reported on the number of different persons with whom s/he had sexual intercourse during the past 12 months. Ratings were obtained on a 7-point Likert-type scale, ranging from 0 (*none*) to 6 (*six or more partners*).

Drinking behavior—At each assessment, the target reported on how often s/he consumed beer, wine, or hard liquor during the past 12 months. Drinking frequency was coded on the following 4-point Likert-type scale: 0 (*never*), 1 (*1 – 3 times per month or less*), 2 (*1 – 2 times per week*), and 3 (*3 or more times per week*).

Impulsiveness—In the 9th grade, target adolescents from the IYFP filled out the NEO Personality Inventory (NEO PI), which measures five major domains of personality each with six facets (Costa & McCrae, 1985). Eight questions assessed the impulsiveness facet of the Neuroticism domain. Respondents were asked to rate how strongly they agreed with a set of statements about themselves. Examples of the items include: “I have little difficulty resisting temptation,” “sometimes I do things on impulse that I later regret,” and “I seldom give into my impulses.” Response categories ranged from 0 (*strongly agree*) to 4 (*strongly disagree*). The reliability coefficient for the measure, using coefficient alpha, was .52. Although this level of reliability is relatively low, later analyses demonstrate that the measure is a significant predictor of both drinking and number of sex partners. Given the low reliability, we expect that these estimates are quite conservative. Items were averaged to create a composite variable with higher scores indicating higher impulsivity. Participants from the ISPP were not administered the NEO PI; thus, these data were considered missing by design for some participants in the full sample.

Excitement seeking—In the 9th grade, the NEO PI was also used to assess adolescents’ excitement seeking, a facet of the Extraversion domain (Costa & McCrae, 1985). Examples of the items include: “I often crave excitement,” “I have sometimes done things just for kicks and thrills,” and “I’m attracted to bright colors and flashy styles.” Coefficient alpha for the 8 items was acceptable ($\alpha = .67$). Items were averaged to create a composite score for excitement seeking. Higher scores indicate a stronger attraction to excitement. Again, as part of the study design, participants from the ISPP were not administered this survey.

Hostility/aggression—In the 9th grade, target adolescents filled out the Hostility Inventory (Buss & Durkee, 1957), which assesses different types of hostility including physical aggression, verbal aggression, and anger. Adolescents rated the extent to which each statement is like them on a 5-point Likert-type scale, ranging from 0 (*not at all*) to 4 (*exactly*). Examples of the items include: “if someone hits me first, I let him have it;” “when I get mad, I say nasty things;” “if I have to use physical violence to defend my rights, I will;” and “I will do whatever I have to in order to get what I want.” Reliability for the 9-item scale was high ($\alpha = .86$). Items were averaged to create a single variable with higher scores indicating more hostile, aggressive, and angry tendencies.

Conduct problems—Conduct problem were assessed in the 9th grade using the conduct disorder subscale of the Revised Behavior Problem Checklist (Quay & Peterson, 1983). Mothers reported on the degree to which 22 behaviors are a problem for the target child,

including "disruptive, annoys and bothers others;" "argues, quarrels;" "tries to dominate others, bullies, threatens;" "brags and boasts;" "teases others;" and "deliberately cruel to others." Each conduct problem was rated on a 4-point Likert-type scale ranging from 0 (*no problem or no opportunity to observe this*) to 3 (*severe problem*). The reliability coefficient for the subscale was high (α = .95). The items were averaged and higher scores represent more severe conduct problems.

Conventional attitudes—In the 9th grade, target adolescents reported on their conventional goals, values, and activities using a measure adapted from the Thornberry study of urban youth in New York. Adolescents rated the importance of 22 items which included: "to own your own home," "to have a good-paying job," "to work hard to get ahead," "to have a college education," "to save money for the future," "to be a religious person," and "to be successful in your work or career." Each item was rated on a 5-point Likert-type scale, ranging from 0 (*not at all important*) to 4 (*extremely important*). The scale demonstrated good reliability (α = .90). Items were averaged to create a composite score for conventional attitudes. Higher scores represent a stronger orientation to conventional goals, values, and institutions.

Background variables—Gender was coded as 0 (*female*) and 1 (*male*). Recent divorce was coded as 0 (*two-parent families; IYFP*) and 1 (*single-parent, mother-headed households; ISPP*).

Analyses

In the prototypical bivariate LDS model of McArdle and Hamagami (2001) for equally spaced times of measurement (cf. Figure 2) in two longitudinal sequences, autoproportion path coefficients (e.g., $\beta_{\Delta a2.a1}$) and residual variances (e.g.,σ^2) are constrained to equality across measurement occasions; slope coefficients (e.g., $\beta_{\Delta a2.Ga}$) are fixed at unity and the associated mean α_G is estimated, modeling constant growth; and variances of change scores are fixed at 0. In the present analyses, autoproportion path coefficients and residual variances for both alcohol use and number of sexual partners were freely estimated. The growth portion of the model (G) was identified by constraining the mean of the slope for each outcome to unity ($\alpha_G = 1$), enabling estimation of slope coefficients at all times of measurement after the first. Variances of the change scores remained fixed at 0. We chose to relax certain constraints in the prototypical model because (a) times of measurement were not evenly spaced across the eight waves; and (b) overall growth was not linear for either outcome, but rather each behavior increased and then decreased, as expected. The model as described was fitted to alcohol use and number of sex partners.

We used Mplus 5.1 (Muthén & Muthén, 2008) and full information maximum likelihood (FIML) estimation to fit LDS models to the data. The assumption in LDS models is that random effects – including measurement residuals – are normally distributed. Furthermore, the FIML estimator accommodates missing data and is acceptable when data are either missing at random or missing completely at random. Based on missing data patterns explained earlier, missing at random seems justified. Because repeated measures on an individual tend to be correlated, FIML estimation is the most appropriate method of handling missing data as it uses all available data from earlier and later waves to estimate parameters and standard errors.

Results

Descriptive Statistics and Correlations

At each wave, the number of sex partners ranged from none to six or more partners a year – the entire range of the variable. Likewise, alcohol use ranged from no drinking to drinking three or more times a week. The descriptive statistics and zero-order correlations of interest

are provided in Table 1. As expected, mean levels of drinking increased until approximately age 24 and then decreased slightly and remained stable. The number of yearly sex partners increased as well until approximately age 21 and then decreased slightly. Considerable individual differences in both of these behaviors existed at each time of measurement. For the most part, significant correlations were found among alcohol use across time and among number of sex partners across time. In addition, alcohol use and number of sex partners were significantly related at most points in time, consistent with previous research. In line with the hypothesis of developmental change, correlations between alcohol use and number of sex partners decreased in adulthood. For example, the concurrent association between alcohol use and number of sex partners decreased from age 15, $r = .47$, to age 28, $r = .19$.

Bivariate Dual Change LDS Model

Three bivariate dual change LDS models were fit to the data to examine the direction of influence and association between alcohol use and number of sex partners. Model 1 was a fully parameterized model like the one in Figure 2. Coupling parameters were freely estimated in both directions – from alcohol use at a given time of measurement to change in number of sex partners at the next time of measurement, and from number of sex partners at a given time of measurement to change in alcohol use at the next time of measurement. This model fit the data rather well statistically, χ^2 (82, $N = 553$) = 109.94, $p = .02$, and had good practical fit, with RMSEA = .025 (CI = .010, .036), CFI = .988, and TLI = .982.

Model 2 was more restricted than Model 1, obtained by deleting from Model 1 coupling parameters from alcohol use at a given time of measurement to change in number of sex partners at the next time of measurement. Model 2 had poorer fit to the data, χ^2 (89, $N = 553$) = 169.26, $p < .0001$, and notably worse indices of practical fit, with RMSEA = .040 (CI = .031, .050), CFI = .965, and TLI = .953. In addition, the difference in fit between Models 1 and 2 was statistically significant, $\Delta\chi^2$ (7, $N = 553$) = 59.32, $p < .0001$, implying that dropping coupling parameters from alcohol use to change in number of sex partners led to much poorer fit of the model to the data.

The third model, Model 3, was an alternate restricted model, obtained by deleting from Model 1 coupling parameters from number of sex partners at a given time of measurement to change in alcohol use at the next time of measurement. Model 3 had somewhat worse statistical fit to the data than did Model 1, χ^2 (89, $N = 553$) = 127.51, $p = .005$, but indices of practical fit were very similar to Model 1, with RMSEA = .028 (CI = .016, .038), CFI = .983, and TLI = .978. The difference in fit between Models 1 and 3 was statistically significant, $\Delta\chi^2$ (7, $N = 553$) = 17.27, $p = .02$; however, only a single coupling parameter from number of sex partners to change in alcohol use was statistically significant, and this coupling parameter was small in magnitude. Based on these considerations, Model 3 was selected as the optimal model for these data given its adequate fit and parsimony. Model 3 was further refined by freeing the covariances between manifest variable residuals at each time of measurement leading to an even better fit to the data, as shown by the fit statistics in Table 2. Results for drinking behavior, number of sex partners, and their associations with one another are addressed next.

Drinking behavior—As shown by the growth coefficients in Table 2, the trajectory of alcohol use frequency rose across the period from age 15 until age 21, then declined. The five statistically significant autoproportion coefficients for drinking in Table 2 indicate that drinking at time *t-1* predicted subsequent change in drinking behavior from *t-1* to time *t* for ages 16 through 26. The negative autoproportion coefficient estimates for alcohol use dampened the overall rate of growth.

Number of sex partners—As shown by the growth coefficient estimates in Table 2, the trajectory of sexual behavior rose throughout the ages of evaluation from 16 to 28. The autoproportion coefficients indicate that number of sex partners at time *t-1* predicted subsequent changes in number of yearly sex partners from time *t-1* to time *t* for ages 16 through 28 (see Table 2). As with drinking behavior, the negative autoproportion coefficient estimates dampened the rate of growth. In fact, the relatively large autoproportion coefficients for number of yearly sex partners (relative to those for alcohol use) at ages 26 (−0.99 vs. −0.49) and 28 (−1.23 vs. −0.25) serve to severely limit the overall growth in the number of sex partners in the later years. Thus, it appears that the number of yearly sexual partners rises early, but tends to asymptote and then decline throughout the study period.

Relations between drinking behavior and number of sex partners—Associations between alcohol use and number of sex partners were evaluated from two perspectives: (a) overall growth of the two behaviors and (b) occasion-to-occasion prediction from one behavior to the other. As shown in Table 2 (Variance and Correlation Estimates panel), several statistically significant relations were found between both the initial level (I) and growth (G) of alcohol use and number of sex partners. The correlation between the intercepts was moderately strong, $r_{Ia,Is} = .43$, $p < .001$, indicating that individuals who had higher levels of alcohol use at age 15 tended to have more sex partners than individuals with initially lower levels of alcohol use. Further, the initial level of alcohol use (age 15) was significantly related to growth in trajectories of the number of yearly sex partners from adolescence to adulthood, $r_{Ia,Gs} = .25$, $p < .001$, but the initial number of sex partners was not related to growth in alcohol use across time. Importantly, growth patterns in alcohol use and number of yearly sex partners were positively related across the study period, $r_{Ga,Gs} = .36$, $p < .001$, indicating that individuals who showed greater growth in alcohol use also showed greater growth in the number of yearly sex partners.

Lead-lag relations between the two behaviors are shown in the Couplings panel of Table 2. Importantly, drinking at age 15 significantly predicted subsequent change in the number of sex partners from age 15 to age 16, $\gamma_{\Delta s2.a1} = .47$, $p < .001$. Level of alcohol use continued to be a significant predictor of change in the number of yearly sex partners until age 21, $\gamma_{\Delta s7.a5} = .28$, $p < .001$, *but not thereafter*. Thus, throughout the adolescent years, ages 15 to 21, alcohol use was a significant leading indicator of change in the number of sex partners.

Effect of Selected Covariates: Testing for Spuriousness

As just mentioned, alcohol use was a leading indicator of changes in the number of yearly sex partners through age 21, but not thereafter. To investigate the possible influence of common causes or "third variables" on these relations, we studied whether controlling for gender, recent divorce, impulsiveness, excitement seeking, hostility/aggression, conduct disorder, and conventional attitudes affected (a) the magnitude and significance of the coupling parameters from alcohol use to changes in number of sexual partners (e.g., $\gamma_{\Delta s2.a1}$), (b) the estimated change scores for both drinking behavior and number of sexual partners (Δs and Δa) at each time of measurement, and (c) model fit.

Covariate effects were evaluated by three different modeling techniques (refer to Figure 2 for visual clarification). First, the intercept (I) and growth (G) of both alcohol use and number of sex partners were regressed on each covariate to determine the effect of the covariate on the individual growth trajectories. Second, the intercept (I) and change scores for both alcohol use and number of sexual partners (Δs and Δa) at each time point were simultaneously regressed on each covariate to model covariate effects on occasion-to-occasion change only. Third, both the individual trajectories (I, G) and change score (Δs and Δa) were regressed on each covariate, which estimated simultaneous effects of covariates on both the underlying growth trajectories

and occasion-to-occasion change. For virtually every covariate, the second model – representing covariate effects on occasion-to-occasion change only – provided the best fitting model, and these results are shown in Tables 3 and 4.

Covariate effect on coupling parameters—Table 3 shows effects of each covariate on the drinking-to-sex estimated coupling coefficients ($\gamma_{\Delta s.a}$), after each change score (Δs and Δa) and the intercept (I) of both behaviors (drinking and sex) were regressed on the covariate. As is readily apparent, the effect of each covariate (columns 2 – 8) compared to a model with no covariates (column 1) was minimal on the (a) magnitude of the coefficient at each wave, (b) significance of the coefficient at each wave, and (c) overall model fit. Most importantly, drinking continued to be a significant predictor of change in number of sexual partners throughout adolescence (to age 21), even after controlling for a host of common causes presumed to explain the relation between these behaviors. These analyses demonstrate that the time-varying effect of alcohol use on change in the number of yearly sex partners during the adolescent years is not due to the "third variables" investigated here.

Covariate effect on change scores—Table 4 shows effects of each covariate on change scores for number of sex partners (top panel) and drinking behavior (bottom panel). Looking at the top panel, males showed greater changes in the number of yearly sex partners at ages 26 and 28, but not before. Adolescents from recently divorced, mother-headed households had significantly more sex partners initially (at age 15), but not after. Impulsiveness was also positively related to change in the number of sex partners from age 21 on, whereas both excitement seeking and hostility had positive effects both initially and on change in the number of sex partners at most ages evaluated in the study. Finally, neither conduct disorder nor conventional attitudes showed any consistent time-ordered effect.

Contrasting with number of sexual partners, gender (i.e., being male) was more consistently related to increases in drinking from age 18 to 28. Recent divorce had the same effect for drinking as for number of sex partners: higher initial levels only and no effect on change scores. Again, impulsiveness, conduct disorder, and conventional attitudes showed little or no predictive effect on the change scores. Finally, both excitement seeking and hostility were associated with drinking behavior initially (age 15) and predicted change in drinking behavior at several other ages. Importantly, despite several significant effects of covariates on the intercept (age 15) and change scores, controlling for these influences had little effect on the magnitude of the coupling parameters from alcohol use to change in the number of sexual partners.

Discussion

The present study had two primary goals. The first goal was to evaluate whether alcohol use precedes and predicts change in the number of sex partners, whether number of sex partners precedes and predicts changes in alcohol use, or whether these relations reflect a common, external cause. No prior study has investigated the differential lead-lag relations between alcohol use and sexual behavior allowing for the estimation of individual growth trajectories underlying these behaviors and controlling for potential common causes. Second, we investigated whether significant lead-lag relations between alcohol use and number of sex partners are altered over time as adolescents transition to adulthood. Previous studies have been limited by their short duration and few repeated assessments.

With respect to the first goal, results were consistent with the hypothesis that alcohol use is a leading indicator of change in sexual behaviors, assessed as the number of sex partners. Results of the latent growth curve portion of the LDS model indicated that individuals with higher levels of alcohol use in mid-adolescence showed greater changes in the number of sex partners

across the study period. Levels of sexual behavior at the start of the study (age 15) were not related to changes in alcohol use across the study period. Further, results indicated that the trajectories of alcohol use and number of sexual partners wax and wane together over time. Beyond an association between the growth trajectories, alcohol use had significant positive effects on changes in the number of yearly sex partners throughout adolescence, but not thereafter. In contrast, with one minor exception, number of sex partners did not have significant effects on changes in alcohol use. These findings are consistent with previous research that indicates alcohol use plays a role in sexual behaviors, such as the number of sex partners (e.g., Blinn-Pike et al., 2004; Capaldi et al., 1996; Cooper, 2002; Cooper & Orcutt, 1997; Guo et al., 2005; Tapert et al., 2001; Tubman et al., 1996; Whitbeck et al., 1999).

Importantly, even after introducing several variables identified as potential common causes – impulsivity, excitement seeking, hostility/aggression, conduct disorder, conventional attitudes, gender, and divorce – the predictive effects of alcohol use on changes in the number of yearly sex partners remained significant and very little, if any, attenuation in the magnitude of the relations occurred. The results indicated that the effect of alcohol use on number of sexual partners is not due to the “third variables” investigated here.

The results of this study are consistent with causal explanations of the effect of alcohol use on sexual behavior. Whether the association reflects the pharmacological effects of alcohol use on cognition and behavior (Poulos et al., 1998; Spear & Varlinskaya, 2006), such as those outlined by alcohol myopia theory (Steele & Josephs, 1990), or alcohol-related expectations (George et al., 2000; Lang, 1985), this study cannot address. The findings, however, do suggest that targeting alcohol use in prevention and intervention programs may reduce the number of sexual partners – a potentially risky sexual behavior.

This study is the first to demonstrate that the influence of alcohol use on change in the number of sex partners is altered as adolescents transition to adulthood. Specifically, alcohol use predicted increases in the number of yearly sex partners across the adolescent years (age 15 to 21), but alcohol use stopped being a significant predictor of change in the number of sex partners after this point. Interestingly, these developmental changes occurred during the period when the trajectory of drinking behavior declined; thus, as alcohol use declined into the adult years the association with sexual behavior weakened.

Although the exact mechanism for these developmental changes is not known, some areas for future research can be garnered from extant literature. Adults may be less sensitive to some pharmacological effects of alcohol use that purportedly spur sexual behaviors (e.g., Spear & Varlinskaya, 2006). Also, maturation of the frontal lobe may result in greater impulse control, reasoning, and logical thought that may inhibit sexual behavior, even under the influence of alcohol. Likewise, alcohol expectancies are found to change from adolescence to adulthood (e.g., Lundahl et al., 1997), which may weaken the association between alcohol use and sexual behaviors. Future studies with prospective longitudinal data and multiple repeated assessments should explore these possibilities. Once mechanisms underlying attenuated effects in adulthood are found they can be incorporated into preventive interventions to help interrupt the progression from drinking to potentially risky forms of sexual behavior, such as having more sexual partners.

It is also possible that changes in the association between alcohol use and number of sexual partners in adulthood result, in part, from young adults becoming involved in stable, romantic relationships and marrying. In the present study, the association between alcohol use and number of sexual partners was no longer significant after age 21. At age 19, 45% of the sample reported being single while 44% of the sample reported being in a committed, monogamous relationship and 2% were married; at age 21, these estimates were 34%, 48%, and 10%,

respectively; and at age 24, 25% of the sample reported being single while 33% of the sample reported being in a committed monogamous relationship and 29% were married. These changes in relationship status do show some parallels to developmental changes found between alcohol use and number of sex partners in the present study and future research should explore whether they help explain this finding.

The primary limitation of the present study is that we did not have event-level measures available, which help ensure temporal contiguity of events by asking about a discrete sexual encounter and events surrounding it (e.g., alcohol use prior to sex). However, we tried to limit the likelihood that the temporal associations found were due to other factors by including several personality, behavioral, and attitudinal variables as control variables in the analyses. It is possible, however, that other unobserved variables may have explained the relation between drinking and sexual behavior. In short, while event-level measures were not available we tried to overcome this limitation through our analyses.

An additional limitation is the composition of the sample, which consists of White families. Future research is needed to determine if findings replicate across more ethnically diverse samples. Previous research indicates that African American and Hispanic adolescents are less likely to drink alcohol and the relation between drinking and sexual behavior is weaker than in White adolescents (e.g., Cooper et al., 1994; Graves & Hines, 1997). However, Blum et al. (2000) found that African American and Hispanic adolescents are more likely to have sexual intercourse than White adolescents. Despite these ethnic differences, several studies demonstrate that alcohol use predicts sexual behavior in African American and Hispanic adolescents (e.g., Niccolai et al., 2004; Stueve & O'Donnell, 2005). Taken together, these studies suggest that in cultures where alcohol use is less likely the association with sexual behavior is weaker, which further supports alcohol use drives the association.

Despite limitations, the present study advances our understanding of developmental relations between alcohol use and sexual behavior, specifically the number of sexual partners. The results indicate that alcohol use is a leading indicator of number of sex partners – consistent with causal explanations. Finally, this study is the first to report developmental changes in the relation between alcohol use and number of sex partners as adolescents transition to adulthood.

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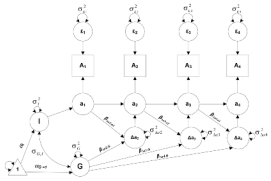

Figure 1.
Latent Difference Score Model of Four Measurement Occasions: Dual Change Variant.

Figure 2.

Conditional Bivariate Dual Change Latent Difference Score Model evaluating the relations between alcohol use and number of sexual partners. The manifest variable time series at the top of the figure is denoted A for alcohol use, and the manifest variable time series at the bottom of the figure is denoted S for number of sexual partners. Due to space limitations, some representations were omitted from the figure such as covariances among residuals (e.g.,$\sigma_{\varepsilon S1,\, \varepsilon A1}$), covariances among intercepts (I) and growth factors (G) of alcohol use and sex, and residual variances of the difference scores, Δa and Δs.

Table 1

Zero-Order Correlations, Means (M), and Standard Deviations (SD) (N = 553)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	M	SD
Alcohol use in the past year																		
1. Age 15	1.00																0.55	0.71
2. Age 16	**0.57**	1.00															0.77	0.80
3. Age 18	**0.34**	**0.46**	1.00														1.01	0.96
4. Age 19	**0.26**	**0.36**	**0.53**	1.00													1.41	1.02
5. Age 21	**0.18**	**0.29**	**0.43**	**0.52**	1.00												1.54	0.87
6. Age 24	**0.16**	**0.24**	**0.28**	**0.41**	**0.52**	1.00											1.57	0.85
7. Age 26	**0.11**	**0.21**	**0.22**	**0.39**	**0.48**	**0.62**	1.00										1.44	0.83
8. Age 28	**0.15**	**0.18**	**0.19**	**0.32**	**0.42**	**0.56**	**0.65**	1.00									1.45	0.86
Number of sex partners in the past year																		
9. Age 15	**0.47**	**0.20**	0.06	0.01	−0.03	0.01	0.00	0.00	1.00								0.16	0.62
10. Age 16	**0.46**	**0.33**	**0.14**	0.07	0.07	0.03	0.06	0.06	**0.49**	1.00							0.40	0.92
11. Age 18	**0.26**	**0.31**	**0.33**	**0.19**	**0.19**	0.08	0.06	0.03	**0.20**	**0.35**	1.00						0.93	1.27
12. Age 19	**0.22**	**0.26**	**0.32**	**0.36**	**0.32**	**0.22**	**0.22**	**0.20**	**0.12**	**0.21**	**0.50**	1.00					1.37	1.53
13. Age 21	**0.13**	**0.21**	**0.27**	**0.29**	**0.39**	**0.26**	**0.25**	**0.20**	−0.04	**0.15**	**0.32**	**0.48**	1.00				1.57	1.57
14. Age 24	**0.11**	**0.16**	**0.17**	**0.21**	**0.25**	**0.25**	**0.19**	**0.18**	0.03	0.05	**0.28**	**0.31**	**0.32**	1.00			1.34	1.21
15. Age 26	**0.18**	**0.11**	**0.08**	**0.09**	**0.13**	**0.14**	**0.21**	**0.13**	**0.17**	**0.13**	**0.15**	**0.22**	**0.28**	**0.35**	1.00		1.26	1.04
16. Age 28	**0.13**	**0.16**	**0.12**	**0.11**	**0.13**	**0.18**	**0.17**	**0.19**	0.06	**0.24**	**0.25**	**0.29**	**0.26**	**0.34**	**0.34**	1.00	1.29	1.03
Potential common causes																		
17. Gender[a]	−0.05	−0.04	**0.09**	**0.16**	**0.23**	**0.23**	**0.22**	**0.25**	−0.03	−0.07	0.00	**0.09**	0.07	**0.09**	**0.14**	**0.10**	0.48	0.50
18. Divorce[b]	**0.13**	**0.17**	**0.15**	0.01	0.01	0.04	0.07	0.08	**0.12**	**0.16**	**0.14**	0.07	0.03	0.00	0.03	**0.10**	0.21	0.40
19. Impulsiveness	**0.24**	**0.18**	0.07	0.07	0.08	**0.11**	**0.12**	**0.15**	**0.11**	**0.12**	0.07	**0.15**	**0.19**	**0.12**	**0.15**	**0.11**	2.07	0.46
20. Excitement seeking	**0.34**	**0.34**	**0.26**	**0.25**	**0.21**	**0.18**	**0.15**	**0.20**	**0.15**	**0.17**	**0.28**	**0.31**	**0.23**	**0.19**	**0.17**	**0.20**	2.72	0.57
21. Hostility	**0.39**	**0.30**	**0.25**	**0.22**	**0.22**	**0.13**	**0.13**	**0.18**	**0.25**	**0.23**	**0.24**	**0.29**	**0.14**	**0.17**	**0.18**	**0.17**	1.52	0.76
22. Conduct disorder	**0.15**	**0.09**	**0.13**	**0.08**	0.03	−0.04	−0.03	**0.10**	**0.09**	**0.19**	**0.12**	**0.14**	**0.12**	0.02	0.00	**0.12**	0.46	0.48
23. Conventional attitudes	−0.02	−0.05	−0.01	−0.01	0.02	−0.01	−0.01	0.03	−0.04	−0.02	−0.03	0.01	0.07	**0.09**	0.04	0.04	3.03	0.45

Note. Bold correlations statistically significant at $p < .05$, two-tailed test.

[a]Gender (0=female, 1=male).

[b] Divorce (0=two-parent families; IYFP, 1=single-parent, mother-headed households; ISPP).

Table 2

Parameter Estimates, Standard Errors (SE), and Fit Statistics of the Baseline Bivariate Dual-Change Model Between Drinking and the Number of Sex Partners

	Growth Coefficients (*SE*)		Autoproportion Coefficients (*SE*)		Couplings (*SE*)			Variance and Correlation Estimates (*SE*)			
Wave (Age)	**Drinking (a)**	**Sex (s)**	**Drinking (a)**	**Sex (s)**	**Sex to drinking**	**Drinking to sex**	**Factor**	**Drinking (a)**	**Sex (s)**	**Fit Statistics**	
1 (15)	0.54 (0.03)[a] ***	0.15 (0.03)[a] ***					Intercept (I)	0.35 (0.04)***	0.22 (0.02)***	Chi-Square	103.92
2 (16)	0.32 (0.06)***	0.01 (0.07)ns	−0.14 (0.09)ns	@ 0	@ 0	0.47 (0.11)***	Growth (G)	0.15 (0.02)***	0.29 (0.05)***	*df*	82
4 (18)	0.55 (0.07)***	0.52 (0.09)***	−0.40 (0.08)***	−0.59 (0.08)***	@ 0	0.32 (0.11)***	$r_{Ia,Is}$	0.43 (0.08)***		*p* of Chi-Square	0.052
5 (19)	0.90 (0.08)***	0.56 (0.11)***	−0.49 (0.07)***	−0.52 (0.06)***	@ 0	0.37 (0.08)***	$r_{Ia,Gs}$	0.25 (0.06)***		CFI	0.990
7 (21)	2.00 (0.12)***	0.70 (0.13)***	−0.76 (0.09)***	−0.64 (0.05)***	@ 0	0.28 (0.08)***	$r_{Ia,Ga}$	0.25 (0.06)***		TLI	0.986
10 (24)	1.49 (0.34)***	0.99 (0.16)***	−0.95 (0.22)***	−0.92 (0.05)***	@ 0	0.16 (0.09)ns	$r_{Is,Ga}$	−0.05 (0.07)ns		RMSEA	0.022
12 (26)	0.63 (0.25)*	1.27 (0.21)***	−0.49 (0.16)***	−0.99 (0.07)***	@ 0	−0.03 (0.10)ns	$r_{Is,Gs}$	0.18 (0.08)*		*p* RMSEA < .05	1.000
14 (28)	0.37 (0.22)ns	1.58 (0.36)***	−0.25 (0.15)ns	−1.23 (0.21)***	@ 0	−0.02 (0.12)ns	$r_{Ga,Gs}$	0.36 (0.09)***			

[a] Intercept Mean Estimate; Slope Mean fixed @ 1.

* $p < .05$,

** $p < .01$,

*** $p < .001$.

Table 3

Effect of Selected Covariates on Estimated Coupling Parameters for Drinking Behavior (a) Predicting Change in the Number of Sex Partners (s): Estimated Coefficient Values (Standard Errors)

		Covariate						
Coupling	**No Covariate**	**Gender[a]**	**Divorce[b]**	**Impulsive**	**Excitement Seeking**	**Hostility**	**Conduct Disorder**	**Conventional Attitudes**
$\gamma_{\Delta s2,a1}$	**0.47 (0.11)**	**0.46 (0.11)**	**0.48 (0.11)**	**0.53 (0.12)**	**0.54 (0.12)**	**0.61 (0.14)**	**0.46 (0.12)**	**0.51 (0.12)**
$\gamma_{\Delta s4,a2}$	**0.32 (0.11)**	**0.33 (0.11)**	**0.30 (0.11)**	**0.29 (0.12)**	**0.26 (0.12)**	**0.29 (0.12)**	**0.31 (0.11)**	**0.28 (0.11)**
$\gamma_{\Delta s5,a4}$	**0.37 (0.08)**	**0.36 (0.08)**	**0.38 (0.08)**	**0.33 (0.09)**	**0.34 (0.09)**	**0.34 (0.08)**	**0.35 (0.08)**	**0.37 (0.08)**
$\gamma_{\Delta s7,a5}$	**0.28 (0.08)**	**0.29 (0.08)**	**0.27 (0.08)**	**0.21 (0.09)**	**0.24 (0.10)**	**0.33 (0.08)**	**0.26 (0.08)**	**0.27 (0.08)**
$\gamma_{\Delta s9,a7}$	0.16 (0.09)	**0.19 (0.09)**	0.15 (0.09)	0.12 (0.12)	0.14 (0.13)	**0.18 (0.09)**	0.16 (0.09)	0.13 (0.10)
$\gamma_{\Delta s11,a9}$	−0.03 (0.10)	−0.05 (0.10)	−0.04 (0.10)	0.03 (0.08)	0.02 (0.08)	−0.01 (0.11)	−0.04 (0.11)	−0.03 (0.11)
$\gamma_{\Delta s13,a11}$	−0.02 (0.12)	−0.01 (0.12)	−0.02 (0.12)	0.07 (0.08)	0.05 (0.08)	−0.02 (0.11)	0.00 (0.12)	0.00 (0.11)
					Fit Statistics			
Chi-Square	103.92	103.10	106.42	98.21	104.13	102.74	108.57	102.35
df	82	82	82	82	82	82	82	82
P	0.05	0.06	0.04	0.11	0.05	0.06	0.03	0.06
CFI	0.990	0.991	0.989	0.993	0.991	0.991	0.989	0.991
TLI	0.986	0.985	0.983	0.988	0.985	0.986	0.981	0.985
RMSEA	0.022	0.022	0.023	0.019	0.022	0.021	0.024	0.021

Note. Bold estimated coefficient values statistically significant at $p < .05$, two-tailed test.

[a] Gender (0=female, 1=male).

[b] Divorce (0=two-parent families; IYFP, 1=single-parent, mother-headed households; ISPP).

Table 4

Effect of Selected Covariates on Change Scores for the Number of Sex Partners and Drinking Behavior at Each Time of Measurement: Estimated Coefficient Values (Standard Errors)

Number of Sex Partners

	Intercept							
	Age 15	**Age 16**	**Age 18**	**Age 19**	**Age 21**	**Age 24**	**Age 26**	**Age 28**
Gender[a]	−0.03 (0.05)	−0.09 (0.07)	0.06 (0.10)	0.17 (0.11)	0.03 (0.12)	0.11 (0.11)	**0.33 (0.10)**	**0.28 (0.13)**
Divorce[b]	**0.19 (0.07)**	0.06 (0.09)	0.19 (0.13)	−0.13 (0.15)	0.00 (0.15)	−0.02 (0.13)	0.10 (0.12)	0.25 (0.13)
Impulsiveness	0.09 (0.23)	−0.05 (0.04)	0.11 (0.08)	0.16 (0.09)	**0.27 (0.10)**	**0.36 (0.14)**	**0.38 (0.09)**	**0.32 (0.09)**
Excitement Seeking	**0.15 (0.06)**	−0.03 (0.03)	**0.20 (0.06)**	**0.23 (0.07)**	**0.32 (0.11)**	**0.45 (0.14)**	**0.38 (0.08)**	**0.38 (0.07)**
Hostility	**0.21 (0.03)**	**0.14 (0.06)**	**0.15 (0.06)**	**0.18 (0.07)**	0.01 (0.08)	**0.18 (0.07)**	**0.25 (0.07)**	**0.29 (0.09)**
Conduct Disorder	**0.14 (0.06)**	0.10 (0.08)	0.11 (0.11)	0.15 (0.13)	0.17 (0.13)	0.01 (0.11)	0.02 (0.11)	**0.26 (0.12)**
Conventional Attitudes	0.10 (0.06)	−0.06 (0.07)	−0.05 (0.09)	−0.19 (0.11)	**−0.26 (0.12)**	**−0.26 (0.12)**	−0.08 (0.12)	−0.05 (0.11)

Drinking Behavior

	Intercept							
	Age 15	**Age 16**	**Age 18**	**Age 19**	**Age 21**	**Age 24**	**Age 26**	**Age 28**
Gender[a]	−0.07 (0.06)	−0.02 (0.06)	**0.19 (0.07)**	**0.24 (0.07)**	**0.33 (0.07)**	**0.39 (0.11)**	**0.17 (0.08)**	**0.17 (0.08)**
Divorce[b]	**0.21 (0.08)**	0.15 (0.08)	0.16 (0.09)	−0.17 (0.10)	0.01 (0.08)	0.07 (0.09)	0.09 (0.08)	0.07 (0.08)
Impulsiveness	**0.32 (0.07)**	−0.02 (0.06)	−0.02 (0.06)	0.08 (0.07)	0.13 (0.09)	**0.24 (0.10)**	0.06 (0.05)	0.08 (0.04)
Excitement Seeking	**0.41 (0.05)**	0.05 (0.04)	**0.10 (0.04)**	**0.20 (0.05)**	**0.28 (0.08)**	0.57 (1.01)	0.10 (0.06)	0.07 (0.05)
Hostility	**0.37 (0.04)**	−0.02 (0.06)	**0.11 (0.05)**	**0.13 (0.05)**	**0.19 (0.04)**	**0.14 (0.07)**	0.07 (0.05)	**0.10 (0.04)**
Conduct Disorder	**0.23 (0.07)**	−0.05 (0.07)	**0.16 (0.08)**	0.03 (0.08)	0.01 (0.08)	−0.08 (0.09)	−0.03 (0.07)	**0.22 (0.07)**
Conventional Attitudes	0.07 (0.07)	0.01 (0.06)	−0.06 (0.07)	−0.04 (0.08)	−0.07 (0.08)	0.01 (0.09)	0.00 (0.06)	0.00 (0.06)

Note. Bold estimated coefficient values statistically significant, $p < .05$, two-tailed test.

[a] Gender (0=female, 1=male).

[b] Divorce (0=two-parent families; IYFP, 1=single-parent, mother-headed households; ISPP).