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Predicting Alcohol Use Across Adolescence: Relative Strength of Individual, Family, Peer, and Contextual Risk and Protective Factors

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The current study examined developmental changes in the relative influence of risk and protective factors (RPFs) across individual, family, peer, school, and community domains on adolescent alcohol use. Using longitudinal data from two independent samples, multivariate cross-lagged models were used to estimate the unique influence of each RPF on subsequent changes in recent alcohol use between early to late adolescence. The results supported the hypothesis that the influence of Individual Risk would increase during this developmental period. However, less consistent evidence was found concerning developmental changes among the other domains. Whereas the influence arising from Family Protection diminished during adolescence, the influence of Family Risk, School Protection, and Community Protection did not vary. The influence of Peer Risk showed a nonlinear pattern across adolescence, peaking during the middle adolescent years. The results of this study support a developmental approach to adolescent alcohol use and emphasize the need for prevention strategies that account for these developmental changes.

Keywords: risk and protective factors, developmental, adolescence, alcohol use, longitudinal

Alcohol is the most commonly used substance among U.S. youth, with 71% of high school seniors reporting that they have tried alcohol at least once in their lives and more than 40% of seniors reporting alcohol use in the previous month (Johnston, O'Malley, Bachman, & Schulenberg, 2011). These rates represent the culmination of a rapid escalation in use that typically begins in early adolescence, when the initiation of alcohol use often begins. For example, data from the 2009 National Survey on Drug Use and Health indicate that while only 3.5% of young people between ages 12 and 13 reported current alcohol use, that figure increased to 13% of 14- or 15-year-olds, 26.3% of 16- or 17-year-olds, and 49.7% of 18- to 20-year-olds (Substance Abuse & Mental Health Services Administration, 2010). Adolescents who use alcohol are at heightened risk for experiencing a host of negative health and social consequences, including physical and sexual assault, academic problems, and motor vehicle accidents (Hingson, Zha, & Weitzman, 2009.). It is thus clear that underage drinking remains a significant public health concern and warrants continued investigation.

Successful efforts to reduce adolescent alcohol use and related consequences identify and target malleable risk and protective factors (RPFs) to which adolescents are exposed (O'Connell, Thomas, & Kenneth, 2009). For example, one of the most widely used prevention programs in the U.S. is the Communities That Care (CTC) system in which healthy youth development is promoted through identification of elevated risk factors (and diminished protective factors) across several domains (individual, family, peers, community) that provide the basis for community-based prevention policies. The core principles of the CTC model have been incorporated into U.S. federal initiatives for the prevention of substance use and other problem behaviors and both efficacy trials and quasi-experimental effectiveness studies have shown CTC to reduce substance use rates among youth (Feinberg, Greenberg, Osgood, Sartorius, & Bontempo, 2007; Feinberg, Jones, Greenberg, Osgood, & Bontempo, 2010; Hawkins et al., 2008).

Several assumptions are implicit in the community-based approach of CTC that serve a simplifying function in the translation of science to practice (Feinberg, 2010). We have previously examined two of these assumptions. One study (Jones, Feinberg, Cleveland, & Rhoades, in press) examined whether individual RPFs have equivalent influences on alcohol use; we found that antisocial peer associations and individual antisocial attitudes had larger influence relative to other RPFs (family, school, and community). These findings were consistent with other research indicating the primary importance of these two domains (e.g., Allen, Donohue, Griffin, Ryan, & Mitchell Turner, 2003; Cleveland, Feinberg, Bontempo, & Greenberg, 2008; Cooper et al., 2003). In a second empirical article, we examined the assumption that RPFs are consistently associated with underage drinking across communities (Feinberg, Cleveland, Jones, & Greenberg, 2011). Results indicated that RPFs are not equally influential across communities; community-level variation was greatest for the associations be-

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tween underage drinking and antisocial peer risk and community protection.

The current article focuses on a third assumption common in community-based prevention: Each RPF is equally related to substance use outcomes across developmental periods. Thus, for example, the association between deviant peer associations and adolescent alcohol use is assumed to be equally strong in both early and late adolescence. Given the age-patterned nature of alcohol onset and use, and the developmental changes in adolescent relations with family and friends (Osgood, Wilson, O'Malley, Bachman, & Johnston, 1996), such an assumption is questionable. In fact, a developmental perspective that explicitly acknowledges these patterns has been advocated by the National Institute on Alcohol Abuse and Alcoholism (NIAAA) Underage Drinking Research Initiative (Masten, Faden, Zucker, & Spear, 2008).

The Social Development Model

The CTC system is guided theoretically by the Social Development Model (SDM; Catalano & Hawkins, 1996), which postulates that children and adolescents learn behavior from four socializing units: family, school, religious and community institutions, and peers. The SDM proposes that the development of social bonds between an adolescent and socializing agents in each of the four contextual domains depends on the perceived opportunities and rewards for involvement in either prosocial or antisocial activities. Thus, youth who perceive positive reinforcement from prosocial activities will be more likely to engage in prosocial activities. In contrast, youth who perceive positive reinforcement from antisocial activities are more likely to develop antisocial behavior. The model also proposes that other constraining or enabling influences on adolescent risk behavior include family socialization processes (e.g., parental monitoring of their children's behavior), peer attitudes toward ATOD use, and community norms about alcohol use. Research with the SDM has provided evidence that individual factors, such as emotion regulation skills, indirectly influence antisocial behavior by increasing the likelihood of forming prosocial bonds and diminishing the development of antisocial bonds (Brown et al., 2005; Catalano, Oxford, Harachi, Abbott, & Haggerty, 1999).

A key feature of the SDM is the incorporation of a developmental perspective of adolescent behavior. Specifically, the model identifies four age-specific submodels (preschool, elementary, middle, and high school) that are defined by changes in social environments and that correspond with developmentally specific behavioral outcomes. The SDM also proposes that the salience of socializing agents within the contextual domains (i.e., family, peers, school, and community) may change as children progress through different developmental periods (Catalano, Kosterman, Hawkins, Newcomb, & Abbott, 1996). For example, while families are the primary socialization unit during childhood and early adolescence (Catalano & Hawkins, 1996), the influence of peers increases as youth spend more time outside the family during middle and late adolescence (Furman & Buhrmester, 1992). Moreover, the developmental perspective offered by the SDM includes recognition that mutual causal influences exist among antisocial behaviors and RPFs, thereby suggesting that life events and changing social contexts can modify the course of antisocial behavior over time (Catalano et al., 1996).

Developmental Changes in RPFs

Despite the explicit recognition of developmental differences in the SDM, few studies have used the model to investigate relative changes in the importance of RPFs on risk behaviors across developmental periods. Two of these studies provided cross-sectional evidence that family factors, such as parental monitoring, were more influential among younger adolescents (Cleveland et al., 2008; Fagan, Van Horn, Antaramian, & Hawkins, 2011). Cross-sectional studies have also suggested that individual, peer, and school factors are more salient among older adolescents compared to younger cohorts (Cleveland et al., 2008; Harris Abadi, Shamblen, Thompson, Collins, & Johnson, 2011).

Longitudinal studies based on the SDM have arrived at similar conclusions. For example, Fleming, Catalano, Haggerty, and Abbott (2010) modeled growth in RPFs during two developmental periods (Grades 5–8 and Grades 9–12) to predict substance misuse at age 19. These authors found that family protective behaviors (e.g., monitoring, use of appropriate discipline, and family bonding) and positive school bonding during both periods were related to late adolescent substance misuse, whereas significant effects for antisocial peers were found only during the high school period. Similarly, Guo, Hill, Hawkins, Catalano, and Abbott (2002) used survival analysis to examine the effects of RPFs on initiation of illicit drug use between ages 12 and 21. Guo and colleagues found that certain family factors, such as parental monitoring, consistent discipline, and involvement were consistent predictors of illicit drug use across adolescence whereas the effects of family bonding were strongest before age 18. These authors also found that the effect of peer antisocial activity on drug use initiation was strongest at older ages (i.e., 16 to 21 years).

Past research with the SDM also indicates that factors within the community domain are more important at earlier ages, relative to late adolescence (e.g., Cleveland et al., 2008; Harris Abadi et al., 2011). These findings are consistent with the few other studies in the general literature that have examined age differences of community-level factors (Allen et al., 2003; Donovan, 2004; Ferguson & Meehan, 2011).

Thus, both cross-sectional and longitudinal studies guided by the SDM have found that the salience of RPFs varies according to age. In particular, there seems to be consistent evidence across SDM studies that the influence of individual traits on adolescent behaviors increases across adolescence, the relative influence of RPFs in the family domain diminishes with increasing age, and that the influence of peer and school domains increase.

However, several limitations of the studies cited above preclude firm conclusions about developmental differences in RPFs on adolescent alcohol use. First, the studies conducted by Cleveland et al., (2008) and Harris Abadi et al., (2011) utilized cross-sectional data that divided the samples into rough 2-year divisions. Although both Guo et al. (2002) and Fleming et al. (2010) provided longitudinal assessments of RPFs and alcohol use, both of these studies relied on separate analyses for each RPF rather than multivariate methods that controlled for possible associations or reciprocal effects among RPFs (e.g., parental management practices and deviant peer processes; Dishion, Nelson, & Bullock, 2004). Because adolescent development occurs in an ecological context with multiple interacting systems (Masten et al., 2008), longitudinal research that considers the influence of all RPF domains together in a multivariate model is needed to more fully understand the relative importance of each RPF on adolescent alcohol use across development (Donovan, 2004).

The Current Study

The current study draws on the SDM to examine associations among RPFs within several domains and subsequent-year alcohol use across early- to late-adolescence in two independent samples. Although each sample included data that were collected annually across five years, the two samples differed in terms of beginning and ending grades. However, common measures were available across Grades 7 to 10 (see Figure 1). For each sample, we examined the reciprocal relations among the RPFs and alcohol use within a multivariate cross-lagged model. This allowed us to evaluate the unique contribution of each RPF to alcohol use in the following year, over and above the stability in the alcohol use over time and the influence of each of the other RPFs. Based on previous research with the SDM, we tested three hypotheses:

Hypothesis 1. The influence of the individual domain on adolescent alcohol use will increase linearly from early- to late-adolescence.

Hypothesis 2. The influence of the family and community domains on adolescent alcohol use will decrease linearly from early- to late-adolescence.

Hypothesis 3. The influence of the peer and school domains will increase linearly across early- to late-adolescence.

Method

Samples

We used data from two longitudinal, school-based, randomized prevention trials to examine the study aims. Only the control group samples were used from both datasets so that we could examine risk factor-to-alcohol use associations outside of the influence of possible intervention effects from these projects.

Promoting School-University-Community Partnerships to Enhance Resilience (PROSPER) is a community-randomized trial of a dissemination system for evidence-based substance use prevention programs (Spoth et al., 2007). PROSPER follows two successive cohorts of sixth grade students living in 28 rural communities in Iowa and Pennsylvania (total sample = 17,425 students; control only sample = 8,744). Each community had a single public school district with 1,300 to 5,200 enrolled students. The average population in these communities was 19,000 residents and the median household income was $37,000. Students completed questionnaires administered in school during class sessions by trained university-based data collectors. Confidentiality of responses was assured and students were informed that parents or school administrators would not see the information that they provided.

The current study focused on the first 5 years of PROSPER, with Wave 1 occurring in the spring of the sixth grade (average age = 12.3 years) and annual assessments occurring thereafter.[1] A total of 7,819 students (51% female) provided data for at least one of the five waves and were included in the current analyses. At baseline, 85% of the students were White, 5% were Latino/Hispanic, and 3% were Black. A recent evaluation of the PROSPER study (Spoth et al., 2011) found no differential attrition across experimental conditions for a range of substance use outcomes at the tenth grade follow-up, including lifetime, past month, and past-year use of alcohol. However, analyses of the control condition subsample revealed that students who were not present at the tenth grade follow-up were more likely to have used alcohol in the past month at Wave 1, $t = -3.54$, $p < .001$.

The Adolescent Substance Abuse Prevention Study (ASAPS) is a clustered randomized controlled field trial designed to evaluate the effectiveness of a school-based substance abuse prevention program targeting seventh and ninth grade students (Sloboda et al., 2009). Data were collected from 19,200 students (control = 8,051 students) in 83 public school districts in several U.S. regions: Detroit, Houston, Los Angeles, Newark, New Orleans, and St. Louis, where 41 of the high school and middle school clusters were randomly assigned to the treatment condition and 42 clusters to the control condition. A total of 8,051 students (56% females) were included in the control condition, of which nearly 40% were White, 15% were Black, 18% were Latino/Hispanic, 5% were Asian, and 8% described themselves as American Indian. Data were collected using self-administered surveys completed by study participants. Over the 5-year study period, seven survey waves were conducted. As described in Sloboda et al. (2009), students who were not present at the final wave (eleventh grade) were more likely to be older at baseline, female, nonwhite, substance users, and from Los Angeles and Detroit. Differential attrition was also noted such that those coded as "other race" were more likely to be in the control condition than the treatment condition. The current study utilized data collected in the spring semester of each year between Grade 7 and Grade 11. The average age of the students at Wave 1 was 12.5 years.

Measures

Recent alcohol use was measured with a single item that asked youth to indicate the number of occasions that they drank alcohol in the past 30 days. Students in the PROSPER study responded to the question, "During the past month, how many times have you had beer, wine, wine coolers, or other liquor?" on a 5-point scale (1 = *not at all*, 5 = *more than once per week*). For ASAPS, students responded to the question, "How many times (if any) have you had alcoholic beverages to drink (more than a few sips) during the last 30 days?" on a 7-point scale (1 = *zero times*, 7 = *40 or more times*).

Based on previous research (Feinberg, Ridenour, & Greenberg, 2007; Jones et al., in press), we aggregated RPF scales into six domain indices that corresponded to hypothesized factors in the SDM: Individual Risk, Family Protection, Family Risk, Peer Risk, School Protection, and Community Protection. Comparable measures for Family Risk and Community Risk were not available for the PROSPER sample. Several steps were followed in each dataset to create the aggregate RPF scale. Individual items were first

[1] A pretest in the fall of sixth grade was also available but not included in the current study in order to provide annual measurement periods consistent across both samples.

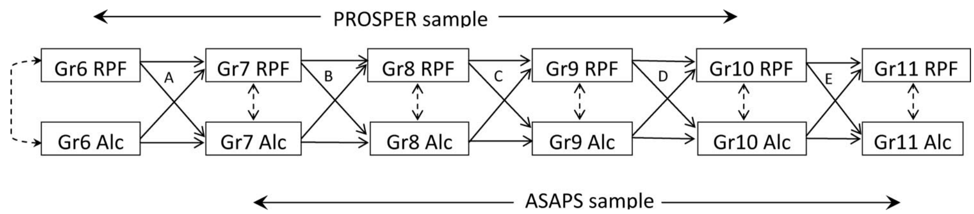

Figure 1. Conceptual model of cross-lagged associations. Gr = Grade; RPF = Risk and Protective Factors.

standardized (M = 0, standard deviation = 1) and then combined into a scale index (e.g., "sensation seeking") by computing the summed average of the individual items. Next, these scale indices were also standardized and combined into the aggregate RPF scales (e.g., Individual Risk) by computing another summed average score. Reliability coefficients (alpha) for specific scales are provided below based on the Wave 1 samples in each dataset. Specific details regarding domain aggregate scales as well as response scales and anchors for each item are available from the first author.

RPF Measurement in the PROSPER Sample

Individual Risk was measured by two scale indices: positive attitudes toward alcohol and tobacco use (three items, e.g., "How wrong do you think it is for someone your age to drink beer, wine, or liquor?" α = .90) and sensation seeking (six items, e.g., "How often do you do what feels good, regardless of the circumstances?" α = .67).

Family Protection was measured by four indices. Family attachment included four items (e.g., "During the last year, how often did your mother let you know she really cares for you?" α = .88), family opportunities for prosocial involvement comprised six items (e.g., "During the last year, how often did you do things with your mom or dad, like work on homework together?," α = .87), family supervision included five items (e.g., "During the day, my parents know where I am" α = .77), and parents' use of inconsistent discipline (five items, "When my parents discipline me, discipline depends on their mood" -reverse scored; α = .76).

Peer Risk was assessed with two scale indices: friends' delinquent behavior (three items, α = .80, e.g., "Your closest friends sometimes break the law") and peer rewards for antisocial behavior (11 items, α = .94 e.g., "Kids who drink alcohol have more friends").

The *School Protection* domain included school commitment (five items, "Grades are very important to me" α = .72) and school rewards for prosocial involvement (two items, "I feel very close to at least one of my teachers" r = .38).

RPF Measurement in the ASAPS Sample

Individual Risk was measured by two scale indices in the ASAPS sample. Perceived risks of ATOD use included three items (e.g., "How much does drinking alcohol to get drunk once a week affect how the brain works?" α = .73). Positive attitudes toward ATOD use included six items, (e.g., "I think it is okay for students my age to drink alcohol almost every weekend" α = .91).

Family Protection was measured by a single item that corresponded to family opportunities for prosocial involvement: "If you were having problems in your life, would you talk them over with either of your parents?"

Family risk included a single item that measured parental attitudes favorable to ATOD use: "When it comes to drinking alcohol (more than a few sips) even once or twice, over the next 30 days, would your parents be upset?"

Peer Risk was assessed using three scale indices: friends' delinquent behavior (single item, "How many of your closest friends have dropped out of school or just stopped coming to classes?"), peer substance use (three items, α = .82, e.g., "In the past 12 months, how many of your friends have drank alcohol almost every weekend?"), and peer rewards for antisocial behavior (six items, α = .89, e.g., "Most students my age think it is okay to drink alcohol almost every weekend").

The *School Protection* domain included school commitment (three items, "In the last 12 months, I enjoyed being in school" α = .69), school opportunities for prosocial involvement (two items, "I do things in school that make a difference" r = .37), school rewards for prosocial involvement (four items, "At my school there is a teacher or adult who really cares about me" α = .86).

Community Protection was measured by community rewards for prosocial involvement (single item, "Other than your parents, is there at least one other adult you could talk to if you are having problems in your life?"), community opportunities for prosocial involvement (two items, e.g., "In the last 12 months, I participated in group activities outside of school," r = .38), and perceived availability of drugs and firearms (three items, e.g., "How hard do you think it would be for you to get alcohol if you wanted some?" α = .80).

Statistical Analysis

We used the Mplus statistical software package (Muthén & Muthén, 1998-2010) to estimate two cross-lag models, each using five waves of data (Grades 6–10 for PROSPER, Grades 7–11 for ASAPS; see Figure 1). To acknowledge correlation in error structures among students within the same schools, we specified Wave 1 school membership as a clustering variable in the models. Thus, robust maximum likelihood estimation (MLR) was used to obtain corrected standard errors that accounted for the nested data structure as well as the non-normal distributions of the alcohol use outcomes. Mplus utilizes full information maximum likelihood estimation under the assumption of data missing at random (MAR); thus, all cases were included in the analysis models.

For the PROSPER sample, the multivariate cross-lag model included four RPFs: Individual Risk, Family Protection, Peer Risk, and School Protection. As noted above, two additional

RPFs were available for the ASAPS sample: Family Risk and Community Protection. Both models included 1-year cross-lag associations between each RPF and alcohol use as well as among all of the RPFs. That is, paths were estimated from each RPF and alcohol use at one year to the subsequent year's measure of alcohol use and each of the other RPFs. One-year lagged stability paths were estimated for all variables. In addition, associations among all endogenous variables were estimated by allowing residuals between concurrent measures of the RPFs and alcohol use to covary.

Wald tests were used to examine differences in corresponding cross-lag paths across grade levels by constraining paths to be equal across two or more grade transitions. The Wald test examines the null hypothesis that a set of parameters is equal to a certain value and has the advantage that it requires estimating only one model rather than two nested comparison models, as required by the Likelihood Ratio test (Engle, 1984). A significant Wald test indicates that constraining paths to be equal results in a significantly worse fitting model. We first compared the freely estimated model with the fit of a model with cross-lag paths across all waves constrained as equal. Next, we examined whether the following sets of paths were statistically equivalent (the RPF for these paths is always at the prior time point, predicting alcohol use at the next time point): (a) Wave 1 → 2 versus Wave 2 → 3; (b) Wave 1 → 2 versus Wave 3 → 4; (c) Wave 1 → 2 versus Wave 4 → 5; (d) Wave 3 → 4 versus Wave 4 → 5.

Results

Descriptive Statistics

Tables 1 and 2 provide summary statistics for the study variables among the two samples, including the means and standard deviations of the variables as well as bivariate correlations between the RPFs and alcohol use at each grade. All correlations were significant ($p < .001$) and the results indicated that the strongest correlations were found between concurrent measures of the RPFs and alcohol use (highlighted in italics). Rates of alcohol use were similar across the two samples. The proportion of students in the PROSPER sample who reported alcohol use in the past month increased from 11% in sixth grade to 40% in tenth grade. For ASAPS, the proportion of students reporting past 30-day use increased from 15% in seventh grade to 45% in eleventh grade. There was considerable stability in alcohol use among both samples, with bivariate correlations between 1-year lagged measures of alcohol use ranging from 0.35 to 0.51 in the PROSPER sample and 0.36 to 0.47 in the ASAPS sample. In both cases, the magnitude of these correlations increased across the grade levels, with greater stability at the higher grades.

Table 1
Descriptive Statistics for the PROSPER Sample

					Correlation with alcohol use by grade						
					Range *N*						
RPF	Grade	*N*	Mean	*SD*	Min	Max	6	7	8	9	10
Individual	6	5287	−0.01	0.82	3471	5271	*0.33*	0.28	0.24	0.20	0.15
	7	5588	0.03	0.87	3879	5572	0.24	*0.46*	0.35	0.30	0.22
	8	5577	0.02	0.85	4048	5534	0.23	0.37	*0.50*	0.39	0.34
	9	5629	0.02	0.85	3954	5603	0.19	0.27	0.38	*0.49*	0.39
	10	5073	0.03	0.85	3472	5060	0.15	0.23	0.32	0.38	*0.49*
Family prot	6	5250	0.00	0.71	3451	5233	*−0.21*	−0.22	−0.17	−0.17	−0.10
	7	5548	−0.03	0.72	3858	5532	−0.17	*−0.29*	−0.23	−0.21	−0.16
	8	5544	−0.03	0.72	4029	5503	−0.13	−0.19	*−0.27*	−0.25	−0.20
	9	5711	−0.03	0.72	3957	5559	−0.11	−0.16	−0.20	*−0.27*	−0.21
	10	4990	−0.02	0.69	3425	4979	−0.05	−0.09	−0.15	−0.19	*−0.25*
Peer	6	5283	−0.01	0.82	3468	5266	*0.34*	0.28	0.26	0.22	0.18
	7	5592	0.04	0.89	3879	5570	0.26	*0.47*	0.37	0.33	0.23
	8	5582	0.04	0.88	4051	5536	0.21	0.35	*0.49*	0.36	0.30
	9	5635	0.04	0.88	3959	5602	0.17	0.28	0.35	*0.48*	0.38
	10	5072	0.05	0.90	3470	5056	0.15	0.21	0.29	0.37	*0.52*
School	6	5276	0.02	0.87	3463	5260	*−0.23*	−0.22	−0.18	−0.19	−0.15
	7	5577	−0.02	0.88	3873	5563	−0.16	*−0.29*	−0.22	−0.22	−0.17
	8	5559	−0.02	0.88	4038	5523	−0.11	−0.21	*−0.28*	−0.23	−0.24
	9	5616	−0.03	0.87	3945	5593	−0.11	−0.14	−0.20	*−0.27*	−0.24
	10	5057	−0.03	0.88	3461	5044	−0.08	−0.10	−0.14	−0.19	*−0.27*
Alcohol use	6	5272	1.16 (11)	0.52	3466	5272	—				
	7	5578	1.28 (18)	0.70	3875	5578	0.35	—			
	8	5539	1.46 (27)	0.87	4022	5539	0.25	0.45	—		
	9	5605	1.68 (36)	1.05	3937	5605	0.21	0.37	0.47	—	
	10	5067	1.81 (40)	1.18	3466	5067	0.16	0.25	0.37	0.51	—

Note. N = number of participants present at the wave. SD = standard deviation. Correlation with Alcohol use refers to pairwise Pearson correlation between the RPF and alcohol use at each grade level. Range N includes minimum and maximum number of cases included in pairwise correlations. Prot = Protection. Correlations between concurrent measures of the RPF and alcohol use are highlighted in italics. For Alcohol use, values in parentheses refer to the percent of students who endorsed any alcohol use in the past 30 days. All correlations are significant at $p < .001$ level.

Table 2
Descriptive Statistics for the ASAP Sample

							Correlation with alcohol use by grade				
					Range *N*						
RPF	Grade	*N*	Mean	*SD*	Min	Max	7	8	9	10	11
Individual	7	7112	−0.03	0.78	4175	6836	*0.42*	0.28	0.22	0.21	0.22
	8	6695	−0.03	0.82	4252	6590	0.29	*0.51*	0.36	0.29	0.27
	9	5372	0.01	0.83	4177	5305	0.22	0.32	*0.48*	0.34	0.31
	10	5162	−0.02	0.82	4357	5079	0.22	0.30	0.39	*0.48*	0.38
	11	4666	−0.01	0.82	4123	4595	0.16	0.24	0.30	0.36	*0.48*
Family prot	7	6927	0.00	0.99	4090	6670	*−0.26*	−0.24	−0.18	−0.17	−0.17
	8	6564	0.02	0.98	4189	6465	−0.16	*−0.28*	−0.24	−0.17	−0.15
	9	5300	0.00	0.99	4132	5263	−0.12	−0.17	*−0.27*	−0.15	−0.15
	10	5039	0.00	0.98	4265	4959	−0.08	−0.13	−0.15	*−0.17*	−0.13
	11	4559	0.01	0.99	4034	4499	−0.03	−0.09	−0.12	−0.12	*−0.17*
Family risk	7	6839	−0.03	0.97	4062	6604	*0.24*	0.17	0.14	0.14	0.12
	8	6440	−0.06	0.95	4131	6351	0.20	*0.25*	0.19	0.14	0.12
	9	5099	−0.02	0.98	3992	5058	0.13	0.18	*0.25*	0.20	0.18
	10	5070	−0.05	0.97	4289	4998	0.12	0.16	0.19	*0.25*	0.20
	11	4595	−0.05	0.97	4065	4530	0.12	0.12	0.17	0.20	*0.23*
Peer	7	7108	0.02	1.02	4174	6819	*0.30*	0.22	0.15	0.12	0.11
	8	6714	−0.02	0.77	4262	6595	0.30	*0.53*	0.31	0.25	0.23
	9	5386	0.02	0.80	4186	5314	0.21	0.30	*0.48*	0.34	0.29
	10	5172	−0.01	0.77	4365	5084	0.17	0.26	0.33	*0.45*	0.29
	11	4670	0.00	0.76	4126	4596	0.14	0.22	0.28	0.33	*0.45*
School	7	6807	0.03	0.97	3953	6037	*−0.18*	−0.18	−0.18	−0.17	−0.15
	8	6715	0.04	0.78	4261	6596	−0.16	*−0.27*	−0.23	−0.20	−0.17
	9	5375	0.00	0.81	4180	5311	−0.11	−0.16	*−0.22*	−0.19	−0.15
	10	5173	0.02	0.78	4365	5084	−0.08	−0.13	−0.15	*−0.20*	−0.18
	11	4669	0.02	0.78	4125	4594	−0.07	−0.11	−0.14	−0.15	*−0.17*
Community	7	7095	0.00	0.66	4178	6825	*−0.21*	−0.20	−0.15	−0.13	−0.13
	8	6713	0.03	0.66	4262	6596	−0.21	*−0.33*	−0.27	−0.21	−0.18
	9	5372	0.00	0.67	4177	5317	−0.13	−0.19	*−0.28*	−0.19	−0.17
	10	5168	0.00	0.65	4360	5084	−0.14	−0.18	−0.21	*−0.24*	−0.20
	11	4670	0.01	0.65	4126	4599	−0.08	−0.14	−0.18	−0.20	*−0.25*
Alcohol use	7	6841	1.28 (15)	0.88	4072	6841	—				
	8	6597	1.50 (25)	1.13	4212	6597	0.36	—			
	9	5318	1.94 (41)	1.53	4143	5318	0.25	0.40	—		
	10	5086	1.83 (41)	1.35	4301	5086	0.21	0.31	0.45	—	
	11	4599	1.95 (45)	1.42	4072	4599	0.22	0.30	0.37	0.47	—

Note. N = number of participants present at the wave. *SD* = standard deviation. Correlation with Alcohol use refers to pairwise Pearson correlation between the RPF and alcohol use at each grade level. Range N includes minimum and maximum number of cases included in pairwise correlations. Prot = Protection. Concurrent values in italics. For Alcohol use, values in parentheses refer to the percent of students who endorsed any alcohol use in the past 30 days. All correlations are significant at $p < .001$ level.

Multivariate Cross-Lagged Models

Multivariate cross-lagged models were estimated separately for each of the two samples. The fit of the models was very good as indicated by several indices of fit. For the PROSPER model (χ^2 (150) = 1558.16, $p < .001$), the Comparative Fit Index (CFI) and Tucker Lewis Index (TLI) were both greater than 0.90 (CFI = 0.97, TLI = 0.94) and the root mean square error of approximation (RMSEA) was equal to 0.035 (90% confidence interval = 0.033 to 0.036). For ASAPS (χ^2 (294) = 2716.28, $p < .001$), CFI = 0.95, TLI = 0.90, and RMSEA = 0.032 (90% confidence interval = 0.031 to 0.033).

Selected coefficients for the multivariate cross-lag models are presented in Table 3. For each sample, unstandardized coefficients of the path between each RPF and subsequent-year alcohol use are displayed in the top row and completely standardized coefficients are included in the row below. Path coefficients for the PROSPER sample indicate that all of the RPFs were significant predictors of alcohol use across the first two waves (Grade 6 → Grade 7). Cross-lag paths involving Individual Risk and Peer Risk remained significant at all subsequent waves. In contrast, Family Protection was a significant predictor of change in alcohol use only in the earliest grades (i.e., from Grade 6 to Grade 7) and School Protection had significant effects on change in alcohol use only among the earliest and latest waves.

The results of the multivariate cross-lag model for the ASAPS sample are also provided in Table 3. All of the RPFs were found to significantly predict change in alcohol use across the first two waves (Grade 7 → Grade 8) and several remained significant at all subsequent waves (Individual Risk, Family Risk, Peer Risk, and Community Protection). Family Protection exhibited a positive relation with alcohol use between Grades 9 and 10 and was not a significant predictor of subsequent-year alcohol use between

Table 3
Unstandardized and Completely Standardized Path Coefficients for RPF → Alcohol Use in PROSPER and ASAPS Samples

		RPF → Alcohol use path (Grade)				
		A	B	C	D	E
RPF Domain	Sample	6 → 7	7 → 8	8 → 9	9 → 10	10 → 11
Individual risk	PROSPER	0.09^{***} (0.11)^{a}	0.10^{***}(0.10)	0.17^{***} (0.14)^{a}	0.15^{***} (0.11)	—
	ASAPS	—	0.12^{***} (0.08)^{a,b}	0.24^{***} (0.13)^{a}	0.16^{***} (0.10)^{c}	0.29^{***} (0.17)^{b,c}
Family protection	PROSPER	-0.05^{***} (-0.05)^{a}	-0.02 (-0.02)	-0.05 (-0.03)	0.05 (0.03)^{a}	—
	ASAPS	—	-0.10^{***} (-0.08)^{a,b}	-0.10^{**} (-0.06)	0.04^{*} (0.03)^{a}	-0.02 (-0.01)^{b}
Family risk	PROSPER	—	—	—	—	—
	ASAPS	—	0.05^{**} (0.04)	0.08^{**} (0.05)	0.05^{*} (0.04)	0.07^{**} (0.05)
Peer risk	PROSPER	0.09^{***} (0.10)^{a}	0.14^{***} (0.14)	0.07^{**} (0.06)^{b}	0.16^{***} (0.12)^{a,b}	—
	ASAPS	—	0.10^{***} (0.09)^{a}	0.12^{*} (0.06)	0.20^{***} (0.12)^{a,b}	0.08^{**} (0.04)^{b}
School protection	PROSPER	-0.04^{**} (-0.06)	-0.01 (-0.01)	-0.03 (-0.03)	-0.07^{***} (-0.05)	—
	ASAPS	—	-0.06^{***} (-0.05)	-0.04 (-0.02)	-0.06^{*} (-0.04)	0.02 (0.01)
Community protection	PROSPER	—	—	—	—	—
	ASAPS	—	-0.08^{***} (-0.05)	-0.13^{**}(-0.05)	-0.06^{*} (-0.03)	-0.09^{*} (-0.04)

Note. Path coefficients on top row refer to unstandardized solution; path coefficients on bottom row (in parentheses) refer to completely standardized solution; Coefficients with different superscripts refer to significant Wald Tests that constrain the coefficients to be equal.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Grades 10 and 11. The effects of School Protection on alcohol use were inconsistent across the waves.

Comparing RPF → Alcohol Use Paths Across Grades

Table 4 displays the results of Wald tests obtained within each sample by constraining paths to be equal across two or more grade transitions. For the PROSPER sample, the omnibus Wald tests that constrained all four paths to be equivalent were significant for three of the RPFs: Individual Risk, Family Protection, and Peer Risk. Additional Wald tests indicated that the path from Grade 6 Individual Risk → Grade 7 Alcohol Use was not equal to the path from Grade 8 Individual Risk → Grade 9 Alcohol Use (χ^2 (1) = 5.48, $p < .05$). Examination of the unstandardized paths coefficients in the freely estimated model suggests that the path from Grade 8 Individual Risk to Grade 9 Alcohol Use (b = 0.17, SE = 0.03, t = 6.25) was nearly twice that of the Grade 6 to Grade 7 path (b = 0.09, SE = 0.03, t = 3.52). Similarly, the Wald tests for Family Protection indicated that the association between Grades 6 and 7 was different than the association between Grades 9 and 10 (χ^2 (1) = 4.51, $p < .05$). Whereas the path from Grade 6 Family Protection to Grade 7 Alcohol Use was negative ($b = -0.05$, SE = 0.02, t = 3.20), the Grade 9 to Grade 10 path was positive, though not statistically different from zero (b = 0.05, SE = 0.03, t = 1.49). Two additional Wald tests were significant among the Peer Risk → Alcohol Use associations. These indicated that the association of Grade 9 Peer Risk to Grade 10 Alcohol Use (b = 0.16, SE = 0.03, t = 5.69) was greater than both the Grade 6 to Grade 7 association (b = 0.09, SE = 0.02, t = 5.46) and the Grade 8 to Grade 9 association (b = 0.07, SE = 0.02, t = 3.14).

Results of the omnibus Wald tests among the ASAPS sample also indicated that nonequivalent cross-lag associations were found among the Individual Risk, Family Protection, and Peer Risk domains. For Individual Risk, additional tests suggested that the strongest effects were found among associations between Grades 8 and 9 (b = 0.24, SE = 0.03, t = 7.85), and Grades 10 and 11 (b = 0.29, SE = 0.04, t = 8.10). For Family Protection, the Wald tests indicated that the association at the earliest grades (b =

Table 4
Results of Wald Tests Comparing Equality of Cross-Lagged Associations

	PROSPER Sample					ASAPS Sample				
	Wald test (df)					Wald test (df)				
RPF	A = B = C = D (3)	A = B (1)	A = C (1)	A = D (1)	C = D (1)	B = C = D = E (3)	B = C (1)	B = D (1)	B = E (1)	D = E (1)
Individual	11.69^{**}	0.04	5.48^{*}	1.73	0.36	21.82^{***}	12.20^{***}	0.94	17.01^{***}	6.96^{**}
Family Protection	14.47^{**}	1.02	0.00	8.46^{**}	3.43	28.76^{***}	0.00	24.10^{***}	4.92^{*}	2.54
Family Risk	—	—	—	—	—	0.82	0.74	0.01	0.30	0.15
Peers	8.65^{*}	3.22	0.18	4.51^{*}	4.34^{*}	8.57^{*}	0.30	6.38^{*}	0.21	7.70^{**}
School	4.58	1.61	0.25	0.83	2.15	2.23	0.34	0.00	1.55	1.35
Community	—	—	—	—	—	2.11	0.75	0.24	0.03	0.38

Note. Wald tests refer to tests of constraining indicated paths (see Figure 1) to be equal.
* $p < .05$. ** $p < .01$. *** $p < .001$.

−0.10, $SE = 0.02$, $t = 5.03$) was significantly different than those at the later waves, when the association with subsequent alcohol use was (unexpectedly) positive between Grades 9 and 10 ($b = 0.04$, $SE = 0.02$, $t = 2.05$) or nonsignificant between Grades 10 and 11 ($b = -0.02$, $SE = 0.03$, $t = 0.51$). The Wald tests also indicated that the cross-lag association between Peer Risk and alcohol use was strongest between Grades 9 and 10 ($b = 0.20$, $SE = 0.04$, $t = 5.44$).

Discussion

Using multivariate cross-lag models, we examined the influence of major RPF domains drawn from the Social Development Model (SDM) on annual change in alcohol use across early to late adolescence. Considering results from two independent longitudinal samples revealed several consistent patterns. The results for each sample supported our first hypothesis, but provided mixed support for our two other hypotheses.

Our first hypothesis was that the influence of Individual Risk would increase across adolescence. For the PROSPER sample, the effect of Individual Risk on change in alcohol use increased between Grades 6 to 9 and then remained at a high level through Grade 10. A similar pattern was found among the ASAPS sample, such that the effect of Individual Risk on change in alcohol use was lowest across the earliest grades (7 → 8), and the effect was strongest across the oldest grades (10 → 11).

There is epidemiological evidence that older adolescents hold more positive attitudes toward alcohol use and perceive binge drinking as less risky than younger adolescents (Johnston et al., 2011). Thus, it is likely that these individual-level factors may become more salient with age, as alcohol use becomes more normative during late adolescence. Such developmental changes are consistent with dual-processing models of adolescent behavior, which propose that adolescent health behavior shifts from impulsive and reactive to more planful and deliberative processes with age and experience (Chaiken & Trope, 1999; Gibbons, Houlihan, & Gerrard, 2009; Reyna & Farley, 2006). Thus, substance use (and other health risk behaviors) at later adolescence may become a more planful behavior and less a reaction to social opportunities (Pomery, Gibbons, Reis-Bergan, & Gerrard, 2009). It is also possible, however, that as adolescents get older, they have greater ability to actualize their attitudes and preferences via behavior as they gain access to alcohol, a greater sphere of independent activity outside of family supervision, and resources such as money from work or the ability to drive.

We found partial support for our second hypothesis that the relative influence within the Family and Community domains would decrease across adolescence. As expected, the relative importance of Family Protection waned during the years spanning middle and high school for adolescents in both samples. However, no age-related differences in the influence of Family Risk or Community Protection were apparent during this time. There was also mixed support for our third hypothesis, which stated that the influence of the Peer and School domains would increase as adolescents matured. Although displaying a generally increasing trend in the early grades, the results suggested a peak at ninth grade for the influence of Peer Risk on subsequent change in alcohol use. In contrast, the results of Wald tests indicated that the effect of School Protection did not differ across the grade levels in either sample.

Thus, our findings provide only weak support for the expectation that as adolescents spend more time in peer, school and neighborhood environments, and less within the family, the relative influence from these extrafamilial domains would increase with age and the influence of family factors would decrease (Furman & Buhrmester, 1992). Although we found that the influence of Family Protection decreased across adolescence, the results indicated that the influence of Family Risk remained fairly consistent. Although unexpected, this result supports research conducted on college youth, which confirms that parents remain influential throughout late adolescence and early adulthood (Patock-Peckham & Morgan-Lopez, 2007), particularly in terms of modeling behavior and setting expectations for abstinence from alcohol (Abar, Abar, & Turrisi, 2009).

We also found that the influence of Peer Risk peaked between Grades 9 and 10, when adolescents were 14 to 16 years old. Though unexpected, this finding is consistent with some past research, which has shown that conformity to peers does not increase linearly across adolescence but rather is curvilinear, peaking between sixth and ninth grades (Berndt, 1979). Recent research, however, indicates that this age-graded pattern may depend on the type of peer behavior that is considered. While heightened susceptibility to *antisocial* peer pressure has been shown to peak in mid-adolescence (Erickson, Crosnoe, & Dornbusch, 2000), the development of *resistance to general peer influence* increases linearly across adolescence (Steinberg & Monahan, 2007; Sumter, Bokhorst, Steinberg, & Westenberg, 2009). This pattern is consistent with our finding of linearly increasing influence of Individual Risk, discussed above, and suggests that adolescents gain more autonomy as they mature. That is, young people gain more self-awareness, impulse control, and responsibility (Sumter et al., 2009), which may counter the influence of peer exposure and peer pressure.

The current results suggest that influence from macrolevel environments, such as the school and community, displayed inconsistent patterns during early to late adolescence. We expected that school influence would show an increasing trend while community would decrease across adolescence. While results of univariate models (not shown) confirmed that these two RPFs had notable influence on adolescent alcohol use when examined in isolation, multivariate models showed that this influence was not as evident when controlling for the effects of the RPFs. It is possible that the relative influence of these more distal domains were underestimated in the multivariate models. For instance, measurement of these distal factors via adolescent self-reports may not fully capture community- or school-level processes (e.g., community poverty) that may have stronger associations with alcohol use.

Implications for Community-Based Prevention

Our results have several implications for prevention of adolescent alcohol use, in general, as well as for the specific approach taken in the community-based CTC model. First, as suggested by the CTC model, prevention efforts should target multiple risk and protective factor domains that range across individual, family, peer, and community contexts (Hawkins, Catalano, & Miller, 1992). The finding that Individual Risk strongly and consistently predicted adolescent alcohol use corroborates evidence that alcohol-related expectancies are among the strongest correlates of alcohol use by both early (Callas, Flynn, & Worden, 2004) and late adolescents (Borsari, Murphy, & Barnett, 2007). Indeed, positive and negative expectancies about the effects of alcohol use are often mediators of effective school-based prevention programs (e.g., Trudeau, Spoth, Lillehoj, Redmond, & Wickrama, 2003). Epidemiologic data also demonstrate that as more youth view such behaviors as risky, rates of actual binge drinking decrease (Johnston et al., 2011). At the peer level, past research also suggests overestimation of rates of peer substance use is linked to increased levels of adolescent substance use (Prinstein & Wang, 2005); thus, strategies to correct these misperceptions may also be effective strategies to reduce adolescent alcohol use, especially among older teens (Schulte, Monreal, Kia-Keating, & Brown, 2010).

These results also support the view that family based interventions may prevent adolescent problem behaviors, such as alcohol use (e.g., Lochman & van den Steenhoven, 2002). For example, programs should encourage parents to remain involved in their children's lives throughout all of high school, although the focus of these family focused prevention programs should reflect the most important aspects of parent behaviors at different ages. Prevention programs that target earlier ages may be most effective by emphasizing protective family factors, such as effective parental management and monitoring techniques. In contrast, we found that family risk (measured in the ASAPS sample by a single item indicating favorable parent attitudes toward ATOD use) was a consistent predictor of adolescent alcohol use. Thus, even older adolescents may benefit from programs that emphasize parental modeling of attitudes and behaviors around alcohol use (Abar et al., 2009). In addition, school-based and community-wide prevention efforts have demonstrated positive effects in reducing adolescent problem behaviors (Feinberg et al., 2007, 2010; Dishion & Kavanaugh, 2003). We found that the relative influence of RPFs within these domains did not vary across adolescence. These results suggest that intervention efforts that encourage the development of prosocial bonds to school and community institutions may have positive benefits for elementary, middle, and high school youth (Bond et al., 2007).

Strengths and Limitations

A particular strength of our study was that the results were based on longitudinal data drawn from two distinct samples. Although some inconsistencies in the results were found across the two samples, several notable similarities were found. Most importantly we found consistent developmental differences for the influence of Individual Risk, Family Protection, and Peer Risk in both datasets. These similarities are striking given the differences in measurement and samples. For example, some domains were measured by multiple measures in one sample but only a single item or scale in the other (e.g., Family Protection in ASAPS). In such cases, the precision of measurement may have been diminished compared with other RPF domain measures, perhaps leading to attenuated estimates of influence. Further, not all of the RPFs were available in the PROSPER sample (Family Risk and Community Protection) while measurement of Individual Risk in the ASAPS sample was limited to attitudinal measures and did not include personality-based risk (sensation seeking), which was available in the PROSPER sample. Thus, different results could be due to differences in the RPFs included in the multivariate models.

Another limitation of the study lies in the characteristics of the two samples. Whereas PROSPER is composed of adolescents residing in small, primarily rural communities in two states (Iowa and Pennsylvania), the ASAPS sample includes several urban settings across several states. Unfortunately, control variables, such as parental or school-level SES or community-level poverty were not available across the two samples. Thus, we were unable to account for possible differences between the studies. Due to model complexity, our path models also did not include gender and ethnicity as control variables nor did we examine if the associations between RPFs and alcohol use varied across these subgroups. Given the likelihood that these associations may vary across communities (Feinberg et al., 2010) or genders (Fagan et al. 2011), further investigations that examine how the relative influences of RPFs over development may differ across subgroups are needed.

We also note several limitations of our modeling decisions. Due to difficulty in estimating such complex models, we did not include higher-order stability or cross-lag paths, such as between Grade 7 → Grade 9, in our models nor did we include interactions among the RPFs.[2] Thus, we did not investigate the assumption that risk in one domain may depend upon the level of risk in another domain (Cleveland, Feinberg, & Greenberg, 2010; Donovan, 2004; Jones et al., in press). We also note that our models were specified by manifest indicators of RPFs rather than multiple indicators of latent variables. This decision was also based on the difficulty of estimating such complex models and is consistent with previous research, which has conceptualized the RPFs as single aggregates (Feinberg et al., 2007; Jones et al., in press).

Although there is evidence to suggest that alcohol use is multidimensional, reflecting frequency, quantity, duration, and timing of use (Auerbach & Collins, 2006; Cleveland, Lanza, Ray, Turrisi, & Mallett, in press), we relied on a single item of frequency of use in the past 30 days. Future work that investigates other aspects of alcohol use, ideally in combination, will help elucidate the developmental model of adolescent alcohol use that may better guide prevention and intervention efforts. We also did not compare effects of the RPFs on different stages of alcohol use (i.e., initiation, escalation, and desistance). However, there is evidence that initiation and experimentation stages of alcohol use are not highly differentiated in terms of predictive factors (Jackson, 1997). These remain additional important areas for future research.

[2] Several alternative models were estimated that included higher-order stability and cross-lag associations. First, fully saturated models with all possible paths indicated that very few of the higher order cross-lags were significant for either sample. Next, models with higher-order stability paths were compared to the original models. For PROSPER, the Satorra-Bentler chi-square difference test indicated that the original model provided a better fit to the data. A similar model for the ASAPS sample was not able to provide robust standard errors, due to a lack of covariance coverage. Given the evidence cited above that the original model was preferred for the PROSPER sample and that few higher order paths were significant in the fully saturated model fit to both sets of data, we decided that model parsimony favored keeping only the 1-year lags and stability paths.

Conclusion

Our results support a developmental approach to adolescent alcohol use prevention. Such an approach requires the inclusion of multiple RPFs across multiple domains but also acknowledges that the relative influence of these RPFs is not equally strong at all ages. Specifically, the strongest predictors of adolescent alcohol use include Individual Risk, which increased across time, and Peer Risk, which peaked during middle adolescence. In contrast, other RPFs either showed little or no change across development (Family Risk, School and Community Protection) or decreased in influence as adolescents matured (Family Protection). Prevention efforts might incorporate these developmental differences by investing resources targeting certain RPFs at younger ages, other RPFs at older ages, and some RPFs across the entire span of adolescence.

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