Dynamic Growth Models of Self-Esteem and Adolescent Alcohol Use

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Latent growth modeling was used to test dynamic relations between self-esteem and alcohol use in 740 middle school youth assessed at four time points. Self-esteem was characterized by a negative growth trajectory, whereas alcohol use increased steadily in a linear fashion. An initial simplified model positing bidirectional influences indicated an inverse relation between changes in self-esteem and alcohol use over time, but that initial levels of neither alcohol use nor self-esteem influenced changes in the other construct. With the addition of external covariates (i.e., gender and indices of social skills and competence risk), findings indicated that high initial levels of self-esteem fostered more increases in alcohol use compared to low initial levels of self-esteem. Findings further indicated that youth with poor competence skills advanced more rapidly in their alcohol use and declined more gradually in their self-esteem, and that poor social skills accelerated the rate of decline in self-esteem. Results indicate that self-esteem is part of a dynamic set of etiological forces that instigate early-stage alcohol use.

Self-esteem is defined operationally as an evaluation of the self and includes how the person feels about himself or herself or a personal judgment of worthiness (Beane & Lipka, 1986; Coopersmith, 1967). Whereas self-concept refers to the identity roles and attributes the person attaches to himself or herself (i.e., self-related descriptive beliefs), self-esteem refers to the personal evaluation given to the effectiveness of those roles (Brinthaupt & Erwin, 1992). Developmental studies of adolescents, as well as young adults, indicate that self-esteem is important for promoting physical and mental well-

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being (Kernis et al., 1998; Zimmerman, Copeland, Shope, & Dielman, 1997), family attachment (Harvey & Byrd, 1998), positive interpersonal relations (Bringle & Bagby, 1992), academic achievement (Mone, Baker, & Jeffries, 1995), and resilience to stressful life events (Brown & Dutton, 1995; Dumont & Provost, 1999).

In recent years, researchers have investigated a role for self-esteem as an antecedent of alcohol and drug use (Abernathy, Massad, & Romano-Dwyer, 1995; Vega, Apospori, Gil, Zimmerman, & Warheit, 1996; Wills, 1994). Support for a developmental linkage between self-esteem and alcohol and drug use comes primarily from problem behavior theory (Jessor & Jessor, 1977) and self-derogation theory (Kandel, 1980; Kaplan, 1975; Kaplan, Martin, & Robbins, 1982, 1984). According to problem behavior theory, self-esteem is part of a personal belief structure composed mainly of cognitive regulatory mechanisms (i.e., social criticism, alienation, locus of control) that suppress vulnerability to engage in nonconforming behavior. Combined with additional precipitating factors such as parental tolerance for deviance, low valuation on achievement and independence, and support from deviant peers, problem behavior theory posits that low self-esteem can reduce barriers to engaging in delinquent behaviors. Self-derogation theory augments this view by positing that low self-worth produces psychological distress, including a desire for greater self-acceptance, which can encourage some youth to distance themselves from conventional groups in an effort to find alternative sources of esteem-enhancement. According to self-derogation theory, once emotional ties to important socializing agents such as family and school are broken, self-derogating youth become more likely to bond with deviant peers as a means of gaining self-acceptance, thus heightening vulnerability to problem behaviors.

Empirical Findings Relating Self-Esteem to Alcohol and Drug Use

Despite promising theoretical arguments, empirical evidence for a role of low self-esteem in promoting alcohol or drug use is inconclusive. Cross-sectional studies have provided evidence of an association between self-esteem and alcohol use. These studies are hampered, however, by the inability to infer causation from correlational data (Botvin, Baker, Goldberg, Dusenbury, & Botvin, 1992; Crump, Lillie-Blanton, & Anthony, 1997; Young & Werch, 1990). Prospective studies have not provided unequivocal evidence supporting a prominent role for self-esteem in alcohol or drug etiology; these investigations report either null findings (Brook, Whiteman, Nomura, Gordon, & Cohen, 1986; Kandel, Kessler, & Margulies, 1977;

Labouvie & McGee, 1986; Wills, 1994) or relatively small effects (e.g., Dielman, Campanelli, Shope, & Butchart, 1987; Kaplan et al., 1982, 1984; Olmstead, Guy, O'Malley, & Bentler, 1991; Schroeder, Laflin, & Weis, 1993).

Several factors could contribute to the lack of consistent findings in previous studies to link self-esteem to alcohol use. First, adolescence is a period of rapid developmental change and a thus a lack of stability in either alcohol use or self-esteem could influence the statistical reliability of their relations with one another. The period of initiation to alcohol use begins with early adolescence (Kandel & Logan, 1984; Newcomb & Bentler, 1986). There are dramatic changes, however, in the prevalence and intensity of alcohol use over the next few years (Johnston, O'Malley, & Bachman, 1996; Kandel, 1980). In addition to increases in alcohol use, there is conflicting evidence regarding the stability of self-esteem during adolescence. Some studies provide evidence of rapid changes in self-esteem (Hirsch & DuBois, 1991; McCarthy & Hoge, 1982; Zimmerman et al., 1997), whereas other studies report modest stability in self-esteem during early (Demo & Savin-Williams, 1992; Labouvie, Pandina, White, & Johnson, 1990; O'Malley & Bachman, 1983) and late (Newcomb & Keunho, 1997; Olmstead et al., 1991) adolescence.

In addition to concerns regarding developmental changes, the operative mechanisms that link self-esteem and alcohol are likely to be complicated, and thus not necessarily straightforward, to delineate adequately. For instance, despite theory positing a negative relation between self-esteem and alcohol use, empirical findings have indicated that in certain situations, delinquent activities (e.g., alcohol use) can enhance self-esteem (e.g., Bynner, O'Malley, & Bachman, 1981; Jang & Thornberry, 1998; Vega et al., 1996). The possibility also exists for alcohol use to have differing effects on self-esteem by reducing self-deprecation and dampening feelings of distress (e.g., Labouvie & McGee, 1986). With increasing involvement in deviant activities, more extensive and problematic alcohol use has the potential to foster disenfranchisement and influence self-esteem adversely (Vega et al., 1996).

A Growth Model Framework Linking Self-Esteem With Alcohol Use

In light of the possible dynamics underlying self-esteem and alcohol use during adolescence, it is important that models be developed that can account for change reliably as part of the developmental mechanisms linking self-esteem with alcohol use. Unfortunately, a careful reading of the literature shows that researchers often have been remiss to model growth effectively in this type of developmental framework. Previous efforts to understand the likely complex relations involved reflect primarily static views of develop-

ment in which an outcome measure of alcohol use has been regressed on a temporally precedent measure of self-esteem. This type of fixed-effect, regression model would not appear to represent the best approach to capturing possible dynamic relations between self-esteem and alcohol use in early adolescence.

Recent technical advances in the area of structural equation modeling, specifically latent growth modeling (LGM), provide new opportunities to model developmental patterns of change effectively. As a special type of random coefficient regression model, LGM is suited especially for repeated-measures data when the focus is on change in behavior as dependent on time. In contrast to an incremental view that equates change as the difference between two time points, LGM regards development as a continuous underlying process and fits a regression curve to a series of repeated measures taken on the same individual. In this regard, a unique feature of LGM is its ability to estimate a fixed regression component reflecting group-level characteristics of growth over time (the average starting point and average rate of change for the group) and to combine this information with the estimation of random effect components reflecting individual differences in the starting point and rates of growth. More detailed and technical explanations of LGM can be found in Willett and Sayer (1994), and applications of LGM to studies of alcohol and drug use etiology are reported by Duncan and Duncan (1996) and by Curran, Stice, and Chassin (1997).

Factors Contributing to Growth in Self-Esteem and Alcohol Use

In addition to gaining greater appreciation of developmental growth trajectories for alcohol and self-esteem, a benefit of LGM is the ability to model additional exogenous influences on growth. Particularly relevant in the present context are risk factors other than self-esteem that also have the potential to increase susceptibility to alcohol use. One major developmental task during adolescence is the acquisition of new social competencies and personal skills that prepare youth for adult role socialization (e.g., Waters & Sroufe, 1983). As part of the transition from elementary to middle school, adolescents experience an expanding peer network and face new interpersonal challenges (Savin-Williams & Berndt, 1990). Failure to develop adequate social skills can serve as a precursor to peer rejection (Coie, 1990), which can promulgate self-derogation and low self-confidence (Demo & Savin-Williams, 1992).

A second and no less important development task during adolescence is the construction of beliefs in personal competence and self-efficacy as the

foundation for feelings of personal self-worth (Masten et al., 1995). Self-efficacy theory indicates that perceived and actual competence both can offset stress by providing an expectation or belief that internal resources exist to find solutions to problems. These internal resources are likely to take shape as cognitive strategies or applied decision skills that provide a foundation for perceived control. Over time, perceived control and a sense of mastery become equated with positive self-worth and lead to the development of an efficacy expectation (Bandura, 1977). High perceived competence can encourage youth to grapple with difficult tasks, including navigating some of the emotional turmoil encountered with the transition through adolescence. Deficits in these areas, on the other hand, can undermine task engagement and reduce opportunities to benefit from mastery and self-efficacy. Faced by repetitive feelings of insecurity and a noted absence of skills, youth under these circumstances are apt to devalue their performance, leading to despair and low feelings of self-worth.

In addition to contributing to normative development, etiologic studies indicate a significant role of personal competence and social skills as determinants of early-stage alcohol use (Botvin, 1995; Scheier & Botvin, 1998). Despite that promising research, the precise mechanisms through which various facets of competence contribute to changes in alcohol use (as well as perhaps self-esteem) remain unclear. One possibility that was tested in the current study was that a common developmental vulnerability based on limitations in actual and/or perceived social and personal competence underlies changes in both alcohol and self-esteem over time.

In addition to risk factors that can influence developmental growth, gender-role socialization has the potential to be influential in determining psychosocial vulnerability. There is increasing evidence of divergent etiologies and differing consequences for alcohol use among males and females (e.g., Newcomb & Bentler, 1988). National trend data show that male adolescents report drinking more frequently and more intensely (measured by excessive binge drinking and drunkenness) than do females (Johnston et al., 1996). Greater exposure to alcohol during this critical period has the potential to catalyze a faster rate of alcohol involvement and to influence subsequent vulnerability to low self-esteem. In a related vein, studies also have found mean gender differences in reported levels of self-esteem (for a review, see Kling, Hyde, Showers, & Buswell, 1999). Factors that presage gender differences in self-esteem include menarche and pubertal development and the onset of secondary sex characteristics that can heighten distress among females and foster problems with feelings of self-worth (e.g., Brooks-Gunn & Reiter, 1990). In addition to observations of absolute mean differences in self-esteem scores, some evidence points toward a rapid downward shift in

self-esteem among females at the beginning of adolescence (American Association of University Women, 1990; K. Brown et al., 1998; Zimmerman et al., 1997). This type of developmental trajectory for self-esteem could represent responses to stressful role socialization experiences that are present for females but not for males.

Present Study

In accordance with the preceding considerations, the present study contained two main goals. First, to improve on previous studies that have relied mainly on fixed-effect models of change, the design for the current study relied on random coefficient models to estimate individual differences in growth for alcohol and self-esteem. Growth functions first were established for each construct independently, and then a combined growth model was tested. Each individual growth model details the shape and form of growth over a 4-year period corresponding to early adolescence. Subsequent to testing the individual growth trajectories, a combined growth model provides information on three important developmental relations, including whether (a) initial levels of self-esteem predict differential growth trajectories in alcohol use, (b) initial levels of alcohol use predict differential growth or change in self-esteem, and (c) growth processes for self-esteem and alcohol use proceed relatively independently or are correlated over time. This portion of the analyses represented an improvement over previous studies that have not modeled possible effects of either construct on individual differences in developmental patterns of change in the other over multiple points in time, and studies that have modeled change in these domains as discrete, rather than potentially mutually influential processes. A second goal was to investigate whether specific individual-difference risk factors influence respective growth functions for self-esteem and alcohol use. Three theoretically meaningful control measures were added to the overall growth model in this regard (i.e., indices of social skills and competence risk, as well as gender) to facilitate a more comprehensive understanding of factors that have the potential to shape vulnerability to alcohol use in the early stages of adolescence.

METHOD

Sample Characteristics

Participants in this study were part of a prospective, randomized, drug abuse prevention trial conducted between 1987 and 1991 in the northeastern

United States. To avoid any confounding associated with treatment effects, only nontreatment (no-contact) participants were used in the current analyses. A pretest assessment was conducted in the fall of 7th grade (T1: n = 1,181), and follow-up assessments were conducted annually through the 10th grade (T3 = 8th grade: n = 974, T4 = 9th grade: n = 900, and T5 = 10th grade: n = 822; T2 was a 3-month posttest and is not included in the current study). The final panel sample is composed of 740 students who were present at the pretest and all three follow-up assessments.

The protocol for the current study was approved by the University Institutional Review Board consistent with federal regulations concerning the protection of human subjects in research. The confidential nature of the survey was stressed both in writing and presented orally at the time of administration (a certificate of confidentiality was issued by the Department of Health and Human Services). Questionnaires were administered by trained research staff to students during a 45-minute classroom period. Coded identification numbers lithocoded on each questionnaire were used to link surveys across multiple follow-up assessments. Survey content assessed substance use behaviors (alcohol, cigarettes, and marijuana) as well as hypothesized psychosocial correlates and causes of early-stage drug use. The sample was 90% White, and (based on zip code information) 82% lived in suburban areas, 7% lived in urban areas, and 11% lived in rural areas. Seventy-two percent of the participants reported living with both biological parents, 26.5% reported living with one parent (mother or father), and 2% reported living with family other than their parents. A single item to tap parental education indicated that 30% of the participant's fathers had finished high school and that 39% of their mothers had a minimum of a high school education.

Measures

Alcohol use. Measures of alcohol use were available at pretest and each follow-up assessment. A single item assessed frequency of alcohol use ("How often [if ever] do you drink alcoholic beverages?" with responses ranging from 1 = *never tried them* through 9 = *more than once a day*) and a single item assessed intensity (quantity) of alcohol use ("How much [if at all] do you usually drink each time you drink?" with responses ranging from 1 = *I don't drink* through 6 = *more than 6 drinks*). A third item assessed drunkenness ("How often [if ever] do you get drunk?" with response categories ranging from 1 = *I don't drink* though 9 = *more than once a day*). All three items were averaged into a summary index tapping degree of alcohol involvement, and this index was repeated at each assessment point.

Self-esteem. The 10-item Rosenberg (1965) Self-Esteem Scale was used to assess global self-acceptance and the evaluative component of self-esteem. The 10 items include 6 items to tap negative features of self-rejection (e.g., "I feel I do not have much to be proud of") and 4 to tap positive feelings of self-worth (e.g., "I take a positive attitude toward myself"). Response categories for the 10 items ranged from 1 = *strongly disagree* through 5 = *strongly agree*. At each of the four assessment points, the negative self-esteem items were reverse coded and summed with the positive items into a single score to reflect higher self-esteem (α = .83).

Psychosocial control measures. Based on measures available in the 7th grade, an index of social competence risk was derived based on six indices to tap social communication skills, social confidence, social concern (anxiety), assertiveness, fear of social assertiveness, and social confrontation. Ten dichotomously coded *true/false* items were developed specifically to evaluate a competence enhancement, drug abuse prevention trial and were used to tap social communication skills (e.g., "restating a message in your own words can clarify meaning" and "asking questions about the other person is a good way to keep a conversation going"). Coding was arranged so that correct items were coded "1" and incorrect answers were coded "0." An index of social communication skills then was created that ranged from 0 through 10.

Seven items were used to assess perceived social confidence (α = .70). Participants were provided a stem (i.e., "How confident are you that you could do well in the following situations . . . ") and asked to respond to items such as "ending a conversation with friends without offending them," "making requests or asking favors," and "saying no to an unfair request." Response categories ranged from 1 = *not at all confident* through 5 = *very confident*.

Eight items from a modified version of the Janis and Field (1959) Feelings of Inadequacy Scale (Fleming & Courtney, 1984; Fleming & Watts, 1980) were used to assess social concern and anxiety (α = .76). These items closely parallel those on the Fear of Negative Evaluation and Social Avoidance and Distress scales (Watson & Friend, 1969). Sample items include "I'm concerned about whether people will regard me as a success or a failure" and "I often worry about what other people think of me." Response categories ranged from 1 = *strongly disagree* through 5 = *strongly agree*. Internal consistency for this scale based on the current sample was .77.

Seven items from the Defense of Rights subscale of the Gambrill and Richey (1975) Assertiveness Inventory were used to measure assertiveness (α = .76). The Defense of Rights subscale of the Assertiveness Inventory specifically measures reported frequency of assertive behavior when people cut in line, don't return borrowed objects, request to copy homework, or express

a controversial opinion. Response categories for this scale ranged from 1 = *never* through 5 = *almost always*.

Thirteen items from the Richardson and Tasto (1976) Social Anxiety Inventory were used to create a nine-item scale to assess social confrontation ($\alpha = .86$) and a four-item scale to assess fear of social assertiveness ($\alpha = .75$). For both sets of items, participants were given a brief stem asking them to "indicate how nervous you would feel in each of the following situations . . . " with sample situations for social confrontation including "expressing a controversial opinion in a group or meeting" and "being asked to be the leader in a group or meeting." Sample items for fear of social assertiveness included "telling someone you know that you are angry with him (her)" and "you tell someone who is embarrassing you to stop." Response categories for both scales ranged from 1 = *not at all nervous* through 5 = *very nervous*.

Five measures were used to assess personal competence risk that tapped academic esteem, perceptions of personal control, self-reinforcement, problem-solving confidence, and self-reported grades. Six items from the Fleming and Watts (1980) Self-Rating Scale assess perceived school abilities and academic esteem ($\alpha = .62$). Based on a facet model of self-esteem, Fleming and Watts provided adequate psychometric evidence of a school confidence factor that was distinct conceptually from general self-esteem ($\alpha = .76$). Derivation of their original scale relied on college-age youth, and thus the wording of these items was modified considerably for the current application with adolescents. Sample items include "I find it difficult to express my ideas in writing" and "When I have to write a paper or do a reading assignment, I get kind of worried about it." Response categories ranged from 1 = *strongly disagree* through 5 = *strongly agree*. Five items taken from the Spheres of Control Battery (Paulhus, 1983; Paulhus & Christie, 1981) were used to assess perceptions of personal efficacy and control ($\alpha = .73$). Sample items included "The things I achieve are due to my hard work and ability" and "I can learn almost anything if I set my mind to it." Response categories for this scale ranged from 1 = *strongly agree* through 5 = *strongly disagree.*

Frequency of self-reinforcement was measured by eight items from the Heiby (1983) Frequency of Self-Reinforcement Attitudes Questionnaire ($\alpha = .77$). Sample items include "When I succeed at small things, I become encouraged to go on" and "The way I achieve my goals is by rewarding myself every step along the way." Response categories ranged from 1 = *strongly disagree* through 5 = *strongly agree*. Seven items from the Problem-Solving Inventory (Heppner & Petersen, 1982) were used to measure perceived confidence in a wide range of problem-solving activities ($\alpha = .76$).

Sample items include "Many of the problems I face are too hard to solve" and "When a problem comes up, I can usually think of many different ways of dealing with it." Response categories ranged from 1 = *strongly disagree* through 5 = *strongly agree*. Finally, the measure of self-report grade point average ranged from 1 = *Ds or lower* through 7 = *mostly As* and was included to provide an objective index of academic performance.

Derivation of risk indices. Indices of social skills and personal competence risk were constructed using an epidemiologically based risk factor methodology. The general assumption underlying a risk factor methodology is that rather than search for a single efficient predictor, it is better to construct a profile based on multiple risk factors, which has greater ecological validity, is more parsimonious, and is more likely to account for a larger share of outcome variance (Newcomb, 1992). Empirical trials with this approach have predicted extent of alcohol and drug use successfully from the sheer number of risk factors (Bry, McKeon, & Pandina, 1982; Newcomb, Maddahian, & Bentler, 1986). The methodology consists of dichotomizing individual risk factors based on empirically based cut-points that reflect heightened levels of risk. In the present study, scores in the upper tertile for the distribution of each risk factor measure were assigned a "1" to designate "at-risk" and the remaining scores received a "0." The dichotomized risk factors then were grouped conceptually into two summative indices of cumulative risk; one index tapped social competence (i.e., poor social communication, low social confidence, social concern, low frequency of assertiveness, fear of social assertiveness, and poor social confrontation), and the other tapped primarily personal competence (i.e., low academic esteem, low perceived self-control, low self-reinforcement, poor problem-solving confidence, and low grades).

Psychometric analyses supported the distinction between the two risk indices, although it was expected that a moderate level of overlap would exist between them. A confirmatory factor analysis was conducted with the 11 individual risk factors specified as indicators of two primary latent constructs, one capturing social skills risk and one capturing personal competence risk. All factor loadings on the respective constructs were significant, and there was no evidence of complex factor loadings (a simple structure was modeled with specification searches conducted for cross-factor loadings). The estimated correlation between the social skills and personal competence risk factors was .85. A model constraining this association to unity did not improve statistically on a model that allowed this association to be estimated freely.

Analysis Procedures to Determine Growth

Estimation of developmental growth functions using LGM includes specifying mean and variance terms for an intercept growth factor and a slope growth factor. The mean of the intercept factor is used to establish the height of the reference growth curve prior to estimation of growth. The mean of the slope factor reflects the average or group rate of growth over a defined time period (i.e., mean rate of change). Variance estimates for the slope and intercept terms capture individual differences or deviations from the average group growth rate and variability in initial status, respectively. In addition to hypothesizing the shape and functional form of growth, specification of a growth curve model permits parameterization of several key developmental relations. In a two-factor, univariate growth model, significant covariances between intercept and slope factors indicate that initial levels are informative with respect to the observed rate of growth. With specification of a bivariate growth framework that includes more than one developmental construct (e.g., self-esteem and alcohol use), additional paths between initial status and slope growth factors across constructs indicate whether initial levels of one construct (e.g., self-esteem) are informative with respect to differential growth in another (e.g., alcohol use). Specification of a covariance between two slope factors provides a means to examine whether respective growth processes are related over time. The direction or sign of this relation indicates whether the respective developmental trajectories are moving in a similar or dissimilar direction.

RESULTS

At baseline in the 7th grade, less than one quarter of the participants reported some alcohol use (21.3%); and this proportion increased to 38% in the 8th grade, 53% in the 9th grade, and 64% in the 10th grade. Intense and more problematic drinking, defined as at least two or more drinks per occasion was reported by 10% of the sample in the 7th grade, 27% in the 8th grade, 43% in the 9th grade, and 56% in the 10th grade. Being drunk at least two or three times a month was reported by 3%, 7.4%, 12%, and 19% of the participants in each of the four grades, respectively. A significantly greater proportion of males reported drinking in each of the four grades. The proportion of females reporting alcohol use increased substantially over the 4-year period, going from 14% in the 7th grade to 34.9%, 49.8%, and 63.2% in the 8th through 10th grades, respectively.

Attrition analyses were conducted to determine if there was any systematic bias in the data resulting from the loss of participants at each follow-up assessment. Despite intensive and aggressive follow-up procedures, some participants were not available for follow-up because of truancy, absenteeism, and relocation outside of the participating school district. Overall, there was a loss of 38% of the participants from the 7th through 10th grades. There was a marginally significant trend for a loss of alcohol users at follow-up (T1-T5: $\chi^2[1, 1181] = 3.59$, $p < .06$: 24.3% as compared with 19.59% for dropouts vs. panel students, respectively). Females were more likely to participate in the 10th grade follow-up, $\chi^2(1, 1181) = 7.24$, $p < .01$ (57.14% were male dropouts as compared with 49.05% females dropouts), and participants residing in two-parent households were more likely to be retained across the 4 years, $\chi^2(1, 1158) = 25.62$, $p < .001$ (85.9% as compared with 73.9%, respectively).

Mean comparisons between panel sample and dropout participants showed that those in the panel sample reported being significantly more assertive, more socially confident, having more confidence in their social skills, having higher levels of social communication skills, and having greater social concern. Panel youth also reported significantly higher grades, more personal self-control, greater self-reinforcement, more problem-solving confidence, higher self-esteem, and less academic esteem. With regard to the behavioral measures, panel students reported significantly lower levels of alcohol use, less intense alcohol use (drinks per occasion), and that they got drunk less often. A regression model predicting retention status (panel coded as "1" and dropout as "0") indicated that gender ($\beta = .06$, $p < .05$), intact living situation ($\beta = .11$, $p < .0001$), grades ($\beta = .19$, $p < .0001$), social concern ($\beta = .069$, $p < .01$), and self-esteem ($\beta = .09$, $p < .05$) combined to account for 9% of the variance, $F(14, 1142) = 7.97$, $p < .001$.

Table 1 contains bivariate associations and univariate descriptive statistics for all of the measured variables used in the growth modeling. The moderate skewness and kurtosis for the alcohol use measures in the 7th and 8th grade was not anticipated to strain the robustness of the maximum likelihood estimation procedures used in the growth curve analyses (Bentler, 1995; Huba & Harlow, 1987). Across the 4-year period, mean reported level of alcohol use increased (and variability also increased), whereas mean reported level of self-esteem decreased (and variability increased slightly). All of the bivariate associations were in the expected directions. Higher reported self-esteem was associated with lower reported alcohol involvement across all 4 years (both within and across waves). There was a slight downturn in the magnitude of these associations in the 9th grade as compared to the 8th grade.

TABLE 1: Intercorrelations and Descriptive Statistics for Observed Variables Used in Latent Growth Models

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1. Alcohol use (7th)		.60	.44	.36	–.10	–.13	–.09	–.07	.16	.24	.17
2. Alcohol use (8th)			.66	.53	–.12	–.16	–.11	–.10	.15	.22	.07
3. Alcohol use (9th)				.67	–.06	–.14	–.12	–.11	.13	.22	.08
4. Alcohol use (10th)					–.01	–.11	–.08	–.09	.14	.21	.11
5. Self-esteem (7th)						.44	.40	.34	.06	–.44	.10
6. Self-esteem (8th)							.55	.48	.03	–.34	.13
7. Self-esteem (9th)								.55	.02	–.30	.12
8. Self-esteem (10th)									.01	–.26	.12
9. Social skills risk[a]										.17	–.09
10. Competence risk[a]											–.03
11. Gender[a]											
Mean	1.57	2.11	2.60	3.16	35.25	35.02	34.92	34.63	1.87	1.30	0.49
Skewness	1.89	1.40	0.92	0.44	–0.16	0.32	0.16	0.07	0.41	0.75	0.04
Kurtosis	3.69	1.52	0.08	–0.74	0.71	0.09	–0.13	0.16	–0.17	–0.31	–2.00
Variance	0.67	1.82	2.48	2.87	38.83	43.23	46.76	45.28	1.63	1.61	0.25

NOTE: $N = 740$ (panel sample participants). Significance level of $p < .05$ (two-tailed) is obtained for $r < –.08$ or $r > .08$.
a. Measured in the 7th grade.

As expected, distributional characteristics for the measures of competence and social skills risk indicated a slight negative skew for each risk index with fewer youth reporting greater numbers of risk factors. For three fourths of the sample, two or fewer risk factors were indicated for the competence index, and 80% of the sample had three or fewer risk factors for the social skills index. Correlations between the two risk indices and reported level of alcohol use all were positive and significant. Reported level of self-esteem was not associated significantly with the social skills risk index but was associated moderately and significantly with the competence risk index (the magnitude of this association declined over the 4 years). Gender was associated significantly with the social skills risk index but not with the competence risk index. Mean comparisons based on gender showed that male participants reported significantly higher alcohol use at baseline and at each successive follow-up (despite the disproportionate loss of both high-end alcohol users and male participants through attrition). Males also reported significantly higher levels of self-esteem in each grade and had significantly higher scores on the social skills risk index.

Results of Growth Modeling Analyses

Estimation of the growth processes underlying the relations between reported levels of alcohol use and self-esteem proceeded in a hierarchical manner. First, a two-factor, unspecified growth model was estimated separately for reported levels of alcohol use and then reported levels of self-esteem. Each respective model determines empirically the average developmental trajectory for the sample without inclusion of covariates that could influence growth. Following, a combined model tested whether initial levels in each construct influenced growth in the other construct. A final conditional growth model included regression adjustments for the exogenous control measures. Findings for this model address whether indices of risk relating to social skills and competence, as well as gender, were predictive of differential growth in reported levels of self-esteem and alcohol use. The EQS statistical software (Bentler, 1995) was used to estimate the models, and data were entered as a variance/covariance matrix with a vector of observed means.

The two-factor unspecified growth model for alcohol included equally spaced basis terms (0, 1, 2, 3) designating linear growth over the 4-year period. Several model fit indices indicated that there was a good fit between the hypothesized linear growth curve and the sample data: $\chi^2(4) = 4.10$, $p = .393$, Normed Fit Index (NFI) (Bentler & Bonett, 1980) = .997, Comparative Fit Index (CFI) (Bentler, 1990) = 1.00, Root Mean Square Residual (RMSR) = .01, and Root Mean Square Error of Approximation (RMSEA) (Steiger &

Lind, 1980) = .01 (Confidence Intervals [C.I.] = .000 – .056). The slope mean was positive and significant (μ = .53, z-critical value [z] = 27.45), indicating systematic growth in reported alcohol use of .53 units for each corresponding unit increase in grade (e.g., from 7th to 8th grade). The variance term for the slope growth factor also was significant (ψ = .23, z = 14.45), indicating substantial individual variability in developmental trajectories for reported levels of alcohol over the four-year period. Using Time 1 as an initial reference point, the mean intercept was significant (μ = 1.57, z = 52.05), indicating that the average reference point for the group growth curve started at 1.57 units. There also was significant variability in the initial level of reported alcohol use (ψ = .67, z = 19.22), indicating that there was a discernible range of drinking patterns for participants in the 7th grade.

A significant negative association was evident between the intercept and slope growth factors (r = –.14, p < .001), thus indicating a faster rate of growth in reported alcohol use for participants beginning with lower reported levels of drinking when compared to those beginning with higher reported levels of drinking. The initial two-factor growth model did not posit any relations between residual terms (reflecting unique aspects of alcohol use not captured in the growth portion of the model). Specification searches then were conducted to assess whether additional parameterization might improve the fit of the model. The addition of a correlated residual between 8th- and 9th-grade alcohol use (r = .37, p < .001) improved the fit of the model significantly, $\chi^2(1) = 79.66$. In autoregressive models, the addition of correlated error terms among repeated measures helps to improve estimation of stability effects when there are confounds from measurement-specific variation. In an LGM, these residual covariances capture a time-specific component of alcohol use occurring between the 8th and 9th grades that is not estimated as part of the growth curve.

A two-factor unspecified growth model with a linear growth form also was posited for self-esteem. The various fit indices indicated an adequate model fit, $\chi^2(4, N = 740) = 2.30$, p < .681, NFI = .997, CFI = 1.00, RMSR = .001, RMSEA = .000 (C.I. = .000 – .043). In contrast to the positive growth observed in reported level of alcohol use over the 4-year period, a significant negative mean slope was found (μ = –.20, z = 2.26), indicating a downward growth trajectory for reported level of self-esteem across the 4-year period. Significant variance components for the intercept (ψ = 19.98, z = 9.58) and slope (ψ = 2.33, z = 5.54) growth factors further indicate discernible individual differences in initial reported levels of self-esteem as well as in growth patterns for this measure across the 4-year period. Initial reported level of self-esteem and, in this case, the rate of decline in reported level of self-esteem exhibited a significant and inverse relation (r = –.24, p < .001),

indicating that youth in the 7th grade who reported higher levels of self-esteem declined more rapidly in reported levels of self-esteem than did those who reported lower initial levels of self-esteem.[1] Following a series of post hoc specification searches, a correlated residual term was added between 8th- and 9th-grade measures of self-esteem ($r = .18$, $p < .001$) and improved the fit of the model significantly, $\chi^2(1) = 13.04$.

The next step tested a conditional growth model by combining the two independent growth models. This model tested whether (a) initial levels of either self-esteem or alcohol use were informative with respect to differential growth in the other construct, and (b) whether the respective indicated growth processes for alcohol and self-esteem were related to each other across the 4-year period. Additional parameterization in the combined growth model included estimating correlations between the two intercept and slope parameters for alcohol and self-esteem, respectively. This model fit the data well, $\chi^2(20, N = 740) = 21.28$, $p = .381$, NFI = .990, CFI = .999, SRMR = .004, RMSEA = .009 (C.I. = .000 – .034). There was some slight change in the magnitude of the mean and variance terms for the intercept and slope growth factors; however, all of the terms remained significantly different from zero. Initial reported levels of self-esteem and alcohol use were related inversely ($r = –.16$, $p < .001$), indicating that higher reported alcohol use was associated with lower reported levels of self-esteem. The two slope factors also were related inversely ($r = –.13$, $p < .05$), indicating that individual patterns of growth tended to be moving in opposite directions over time. Contrary to expectation, neither of the bidirectional structural paths were significant ($\beta = .01$ for path from self-esteem intercept factor to alcohol slope growth factor and $\beta = .04$ for path from alcohol intercept factor to self-esteem slope growth factor), indicating that initial assessed levels of each construct were uninformative relatively with respect to differential growth in assessed level of the other construct over time.

The final step in the growth modeling procedure involved incorporating exogenous control measures (i.e., gender, social skills, and personal competence risk) and determining whether they influence differential growth for alcohol use and self-esteem. A growth model with the three covariates fit the observed data well, $\chi^2(38, N = 740) = 41.65$, $p = .315$, NFI = .983, CFI = .998, SRMR = .01, RMSEA = .01 (C.I. = .000 – .029) and is presented in Figure 1. Although the model as depicted in Figure 1 is trimmed with respect to nonsignificant paths and nonsignificant associations (among exogenous predictors), the intercepts for the growth factors remain regression-adjusted for all three covariates. Of particular importance is that in this fully conditioned model with regression adjustments for covariates, the bidirectional structural path representing the relation between the self-esteem intercept growth

factor and the alcohol slope growth factor became significant ($\beta = .14$, $p < .05$). In this model, higher reported levels of self-esteem in the 7th grade were indicated to predict more rapid increases in reported alcohol use over the 4-year period. The association between the intercept factors for self-esteem and alcohol use was small, albeit significant ($r = -.08$, $p < .05$). The two slope growth factors continued to be related significantly ($r = -.15$, $p < .01$), such that an inverse relation remained evident between individual growth trajectories for reported levels of alcohol and self-esteem. The significant negative correlation between the intercept and slope factor for reported alcohol use ($r = -.18$, $p < .001$) indicates that youth with lower reported levels of alcohol use in the 7th grade increased their reported involvement in alcohol use at a more rapid pace than youth with initially higher levels of alcohol use. A similar inverse relation between the self-esteem intercept and slope factors ($r = -.18$) was not significant.

Paths from all three exogenous predictors to initial reported levels of alcohol and self-esteem were significant. Specifically, higher scores on the social skills risk index were associated with higher reported levels both of alcohol involvement ($\beta = .11$, $p < .01$) and self-esteem ($\beta = .17$, $p < .001$). Higher scores on the competence risk index were associated with higher reported levels of alcohol involvement ($\beta = .23$, $p < .001$) and lower reported levels of self-esteem ($\beta = -.62$, $p < .001$). The significant positive paths from gender to the two intercept factors indicates that males reported higher mean levels of alcohol use ($\beta = .17$, $p < .001$) and self-esteem ($\beta = .13$, $p < .001$).

As shown in Figure 1, further aspects of findings for the model indicated that personal competence risk predicted growth in reported levels of both alcohol use and self-esteem over time (βs = .20 and .22, respectively, ps < .001). The positive path from personal competence risk to the alcohol slope growth factor indicates that youth who reported greater degrees of this type of risk in the 7th grade grew in their reported alcohol use faster than youth with less indication of personal competence of risk. Given the negative change in self-esteem over time evident for the overall sample, the positive path from personal competence risk to the self-esteem slope growth factor is best conceptualized as indicating that youth with greater reported amounts of this type of risk declined in their reported levels of self-esteem at a more gradual pace than did youth with less reported amounts of this type of risk.

The opposing relations obtained between perceived personal competence and initial status for self-esteem and growth in self-esteem indicates that multiple forces could be operating to determine growth in self-esteem. To help clarify these relations, the upper portion of Figure 2 shows change in reported level of self-esteem as a function of three indicated levels of competence risk. The three levels correspond to scores at the mean and one standard deviation

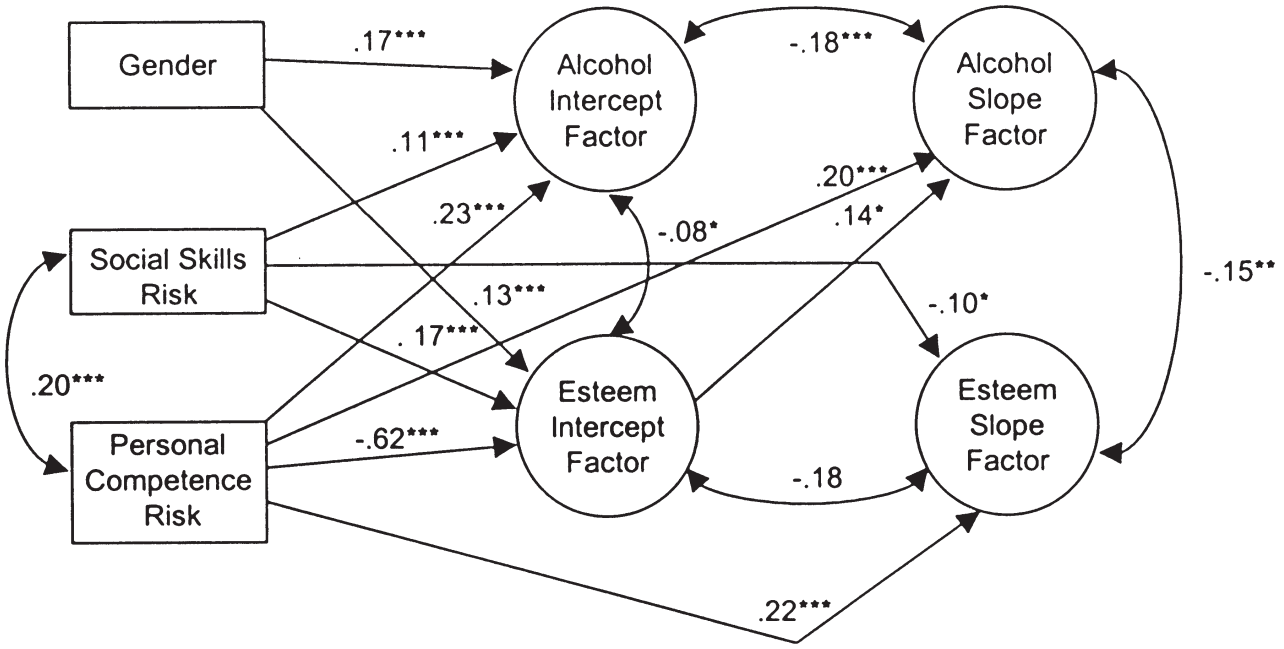

Figure 1: Final latent growth curve model depicting influence of control risk mechanisms on the developmental growth functions for alcohol and self-esteem.

NOTE: $N = 740$. Model is trimmed with respect to nonsignificant paths from control measures to growth functions.

*$p < .05$. **$p < .01$. ***$p < .001$.

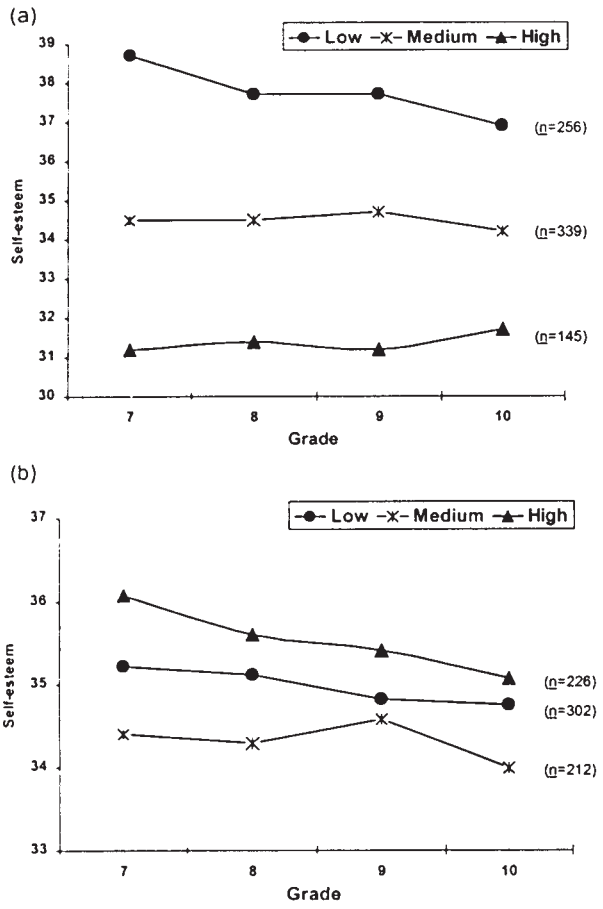

Figure 2: Graphic depictions of growth in self-esteem as a function of (a) competence risk status and (b) social skills risk status.

above and below the mean, respectively, on this index. As depicted, participants in the lowest bracket of risk for personal competence scored highest on initial levels of self-esteem, but they also had the steepest downward growth trajectory. Conversely, youth in the highest risk category (lowest perceived competence) reported lower initial self-esteem scores, with their self-esteem growth trajectory containing both positive and negative inflections across the four time points.

As noted previously, higher initial assessed levels of social skills risk were associated with higher initial reported levels both of self-esteem and alcohol

use. In addition, there was a significant negative path from the social skills risk index to the esteem slope growth factor ($\beta = -.10$, $p < .05$). This finding indicates that youth at greater assessed risk for poor interpersonal skills reported a steeper decrease in self-esteem over the 4-year period. However, when the positive path from social skills risk to the self-esteem intercept growth factor is considered in conjunction with the negative path to the developmental trajectory of self-esteem, a more complex picture emerges. Specifically, the lower portion of Figure 2 shows that the rate of decline in reported levels of self-esteem is not consistent for all levels of social skills risk. The highest risk group reported higher levels of self-esteem in the 7th grade but declined more rapidly in their reported self-esteem than youth with better assessed social skills. The lowest risk group (i.e., superior social skills) started at the middle point between high and medium risk, and their rate of descent was the most gradual of the three groups. Youth in the middle range for poor social skills actually improved their reported self-esteem in the period between the 8th and 9th grades and then declined substantially between the 9th and 10th grades.

DISCUSSION

Results of this study provide partial support for an early developmental linkage between self-esteem and alcohol use. Whereas previous studies have examined this relation using methodologies that incorporate static views of development, the present study relied on analytic strategies that emphasize change and growth. As a result, the current findings provide a more refined and detailed view of etiologic relations between self-esteem and alcohol use. Results reveal that reported levels of alcohol use and self-esteem both changed systematically over the 4-year period. These developmental functions, however, were moving in opposite directions. That is, the growth trajectory for alcohol use increased positively over the 4-year period, whereas that for self-esteem indicated a relatively straight-line decline over the same period. Additional findings provide support for a consolidation of alcohol use behaviors over this same time frame. Prevalence estimates increased dramatically over the 4-year period, for example, and greater numbers of youth reported intense drinking patterns including drunkenness. Moreover, those youth who reported the lowest initial levels of alcohol use were indicated to become progressively more involved with alcohol at a faster rate than were youth with higher initial levels of alcohol use.

As noted, in contrast to the steady linear increase evident in alcohol use, self-esteem was indicated to be characterized by negative, downward growth.

The magnitude of the indicated declines in self-esteem were modest relatively in absolute terms, but still nonetheless are noteworthy given the extended time frame involved. A careful inspection of differences in mean levels between time-adjacent intervals indicated a slight leveling in the rate of decline between the 8th and 9th grades. Nevertheless, tests of whether the developmental growth pattern for self-esteem was characterized better by fragmented pieces of negative growth or a curvilinear pattern proved not to improve on the basic linear growth model. Further findings indicated that early levels of self-esteem were related inversely to growth in self-esteem, such that youth with initially higher reported levels of self-esteem declined in their scores on this measure more rapidly than did youth with initially lower reported levels of self-esteem (who reported some increase over time). Additional studies also report negative growth trajectories for self-esteem among adolescents studied over a similar time frame (Hirsch & DuBois, 1991; Zimmerman et al., 1997). Those investigations used cluster analysis to differentiate growth trajectories among subsamples of youth, some of whom showed increased levels of self-esteem. The design for the present study involved a more powerful methodology to examine individual differences in growth, included a large sample, and the ability to demonstrate empirically a relation between initial reported levels of self-esteem and change or growth in ratings over time.

Once the growth processes for alcohol and self-esteem were modeled together, an interesting and more complex picture emerged. Initial levels of self-esteem were indicated to provide no significant information with regard to subsequent growth in alcohol use. Likewise, initial status in alcohol use was not indicated to do so with respect to growth in self-esteem. If this represented a final stage of the analyses, the present findings would comport with the null or relatively weak findings reported previously by investigators who used extended longitudinal designs (Kaplan et al., 1984; Schroeder et al., 1993; Wills, 1994). Direct estimation of the respective growth processes in LGM, however, provides additional information that is not apparent in previous studies that relied on fixed-effect approaches. An important finding to emerge in this regard was the evidence of a significant negative relation between the two slope factors. This association indicates that those youth who increased in their reported levels of alcohol use over the 4-year period to a relatively greater extent simultaneously experienced more precipitous declines in their reported levels of self-esteem. This evidence of divergent growth functions over time between self-esteem and alcohol use, combined with their negative cross-sectional pattern of association, provides some support for a protective developmental role for self-esteem.

Change also might be dependent on characteristics of the individual that accelerate or retard growth, however, and as a result assume an integral role in determining vulnerability. In this regard, an important finding of the study is the noted difference in findings between the model with regression adjustments for exogenous covariates and the basic growth model that did not include regression adjustments for the covariates. As noted, without regression adjustments, initial reported levels of self-esteem were not a significant predictor of growth in reported levels of alcohol use. Nevertheless, with the inclusion of the risk indices, the path from initial self-esteem status to the alcohol slope growth factor became positive and significant. Findings based on the expanded model framework thus indicate that when controlling for the presence of shared variance between the intercept factors for self-esteem and alcohol use and the background covariates, higher initial reported levels of self-esteem were predictive of relatively more rapid growth in reported levels of alcohol use.

Given what is known currently about the protective effects of self-esteem, it is somewhat unexpected that self-esteem would be indicated to foster increased alcohol use. There are a number of important factors to consider when constructing an explanation to account for this finding. First, as noted, both the zero-order relations evident between self-esteem and alcohol use and the indicated inverse relations between their patterns of change over time are consistent with a protective role for self-esteem that conforms to predictions based on existing theory and previous empirical findings. Why, then, should this pattern have changed when exogenous control measures were added to the growth framework? One possible explanation for this counterintuitive finding is that the control measures moderate the relation between initial reported levels of self-esteem and growth in reported levels of alcohol use. When modeled as third-variable alternatives, moderators can change the sign of a bivariate relation or diminish considerably its magnitude (Aiken & West, 1991).

In fact, a closer inspection of the growth trajectories divided up on the basis of high, medium, or low competence risk showed that youth who reported the highest competence levels (i.e., lowest competence risk) reported the highest initial levels of self-esteem but declined most rapidly on this measure over time. Conversely, those with the lowest levels of assessed competence started off with the lowest reported levels of self-esteem (initial reference point for their growth curve) and essentially showed flatline growth over time (with an indication of a trend toward positive growth between the 9th and 10th grades). One interpretation for these findings is that highly competent youth pay a price to maintain their high levels of perceived competence and

efficacy. That is, for such youth, there could be an emotional cost associated with maintaining feelings of personal control and high levels of perceived/actual competence. For instance, within their peer network, standards of excellence can be higher for competent and highly efficacious youth. The strain of maintaining high levels of efficacy (i.e., high grades) might compromise social development or contribute to negative social comparisons in other areas of functioning. Those factors, in turn, might have the potential to result in low self-esteem.

In addition to the possibility of moderation by the exogenous control measures, the residualization of the growth functions on the intercept factors and control measures could leave intact a piece of extraneous variance in self-esteem that reflects something other than sources of personal self-evaluation that are protective with respect to alcohol use. This variance, partialled for the effects of psychosocial vulnerability (most notably, assessed levels of competence that exhibited a particularly strong association with initial ratings of self-esteem), could reflect factors such as self-acceptance gained through peer socialization processes that are instrumental to fostering the early stages of alcohol use. Each year, there was a notable increase in the proportion of youth who reported having tried alcohol, and there were dramatic increases in the reported levels of intense alcohol use and levels of drunkenness. In this context, there is ample basis to expect at least certain facets of positive feelings of self-worth to become associated with normative pressures to use alcohol. High self-esteem derived from sources other than competence, such as elevated peer status, for example, could perhaps help to pave the way toward entry into desired peer networks and thus promote participation in group-sanctioned activites that include precocious alcohol use. Additional support for this view comes from several studies that have reported positive associations between social efficacy, assertiveness skills, and alcohol use (Scheier & Botvin, 1998; Wills, Baker & Botvin, 1989). In particular, Scheier and Botvin (1998) reported findings that indicated that social efficacy contributed to elevated levels of alcohol use controlling for early levels of competence. It would appear, then, that social factors can represent an important linkage between appraisals of self-worth and alcohol use.

In addition to highlighting a role of social skills in the early stages of alcohol use, each of the risk indices exhibited differing patterns of relations with initial reported levels of self-esteem and the various growth functions. On one hand, assessed level of risk for poor social skills was associated with higher reported levels of initial self-esteem but a more rapid decline in reported levels of self-esteem over time. The positive association evident between social skills risk and self-esteem is unexpected and difficult to interpret. Nevertheless, the emergence of the theoretically expected inverse

relation to self-esteem in the longitudinal portion of the model is consistent with the increasingly important role that social concerns and related skills are understood to assume as youth move further into adolescence. Social skills risk also was implicated as a factor that contributed to higher initial levels of alcohol use. However, if this relation is carried through to include the relation between initial levels of alcohol use and growth in alcohol use, it would seem that poorer social skills were associated contemporaneously with early alcohol use but assumed a minimal role in accelerating later and more progressive involvement. This is because youth lower in initial reported alcohol use accelerated faster in their reported alcohol involvement than youth who already reported relatively high initial levels of alcohol use.

Competence risk was indicated to have important linkages both to initial status and differential growth in alcohol use and self-esteem. Specifically, the contemporaneous relations indicate a protective role such that higher competence was associated with less alcohol use and greater reported levels of self-esteem. With respect to developmental growth functions, competence risk also was indicated to accelerate the rate of involvement with alcohol use such that youth with higher levels of assessed risk advanced more rapidly in their alcohol use, when compared to youth with lower levels of assessed risk. Although, as noted, youth assessed to be at greater risk for poor competence showed less decline over time in their reported levels of self-esteem as compared to youth with lower levels of assessed risk for poor competence, their reported level of self-esteem remained substantially lower throughout the 4-year period. Despite some exceptions, results for the most part thus implicate higher levels of perceived/actual competence in linkages in theoretically expected directions with criterion measures of functioning in other areas. When broken down into its constituent parts, personal competence taps a constellation of cognitive skills that can be expected to maintain feelings of self-worth through self-reinforcement, internal control, positive self-statements, a conviction that one can solve problems, and observed success in school. In one way or another, all of the personal competence risk factors assessed in the present research thus overlap conceptually with the rich set of interpersonal and intrapersonal experiences that theoretically fuel the development of self-esteem (e.g., Harter, 1993; Stanley & Murphy, 1997). If self-esteem reflects an appraisal or summary evaluation of self-worth, then perceived personal competence can be viewed as a collection of positive expectancies applied across multiple life domains that provide a cognitive framework to guide beliefs about the self.

A closer look at the findings for the model that included the risk indices also shows that the magnitude of association observed between the index of personal competence risk and initial status in self-esteem is both positive and

substantially larger than the negative and much smaller association between the index of social skills risk and initial status in self-esteem. Whereas competence represents a broad catchall for many skills and abilities, the risk factors included in the social skills index relate primarily to interpersonal mastery and social efficacy (e.g., assertiveness skills). It is possible that in the early stages of adolescence, when peer groups gain in stature and social skills are in constant developmental flux, social efficacy does not influence heavily the construction of self-esteem. In contrast, those factors contributing to the competence risk index are aligned more closely with traditional views of perceived efficacy as a fundamental cause of self-esteem and thus more likely to tap directly those factors that promote higher levels of this construct during early adolescence.

Despite the lack of indication of any significant effects on long-term growth, gender remained an important control for differences in mean levels of alcohol use and self-esteem. Consistent with previous reported studies of secondary school students, males reported higher levels of alcohol use (Barnes & Welte, 1986; Kandel, 1980). In particular, males reported more intense drinking and more frequent drunkenness, and they also were more likely to drop out from the study. These findings indicate conditions of psychosocial vulnerability for males even in the earliest stages of adolescence. Consistent with a wide body of literature (Kling et al., 1999), males also reported higher mean levels of self-esteem than did females. In the present study, higher initial levels of self-esteem prefaced greater declines in self-esteem over time. Thus, in addition to increased susceptibility stemming from precocious and more intensive alcohol use, it is not clear, based on the results, that young male adolescents derive lasting protective benefit from their relatively higher reported levels of self-esteem at this age. Although the present sample was not sufficiently large enough to provide robust estimation of differing growth trajectories on the basis of gender, it is important that further studies examine the possibility that males and females differ not only in reported levels of self-esteem and alcohol use, but also in growth mechanisms underlying psychosocial vulnerability in these areas.

Limitations of the Study

Several limitations of this study should be noted. First, the data were entirely self-report, which introduces the potential of confounding construct with method variance in the modeling portion of the analyses. A number of studies attest to the strength of self-report data to assess substance-use behaviors (e.g., Stacy, Widaman, Hays, & DiMatteo, 1985). However, using

multiple agent data (i.e., observational measures) for some of the behavioral and skills measures would have helped to clarify and strengthen the generalizability of these findings.

Second, only three prominent exogenous control measures that have been identified as determinants of early-stage alcohol use were examined in the present study (e.g., Hawkins, Catalano, & Miller, 1992). Most likely, numerous other factors influence differential growth and should be modeled accordingly. Furthermore, by bundling each set of risk factors into a single index, there was some loss of precision insofar as it was no longer possible to estimate effects of individual indicators of risk. One or more risk factors that account for a large share of influence cannot be detected when using this type of methodology. Disaggregation of the risk indices into measures of discrete risk factors was not feasible with the present moderately sized sample but should be a focus of further study. It also would likely prove informative to model growth functions for such risk indices in subsequent research or relatedly to model them as distal outcomes and thus be able to examine whether growth in either self-esteem or alcohol use exacerbates risk.

Additionally, the exogenous risk indices were modeled as manifest (i.e., observed) indicators, thus introducing an element of measurement error in model estimation. One alternative would be to use latent factors to reflect individual differences in risk, although this would require the use of larger samples to avoid compromising statistical power. Likewise, the measures of alcohol and self-esteem were modeled as manifest indicators at each assessment point and represent another source of measurement error. One potential solution to this problem is to posit a multilevel model with multiple indicators specified at each assessment point (Duncan & Duncan, 1996). This curve of factor method, however, requires larger samples to ensure adequate and robust parameter estimation. Alternatively, the residual variances corresponding to the observed indicators can be adjusted to reflect unreliability. Curran et al. (1997) applied this method and reported no difference in the final results for their analyses.

The loss of participants over the 4-year period introduces an element of potential bias to study findings. In particular, youth present at all four waves were indicated to be more socially efficacious; they perceived themselves as more competent and as having higher self-esteem, and also reported less involvement with alcohol. These differences could have altered the relations between self-esteem and alcohol use, given that more high-risk, alcohol-abusing youth were not available for follow up. Finally, despite the use of four waves of data to model longitudinal growth, it is possible that the model fit does not elaborate fully the precise sequencing of growth that ties together

self-esteem and alcohol use. In particular, it was possible only to model contemporaneous growth mechanisms based on four waves of data. Further studies should consider alternative mechanisms of growth that involve more extensive time frames. For instance, it would be informative to examine whether growth in one construct tends to temporally precede (and thus possibly influence) growth in the other, and whether there is evidence of effects on growth that are staggered or delayed. Specification of growth curves over more extended time frames combined with analyses to detect moderation by important socializing influences offer promise to clarify further the role of self-esteem in alcohol-use etiology during development.

Cumulatively, these limitations provide some basis for caution in the interpretation of the current findings. This is especially true with respect to those results that were counter to theoretical expectation, for which only post hoc interpretations can be offered. Further research on the developmental relations between self-esteem and alcohol use certainly is warranted in light of the overall evidence favoring a protective and beneficial role of self-esteem.

NOTE

1. Plots of the model-estimated growth trajectories indicated that there was a slight deceleration of the growth curve for self-esteem between the 8th and 9th grades. Specifically, the differences between observed mean scores for adjacent time periods (7th to 8th = .231; 8th to 9th = .096; and 9th to 10th = .296) indicated a pattern of uneven deceleration. A flattening or deflection in the growth trajectory during a specified time frame indicates a possible need for estimation of the growth portion of the model to proceed independently for different time intervals. To explore modeling the dissimilar trajectories evident in the present context more accurately required specifying a trend factor to model growth from the 7th to 8th and 9th to 10th grades and a separate trend factor to capture growth from the 8th to 9th grades. This piecemeal model did not fit the data well, $\chi^2(1, N = 740) = 11.843$, $p < .001$, NFI = .985, CFI = .986, SRMR = .001, RMSEA = .121 (C.I. = .066 – .187). The means for the two slope growth factors were nonsignificant ($\mu = -.27$ for the trend capturing 7th to 8th and 9th to 10th: $\mu = -.10$ for the 8th to 9th grade trend). The different estimated means for the slope factors do show, however, that the rate of decline in reported level of self-esteem was almost three times as steep in the two time intervals surrounding the period between the 8th and 9th grades.

Subsequent to testing a piecemeal model, a logarithmic scaling for the basis loadings of the slope growth factor also was estimated to account for the asymptotically shaped curvature in the period between the 8th and 9th grades. This model fit well, $\chi^2(4, N = 740) = 1.678$, $p = .795$, NFI = .998, CFI = 1.00, SRMR = .001, RMSEA = .000 (C.I. = .000 – .036), but did not improve appreciably on the model fit indices obtained from a model positing linear (straight-line deceleration) growth. Therefore, subsequent estimation of the growth function for self-esteem was based on a linear growth form.

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