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Measuring Developmental Changes in Alcohol Expectancies

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The goal of this study was to measure shifts in alcohol expectancies from childhood into adolescence while controlling for changes in the psychometric properties of the instrument. One thousand nine hundred ninety-three 4th-grade and 1,632 9th-grade students from South Dakota rated the likelihood that 23 outcomes would result from alcohol use. These expectancies were modeled using a 2-factor confirmatory factor analysis. After differences in the psychometric properties of the instrument were controlled, the cohorts were distinguished by a large difference in Alcohol Positivity, with older participants viewing alcohol's effects more positively. Additionally, older participants displayed greater Alcohol Potency, believing that alcohol has a larger impact on all outcomes. There were also significant differences in the interpretation of the alcohol expectancies items across cohorts.

Over the past two decades, numerous studies have demonstrated associations between alcohol outcome expectancies—beliefs that people have about the cognitive, behavioral, and emotional effects of alcohol—and self-reported drinking behavior (Goldman, Brown, Christiansen, & Smith, 1991; Jones, Corbin, & Fromme, 2001). In addition, several studies have attempted to document the changes in alcohol expectancies that occur as children become adolescents. Knowledge of both the negative and positive effects of alcohol appears to increase from childhood to early adolescence, with older youth tending to associate a greater number of positive and negative outcomes with drinking (Gillmore et al., 1998; Johnson & Johnson, 1995; Miller, Smith, & Goldman, 1990). Also, adolescent expectancies become more positive with age, with older children more likely than younger children to rate the positive effects of drinking as more probable than the negative consequences (Christiansen, Goldman & Brown, 1985; Gillmore et al., 1998; Miller et al., 1990).

However, observed changes on expectancy instruments might have little to do with changing beliefs about alcohol and instead reflect cognitive changes that alter how children make causal and probabilistic inferences and how they understand the outcomes asked about on the scales. Supporting this possibility, Dunn and Goldman (1998) found that the semantic interpretation of various potential drinking outcomes changed substantially from 3rd through 12th grade. For example, they found that some formerly undesirable events took on desirable characteristics (e.g., *dangerous* changed from a negative to a positive outcome) as children aged. Changing interpretations of the outcomes used in alcohol expectancy scales may contribute to the observed age-related differences in alcohol expectancies. Additionally, developmental theorists have identified changes in the cognitive processes children

use to make judgments assessing likelihood and causality (Scholz & Waller, 1983). Younger children tend to make likelihood judgments by examining their own experiences, whereas adolescents reference abstract causal models. Thus, adolescents may use a different referent than younger children to interpret instrument response options, responding differently to expectancy questions even when the content and valence of their expectancies are similar.

For these reasons, age-related shifts on alcohol expectancy scales may represent developmental changes in psychometric properties of a measurement instrument. Distinguishing between true shifts in beliefs about alcohol and differences that reflect shifts in the interpretation of the measurement instrument requires ensuring that alcohol expectancies are measured on a common metric across the developmental span of interest. Statistical analyses that create a common metric are regularly used when comparing across scores of ethnic, cultural, or linguistic groups; however, the existing studies documenting developmental changes in alcohol expectancies have not used these methods. Therefore, the observed differences may reflect broader developmental changes that are not specific to alcohol expectancies. The current study was designed to (a) investigate differences in the structure and strength of alcohol expectancies between children and adolescents and (b) document and control for age-related changes in the measurement properties of the instrument so that individuals from different age groups are on a common metric.

Method

Sample

The sample for this study consisted of 1,993 fourth graders and 1,632 ninth graders drawn from 60 South Dakota schools in the spring of 2000. The sample was representative of the population of South Dakota in this age range: 50% female, 85% Caucasian non-Hispanic, 11% American Indian, 4% other ethnicity. Twenty-nine percent of fourth graders and 80% of ninth graders reported having had "at least one drink of alcohol (more than a few sips)."

Measures

The 23-item measure of alcohol-related expectancies was designed specifically for use in the current study to meet three criteria: (a) assess a

wide range of alcohol-related outcomes, (b) be understood across a wide age range, and (c) minimize response burden. Some items were based on the Alcohol Expectancy Questionnaire—Adolescent (AEQ–A; Christiansen, Goldman, & Inn, 1982). To ensure a broad range of outcomes, we drew items from each of the AEQ–A subfactors. We also added 8 items based on focus groups held with South Dakota children in the fourth through ninth grades. We simplified the wording of several items to make them more applicable and understandable to younger respondents. This resulting set of items has approximately equal numbers of positive and negative outcomes and represents a broad range of affective, cognitive, and behavioral effects of alcohol use (see Table 1).

Expectancy items were presented in a single random order and were preceded by the following question: "How likely is it that the following things would happen to people your age if they had one or more drinks of alcohol?" Response options ranged from *very likely* (4) to *very unlikely* (1).

Analyses

We used common multiple-group confirmatory factor analysis procedures to investigate group differences (e.g., Byrne, Shavelson, & Muthén, 1989). In the first step, confirmatory factor analysis models were fit separately to each cohort's covariance matrix to demonstrate a good fit within each cohort. We then developed a multiple-group means model to compare the means across cohorts and assess measurement invariance using common psychometric techniques (e.g., Reise, Widaman, & Pugh, 1993).

The expectancies instrument was designed to assess each participant's overall evaluation of expected alcohol-related outcomes (e.g., Bauman, Fisher, Bryan, & Chenoweth, 1985). Therefore, model development started with a factor that loads positively on good outcomes (e.g., makes you feel cheerful) and negatively on bad outcomes (e.g., get in trouble with your parents). We refer to this factor as *Alcohol Positivity*. It is also possible that

some respondents expect alcohol consumption to affect all outcomes, both good and bad, and to rate all items as likely to occur regardless of valence. To capture this difference, a second factor, called *Alcohol Potency*, was included in the model. This conceptualization of alcohol expectancies as having an evaluative (does alcohol use produce more good than bad outcomes?) as well as a potency (does alcohol generally make outcomes more likely to occur?) component is consistent with Fromme, Stroot, and Kaplan (1993).

Because the measure includes two outcomes from some AEQ subfactors, we expected these pairs of outcomes to have correlated residuals due to high overlap in content (e.g., "feel more cheerful" with "feel happy"). The model includes correlations between seven item pairs with very similar content to control for the possible influence of omitted subfactors.

All parameter estimates were estimated using expectation maximization (EM) maximum likelihood methods. To ensure that our estimated standard errors were robust with respect to the normality of the observed variables, we estimated the standard errors using a sandwich estimator and the Yuan–Bentler T2* (Yuan, Marshall, & Bentler, 2002) test statistic. Model fit was evaluated using the technique outlined by Hu and Bentler (1999), with a standardized root-mean-square residual (SRMR) less than .07 and a root-mean-square error of approximation (RMSEA) less than .06 indicating good fit.

Results

The baseline two-factor model provided a good fit to the data (SRMRs < .04, RMSEAs < .05) in each of the samples. To improve the interpretability of the factors, we wished to simplify the pattern of loadings by assuming tau equivalence (equal factor loadings) on the Alcohol Potency factor. The models maintained

Table 1
Item Means and Model Intercepts by Grade Level

Item	Item means			Model intercepts		
	4th	9th	Diff.	4th	9th	Diff.
Feel more cheerful	1.88	2.91	1.04	2.89	2.89	†
Feel happy	2.07	3.07	1.00	3.06	3.06	†
Feel more friendly	1.76	3.01	1.25	2.61	3.00	0.39*
Have fun	2.37	3.22	0.85	3.23	3.23	†
Feel relaxed	2.15	3.03	0.88	3.03	3.03	†
Look cool	1.87	2.10	0.23	2.64	2.10	−0.54*
Feel romantic	2.17	2.71	0.54	2.76	2.76	†
Feel braver about talking to people	2.43	3.26	0.83	3.00	3.26	0.26*
Forget their problems	2.62	2.69	0.06	3.05	2.68	−0.37*
Feel grown-up	2.98	2.77	−0.21	3.43	2.77	−0.66*
Act wild	3.37	3.54	0.17	3.51	3.51	†
Do something they feel sorry about later	2.93	3.11	0.18	3.12	3.12	†
Act clumsy	3.26	3.47	0.21	3.43	3.43	†
Say things they wished they hadn't said	3.19	3.27	0.07	3.24	3.24	†
Act stupid	3.55	3.50	−0.05	3.48	3.48	†
Get into trouble with the police	3.25	2.88	−0.37	3.13	2.89	−0.24*
Feel sick to their stomach	3.42	3.25	−0.17	3.26	3.26	†
Get into fights	3.31	3.13	−0.18	3.15	3.15	†
Get into trouble with parents	3.65	3.24	−0.41	3.49	3.25	−0.24*
Have trouble thinking	3.58	3.42	−0.17	3.42	3.42	†
Harm their health	3.45	3.22	−0.23	3.25	3.25	†
Do something dangerous	3.52	3.28	−0.25	3.30	3.30	†
Act mean	3.36	2.99	−0.37	3.05	3.05	†

Note.   Model intercepts are item means estimated in the final model while controlling for the differences in the latent variables. Diff. = difference; † = parameters set to be equal in final model.
* *p* < .001, Bonferroni corrected.

good fit in each sample with this constraint (SRMRs < .06, RMSEAs < .05).[1]

To investigate cohort differences in alcohol expectancies and in the psychometric properties of the items, we combined the models that were developed on each cohort. Our initial multiple-group means model assumed equal item loadings and intercepts (i.e., model-adjusted item means) across the two groups but allowed other model parameters (e.g., factor means) to be estimated independently. This model did not fit adequately (SRMR = .08, RMSEA = .06), indicating the need to relax some of the assumptions of measurement invariance. Allowing seven item intercepts to differ across the two groups dramatically improved model fit, $\Delta\chi^2(7) = 735.7$, $p < .001$, and allowing three loadings on the *Alcohol Positivity* factor to differ further improved the model, $\Delta\chi^2(3) = 109.7$, $p < .001$. This final two-group model demonstrated a good fit to the data (SRMR = .06, RMSEA = .05).

The final model revealed several differences between the younger and older participants. Most important, the mean level of Alcohol Positivity among the older cohort was more than one standard deviation higher than the younger cohort (Cohen's $d = 1.16$, $p < .001$), even after controlling for psychometric shifts on several of the items. There were also cohort differences on Alcohol Potency. Respondents from the older cohort indicated that alcohol consumption made both positive and negative outcomes more likely (Cohen's $d = .46$, $p < .001$).

We also observed age-related differences in the psychometric properties of several of the items. Seven items had different intercepts across cohorts even after controlling for differences in the factors, indicating differential item function. Ninth graders judged "feel more friendly" and "feel braver about talking to people" as more likely outcomes than did the fourth graders, whereas fourth graders judged "look cool," "forget their problems," "feel grown-up," "get into trouble with the police," and "get into trouble with parents" as more likely than ninth graders. Although the two factors account for almost all of the cohort differences in item means (see Table 1), these seven items appear to have significant age-related biases. There was also evidence of age-related shifts in the relationship between three of the outcomes and the Alcohol Positivity factor. The older cohort's responses indicated that they viewed "forget their problems" and "act wild" as more positive outcomes than did the younger participants; however, they viewed "do something they feel sorry about later" more negatively (see Table 2).

To assess how these expectancies varied as a function of differential experience with alcohol, we estimated a model that included a dichotomous measure of alcohol consumption (0 = *no lifetime use*, 1 = *any lifetime use*). Alcohol use predicted increased Alcohol Positivity in the older and younger cohorts (βs = .37 and .10, ps < .001, respectively). It was also a weak predictor of decreased Alcohol Potency in both cohorts (βs = −.10 and −.05, ps < .001 and .05, respectively). Unlike the cohort effects, there were no substantial shifts in psychometric properties as a function of drinking status.

Discussion

Previous research has measured shifts in alcohol expectancies as children age into adolescence. However, evidence suggests that the items commonly used to assess expectancies do not function similarly across this age range. In this study we compared alcohol

Table 2
Standardized Factor Loadings by Grade Level

Item	Alcohol Positivity factor		
	4th	9th	Diff.
Feel more cheerful	.66	.73	†
Feel happy	.64	.76	†
Feel more friendly	.65	.69	†
Have fun	.50	.62	†
Feel relaxed	.57	.67	†
Look cool	.40	.44	†
Feel romantic	.36	.41	†
Feel braver about talking to people	.28	.39	†
Forget their problems	.18	.40	*
Feel grown-up	.19	.20	†
Act wild	−.13	.00	*
Do something they feel sorry about later	−.01	−.22	*
Act clumsy	−.11	−.14	†
Say things they wished they hadn't said	−.20	−.25	†
Act stupid	−.35	−.36	†
Get into trouble with the police	−.28	−.31	†
Feel sick to their stomach	−.35	−.36	†
Get into fights	−.30	−.34	†
Get into trouble with parents	−.40	−.36	†
Have trouble thinking	−.42	−.40	†
Harm their health	−.33	−.37	†
Do something dangerous	−.44	−.45	†
Act mean	−.43	−.44	†

Note. Significance refers to comparisons of unstandardized loadings across cohorts. Diff. = difference; † = unstandardized parameters set to be equal in final model. Alcohol Potency factor loadings are equal to each other in the final model and are not included in this table.
* $p < .001$, Bonferroni corrected.

expectancies across two age groups, employing analytic techniques typically used to create a common metric across distinct cultural or language groups. The analyses revealed sharp differences in the alcohol expectancies of fourth and ninth graders as well as important differences in how they interpreted some of the instrument's items. Specifically, ninth graders had substantially more positive expectations of alcohol, even when we controlled for psychometric shifts, with the average fourth grader falling in the 11th percentile of the ninth-grade Alcohol Positivity distribution. In addition, ninth graders scored somewhat higher than fourth graders on Alcohol Potency, indicating a stronger belief among adolescents than among younger children that alcohol can affect their behavior, both positively and negatively. These dramatic shifts in alcohol expectancies occurred across a developmental period in which approximately 50% of individuals initiate drinking (Johnston, O'Malley, & Bachman, 2003); however, the age-related shifts we observed were not attributable to differential alcohol exposure. Additional research is needed to better understand the causes of these changes in expectancies and to determine how prevention programs might modify children's beliefs about the rewarding properties of alcohol consumption.

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[1] Although the models fit well with the equality constraint, there was evidence that this constraint was not appropriate for items that showed floor effects. Specifically, the Alcohol Potency loadings for the least endorsed item in each sample were smaller than for other items ("feel more friendly" among fourth graders and "look cool" among ninth graders). To avoid misspecification caused by this restricted range problem, these two loadings were freely estimated in models that compare across cohorts.

To establish a common alcohol expectancies metric across cohorts, we controlled for several violations of measurement invariance. Age-related item biases that could not be accounted for by global changes in Alcohol Positivity and Alcohol Potency were the largest sources of invariance. In several cases, these item-specific shifts had medium to large effect sizes (Cohen's $d > .5$) and, if ignored, could have significantly biased the results. Although the precise causes of these biases are not known, the developmental literature suggests they may be unrelated to alcohol, stemming instead from developmental changes in the perceived base rates of these specific outcomes (e.g., younger children may see "forgetting their problems" as a more frequent occurrence than adolescents, irrespective of alcohol use) or changes in the meanings of the outcomes (e.g., younger children may not interpret "feeling grown up" in the same way as adolescents). In addition, three of the assessed outcomes differed in their relationship with the Alcohol Positivity factor across the two cohorts. These differences may be due to changes in the interpretation of these outcomes, as Dunn and Goldman (1998) suggested, or to changes in cognitive development (e.g., the capacity to anticipate regret).

Because of these shifts in the psychometric properties of the items, researchers who compare alcohol expectancies across a developmentally significant age range should carefully assess measurement invariance and control for it, either statistically or by dropping the items that function inconsistently across the age range. Although we cannot definitively state that the observed differences in alcohol expectancies are free of measurement artifacts, large differences remained after controlling for numerous potential sources of bias. Future research should continue to investigate how broad developmental factors influence measurement of key constructs and should implement practical analytic tools that mitigate these threats to validity.

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