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Youth Misperceptions of Peer Substance Use Norms: A Hidden Risk Factor in State and Community Prevention

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Abstract Effective community prevention of substance abuse involves the integration of policies and programs to address many different risk and protective factors across the social ecology. This study sought to examine whether youth perceptions of peer substance use norms were operating as a risk factor at the same level as other known risk factors in a statewide community prevention effort. Several different analytical techniques were employed to examine the self-reported data from a sample of over 8,000 students in grades 6, 8, 10, and 12 from across Wyoming using a survey based on a risk and protective factor model. The findings of this study revealed that youth misperception of peer substance use norms operate at a level of significance similar to other known risk factors, and these misperceptions are a risk factor that should be measured in order to estimate its relationship with substance use. The measurement of this risk factor has important strategic implications for community prevention.

Keywords Youth · Social norms · Perceptions · Alcohol and substance abuse · Risk and protective factors

Substance abuse leads to a wide range of negative consequences for society, communities, families, and individuals. According to the World Health Organization, the use of alcohol and tobacco is among the top ten risk factors to good health worldwide (WHO 2002). Many individuals suffer death, injury, and illness each year because of substance abuse (John et al. 2003; Single et al. 2000), and substance abuse often results in severe social problems like interpersonal violence, sexual assault, and crime (Birckmayer et al. 2004). Adolescence represents a time of increased experimentation and use of alcohol, tobacco, and other substances, and young people remain particularly vulnerable to substance use and its consequences (CDC 2010). For example, the National Survey on Drug Use and Health (Substance Abuse and Mental Health Services Administration 2011) estimates that in the USA, 10.7 % of 12 to 17 year olds report past month tobacco use and 10.1 % of 12 to 17 year olds report past month illicit drug use. The same survey estimates current alcohol use rates of 12.4 % among 14 to 15 year olds, 24.6 % among 16 to 17 year olds, and 48.9 % among 18 to 20 year olds. The Youth Risk Behavior Surveillance System provides similar estimates for 9th through 12th graders for 2009. Nineteen point five percent (19.5 %) report smoking cigarettes, 20.8 % report using marijuana, and 41.8 % report using alcohol at least once in the 30 days prior to the survey (CDC 2010).

Over the past two decades, the field of substance abuse prevention has increased considerably its knowledge of the factors that influence the kind of abuse detailed above. Adolescent substance abuse has long been viewed from a social ecological model of human development (Bronfenbrenner 1979), and the field of community prevention owes much to the work of Hawkins, Catalano, and Miller who in 1992 adapted a basic public health framework into factors that promote protective health behaviors and hinder risky health behaviors. They categorized these risk and protective factors into four general domains (community, family,

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school, and individual/peer) and argued that once these factors were identified, community interventions could be designed to directly intervene and change them. The measures were improved in 2002 when Arthur, Hawkins, Pollard, Catalano, and Baglioni published the validity and reliability results of the Communities that Care (CTC) Youth Survey. Many strategies designed to improve identified risk and protective factors have demonstrated positive effects on these predictors and risky health behaviors like alcohol and tobacco use (Biglan et al. 1996; Blitz et al. 2002; Catalano et al. 1998).

While a focus on individual risk and protective factors remains important, research on other variables in the environment that increase or reduce the likelihood of adolescent substance abuse has also increased (Connell et al. 2010). In 2004, Birckmayer et al. (2004) united what they considered a disorganized and fragmented discipline to create a general causal model for substance abuse prevention. This model identified seven domains that connect across alcohol, tobacco, and other drug use. These include individual factors measured on the CTC Youth Survey including risk factors like early and persistent antisocial behavior, rebelliousness, friends who engage in the problem behavior, gang involvement, favorable attitudes toward the problem behavior, early initiation of the problem behavior, sensation seeking, and perceived risks of drug use and protective factors like social skills, impulsiveness, and healthy beliefs and clear standards as well as environmental causal areas like retail availability and community norms. Prevention strategies that target individuals and are designed to influence individual beliefs, attitudes, and behaviors are the most well-known among practitioners, policy makers, and the general public, while environmental strategies that seek to change the context in which substance abuse occurs are less well known (Fisher 2010).

Several theories seeking to predict health behaviors recognize the potential influence of the misperception of peers norms: the Theory of Planned Behavior (Ajzen 1991); the Theory of Reasoned Action (Fishbein and Ajzen 1975); Social Norms Theory (Perkins and Berkowitz 1986); and the Positive Community Norms framework (Linkenbach and Otto 2009). Social norms theory proposes that a gap may exist between the actual norms of a population (what most people do or believe) and what individuals within the population perceive most people do or believe. These normative misperceptions can lead individuals to behave in ways which they believe align with the norms of a population when in fact they do not align. Interventions which correct these misperceptions result in more behaviors aligning with the actual norms (Perkins and Berkowitz 1986). Several studies have shown that misperceptions of peer norms are correlated with individual risk behaviors (Baer et al. 1991; Perkins et al. 1999; Perkins 2003; Prentice and Miller 1993).

One implication of the widespread identification of misperceptions of peer substance use norms is the potential for correcting these misperceptions through population-level interventions known as social norms marketing (Linkenbach 1999). Social norms marketing is based upon the idea that perceived norms are associated with substance use, people overestimate peer substance use, these perceptions lead to subsequent use, and correcting misperceptions can reduce use (Perkins 2003). Research has supported all aspects of this theory (Borsari and Carey 2003; Fabiano et al. 2004; Mattern and Neighbors 2004; Neighbors et al. 2006; Perkins and Craig 2006; Perkins et al. 2005). Correcting normative misperceptions, to be in line with peers' actual behaviors, has resulted in decreased risk behavior among target audiences—especially college students (Agostinelli et al. 1995; Baer et al. 1992; Linkenbach and Perkins 2003; Perkins 2003; Turner et al. 2008; Walters 2000). Evidence for normative approaches was summarized in 2002, when a panel of national prevention specialists appointed by the National Institute on Alcoholism and Alcohol Abuse designated social norms interventions as one of the key strategies to reduce college drinking (Berkowitz 2004).

Effective prevention planning requires the use of empirically established predictors of risky health behaviors (Arthur and Blitz 2000), like the risk and protective factors profiled by the CTC Youth Survey. An effective prevention strategy targets empirically identified predictors of substance use with appropriate interventions. From this perspective two questions arise. How can community prevention leaders use misperception of norms as a predictor of substance use? And when should a community implement a social norms marketing campaign?

The present study was designed to address a gap in published literature that fails to provide a way to empirically create and test misperception as a risk factor for substance use, thereby linking an empirical predictor to the social norms strategy. More specifically, this study's hypothesis is that the misperception of peer substance use as measured on Wyoming's student survey of risk and protective factors is a predictive factor for youth substance use. Using misperception of use as a predictor alongside other risk factors like rebelliousness or sensation seeking allows researchers to answer the above questions as well as understand the relative importance of misperception as a risk factor.

Methods

Survey Instrument

The Wyoming Prevention Needs Assessment (PNA) survey serves as the survey instrument for this study. Wyoming has modified the PNA slightly from its origins as the CTC Youth Survey, with approximately 85 % of the PNA remaining items being identical to those on the CTC Youth Survey. The primary purpose of the PNA is to gather information for the planning and evaluation of substance abuse, violence, and delinquent behavior prevention programs in Wyoming. The PNA has been administered in Wyoming as a census survey of all enrolled 6th, 8th, 10th, and 12th grade students since the 2001–2002 school year. The survey asks students about their lifetime and 30-day use of 13 separate substances and their participation in 11 specific problem behaviors. It also assesses a wide variety of factors, such as student perceptions of their communities, families, and schools, as well as peer interactions and individual attitudes that are likely to influence student use of drugs or student participation in problem behaviors. The 21 risk and protective factors measured in the PNA are identical to those used in the CTC Youth Survey. The 2008 PNA underwent changes when a committee composed of representatives from the Wyoming Department of Health, Wyoming Department of Education, several Wyoming school districts, and the State Advisory Council for Substance Abuse Prevention reviewed the instrument. This committee dropped and changed some questions to streamline the process and decided to add a scale measuring youth misperception of peer substance use.

The new scale consisted of seven questions asking how often the participant thinks that *most students* in their school used a particular substance in the recent past. The questions included: 30-day alcohol use, binge drinking during the past 2 weeks, 30-day cigarette use, 30-day chewing tobacco use, 30-day marijuana use, 30-day methamphetamine use, and 30-day illegal drug use. All items on the new scale, except for illegal drug use, had a corresponding question asking about the participants' own substance use. These actual use questions were unchanged in the 2008 PNA, and researchers worded all the misperception questions as closely as possible to the actual use questions. For example, the actual use question for 30-day marijuana use was, "On how many occasions (if any) have you used marijuana during the past 30 days?" The misperception question asked, "In your opinion, on how many occasions do you think most students in your school used marijuana in the past 30 days?" (emphasis replicated from the survey). For both questions, the students were given the same set of response choices: "0, 1–2, 3–5, 6–9, 10–19, 20–39, 40+." The goal of this design was to make the misperception questions and the actual use questions as comparable as possible. To minimize order effects on actual use, the survey misperception questions followed the actual use questions.

Participants

The 2008 PNA was administered as a census survey of all 6th and 8th grade middle school students and 10th and 12th grade high school students in Wyoming (147 of 153 middle schools participated, 83 of 87 high schools participated). The school staff and/or faculty administered the survey directly in the school to the students. The survey followed similar consent procedures and classroom administration protocols as the Youth Risk Behavior Surveillance System (CDC 2010). The researchers sent a letter to the parents at least 2 weeks prior to the survey administration date to inform them of the survey. A copy of the survey was available at the child's school for review. Parents who did not want their child to participate could return the bottom portion of the letter to opt out of survey participation. At the time of the survey administration, the students' assent was sought as part of the oral and written instructions, which informed the students that the survey was anonymous and voluntary. Non-participating students could participate in an alternative activity, such as homework or independent reading. Students were then given the opportunity to use class time to complete the survey. Students returned the questionnaires in a common classroom envelope which at the end of the classroom period was sealed and sent back to the researchers.

The researchers received a total of 18,162 surveys from 6th, 8th, 10th, and 12th grade students, which represents 69 % of all enrolled students in the state in those grade levels. The research team applied a set of validity criteria to exclude respondents who may have been dishonest or who had large numbers of inconsistent responses. The exclusion criteria followed the model described in Glaser et al. (2005) and are consistent with CTC Youth Survey methodologies. After applying the exclusion criteria, 969 students (5 %) were removed from the original dataset leaving 17,193 valid respondents, for total valid survey response rate of 65 %. Seventy-six percent of the valid respondents were White, non-Hispanic, 13 % Hispanic, 5 % multiracial or some other race, and 3 % Native American. Finally, the racial categories of Black/African American, Asian, Pacific Islander, and unknown race and/or ethnicity each

came in at 1 % or less. The gender distribution was equally divided, with 50 % female, 49 % male, and just over 1 % unreported. For this study, the research team randomly sampled approximately half of the cases for analysis for a total sample of 8,679 cases. The analysis dataset was verified and did not differ significantly with regard to grade level, gender, or race/ethnicity from the total dataset described above.

Analysis

Social norms theory has as its premise that the more a person believes the majority of his or her peers are engaging in a behavior the more likely it is the person will actually engage in the same behavior. Analysis proceeded through the following stages: (1) forming a scale of student perception and checking its psychometric properties, (2) examining the predictive relationship between this scale and actual substance use measures, and (3) comparing this scale against other CTC risk and protective factor scales as measured on the PNA. All analyses were conducted using SPSS version 21.

The first stage examined the feasibility of forming a single scale from the seven social norms questions. If a single scale score was possible, it would represent a measure of not only how much a student believes that most of his or her peers were using a single substance, but a more general perception of how much he or she believes most students are using many different substances. This scale could then be applied more generally to investigate its relationship to single substance and combined substance use measures. Scale score properties were investigated using internal reliability, item-whole analyses, and other classical test theory analyses. The CTC risk factor scoring protocols served as a model to form the final scale score for the misperception of peer substance use.

The second stage used scale scores to investigate the predictive relationship between misperception and actual substance use. The scale scores served as covariates in logistic regression analyses. The dependent variables in these models were the seven actual substance use measures and also the same constructed behavioral classification variables used by Arthur et al. (2002) when validating the original risk and protective factor scale scores. The demographic variables of grade level, gender, and race served as control variables within these models.

The final stage of analysis within this study involved using receiver operating characteristic (ROC) curves to measure the overall scale sensitivity (the true-positive rate) and specificity (the true-negative rate) when categorizing students as being at-risk or not-at-risk for substance use because of student misperceptions. This analysis also compared the CTC risk and protective factor scale scores in their ability to correctly classify students as at risk or not.

Results

Scale Formation

The research team proceeded with creating a scale across the seven perceived use questions. The score for this new Misperception Risk Factor followed the same pattern as other CTC risk and protective factor scale scores (Arthur et al. 2002; Glaser et al. 2005). Most items in the scale had a range of seven different response choices. One of the seven items had only five response choices and another item had only six response choices. To form the scale, the items with seven response choices numbered the ratings from one (no use) to seven (most use) as allowed by the item. For the two items that had fewer than seven response choices, the researchers assigned equidistant fractional values to span the range of one to seven. Calculating the scale score required that the participant answer at least four of the seven items; otherwise, researchers did not calculate the scale score. The mean number of answered scale items was 6.733 (SD=1.181). The scale score consisted of the mean of the seven items, with the two recoded variables being replaced for the items with five and six response choices.

Reliability analysis indicated strong internal consistency between the seven items for all four grade levels (6th grade, Cronbach α=0.907, n=2,310; 8th grade, Cronbach α=0.897, n=2,383; 10th grade, Cronbach α=0.886, n=1,967; 12th grade, Cronbach α=0.872, n=1,421). When compared across grade levels separately, the item-whole correlations for all items ranged from a high of r=0.823 to a low r=0.511 ($\bar{r}$=0.689, SD=.088).

Scale score differences between gender, grade, and race/ethnicity categories were investigated using a 2 (gender)×4 (grade)×3 (race/ethnicity) fixed factors ANOVA. For a more balanced design, the race/ethnicity categories were collapsed into three categories: white, Hispanic, and all other race/ethnicities. Table 1 lists the means and standard deviations for the Misperception Risk Factor Scale score as a function of the model variables. Table 2 provides the summary ANOVA statistics for the full factorial model. Based on these results, the main effect for grade level had the largest effect size (^{2}=.190). Scheffe multiple comparison tests indicated that the sixth grade scale score's mean of 1.600 (SD=0.936) was significantly lower than all the other grade levels. The eighth grade mean (M=2.649,

Table 1 Means and standard deviations of the misperception risk factor score for grade level as a function of gender and race/ethnicity category

Grade level	White		Hispanic		All other race/ethnicity	
	M	SD	*M*	SD	*M*	SD
Male						
6th	1.54	0.92	1.54	0.84	1.62	0.96
8th	2.41	1.35	2.67	1.41	2.64	1.39
10th	3.51	1.50	3.76	1.61	3.67	1.52
12th	3.42	1.41	3.56	1.63	3.47	1.51
Female						
6th	1.60	0.91	1.75	1.04	1.86	1.16
8th	2.78	1.38	3.07	1.38	3.03	1.44
10th	3.92	1.37	4.21	1.47	3.89	1.45
12th	3.86	1.36	4.08	1.48	3.89	1.48

SD=1.380) was also significantly different than all other grade levels. Finally, the 10th and 12th grades did not have any significant differences in their mean scale scores relative to each other (10th grade, M=3.755, SD=1.472; 12th grade, M=3.655, SD=1.398), though they did differ significantly from the sixth and eighth grades. All other model terms had very small effect sizes, and Scheffe multiple comparisons tests yielded no significant subgroup differences.

Scale Validation

Within each grade level, a set of eight binary logistic regression models served to validate the Misperception Risk Factor's predictive relationship with substance use and problem behavior. The research team dichotomized all eight dependent variables to represent no use versus some use. This helped control for the non-normally distributed data in the dependent variable and made model interpretation easier. The first seven dependent variables were 30-day alcohol use, 2-week binge drinking, 30-day cigarette use, 30-day chewing tobacco use, 30-day marijuana use, 30-day methamphetamine use, and 30-day illegal drug use.

Table 2 Analysis of variance results for main effects and interaction effects of grade, gender, and race on misperception risk factor score

Variable	*df*	*MS*	*F*	*p*	^{2}
Grade	3	1,080.640	655.60	<.001	.190
Gender	1	123.256	74.78	<.001	.007
Race/ethnicity	2	24.532	14.88	<.001	.003
Grade×gender	3	5.692	3.45	.016	.001
Grade×race/ethnicity	6	2.312	1.40	.209	.001
Gender×race/ethnicity	2	1.382	0.84	.432	<.001
Grade×gender×race/ethnicity	6	.623	0.38	.893	<.001
Error	8,242	1.648			

The last dependent variable combines substance use and problem behavior as measured on the PNA. This dependent variable is the same one used by Arthur et al. (2002) when validating the original CTC risk and protective factor scales and finding their cut points and classifies students into three groups. The first group represented "students who reported involvement in problem behaviors to a serious degree" (Arthur et al. 2002, p. 200). The second group represented students who engaged in no negative behaviors and who reported engaging in positive behaviors. The third group represented students who did not fall into either of the previous categories. As was done for the CTC Youth Survey, students in this third category were excluded from the analysis whenever this categorization variable was used. For a full description of this classification scheme, see Arthur et al. (2002). A table listing the descriptive statistics for the model variables as a function of each of the eight dependent variables is available online.

The research team examined these relationships through a series of nested logistic regression models. The first regression model controlled for the effects of grade, gender, and race/ethnicity (white, non-Hispanic versus not white, non-Hispanic). As can be seen in Table 3, across all eight dependent variables, the control model was highly significant based on the Likelihood Ratio Statistic.

The second regression model tested the effect of the Misperception Risk Factor score alone in predicting the dependent variable after controlling for the demographic variables. This second model was also significant across all eight of the measured dependent variables, and in all cases, the fit of the models, as measured by the *Nagelkirk* r^2, substantially improved when the Misperception Risk Factor score was added to the models as a covariate (see Table 3).

The third regression model added the interaction effect between grade level and the Misperception Risk Factor. For six of the eight dependent variables, adding this term was statistically significant, but for all eight of the variables adding this term to the model resulted in only minor improvements in the *Nagelkirk* r^2 statistic (see Table 3).

The final model added three interaction effects: (1) the two-way interaction between gender and the scale score, (2) the two-way interaction between dichotomized race/ethnicity variable and the scale score, and (3) the three-way interaction effect between gender, grade level, and the scale score. In all cases, these interaction effects

Table 3 Nested logistic regression model effects for the Misperception Risk Factor Score on the eight substance use and problem behavior dependent variables

DV	Model type	*n*	*LR*	*df*	*p*	*Nagelkirk* r^2
Alcohol		8,200				
	Control model		1,085.06	6	<0.001	0.183
	SS main effect		351.69	1	<0.001	0.237
	SS by GL interaction effect		51.44	3	<0.001	0.245
	Other interactions		4.25	5	0.513	0.246
Binge drinking		8,186				
	Control model		725.22	6	<0.001	0.145
	SS main effect		278.28	1	<0.001	0.197
	SS by GL interaction effect		48.34	3	<0.001	0.206
	Other interactions		9.51	5	0.090	0.208
Chewing tobacco		8,167				
	Control model		645.25	6	<0.001	0.185
	SS main effect		113.57	1	<0.001	0.217
	SS by GL interaction effect		33.14	3	<0.001	0.226
	Other interactions		8.04	5	0.154	0.228
Cigarettes		8,163				
	Control model		545.30	6	<0.001	0.124
	SS main effect		251.40	1	<0.001	0.178
	SS by GL interaction effect		45.01	3	<0.001	0.188
	Other interactions		8.61	5	0.126	0.231
Marijuana		8,207				
	Control model		501.11	6	<0.001	0.139
	SS main effect		193.31	1	<0.001	0.191
	SS by GL interaction effect		28.36	3	<0.001	0.198
	Other interactions		5.88	5	0.319	0.200
Methamphetamines		8,241				
	Control model		18.67	6	0.005	0.035
	SS main effect		47.94	1	<0.001	0.125
	SS by GL interaction effect		1.90	3	0.593	0.129
	Other interactions		0.78	5	0.979	0.140
Illegal drugs		8,255				
	Control model		319.99	6	<0.001	0.072
	SS main effect		320.48	1	<0.001	0.141
	SS by GL interaction effect		25.42	3	<0.001	0.146
	Other interactions		5.89	5	0.317	0.147
CTC problem behavior indicator		5,791				
	Control model		497.469	6	<0.001	0.111
	SS main effect		700.322	1	<0.001	0.252
	SS by GL interaction effect		6.054	3	0.109	0.254
	Other interactions		10.322	5	0.067	0.256

DV dependent variable, *SS* scale score, *GL* grade level, *CTC* Communities That Care, *LR* likelihood ratio statistic

The control model contained the main effects for GL, gender, race/ethnicity (dichotomized into three categories of (1) white, non-Hispanic; (2) Hispanic, and (3) all other race and ethnicities.). The SS main effect model added the SS variable as a covariate. The SS by GL interaction effect model added the two-way interaction between SS and GL. The Other Interactions model added the two-way interaction effects for SS by gender, and SS by race/ethnicity; along with the three-way interaction effect of SS by GL by gender

were non-significant, which suggests that they do not explain the deviance within the models.

Multicollinearity, as measured by the Variance Inflation Factors (VIF < 3) and the Condition Indices (values less than 10), was within the acceptable limits for all the models. The leverage values were also acceptable. Given these findings, it appeared that the parameter estimates coming from these models could be interpreted. Table 4 presents the parameter estimates for the 30-day use of alcohol, and the CTC Indicator models. Logistic regression parameter estimates for the remaining six dependent variables are available online. This paper only presents the parameter estimates for the models involving the control variables, the scale score, and the grade by scale score interaction because of the results from the significance testing described above. In general, the 30-day use of alcohol model represented similar

Table 4 Summary of logistic regression models involving the 30-day alcohol use and the CTC problem behavior indicator

	30-Day use of alcohol		CTC indicator	
	b (SE)	OR (CI)	*b* (SE)	OR (CI)
Control variables				
Intercept	−4.24* (0.18)		−2.76* (0.12)	
Grade level				
8th	1.44* (0.21)	4.23 (2.78–6.43)	0.22 (0.17)	1.24 (0.9, 1.72)
10th	2.44* (0.22)	11.47 (7.4–17.77)	0.23 (0.21)	1.26 (0.84, 1.89)
12th	3.14* (0.23)	23.19 (14.67–36.65)	0.77* (0.25)	2.16 (1.33, 3.49)
Gender, male	0.15* (0.06)	1.16 (1.04–1.29)	0.63* (0.06)	1.88 (1.67, 2.12)
Race				
Hispanic	0.30* (0.08)	1.34 (1.14–1.58)	0.68* (0.09)	1.97 (1.65, 2.36)
All other race or ethnicity	0.22* (0.09)	1.25 (1.04–1.49)	0.60* (0.09)	1.83 (1.52, 2.19)
Misperception scale				
Scale score	0.68* (0.06)	1.96 (1.73–2.23)	0.67* (0.06)	1.96 (1.76, 2.19)
Scale score by grade				
8th Grade scale score	−0.18* (0.08)	0.83 (0.72–0.96)	−0.04 (0.07)	0.96 (0.84, 1.10)
10th Grade scale score	−0.39* (0.07)	0.68 (0.59–0.78)	−0.12 (0.07)	0.89 (0.77, 1.02)
12th Grade scale score	−0.44* (0.08)	0.64 (0.55–0.74)	−0.16 (0.08)	0.85 (0.73, 1.00)

For gender, females were the reference category. For grade level, 6th grade students were the reference category. For race, the category of white, non-Hispanic served as the reference category

CTC Communities that Care, *OR* odds ratio coefficient

*$p<.05$

results as the other six substance use dependent variables (parameter estimates available online). Specifically, for these models the control variables of grade level, gender, and race/ethnicity were all highly significant in predicting substance use. Adding the Misperception Risk Factor scale added substantial predictive power to the model, but the predictive relationship differed by grade level. The CTC indictor did not fit this pattern because the grade level parameters were not as significant and did not interact with the scale score parameter.

For 30-day alcohol use and most of the other substance use variables, the odds ratios of use based on the Misperception Risk Factor were higher in the lower grade level than the upper grade levels. For instance, for each Misperception Risk Factor scale score increase of one point in the 6th grade, there was an increase in the predicted odds of 30-day alcohol by 1.96 times. In the 8th grade, a one-point scale score increase was associated with a 1.65 times increase in the odds of 30-day alcohol use. In 10th grade, each scale score increase of one point was associated with a 1.34 times increase in the odds of 30-day alcohol use. Finally in twelfth grade, the scale score increase of one point was associated with a 1.27 times increase in the odds of 30-day alcohol use.

In contrast, the models involving the CTC indicator demonstrated very small and often insignificant grade level differences. Again, the control model was highly significant, but grade level differences were pronounced. Adding the Misperception Risk Factor scale score again increased the predictive relationship of the model, but grade levels did not significantly differ in their predicted odds ratios for the scale score.

Scale Sensitivity and Specificity

The research team compared the Misperception Risk Factor to other CTC risk and protective factors. They carried out this comparison using the ROC methodology. Plotting the ROC curves for different scale variables allowed the research team to see how well each risk and protective factor scale distinguished users and non-users. The closer the area under the ROC curve came to 1.0, the better its detection rate, and an area under the curve of 0.5 is uninformative.

To make these comparisons consistent with the literature, only the CTC indicator was used as the comparison measure for these ROC analyses. The Misperception Risk Factor measure and other CTC risk and protective measures served as the operator response variables. Table 5 lists the area under the curve (AUC) for the different measures. All measures demonstrated significant abilities to differentiate students who are participating in the negative behaviors from students who were engaging in no negative behaviors. The scale score for Early Initiation of Drug Use demonstrated the greatest ability to differentiate the groups with an AUC of 0.922. The Community Disorganization Scale Score had the smallest ability to differentiate the groups with an AUC of 0.649. Overall, the mean AUC across the 23 measures was 0.783 (SD=0.065). The AUC for the Misperception Risk Factor of 0.746 was well within a

Table 5 Area under the curve (AUC) for the misperception of peer drug use scale score and the other CTC scale scores as measured against the CTC problem behavior indicator

Measures	AUC	SE	95 % CI
Misperception of peer DU	0.746	0.007	0.73, 0.76
Community disorganization	0.649	0.008	0.63, 0.66
Laws and norms favoring DU	0.752	0.007	0.74, 0.77
Perceived availability of drugs	0.784	0.007	0.77, 0.8
Poor family management	0.795	0.006	0.78, 0.81
Parents attitudes toward ASB	0.727	0.008	0.71, 0.74
Parents attitudes toward DU	0.769	0.007	0.75, 0.78
Low commitment to school	0.773	0.007	0.76, 0.79
Rebelliousness	0.792	0.006	0.78, 0.8
Early initiation of ASB	0.725	0.008	0.71, 0.74
Early initiation of DU	0.922	0.004	0.91, 0.93
Attitudes to ASB	0.805	0.006	0.79, 0.82
Attitudes to DU	0.858	0.006	0.85, 0.87
Perceived risk of DU	0.803	0.006	0.79, 0.82
Interaction with anti-social peers	0.768	0.007	0.75, 0.78
Friends use of drugs	0.861	0.006	0.85, 0.87
Sensation seeking	0.792	0.006	0.78, 0.8
Rewards for ASB	0.767	0.007	0.75, 0.78
Depressive symptoms	0.692	0.008	0.68, 0.71
Intent to use drugs as an adult	0.867	0.006	0.86, 0.88
Religiosity	0.672	0.008	0.66, 0.69
Social skills	0.866	0.005	0.86, 0.88
Belief in a moral order	0.833	0.006	0.82, 0.84

All AUCs had p values $<.001$

AUC area under the curve, *SE* standard error, p probability value of the AUC under the null hypothesis, *CI* confidence interval, *LL* lower limit of the confidence interval, *UL* upper limit of the confidence interval, *DU* drug use, *ASB* antisocial behavior

single standard deviation of the mean. This finding suggests that the Misperception Risk Factor generally has the same degree of relationship with problem behavior as do the other CTC scales, and researchers can use peer misperception of substance use as an informative risk factor on student surveys.

Discussion

This study began with the hypothesis that misperceptions of peer substance use as measured on Wyoming's student survey of risk and protective factors is a predictive factor for youth substance use. This hypothesis was based on two questions derived from a gap in the current literature: How can communities use misperception of peer norms as a predictor of substance use? And when should a community implement a social norms marketing campaign? In order to answer these questions, researchers utilized data from Wyoming's 2008 PNA survey of 6th, 8th, 10th, and 12th graders. This survey included questions on perceived substance use that mirrored the questions on actual use. Researchers used these questions to create a Misperception Risk Factor scale. They then tested the validity of this scale, examined its predictive relationships with actual substance use, and compared it with other accepted risk and protective factors. Findings from the research provide answers to the two questions. First, measuring misperception on youth surveys can provide a reliable and robust measure of risk of youth substance use and other risky behaviors. Second, as youth misperception increases so does the likelihood of youth substance use. This implies that if a community knows the prevalence of at risk students based on their misperception, then this can inform any decisions to implement a social norms campaign as part of their prevention efforts. Third, the Misperception Risk Factor compares favorably with other CTC measures when it comes to understanding youth risk for problem behaviors.

Another interesting result of this study is that, while problem behavior in youth increases with the perception that most peers are using drugs, its largest impact is upon younger students. As students move from 6th through 12th grade, misperception has a smaller impact upon their choice to use substances. This may mean that social norms strategies that aim to correct misperceptions should focus on younger students (and their environments) who are more affected by their misperceptions of peer substance use.

There are several limitations to the current study. The lower participation levels among 12th graders limit the accuracy of the actual normative behaviors among the high school populations. Furthermore, as the results are based on self-reported data, if students perceived a lack of confidentiality or a sense of reprisal, they may have underreported risky behaviors (Brener et al. 2003).

Certainly more research into the role of misperception as a risk factor is needed. Next steps for this research include further analysis of misperception data to better understand how misperception impacts different groups of youth and adults across the social ecology. This along with a greater knowledge of how to use the Misperception Risk Factor to develop a social norms campaign could aid communities in prevention planning. Specifically, data demonstrating misperceptions of norms shift the context for communications and policy development discussions. With all of these findings in mind, we recommend that researchers who implement risk and protective factor surveys to youth also consider adding the Misperception Risk Factor to their survey in order to better understand the predictors of substance use and to better plan community prevention efforts.

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