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General Strain Theory and Substance Use among American Indian Adolescents

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Abstract

Despite the well-established finding that American Indian adolescents are at a greater risk of illicit substance use and abuse than the general population, few generalist explanations of deviance have been extended to American Indian substance use. Using a popular generalist explanation of deviance, General Strain Theory, we explore the predictive utility of this model with a subsample of American Indian adolescents from waves one and two of the National Longitudinal Study of Adolescent Health (Add-Health). Overall, we find mixed support for the utility of General Strain Theory to account for American Indian adolescent substance use. While exposure to recent life events, a common measure of stress exposure, was found to be a robust indicator of substance use, we found mixed support for the thesis that negative affect plays a key role in mediating the link between strain and substance use. However, we did find evidence that personal and social resources serve to condition the link between stress exposure and substance use, with parental control, self-restraint, religiosity, and exposure to substance using peers each serving to moderate the association between strain and substance use, albeit in more complex ways than expected.

Introduction

Of the voluminous research exploring adolescent substance use among different racial, ethnic, and cultural groups, one well-established finding is that American Indian adolescents are at significantly greater risk of substance use and abuse than their non-Hispanic white counterparts (Plunkett & Mitchell, 2000; Beauvais, 1992, 1996, 1998; U.S. Senate Select Committee on Indian Affairs, 1985). Studies have revealed that Native American adolescents have an earlier onset of substance use, are more likely to use “hard” drugs beyond marijuana, are equally likely to use marijuana before alcohol, and are more likely to use combinations of substances than white, non-Hispanic adolescents (Plunkett & Mitchell, 2000; Beauvais, 1992, 1996; Oetting & Beauvais, 1990; Costello, Farmer, Angold, Burns, & Erkanli, 1997; Novins, Beals, & Mitchell, 2001). Furthermore, Native American adolescents appear to be at greater risk of substance use and abuse regardless of whether they live on or off of reservations (U.S. Senate Select Committee on Indian Affairs, 1985). The U.S. Indian Health Service has identified substance abuse among Native Americans as their number one health problem (Herring, 1994; as cited in Morris, Wood, & Dunaway, 2006; pg. 579).

While the “race” gap in substance use between Native American and non-Hispanic white adolescents has been well documented, more scholarship that attempts to identify the risk and protective factors associated with substance use among Native American adolescents is warranted. The present study represents such an effort. This study examines the utility of General Strain theory to explain variation in adolescent substance use among a sample of American Indians drawn from the National Longitudinal Study of Adolescent Health (Add-Health). We also conduct parallel analyses on a sample of non-Hispanic whites to compare the utility of the theory for explaining substance use for non-Hispanic white and American Indian adolescents.

Background

A number of well-established substance use risk factors have been identified to explain the gap between non-Hispanic white and Native American adolescent use, including poverty, low educational achievement, social isolation, unemployment and family disruption (Gfellner, 1994; Beauvis, 1998; Plunkett & Mitchell, 2000). And several researchers have forwarded the notion that the risk and protective factors explaining Native American youth substance use are not different from those factors used to explain other racial and ethnic group substance use rates (Plunkett & Mitchell, 2000; Bachman et al., 1991; Oetting et al., 1988; Oetting et al., 1989).

General Strain Theory may be particularly useful in understanding Native American substance use for a number of reasons. First, many of the previously mentioned risk factors coordinate well with the basic tenet of General Strain Theory that deviant behavior is a coping strategy employed in response to strain/stress. For example, Morris and his colleagues (2006), in writing about Native American ethnic dislocation, noted, “cultural differences between native traditions and the norms of White society generate strain, conflict, cultural dissonance, and anomie” (577). Likewise, Plunkett and Mitchell (2000) found that stresses associated with the living conditions of the typical Native American today (e.g., poverty, unemployment, social isolation, prejudice) helped to produce high substance use rates. And Beauvais (1998) argued that these social conditions “place a great deal of stress on the family and other socialization structures within Indian communities” (256). In fact, Manson and colleagues (1996) found that over 50 percent of American Indian students reported having experienced at least one traumatic event during childhood. Similarly, Manson and colleagues (2005) found that lifetime exposure to at least one traumatic event ranged from 62.4% to 69.8% in a study of members from two large American Indian communities.

Despite the general recognition that strain/stress plays a fundamental role in understanding Native American substance use generally, studies are needed that systematically evaluate the strain-substance use relationship among American Indian adolescents. Indeed, Manson and colleagues (2005) reported that their study “represented the first systematic assessment of the prevalence of trauma exposure in American Indian communities...” (851). And there is also a need for research exploring what social and personal resources serve to protect Native American adolescents from engaging in substance use and whether personal and social resources condition the stress/strain-substance use relationship. Overall, it appears that GST would be a viable explanation of American Indian substance use, but we are aware of no published study that has extended GST to explain AI health behaviors.

General Strain Theory and Substance Use

At the core of General Strain Theory (Agnew, 1992) is the notion that negative relationships with others and negative experiences produce strain in the individual that must be managed. Instead of one general source of strain, Agnew (1992) identified three major sources: 1) the

failure to achieve positively valued goals, including the disjunction between expectations and actual outcomes and the perception of what would be a fair or just outcome and actual outcomes; 2) the removal (or threat of removal) of positively valued stimuli that the actor already possesses (e.g., the death of a parent or the loss of a friend); and 3) presentation with negatively valued stimuli, such as abuse. He argued that such strains produce a range of negative emotions (e.g., anger, frustration, resentment, depression, anxiety) that the actor must somehow take corrective action to reduce; corrective actions include crime or deviance, with the behavioral solution potentially being instrumental, retaliatory, or escapist (e.g., engage in substance use to alleviate the displeasure from the negative emotions) in nature (Agnew 1992). However, one can manage these strains legitimately if the actor has effective coping mechanisms. Such conditioning variables include one's self-concept, one's level of social support, mastery and problem-solving skills (Agnew, 1992). Agnew (1992) argued that individuals who are self-efficacious, who have extensive social support networks, and who have a positive self-concept are less likely to resort to crime or substance use in response to exposure to strains. In addition, the inclination of one's peers toward (or against) deviance can affect whether an individual is likely to turn to deviance in response to strain. Thus, explaining deviance involves not only the level of exposure to strains (stress) but also the extent and type of coping mechanisms available to the individual and the individual's peer associations.

While the majority of tests of General Strain Theory have been focused on predicting crime and delinquency (Agnew & White, 1992; Agnew, Brezina, Wright, & Cullen, 2002; Baron & Hartnagel, 1997; Brezina, 1998, 1999; Broidy, 2001; Cernkovich et al., 2000; Mazerolle & Maahs, 2000), a number of studies have also examined the utility of GST in explaining illicit substance use (Baron, 2004; Agnew and White, 1992; Drapela, 2006; Jang and Johnson, 2003; Stogner and Gibson, 2011; Aseltine et al., 2000; Swatt, Gibson, and Piquero, 2007; Carson et al., 2009; Slocum, 2010). According to GST, drug use may be used as a way of managing (or escaping) negative affect triggered by strain, particularly among individuals who experience such emotions as depression or disappointment (Agnew and White, 1992; Jang and Johnson, 2003; Piquero and Sealock, 2000).¹ Agnew notes that such individuals may engage in substance use because they "lack the strong motivation for revenge and the lowered inhibitions that anger provides" (1992, p. 60). Neff and White (2007) note that the use of alcohol and drugs can be understood by employing GST; illicit substance use is a form of self-medication that allows the user to experience relief (or cope) with the underlying strain that triggered negative affect.

Further buttressing the suitability of GST for explaining substance use is the fact that several studies have found a robust association between stress exposure and substance use (e.g., Aseltine and Gore, 2000; Barrett and Turner, 2006; Ford and Schroeder, 2009; Neff and White, 2007; Preston, 2006). The findings are equivocal, however some studies have found that the link between stress exposure and substance use is either marginal or statistically non-significant (Aseltine et al., 2000; Barron, 2004). Further, many tests of the strain-drug use association have not considered the role of negative affect that is of critical import for GST (Drapela, 2006; Jang and Johnson, 2003). But additional studies of illicit drug use have also established a fairly robust relationship between negative affect, especially depression and anxiety, and substance use, lending further credence to the suitability of GST for explaining illicit drug use (Gibbons et al., 2007; Needham, 2007; Poulin, Hand, Boudreau, & Santor, 2005; Saules et al., 2004).

¹However, some research suggests that the association between substance use and depression is bi-direction, with substance use also causing depression (e.g., Wu and Anthony, 1999; Needham, 2007).

Of those examinations of GST exploring substance use, some tests have found support for GST principles, while others fail to support the theory's utility. For example, Agnew and White (1992) found that a composite measure of strain was associated with drug use in cross-sectional analyses but failed to find that strain was associated with drug use in longitudinal analyses. Aseltine and colleagues (2000), using covariance structure models, failed to find that anger and hostility was associated with marijuana use. And Baron (2004) found that only property victimization, a single item representing strain, predicted drug use among a sample of homeless youth, reporting that the models representing GST were more successful in explaining property and violent crime. More recently, Swatt, Gibson, and Piquero (2007) found that anxiety and depression mediated the association between work-related strain and alcohol use/abuse among a sample of Baltimore police officers. Likewise, Carson and colleagues (2009) found that early victimization predicted drug use that was partially mediated by negative emotions (depression and suicidal thoughts). Similarly, Hollist, Hughes, and Schaible (2009) found that while adolescent maltreatment predicted substance use, there was mixed evidence that the negative emotions (anger anxiety, and depression) either predicted substance use or mediated the strain-substance use association. Akins, Smith, and Mosher (2010) found that while strain was associated with alcohol abuse across three racial groups (whites, blacks, and Hispanics), negative affect only played a role in the model predicting white alcohol abuse. And finally, Stogner and Gibson (2011) using the Add-Health data that the present study utilizes, found that measures of health strain were inconsistently associated with the frequency of substance use, with mixed findings of negative affect mediating the strain-substance use association.

Although we are aware of no published study that tests the merits of General Strain Theory to explain American Indian substance use, there have been studies that applied the stress-coping paradigm (a theoretical model similar to General Strain Theory) to American Indian substance use. For instance, Walters, Simoni, and Evans-Campbell (2002) devised a framework for explaining substance use among indigenous peoples that emphasizes both the unique stressors that American Indians face and the role of somewhat novel and potent moderators/protective factors such as spirituality and ethnic identity. Included among the important stressors that affect American Indian substance use are historical trauma (the collective and individual experiences connected to colonial oppression of American Indians historically), prejudice and discriminatory treatment and corresponding high relative rates of child abuse, neglect, and other traumatic life experiences (Walters et al., 2002; see also Mmari, Blum, & Teufel-Shone, 2010). And these stressors were found to be buffered somewhat by such protective factors as a strong family, the importance of spirituality and the rituals of traditional American Indian religious practices, and a positive American Indian identity (Walters et al., 2002; see also Pridemore, 2004). In addition to American Indian specific strains, LeMaster and colleagues (2002) found that two scales capturing more generic strains (stressful life events such as the death of someone, suicide attempts by others, serious injuries or hospitalizations among friends/family members, breakups with boyfriend/girlfriends, and other strains) were predictive of cigarette and smokeless tobacco use in a sample of American Indian adolescents. Whitesell and colleagues found that exposure to recent stressors (adversities) was associated with substance dependence onset among respondents from two American Indian reservations (Whitesell et al., 2007). Finally, Cheadle and Whitbeck (2011), examining five waves of data from 727 American Indian adolescents, found that perceived discrimination (considered a stressor) directly influenced the risk of problem alcohol use as well as indirectly by increasing feelings of anger and exposure to delinquent friends.

And while there have been no studies applying General Strain Theory to American Indian substance use behavior, others have explored the applicability of General Strain Theory to address racial and ethnic minority health and criminal behaviors. For example, Kaufman and

colleagues (2008) argued that African-Americans are more likely to experience more and unique types of strains compared to Whites, including economic strains, negative educational experiences, criminal victimization, discrimination strain, and suffer from community-level strain, and that low social support and inadequate problem solving skills increased the likelihood of engaging in crime as a coping mechanism (see also Kaufman, 2005). Although Kaufman and colleagues focused on the African-American experience, it is likely that such strains are also prevalent in American Indian communities. Likewise, Perez, Jenkins, and Gover (2008) examined the role of strain exposure, including unique strains such as acculturation stress, nativity, intergenerational conflict, and perceived discrimination in their test of GST in explaining violent behavior among Hispanics. The authors concluded that both ethnic-specific and more general strain measures were associated with violence (especially under conditions of a high concentration of Hispanics in the community). Overall, this scholarship suggests that General Strain Theory has significant potential for explaining American Indian adolescent substance use.

In summary, the present study represents a preliminary test of the applicability of General Strain Theory to explaining Native American adolescent substance use. Based upon the core principles of General Strain Theory, we examine the following hypotheses:

- H1** Greater exposure to strain will be associated with an increased risk of heavy alcohol, marijuana, and other illicit drug use.
- H2** Negative affect will mediate the association between strain and illicit substance use.
- H3** Personal and social resources (e.g., social support, self-esteem, religiosity, exposure to substance using peers) will moderate the strain-illicit drug use association.

Method

Data and Sample

This study analyzes data from the first two waves of the in-home interviews of the National Longitudinal Study of Adolescent Health (Add-Health) study. The Add Health sample is representative of schools in the US with respect to region, urbanicity, school size, school sector, and racial composition (Harris et al., 2009). Wave I of the in-home interview was collected between April and December in 1995 and wave II followed a year later, between April and August 1996. Add Health is a nationally representative study of adolescents (7th–12th grade in 1994 when the study began). However, wave II intentionally excluded respondents who were in the 12th grade at wave I. This and other attrition resulted in approximately 75 percent of the original wave I respondents being included in the wave II sample. For our American Indian sample, we selected adolescents from the wave I in-home sample based on the following criteria. First, we selected those adolescents who indicated that their racial/ethnic identity was American Indian/Native American. Second, we selected respondents who participated in both of the first two waves of the in-home interview and for whom a valid wave II sampling weight was available. And third, we selected only those students who answered the questions about substance use in the wave II survey. We selected the non-white Hispanic sample in a similar manner. All measures used in the analyses were measured at wave I, with the exception of the dependent variables, which were measured at wave II in order to reduce concerns about temporal ordering. Finally, due to the unequal probability of sample selection (Chantala 2006), all analyses were weighted to account for the Add Health design effects.ⁱⁱ

ⁱⁱMissing values on independent variables were substituted using a regression estimation procedure in STATA.

Measures

Substance Use—We examined three different measures (measured at wave II) of substance use: *Frequency of heavy alcohol use* (i.e., the number of days since the wave I interview that the respondent had five or more alcoholic drinks in one setting)ⁱⁱⁱ, *frequency of marijuana use* (i.e. the number of times since the wave I interview that the respondent used marijuana), and *frequency of other drug use* (i.e. the number of times since the wave I interview that the respondent used any of the following drugs: cocaine, LSD, PCP, ecstasy, mushrooms, speed, ice, heroin, or pills, without a doctor's prescription). Additionally, we included a measure of *prior substance use* (measured at wave 1; alcohol, marijuana and other drug use) in the models to conduct a more conservative test of General Strain Theory.

Strain Measures—Consistent with prior studies that have utilized Add-Health data to document strains (e.g., Kaufman, 2009; Daigle, 2005; Meadows, Brown, & Elder, 2006), we created an additive measure of *recent life events* composed of fifteen items capturing adverse experiences reported by the respondent to have occurred in the past year. Included in this measure are items asking whether the respondent, friends, or family members attempted suicide in the past year (3 items), witnessed or experienced a violent victimization (5 items), were unable to seek medical care when needed (1 item), had a parent die (2 items), moved (1 item), was tested or received treatment for a sexually transmitted disease (1 item), was pregnant (1 item) and experienced a significant injury (1 item).^{iv} Additionally, a measure of *educational strain* was calculated, derived from two items asking the respondent whether he/she had greater aspirations for attending college than his/her expectation of actually attending (Stogner & Gibson, 2010). And third, we created an additive measure of *school-based strain*, which was composed of two items asking the respondent about whether he/she felt students at the school are prejudiced and whether the respondent felt safe at school.

Other General Strain Theory Measures—In addition to the aforementioned strain measures, we included other variables that are theoretically relevant to General Strain Theory. Consistent with prior studies that have utilized Add-Health data to test the merits of GST (e.g., Kaufman 2005, 2009; Stogner & Gibson 2010; Daigle et al., 2007), we used two measures to capture negative affect depressive symptoms and bad temper. The depressive symptoms scale was comprised of nineteen items from the CES-D twenty-item scale. Each item utilized a 4-point ordinal response measuring negative affect. The resulting scale average of the sum across the nineteen items exhibited high reliability ($\alpha=.864$). *Bad temper* was measured by using a single item asking a parent whether the child has a bad temper or not.

Because of the importance of personal and social resources in General Strain Theory, we also included measures that may predict substance use and condition the relationship between strain exposure and substance use. One such resource is captured in a three-item measure of *religiosity* as a legitimate coping mechanism (Stogner & Gibson, 2010). Consistent with prior studies (e.g., Stogner & Gibson, 2010; Rostosky, Regnerus, & Wright, 2003), we constructed a religiosity scale from three items assessing the importance of religion in their lives, participation in religious services, and associated youth groups (the additive scale demonstrated high reliability $\alpha=.810$). *Social support* was also included as a

ⁱⁱⁱHeavy drinking was used instead of drinking because the former is more congruent with the notion that alcohol use serves as a coping response to stress. The frequency measure of heavy alcohol use was calculated based on a seven category ordinal item that was recoded to midpoint values (in order to be consistent with the marijuana and other drug measures).

^{iv}Additional models were analyzed with the respondent's self-reported suicide attempt (Wave I) omitted due to concerns that such a measure might be largely explaining substance use. The omission of this event from the recent life events measure did nothing to alter the pattern of findings (results available upon request).

social resource. Social support was measured as a seven-item scale including support from parents, friends, and teachers (reliability $\alpha=.783$) and has been used in prior General Strain Theory studies utilizing the Add Health data (e.g., Kauffman, 2005, 2009; Stogner & Gibson, 2010). Likewise, we employed a measure of *self-esteem*, a seven-item scale (average score across the seven items) that has been used in prior research (e.g., Stogner & Gibson, 2010). This measure was comprised of various five-point Likert scale responses (strongly disagree to strongly agree) that asked such questions as whether the respondent has a lot of good qualities, is physically fit, has a lot to be proud of, likes oneself just the way he/she is, feels like one he/she does everything just about right, feels socially accepted, and loved and wanted (reliability $\alpha=.850$).

We also included a three-item scale capturing *self-constraint*. Agnew has posited that self-constraint serves to moderate the strain-deviance relationship, with those exhibiting characteristics of low self-constraint displaying a stronger strain-deviance relationship than those exhibiting more self-constraint. The items (each used a five point ordinal scale) used to capture self-constraint include such questions as “when you have a problem to solve, one of the first things you do is get as many facts about the problem as possible,” “when you are attempting to find a solution to a problem, you usually try to think of as many different ways to approach the problem as possible,” and “when making decisions, you generally use a systematic method for judging and comparing alternatives.” Appropriate items were reversed coded for consistency; higher scores indicated greater constraint (reliability $\alpha=.705$). *Parental control/autonomy*, a scale derived from seven items ($\alpha=.615$) capturing the extent to which parents control or let the respondents make decisions about various aspects of their lives (Haynie, 2003; Daigle, et al., 2007) was also included in the models. Higher scores indicated greater autonomy/less parental control. Finally, *peer substance use*, a scale derived from the average score from three items asking the respondent how many of his/her three best friends smoke at least one cigarette a day, smoke marijuana at least once a month, and drink alcohol at least once a month was included (Kaufman, 2005, 2009). The scale suggests high reliability ($\alpha=.761$). Paternoster and Mazerolle (1994) found that exposure to strain leads to involvement in delinquency, by weakening ties to conventional others and strengthening ties to delinquent others.^v

Other Controls—In addition to the General Strain Theory measures, we included other variables that have been argued to be associated with substance use, including measures of school attachment and commitment, and parental alcohol use. A scale derived from the average score from three items captured *school attachment* ($\alpha=.773$): “do you feel close to people at school,” “do you feel like you are a part of the school,” and “are you happy to be at your school?” A common measure of school commitment, *grades*, was captured by averaging the responses to four items asking the student to report her/his grades (1=D to 4=A) in the subject areas of math, English, history/social studies, and sciences. *Parental alcohol use* was measured by asking the respondent’s parent how often he/she drank alcohol (a 6 item response ranging from ‘never’ to ‘nearly every day’).

Finally, we included the following general controls: gender (1=female), age, family structure (whether or not the child resides in a two-parent family) and parent’s education (whether at least one parent graduated from high school, college, or neither parent finished high school).

^vAgnew (1995) has noted that it is important to control for social control and social learning measures when examining the effect of strain on behaviors in order to avoid overestimating the effect of strain. However, Agnew also recognized that there is considerable conceptual overlap between strain, social control and social learning measures. We interpret the results utilizing a GST framework while recognizing that some of the findings can be interpreted from a social control or social learning perspective as well.

Analysis Strategy

Because the dependent variables are count variables, we utilized negative binomial regression analyses.^{vi} In order to test for significant race differences in the effect of the predictor variables on the dependent variables, the post-estimation command in STATA 11 for seemingly unrelated estimation (suest) was used, and a Wald test was conducted for each predictor testing the $H_0: \beta_{\text{American Indian}} = \beta_{\text{White}}$. The results of these post-estimation Wald tests are reported in the results section.^{vii}

Results

The descriptive statistics are reported in Table One, along with Wald tests indicating whether there are significant differences in the adjusted means between American Indians and non-Hispanic Whites. Among the significant differences between the two groups is a lower level of parental education, weaker levels of school attachment and commitment and higher reported exposure to recent life events and educational-based strains among American Indian adolescents. And consistent with the basic tenets of General Strain Theory, American Indian adolescents not only report greater levels of exposure to strains, but also higher levels of negative affect (depressive symptoms and bad temperament). Overall, the pattern of statistically significant differences suggests that General Strain Theory may be useful in predicting substance use among American Indians.

The results of the negative binomial regression analyses of American Indian and non-Hispanic white past year frequency of heavy drinking are reported in Table Two. In the initial model (column 1), four predictors were found to have statistically significant associations with the heavy drinking measure among American Indians: gender, age, parental alcohol use and exposure to recent life events. Each predictor is associated with the dependent variable in the expected direction: males, older respondents, adolescents whose parents drink, and respondents experiencing more stressful life events are more frequently engaging in heavy drinking than their counterparts. The inclusion of the negative affect measures (column 2) reveals that depressive symptoms is a statistically significant predictor of the heavy alcohol use measure, and consistent with GST, appears to mediate the strain-heavy drinking association (the recent life events coefficient is no longer a statistically significant predictor of the dependent variable). A one unit increase in depressive symptoms increases the expected number of times one engages in heavy drinking by a factor of 4.9, holding all other variables constant. This finding is consistent with other recent tests of GST that have found that depression mediates the strain-substance use association (e.g., Drapela, 2006; Swatt et al., 2007) as well as recent examinations of American Indian drinking behaviors that have found depressive symptoms to be a significant predictor of such behaviors (Cheadle & Whitbeck, 2011). The inclusion of personal and social resources (columns 3 and 4) reveals two additional predictors of heavy alcohol use peer substance use and social support. As expected, peer substance use has a significant influence on heavy alcohol use, with a one unit increase in peer substance use associated with an increase in the expected count of heavy drinking episodes by approximately 177%, holding all other

^{vi}The decision to use negative binomial regression models was based on the results of an analysis comparing the fit of poisson, negative binomial regression, zero inflated poisson, and zero-inflated negative binomial regression models using a procedure in STATA called *countfit* (see Long and Freeze, 2006: pp. 409–414). *Countfit* generates a table of estimates, a table of differences between observed and average estimated probabilities, a graph of any differences, and various tests and measures of fit used to compare count models. These tests revealed that the negative binomial models (for each of the three dependent variables) were either the best fit of the various count models or were essentially equivalent in fit to the zero-inflated negative binomial models.

^{vii}The SUEST procedure, in conjunction with *test*, is a more appropriate test of whether a variable has a similar effect across the models of two different groups in non-linear analyses, because such an approach assesses whether the impact of a measure differs across groups by taking a ratio of the two coefficients" (Hoetker, 2007, pg. 338). "By taking a ratio, we have removed the impact of unobserved variation and are left with a ratio of the variable's underlying effects, which can now be compared across groups" (Hoetker, 2007, pg. 338).

variables constant. Additionally, we find that social support has a negative association with heavy alcohol use, with a one-unit increase in social support associated with a 50% *decrease* in the expected count of marijuana use.

The models predicting non-Hispanic white heavy alcohol use also reveal support for the core GST tenets. In the baseline model, the same four variables that were statistically significant predictors of American Indian heavy alcohol use were also predictive of non-Hispanic white use: gender, age, parental alcohol use, and recent life events. Additionally, parental education also was found to be a statistically significant predictor of the dependent variable: respondents whose parents had a college education drank heavily less frequently than students whose parents did not graduate from high school, *ceteris paribus*. Unlike the analysis of American Indian heavy drinking, however, the measure of recent life events remains statistically significant after the inclusion of the two measures of negative affect. Both depressive symptoms and bad temper were found to be statistically significant predictors of non-Hispanic white heavy drinking, consistent with GST. The inclusion of personal and social resources (column 3) reveals that a number of these resources are statistically significant predictors of the dependent variable: those with higher self esteem, less social support, and less school commitment will engage in more frequent episodes of heavy drinking than their counterparts. And as expected, both prior alcohol use and peer substance use have positive and statistically significant associations with the heavy alcohol use measure.

While such comparisons of the patterns of statistically significant predictors across the American Indian and non-Hispanic white models are illuminating, such an approach fails to consider differences in the samples that influence hypothesis tests. Hence, we conducted post-estimation cross-model hypothesis tests to identify which coefficients were significantly different in their associations with marijuana use across the American Indian and non-Hispanic white groups. Using analogous models (columns 3 for each racial group), we found little evidence that the strength of the coefficients were significantly different across the two groups. Indeed, only one coefficient, depression, was found to be significantly different across the two racial groups.

Table three reports the results of analogous analyses predicting the number of times that a respondent used marijuana in the past year. For the American Indian sample, only three measures were found to be statistically significant predictors of marijuana use: family structure (single-parent family is associated with increased use), parental control/autonomy (greater autonomy is associated with greater use) and exposure to stressful life events. Consistent with GST, a one-unit increase in exposure to stressful life events increases the expected count of marijuana use by 26%, holding all other variables constant. But unlike the models predicting heavy alcohol use, the inclusion of the two measures of negative affect (column 2) does not appear to mediate the association between stress exposure and marijuana use. Somewhat surprisingly, depressive symptoms is not a significant predictor of the dependent variable, and bad temper only becomes statistically significant when other personal and social resources are included in the model (columns 3 and 4).^{viii} Unexpectedly, having a bad temper is associated with *less* frequent marijuana use, holding all other variables constant. Finally, a number of social and personal resources were also found to be significant predictors of the dependent variable in the direction consistent with GST: respondents reporting less social support, less school commitment, prior marijuana use and peers who engage in substance use engage in more frequent marijuana use than their counterparts, *ceteris paribus*.

^{viii}Other recent tests have also failed to find that negative affect mediates the association between strain and deviance (e.g., Tittle, Broidy, and Gertz, 2007).

Relative to the models predicting American Indian marijuana use, the analogous models predicting non-Hispanic white marijuana use reveal few differences in the patterns of significant predictors of the dependent variable. Among non-Hispanic white respondents, being raised in a single parent family, parental alcohol use, and age are associated with more frequent marijuana use. And consistent with General Strain Theory, strain exposure (recent life events) is associated with marijuana use. The inclusion of the two measures of negative affect (depressive symptoms and bad temper) reveal that contrary to the analogous American Indian models, both depressive symptoms and bad temper are associated with an increased frequency of marijuana use. However, the results of the post-estimation cross-model hypothesis tests reveal that only bad temper was found to be significantly different across the two racial groups. This finding is somewhat surprising, given past research that has failed to find that anger is associated with drug use (Aseltine et al., 2000), but the limited nature of the measure of anger must be weighed when considering the importance of this finding (more on this issue during the discussion). And each of the personal and social resources was found to reduce the likelihood of marijuana use, with the exception of self-esteem and school attachment: those with greater self-restraint, more religious, greater social support, and greater commitment to school use marijuana less often than their counterparts. However, once peer substance use and prior use marijuana use were included, the measures of personal and social resources (with the exception of religiosity and social support), and the strain measure failed to reach statistical significance, suggesting that such resources influence friendship patterns (or friendship choices influence one's personal and social resources).

In addition to the aforementioned test of significant differences in the negative affect coefficients across the white and American Indian models, four other coefficients were found to have significant differences across the two groups: family structure (the influence of being raised in a two-parent family appears to be a stronger buffer against marijuana use among American Indian teens), age (age only appears predictive of non-Hispanic white marijuana use), school attachment and autonomy (autonomy appears to be a major risk factor for American Indian marijuana use while having no significant influence on non-Hispanic white use). Overall, there appears to be some differences in the pattern of predictors across the two models, once sample differences are considered, but most of the theoretically relevant variables have similar associations with marijuana use across the two racial groups.

For the third dependent variable, the number of times one used other illicit drugs, the overall pattern of predictors reveals few statistically significant predictors for the American Indian models. Lower parental control was found to be a statistically significant predictor of illicit drug use, with a one unit-increase in autonomy being associated with an increase in the expected count of drug use by a factor of 6.8 (Column 1). However, one of the few statistically significant predictors of drug use is exposure to recent life events, with a one-unit increase in such exposure associated with about a 28% increase in the expected count of drug use. Social support, self-restraint, school commitment, school attachment, prior year other drug use, and peer substance use are each found to be statistically significant predictors of illicit drug use (column 3 and 4). Somewhat surprisingly, both school commitment and school attachment have positive associations with drug use, opposite the direction one would expect. Additionally, in the full model (column 4), the measures of family structure, parental alcohol use, and depressive symptoms have reached statistical significance ($p < .05$). Unexpectedly, when prior use and peer substance use is included, the association between depressive symptoms and other illicit drug use is *negative* (although another recent examination of GST using Add-Health data also found such an association between depressive symptoms and other drug use see Stogner and Gibson, 2011).

Once again, the models predicting non-Hispanic white drug use have a greater number of statistically significant predictors (relative to the American Indian models). We again conducted post-estimation cross-model hypothesis tests to identify which coefficients were significantly different in their associations with other drug use across the American Indian and non-Hispanic white groups. Using analogous models (columns 3 for each racial group), we again found that four coefficients were significantly different across the two groups: autonomy (again, autonomy appears to be a much stronger predictor of illicit drug use among American Indian teens than non-Hispanic whites), social support (social support appears to be a stronger buffer against other drug use for American Indian teens), school attachment (school attachment appears to reduce illicit drug use among whites while having no real predictive utility for American Indians) and exposure to recent life events. Past research suggests that family processes may serve as a stronger protective factor against substance use among American Indians than non-Hispanic whites (Swaim et al., 1993); these findings provide support for that thesis. While the finding that recent life events appears to have a stronger association with white teen's other drug use may suggest race differences in using illicit drugs to cope with such strains, the checklist of recent life events is relatively limited. A more comprehensive inventory of stressful life events may lead to different conclusions (more on this limitation in the discussion section). Beyond this caveat, there is little evidence the variables representing General Strain Theory perform differently in predicting non-Hispanic white versus American Indian illicit drug use.

Tests of Moderators of the Strain-Substance Use Relationship

Consistent with General Strain Theory, additional analyses were conducted that examined the role of potential moderators of the strain-substance use relationship. Interaction terms composed of recent life events multiplied by each of the following resources (autonomy, self-restraint, social support, self-esteem, religiosity, and peer substance use) were included with the variables reported in the prior analyses. In order to conserve space, only select results of models with interaction terms are reported (Table Six reports the results of analogous tests for interaction terms for the non-Hispanic white sample).^{ix} For the American Indian sample, Table Five reports two resources that served to moderate the strain-heavy alcohol use relationship: peer substance use and autonomy. In order to aid in interpreting the conditioning role of these moderators on the strain-heavy alcohol use relationship, Figure 1 and 2 are provided. As one can adduce from figure 1, peer substance use does moderate the strain-heavy alcohol use relationship, but in an unexpected direction. Rather than the expected finding that greater substance use among peers strengthening the association between strain exposure and the dependent variable, strain exposure has little impact on heavy alcohol use when substance use among peers is relatively high. However, when substance use among peers is relatively low, increased strain exposure appears to have its greatest influence on heavy alcohol use. We will discuss this finding more in the following section.

The second variable that appears to moderate the strain-heavy alcohol use association, parental control/autonomy, is illustrated in Figure Two. In this case, a more complex moderating role emerges. Under conditions of low stress exposure, parental control appears to reduce the frequency of heavy drinking. However, under conditions of average stress

^{ix}A number of scholars (e.g., Hoetker, 2007; Zelner, 2009) caution against interpreting interaction terms in nonlinear models in the same way as they are interpreted in OLS regressions. In nonlinear models, the significance of the interaction effect cannot be determined just by the significance of the interaction coefficient (Hoetker, 2007: 336). There can be a significant interaction effect for some observations when the coefficient is not statistically significant, and conversely some observations may not have a significant interaction effect when the coefficient is statistically significant. Hoetker (2007) recommends graphical presentations to "provide a more nuanced understanding of the practical effect" (pg. 337). We follow this advice and provide graphical illustrations of select interactions. Unfortunately, space limitations warrant that we restrict our presentation to a couple of examples. Readers can request additional graphical illustrations of other interaction effects examined in this study.

exposure, parental control has no influence on heavy drinking. And under conditions of high stress exposure, the role of parental control appears to reverse those respondents experiencing relatively high levels of parental control are engaging in heavy drinking more frequently than those experiencing lower levels of parental control. While this may be somewhat surprising given the tenets of GST, extant research on parental control has found that both too much and too little control may be associated with alcohol use/abuse among adolescents (e.g., Hayes et al., 2004; Barnes & Farrell, 1992). These analyses support such a complex relationship exists among American Indian teens.

Testing for the role of moderators in models with the other dependent variables, marijuana use and other drug use, we report the interaction terms for other moderators: for marijuana use peer substance use; for other drug use self-restraint. Again, peer substance use appears to attenuate the strength of the association between recent life events and the marijuana use measure. In the case of self-restraint (Figure available upon request), persons with low self-restraint have an increased risk of drug use as strain increases (as the theory predicts). However, under conditions of average self-restraint, the influence of strain on other drug use is negligible. But under conditions of relatively high (1 standard deviation above the mean) self-restraint, a negative association between strain exposure and other drug use emerges increased exposure to recent life events is associated with a decrease in other drug use. While speculative, it may be that American Indian adolescents with strong self-constraint may increasingly turn to other legitimate coping resources (in the face of stressful experiences) not measured in these analyses.

Discussion

The present study examined the utility of General Strain Theory for explaining American Indian adolescent substance use. Using the National Longitudinal Study of Adolescent Health, we examined a subsample of American Indian students and for comparison purposes, a subsample of non-Hispanic white students. We explored the relationship between exposure to strains and self-reported heavy alcohol, marijuana and other drug use, in the context of a number of controls. Additionally, we examined the role of personal and social resources that according to General Strain Theory serve to directly influence illicit behavior and potentially condition the relationship between strain and deviant behaviors. This study represents (to the best of our knowledge) the first published test of General Strain Theory principles to explain American Indian substance use and one of the few systematic attempts to evaluate the stress-substance use association for American Indians generally.

Overall, we find qualified support for the utility of General Strain Theory to account for American Indian adolescent substance use. While exposure to recent life events, a common measure of stress exposure, was found to be a robust indicator of illicit substance use, we found mixed support for the thesis that negative affect plays a key role in mediating the link between strain and illicit drug use. Only in the models predicting heavy alcohol use did we find that one measure of negative affect, depressive symptoms, served to mediate the strain-substance use association and was found to be a significant predictor of the dependent variable (in the expected direction). This is hardly surprising, as other tests of GST have found mixed results regarding the role of negative affect in mediating the association between strains and various dependent variables (e.g., Stogner and Gibson, 2011; Kaufman, 2009; Tittle, Broidy, & Gertz, 2008). However, we did find evidence that personal and social resources serve to condition the link between stress exposure and such drug use. But the roles of each moderator illustrated were more complex than one would derive from GST. For instance, the conditional role of substance using peers was a bit unexpected, although similar to the findings of Moon and colleagues (2009). Rather than amplifying the effect of strain exposure on the likelihood of illicit substance use, exposure to substance using peers

actually weakened the strain-drug use link. However, as can be adduced from Figure 1, exposure to substance using peers is such a powerful predictor of heavy alcohol use that those respondents who were exposed to such peers already had a (predicted) high likelihood for using alcohol, so one's exposure to strain did not appear to be important. Of course, it is possible that the development of friendships with substance using peers may be connected to earlier/cumulative exposure to strain, but the present study cannot address that possibility. Other moderators also displayed a more complex relationship than GST would predict, suggesting that the nature of the conditional relationship may depend upon a myriad of factors, including how substance use is measured (e.g. count versus the natural log of a measure), what groups are being studied, and how strain is measured, among other factors. These findings merely reinforce the inconsistent and complex portrait painted by prior studies that have examined the role of moderators in tests of GST.

Finally, we found that the variables representing General Strain Theory performed similarly across both the American Indian and non-Hispanic white samples. Prior studies have found that stress exposure is predictive of American Indian alcohol and drug use, and this study not only supports that research but also finds that stress/strain based theoretical models (like General Strain Theory) appear to be equally applicable to American Indians and non-Hispanic whites.

Limitations

While the results reported here suggest that strain exposure plays a role in explaining substance use behaviors of American Indian adolescents, the model ideally should be tailored to capture the unique cultural and structural risk and protective forces in American Indian adolescent lives. As mentioned earlier, Walters et al. (2002) provide one such framework that extends the stress process model to incorporate the unique cultural and structural factors relevant to American Indian health. As noted by Perez, Jennings, and Gover (2008), "it is important to note that this theoretical integration is not arguing that there should be a different theory to explain the criminal and delinquent behavior of different ethnic groups...Instead, it suggests that Agnew's General Strain Theory-related processes operate similarly for all groups (consistent with the intention of a general theory); however, there are strains specific to ethnic-minority groups that are unique and for which theory should account" (pg. 566). Unfortunately, the advantages brought by using a nationally representative sample of high school students (i.e., Add Health) also limited our ability to explore the role of those unique factors mentioned by Walters and colleagues. Clearly, additional research that incorporates such measures is needed.

In addition to the limited nature of the data to capture cultural and structural factors unique to American Indian adolescents, there are a few other issues that the reader should consider when evaluating the present study. First, the measures of strain in the Add Health study are somewhat limited in nature. For example, there were no measures of personal discrimination strain and few measures of chronic stressors (daily hassles that a person experiences as opposed to the strains from discrete events). Additionally, one measure of negative affect, bad temper, may be a weak measure of anger. Instead of capturing situational anger, this measure likely taps into trait anger, which may be a characteristic that existed *prior* to the experience of the strains examined in these analyses. And the measure of recent life events was less than comprehensive compared to some other examinations of the consequences of stress/strain exposure. As Thoits (2010) notes, the more comprehensively that stress is measured, the more likely the research is to reveal significant and substantial health implications. A more comprehensive inventory of strains, including chronic strains, may have provided even stronger support for the utility of General Strain Theory in explaining American Indian substance use.

Additionally, while the American Indian subsample is larger than many other studies of American Indians, nonetheless the sample size has an obvious effect on the ability to detect significant associations, especially when compared to the large sample size of the non-Hispanic white subsample. And finally, it should be noted that although the Add-Health study is a nationally representative sample of high school students, no reservation schools were selected in the sample. Thus, the reported results may have limited application to American Indian adolescents who attend schools wherein American Indians are a racial majority (such as reservation schools). Indeed, readers should remember that the notion that American Indians are a monolithic racial category is an oversimplification that is mandatory in this data analysis because tribal affiliation is not reported. Given that there are 565 federally recognized tribes and many more tribes that are not so acknowledged by the United States, readers should be cautious in interpreting these results.

Implications for Future Research

Our examination, as mentioned earlier, is best viewed as a preliminary study of the applicability of General Strain Theory principles to a sample of American Indian adolescents. There are a number of future avenues concerning the utility of General Strain Theory for understanding American Indian health and related behaviors. For example, future research should assess whether General Strain Theory principles explain other forms of substance use, including substance abuse/dependence. It may be the case that General Strain Theory will be more applicable to circumstances in which the substance use behavior is more pronounced or more problematic for the adolescent than mere substance use. Additionally, future research could also explore whether particular kinds of strains are robust predictors of substance use behaviors, instead of the inventory of strains used in the present study. Agnew (2001) argues that exposure to certain kinds of strain are particularly conducive to engaging in crime, such as strains that are unjust, high in magnitude, associated with low social control, and/or create incentives to engage in criminal coping there may be particular types of strain that are conducive to substance use (instead of crime). And further examinations could also explore the whether General Strain Theory has predictive utility for other types of illicit activity among American Indians, including crime.

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Figure 1.
Expected Counts for American Indian Past Year Frequency of Heavy Drinking with select values of peer substance use and recent life events

Figure 2. Expected Counts for American Indian Past Year Frequency of Heavy Drinking with select values of parental control/autonomy and recent life events

Note: Expected Counts for a sixteen-year-old male, parent is a high school graduate, single parent, parent uses alcohol, bad temper and reported past marijuana use. All other values are at their respective means.

Table One

Descriptive Characteristics for samples of American Indian and non-Hispanic white adolescents (Standard Deviations in parentheses).

	American Indians	Non-Hispanic Whites	Adjusted Wald test F (1, 128)
<i>Dependent Variables</i>			
Frequency of Heavy Alcohol Use	16.89 (50.29)	14.76 (45.23)	1.10
Frequency of Marijuana Use	14.33 (67.70)	13.05 (66.44)	.09
Frequency of Other Drug Use	1.29 (20.46)	2.54 (29.31)	1.99
<i>Controls</i>			
Prior substance use (1=Yes) (marijuana and <i>other drugs</i>)	.40 (.49) .18 (.38)	.27 (.45) .14 (.35)	6.88 ** .61
Gender (Female=1)	.49 (.50)	.51 (.50)	.68
Mother's education (High school graduate=1)	.52 (.50)	.51 (.50)	3.11
Mother's education (College graduate=1)	.24 (.43)	.41 (.49)	44.27 ***
Family structure (Two parent family=1)	.49 (.50)	.61 (.49)	9.74 **
Age	15.92 (1.62)	15.71 (1.59)	.01
School attachment	3.60 (.98)	3.74 (.93)	6.67 *
School commitment	2.57 (.77)	2.86 (.77)	20.57 ***
Parental alcohol use	1.90 (1.07)	2.15 (1.17)	9.65 **
Self-constraint	3.57 (.62)	3.56 (.61)	1.00
Parental control/autonomy	.71 (.24)	.74 (.21)	1.73
<i>Strains</i>			
Recent Life events	1.77 (2.15)	1.17 (1.56)	19.56 ***
Educational strain	.55 (.78)	.36 (.67)	16.86 ***
School-based strain	2.76 (.96)	2.70 (.89)	.44
<i>Personal & Social Resources</i>			
Social support	3.96 (.63)	4.04 (.56)	2.74
Self-esteem	3.99 (.62)	4.08 (.58)	8.32 **
Religiosity	4.42 (3.02)	4.56 (3.05)	.21
Bad temper (yes=1)	.38 (.46)	.30 (.44)	9.84 **
Depressive symptoms	1.69 (.43)	1.54 (.21)	33.92 ***
Peer substance use	.97 (.96)	.87 (.89)	1.56

* <.05;

** <.01;

*** <.001 (two-tailed tests)

Table Two

Negative Binomial Regression Analyses of Past Year Number of Days drinking Five or more Alcoholic Drinks

<i>Controls</i>	American Indians				Non-Hispanic Whites			
	1 (n=657)	2 (n=657)	3 (n=657)	4 (n=651)	1 (n=6940)	2 (n=6940)	3 (n=6940)	4 (n=6905)
Gender	-.789* (.363)	-.976** (.339)	-.581 (.349)	-.908** (.329)	-.476*** (.127)	-.533*** (.128)	-.421** (.132)	-.456*** (.153)
Parental Education (1=High school)	-.244 (.406)	.072 (.395)	-.289 (.425)	-.492 (.425)	-.088 (.240)	-.067 (.233)	.150 (.216)	.398 (.240)
Parental Education (1=College)	-.616 (.487)	.213 (.492)	.004 (.497)	-.478 (.506)	-.570* (.246)	-.514* (.238)	-.245 (.226)	-.160 (.244)
Family structure	-.317 (.350)	-.138 (.339)	-.252 (.376)	.126 (.315)	.053 (.128)	.054 (.130)	.132 (.136)	.057 (.166)
Parental alcohol use	.347** (.107)	.302*** (.111)	.343*** (.112)	.220 (.120)	.185*** (.046)	.182*** (.047)	.172*** (.047)	.122* (.059)
Parental Control/ Autonomy	.437 (.612)	.036 (.645)	-.061 (.673)	.675 (.603)	-.002 (.304)	.061 (.316)	-.136 (.373)	-.148 (.346)
Age	.261** (.081)	.200* (.088)	.268* (.110)	.093 (.108)	.276*** (.042)	.271*** (.043)	.267*** (.042)	.069 (.044)
<i>Strains</i>								
Recent Life events	.258* (.108)	.154 (.099)	.160 (.107)	.174 (.093)	.240*** (.027)	.196*** (.026)	.187*** (.027)	.089** (.029)
School-based strain	.019 (.171)	-.072 (.168)	-.236 (.206)	-.406 (.250)	.025 (.060)	-.003 (.061)	-.023 (.059)	-.055 (.075)
Educational Strain	.293 (.189)	.293 (.181)	.282 (.194)	.121 (.205)	.117 (.084)	.067 (.079)	-.008 (.090)	.061 (.112)
<i>Negative Affect</i>								
Bad temper		-.122 (.315)	.035 (.338)	-.415 (.375)		.261* (.102)	.225* (.113)	.091 (.151)
Depressive symptoms		1.589*** (.353)	1.561*** (.399)	1.085** (.395)		.437*** (.145)	.463* (.179)	.329 (.209)
<i>Personal & Social Resources</i>								
Self-restraint			-.161 (.263)	-.265 (.288)			-.049 (.087)	.050 (.098)
Religiosity			.005 (.051)	.067 (.054)			-.046 (.024)	-.029 (.027)
Self-esteem			.626 (.385)	.314 (.389)			.387** (.128)	.330* (.148)
Social support			-.823** (.280)	-.696* (.306)			-.252* (.127)	.069 (.131)
School commitment			-.116 (.205)	-.033 (.213)			-.329*** (.092)	-.216* (.097)
School attachment			.038 (.180)	-.055 (.224)			-.049 (.057)	-.032 (.060)
Prior year alcohol use				.047 (.354)				.953*** (.128)
Peer substance use				1.021*** (.205)				.684*** (.070)

	American Indians				Non-Hispanic Whites			
	1 (n=657)	2 (n=657)	3 (n=657)	4 (n=651)	1 (n=6940)	2 (n=6940)	3 (n=6940)	4 (n=6905)
<i>Controls</i>								
<i>Constant</i>	-2.485 (1.724)	-3.878* (1.822)	-2.949 (2.651)	.941 (2.590)	-2.144** (.722)	-2.731*** (.754)	-1.865 (1.006)	-1.505 (1.042)
<i>Ln alpha</i>	2.512 (.106)	2.459 (.106)	2.429 (.108)	2.347 (.111)	2.468 (.071)	2.462 (.070)	2.441 (.072)	2.338 (.074)
<i>F</i> statistic	6.54*** (10,119)	8.30*** (12, 117)	8.47*** (18, 111)	10.45*** (20, 109)	14.947*** (10,119)	11.72*** (12,117)	7.62*** (18,111)	17.68*** (20,109)

* <.05;

** <.01;

*** <.001 (two-tailed tests)

Table Three
Negative Binomial Regression Analyses of Past Year Number of Times Used Marijuana

<i>Controls</i>	American Indians (n=644)				Non-Hispanic Whites (n=6877)			
	1	2	3	4	1	2	3	4
Gender	-.383 (.329)	-.431 (.311)	-.107 (.331)	-.325 (.280)	-.547 ** (.191)	-.737 ** (.206)	-.757 *** (.188)	-.754 *** (.167)
Parental Education (1=High school)	.201 (.398)	.007 (.415)	-.165 (.439)	-.555 (.420)	.466 (.266)	.539 (.275)	.318 (.299)	.688 ** (.253)
Parental Education (1=College)	.491 (.505)	.381 (.556)	.143 (.509)	-.442 (.426)	.473 (.264)	.510 (.277)	.402 (.296)	.807 ** (.258)
Family structure	-1.337 *** (.388)	-1.504 *** (.371)	-1.400 *** (.366)	-.207 (.300)	-.391 * (.157)	-.436 ** (.153)	-.341 * (.151)	-.036 (.137)
Parental alcohol use	.200 (.158)	.194 (.149)	.251 (.157)	.040 (.151)	.188 * (.086)	.146 (.079)	.159 (.082)	.067 (.067)
Parental Control/ Autonomy	2.979 *** (.809)	3.269 *** (.738)	3.448 *** (.743)	2.398 ** (.679)	.080 (.376)	.394 (.366)	.234 (.363)	.758 * (.372)
Age	.071 (.104)	.070 (.103)	.025 (.112)	-.193 * (.084)	.420 *** (.061)	.396 *** (.060)	.334 *** (.062)	-.008 (.054)
<i>Strains</i>								
Recent Life events	.235 * (.101)	.234 * (.107)	.298 * (.132)	.207 ** (.076)	.331 *** (.053)	.278 *** (.049)	.205 *** (.044)	-.037 (.036)
School-based strain	.048 (.156)	.081 (.152)	.016 (.146)	-.073 (.108)	.089 (.091)	.106 (.089)	.022 (.089)	.077 (.082)
Educational Strain	.371 (.255)	.436 (.264)	.208 (.277)	.015 (.177)	.009 (.099)	-.080 (.105)	-.185 (.128)	.141 (.131)
<i>Negative Affect</i>								
Bad temper		-.443 (.400)	-.880 * (.390)	-.699 * (.324)		.535 * (.206)	.425 * (.197)	.189 (.200)
Depressive symptoms		-.118 (.435)	-.451 (.507)	-.112 (.445)		.830 *** (.217)	.478 * (.207)	.121 (.256)
<i>Personal & Social Resources</i>								
Self-restraint			-.151 (.295)	.304 (.230)			-.348 ** (.112)	-.000 (.112)
Religiosity			-.033 (.066)	.032 (.058)			-.117 *** (.028)	-.065 * (.029)
Self-esteem			.209 (.386)	.557 (.327)			.271 (.181)	.145 (.161)
Social support			-.985 ** (.312)	-.843 ** (.283)			-.660 *** (.133)	-.549 ** (.154)
School commitment			-.657 ** (.233)	-.636 ** (.238)			-.330 ** (.109)	-.054 (.123)
School attachment			.360 (.203)	.260 (.157)			-.126 (.077)	-.115 (.091)
Prior year marijuana use				1.925 *** (.336)				1.666 *** (.162)
Peer substance use				1.105 *** (.199)				1.227 *** (.106)

	American Indians (n=644)				Non-Hispanic Whites (n=6877)			
	1	2	3	4	1	2	3	4
<i>Controls</i>								
<i>Constant</i>	-1.808 (1.752)	-1.512 (1.839)	3.865 (4.157)	1.822 (2.789)	-5.448 *** (1.157)	-6.604 ** (1.451)	.103 (1.560)	.633 (1.509)
<i>Ln alpha</i>	2.479 (.149)	2.475 (.149)	2.407 (.144)	1.949 (.136)	2.775 (.057)	2.754 (.058)	2.690 (.059)	2.312 (.069)
<i>F statistic</i>	6.91 *** (10,119)	6.18 *** (12,117)	6.48 *** (18,111)	15.83 *** (20,109)	12.21 *** (10,119)	9.30 *** (12,117)	14.24 *** (18,111)	45.72 *** (20,109)

* <.05;

** <.01;

*** <.001 (two-tailed tests)

Table Four

Negative Binomial Regression Analyses of Past Year Number of Times Used Other Illicit Drugs

<i>Controls</i>	American Indians (n=659)				Non-Hispanic Whites (n=6960)			
	1	2	3	4	1	2	3	4
Gender	.908 [*] (.448)	1.056 [*] (.438)	-.058 (.428)	-.406 (.415)	.236 (.312)	.001 (.322)	.034 (.249)	-.217 (.226)
Parental Education (1=High school)	.005 (.534)	.441 (.618)	-.221 (.544)	.170 (.375)	.479 (.478)	.423 (.508)	.727 (.403)	.358 (.407)
Parental Education (1=College)	1.048 (.717)	1.349 (.751)	.940 (.625)	.667 (.639)	.345 (.476)	.332 (.511)	.486 (.433)	.420 (.407)
Family structure	-1.100 (.644)	-1.093 (.587)	-.745 (.405)	-.255 (.353)	-.062 (.302)	-.144 (.307)	-.072 (.251)	.285 (.201)
Parental alcohol use	-.327 (.252)	-.250 (.244)	-.258 (.208)	-.249 (.160)	.063 (.108)	.051 (.106)	.054 (.095)	.088 (.093)
Parental Control/ Autonomy	6.811 ^{***} (1.490)	6.675 ^{***} (1.448)	3.561 ^{***} (.927)	2.931 [*] (1.230)	.370 (.792)	.383 (.735)	.424 (.516)	-.226 (.499)
Age	.297 (.225)	.284 (.197)	.392 ^{**} (.154)	.025 (.107)	.501 ^{***} (.124)	.465 ^{***} (.113)	.224 [*] (.094)	-.061 (.075)
<i>Strains</i>								
Recent Life events	.248 [*] (.102)	.204 (.125)	.295 ^{**} (.091)	.093 (.100)	.585 ^{***} (.094)	.586 ^{***} (.099)	.566 ^{***} (.078)	.260 ^{**} (.075)
School-based strain	-.315 (.230)	-.434 (.246)	-.233 (.146)	-.084 (.168)	-.001 (.184)	-.058 (.171)	-.245 (.137)	-.136 (.131)
Educational Strain	.352 (.355)	.464 (.362)	.052 (.236)	.336 (.244)	.202 (.197)	.586 (.211)	-.494 ^{**} (.175)	-.304 [*] (.143)
<i>Negative Affect</i>								
Bad temper		.882 (.504)	.558 (.406)	.813 [*] (.367)		.258 (.305)	-.168 (.244)	.098 (.248)
Depressive symptoms		.485 (.787)	-.670 (.680)	-1.225 [*] (.554)		1.002 [*] (.406)	.271 (.326)	-.777 [*] (.295)
<i>Personal & Social Resources</i>								
Self-restraint			-.619 [*] (.279)	-.957 ^{**} (.298)			-.214 (.182)	.163 (.159)
Religiosity			-.126 (.083)	-.017 (.069)			-.094 [*] (.038)	-.077 (.039)
Self-esteem			.364 (.382)	.023 (.391)			-.141 (.248)	-.327 (.256)
Social support			-2.893 ^{***} (.415)	-1.604 ^{***} (.284)			-.818 ^{**} (.234)	-.3754 (.244)
School commitment			.662 [*] (.295)	1.322 ^{***} (.316)			-.706 ^{**} (.214)	-.218 (.146)
School attachment			.466 [*] (.226)	.341 [*] (.171)			-.777 ^{***} (.146)	-.441 ^{***} (.117)
Prior year other drug use				3.388 ^{***} (.498)				1.815 ^{***} (.244)
Peer substance use				.770 ^{**} (.239)				1.298 ^{***} (.121)

	American Indians (n=659)				Non-Hispanic Whites (n=6960)			
	1	2	3	4	1	2	3	4
<i>Controls</i>								
<i>Constant</i>	-9.758 ^{***} (3.696)	-10.859 ^{**} (3.841)	.950 (4.614)	.886 (3.718)	-9.348 ^{***} (2.021)	-10.060 ^{***} (2.078)	3.784 (2.315)	3.981 [*] (1.988)
<i>Ln alpha</i>	3.429 (.220)	3.415 (.222)	3.082 (.215)	2.263 (.230)	3.748 (.088)	3.728 (.087)	3.567 (.084)	3.115 (.095)
<i>F</i> statistic	20.65 ^{***} (10,119)	14.03 ^{***} (12,117)	26.61 ^{***} (18,111)	15.54 (20, 109)	11.36 ^{***} (10,119)	13.75 ^{***} (12, 117)	12.72 ^{***} (18, 111)	29.52 ^{***} (20,109)

* <.05;

** <.01;

*** <.001 (two-tailed tests)

Table Five

Interaction Terms from Negative Binomial Regression Analyses of American Indians' Past Year Number of Times Drank Heavily, Used Marijuana, and Used other Illicit Drugs.

	Alcohol Use (n=651)		Marijuana Use (n=644)	Other Drug Use (n=659)
Recent Life Events	.513 ** (.167)	.956 ** (.310)	.461 ** (.131)	.915 *** (.383)
Peer substance use	1.492 *** (.245)		1.540 *** (.215)	
Autonomy		2.493 * (.959)		
Self-restraint				-.219 (.348)
Strain * Moderator	-.253 *** (.068)	-1.020 ** (.364)	-.183 ** (.059)	-.250 * (.115)

*
<.05;

**
<.01;

<.001 (two-tailed tests);

Only variables included in interaction terms reported above full model includes all of the controls, strains, negative affect, and personal and social resources (see column 4 of Table 4 for complete list of variables).

Table Six

Interaction Terms from Negative Binomial Regression Analyses of Non-Hispanic Whites' Past Year Number of Times Drank Heavily and Used Marijuana

	Alcohol Use (n=6905)	Marijuana Use (n=6877)		Other Drug Use (n=6960)
Recent Life Events	.328 ** (.112)	.327 * (.149)	.074 (.066)	.443 *** (.111)
Peer substance use			1.315 *** (.126)	1.487 *** (.046)
Self-restraint	.139 (.110)			
Autonomy		1.411 ** (.477)		
Strain * Moderator	-.066 * (.030)	-.459 ** (.170)	-.063 * (.031)	-.115 * (.046)

*
<.05;

**
<.01;

<.001 (two-tailed tests);

Only variables included in interaction terms reported above full model includes all of the controls, strains, negative affect, and personal and social resources (see column 4 of Table 4 for complete list of variables).