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Posttraumatic growth, stressful life events, and relationship with substance use behaviors among alternative high school students: a prospective study

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Abstract

A highly stressful life event (SLE) can elicit positive psychosocial growth, referred to as Post-traumatic Growth (PTG) among youth. We examined PTG and the number of SLEs for their influence on substance use behaviors among a sample of older, diverse alternative high school students participating in a drug prevention program ($n=564$; mean age=16.8; 49% female; 65% Hispanic). Surveys assessed PTG, SLEs, and substance use behaviors at 2-year follow-up. Multi-level regression models were run to examine the effect of PTG and number of SLEs on frequency of substance use at two-year follow-up, controlling for baseline substance use, sociodemographic variables, peer substance use, attrition propensity, and treatment group. Greater PTG scores were associated with lower frequencies of alcohol use, getting drunk on alcohol, binge drinking, marijuana use, and less substance abuse at two-year follow-up, but not associated with cigarette or hard drug use. Also, PTG did not moderate the relationship between cumulative number of SLEs and substance use behaviors, rather PTG appears to be protective against negative effects of a single, life-altering SLE. Fostering PTG from a particularly poignant SLE may be useful for prevention programs targeting alcohol, marijuana, and substance abuse behaviors among high-risk youth.

Keywords

posttraumatic growth; high-risk; older youth; substance use; stressful life events

Substance use is one of the most problematic health concerns for adolescents and young adults in the United States (Johnston et al., 2013). It has been estimated that by the 10th grade, over 27% of youth have smoked cigarettes, 54% have tried alcohol, 35% have been drunk on alcohol, 34% have tried marijuana, and 15% have used illicit drugs in their lifetime (Johnston, et al., 2013). Adolescents who use or misuse substances have a higher likelihood of having experienced highly stressful events in their past (e.g., childhood sexual abuse,

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witnessing violence, natural disaster), as substances have long been used as a method of coping and relief from distress (e.g., Holahan et al., 2001; Nancy CP Low et al., 2012; McConnell, Memetovic, & Richardson, 2014). Unsuccessful coping with stressful life events (SLEs) and the resulting emotional distress are consistent predictors of earlier and more frequent substance use among adolescents (e.g., Booker et al., 2004; Dube et al., 2006; Newcomb & Harlow, 1986; Unger et al., 1998; Wagner et al., 2009; Wills, 1986). Moreover, use of any of the three most accessible drugs—tobacco, alcohol or marijuana—during adolescence increases the likelihood that an individual will develop a substance use dependence disorder later in life (Palmer et al., 2009).

Some youth are at greater risk than others for engaging in substance use behaviors and experiencing higher levels of stress. In particular, youth who attend alternative high schools (also referred to as continuation, contract, or community high schools in the United States) may experience greater levels of stress than their regular high school counterparts, including emotional and physical abuse or victimization, loss of a parent, cycling in-and-out of foster care, being a witness to violence, and other occurrences that cause them to feel disconnected from mainstream society (Zweig & Institute, 2003). Generally, these students have left regular high schools because of excessive truancy, poor academic performance, drug use, violence, other illegal activity, or disruptive behavior (Rohrbach et al., 2005). Compared to regular high school students, alternative high school students report a higher prevalence rates for current use of tobacco, alcohol, episodic heavy alcohol, marijuana, and cocaine (between 33.4, 14.1, 18.1, 27.7, 12.6 higher rates, respectively; Grunbaum, Lowry, & Kann, 2001).

Although the relationship between self-reported SLEs and elevated substance use has been well established (Wagner, et al., 2009; Wiechelt, 2007; Wills, 1986), not all adolescents exhibit maladaptive behaviors after having experienced a highly stressful life event. Instead, many youth undergo a process of reevaluation and redefinition of their life's priorities, allowing them to successfully adapt despite their high-risk environment and potentially more vulnerable backgrounds (Austin, 2004; Masten, 2004); as such, they emerge in the aftermath of a highly stressful experience with a more positive perspective on life. Such individuals develop Post-traumatic Growth (PTG), variably referred to as benefit finding or meaning-making coping.

PTG has been defined as having garnered positive life changes and having developed a level of psychological functioning and awareness beyond pre-SLE level as a result of struggling with and managing at least one highly stressful life event (Calhoun & Tedeschi, 2001). According to theories of PTG (Schaefer & Moos, 1998; Tedeschi, 1995; Tedeschi & Calhoun, 2004), the occurrence of some SLE, whether or not it qualifies as a diagnosable traumatic stressor¹, according to the Diagnostic and Statistical Manual of Mental Disorders—IV (DSM-IV; Association & DSM-IV., 2000), is a prerequisite for the development of PTG. Thus, in the endeavor to better understand PTG, it is important to further explore the

¹An event qualifies as a traumatic stressor if it (a) involved an actual or threatened death or serious injury, or a threat to the physical integrity of oneself or to others, and (b) if the individual's response involved intense fear, helplessness, or horror (Association & DSM-IV., 2000).

theoretical relationship with SLEs; more specifically, to test whether or not PTG develops in relation to a specific SLE.

Joseph's person-centered theory (Joseph, 2003; Joseph & Linley, 2006) posits that PTG develops because individuals are intrinsically motivated to become *fully functioning*. This means that in the aftermath of an SLE, they strive to accommodate stress-related experiences into their new sense of self, find purpose and meaning in the SLE, experience life as a process, find value in trusting relationships, gain a greater sense of their spirituality, and find an augmented sense of personal strength to therefore function at a higher level than the pre-SLE self (Joseph, 2003; Joseph & Linley, 2006; Tedeschi & Calhoun, 1996). Because those who develop PTG strive to become *fully functioning* and perceive certain behaviors as incongruent with their improved post-SLE self, it follows that such individuals would likely engage in fewer health-compromising behaviors. PTG may therefore serve as a resilience factor that directly promotes congruent behaviors or functions through a stress-buffering effect to discourage health-compromising coping-related behaviors.

Prior research on the relationship between PTG and substance use behaviors has been primarily conducted among adults. Exemplified in several studies, women who developed PTG as a result of being diagnosed with HIV/AIDS report that the diagnosis served as a “wake-up call,” and was the impetus for them to reduce their use of alcohol and/or other drugs (Milam, 2006; Siegel & Schrimshaw, 2000; Updegraff et al., 2002). In a study among successful ex-smokers, many reported that a specific SLE in their lives, such as the break-up of a long-term relationship, had provided them with the necessary motivation to quit (Tsourtos et al., 2011). Furthermore, two studies conducted among homeless women experiencing a wide range of SLEs and breast cancer patients in treatment have demonstrated similar results, an inverse relationship between PTG and substance use (Stump & Smith, 2008; Urcuyo et al., 2005).

Only two quantitative studies have been conducted to examine the relationship between PTG and substance use among high school students, and both were cross-sectional. In the first study, conducted among regular high school students (average age of 15.8 years, $SD=1.52$), PTG was assessed with respect to a range of SLEs, including death of a close family member, moving to a new home, loss of a close friend, major illness/injury to a close family member, parents' separation, being held back a grade (Milam, Ritt-Olson, & Unger, 2004). Among the sample, PTG was inversely related to substance use (a composite index of tobacco, alcohol, and marijuana). In the second study, PTG was assessed with respect to the stress from the September 11th attacks among middle school students (mean age 13.5 years, $SD=0.52$) (Milam et al., 2005). Although an inverse relationship was found between PTG and alcohol use ($r=-.15$, $p<.001$), inverse and non-significant relationships were found between PTG and cigarette smoking and marijuana use. A possible reason for the lack of findings is that the sample was comprised of younger adolescents with relatively low prevalence rates of cigarette (5.8% for past 30-day use) and marijuana use (10.3% for prior year use) compared to alcohol use (34.4% for prior year use), resulting in less statistical variation.

With the current study, we aimed to expand the empirical literature by testing the hypothesis that in accordance with the person-centered theory, older at-risk adolescents who report higher levels of PTG in the aftermath of a life-altering SLE will concurrently report reduced substance use behaviors at the two-year follow-up assessment. Further, because a possible stress buffering relationship between PTG and high cumulative stress from multiple SLEs has not been characterized, we explore whether PTG moderates the relationship between cumulative number of SLEs and substance use.

Methods

Participants

Participants were enrolled in a randomized controlled trial of Project Towards No Drug Abuse (TND), a 12-lesson drug-abuse prevention curriculum that targets youth in alternative high schools (for program and recruitment details, see Sussman et al., 2012). The current trial examined the efficacy of a booster program component that utilizes motivational interviewing techniques. Twenty-four alternative high schools were randomly assigned to one of three experimental conditions: control, TND only, or TND plus motivational interviewing booster. A total of 1704 (71.1%) of students enrolled in classes selected from the 24 alternative high schools consented to participate in the intervention study, for which results are reported elsewhere (see Sussman, et al., 2012).

Data Collection

Data for this study were collected before program implementation (baseline) and at two-year follow-up. All procedures and protocols for this study were approved by the IRB at the University of Southern California (USC). Informed consent was obtained from students who were at least 18 years of age. For those under 18, informed consent was obtained from parents, in addition to student assent. Trained data collectors administered a paper and pencil survey in one 50-minute classroom period at the baseline. Students who provided consent but were absent the day of survey administration received a telephone call and were given the option to complete the survey verbally at that time. Of the 1704 participants who were consented, 1676 completed the baseline survey. For the two-year follow-up data collection, 703 (41.9%) of students completed surveys that were administered by telephone (76.3%), in-person (at school or via home visit; 8.8%), or by mail-back (14.8%). For this study, the analytic sample was comprised of students from both intervention and control groups, who reported having experienced a SLE within the past two-years and answered PTG items referring to the SLE ($n=564$).

Measures

Study Condition—A covariate was included in order to control for the study condition to which students were assigned. Because the goal of this study was not to assess effects of the intervention, and previous studies have shown no differences in substance use outcomes between the two intervention conditions (see Sussman, et al., 2012), the variable for study condition was dichotomously coded as TND-any (either intervention arm) or Control. Additionally, sensitivity analysis demonstrated that results of this study were the same when treatment condition was coded dichotomously (0=control, 1=intervention) or categorically

with 3-levels (0=control, 1=intervention only, 2=intervention + motivational interviewing booster).

Demographics—Socio-demographic information was collected at baseline for age (in years), gender, socioeconomic status (a single variable reflecting either mother's or father's highest educational attainment, whichever was higher), and race/ethnicity categories (Asian or Asian American; Latino or Hispanic; African American or Black; White, Caucasian, Anglo, or European American, not Hispanic; American Indian or Native American; Mixed ('My parents are from two different groups'); or Other). Because of insufficient numbers in the race/ethnic categories other than Hispanic (35%), race/ethnicity was recoded to Hispanic or non-Hispanic.

Stressful Life Events (SLEs)—The SLE checklist included in the 2-year follow-up survey was derived from an abbreviated (18-item) version of the Adolescent Negative Life Events Inventory (Wills, 1986; Wills & Cleary, 1996), used in a previous study among adolescents (mean age=14.4 years $\pm$ 0.8) (Rohrbach et al., 2009). For the present study, we included a checklist of the 8 life events that were most commonly reported among adolescents in the Rohrbach et al., (2009) study. Because the distribution of events has been shown to vary according to contextual factors of age, race/ethnicity, gender, and socioeconomic status (Hatch & Dohrenwend, 2007), wording for some items was altered in order to be more relevant to this older adolescent population (mean age at the time of the 2-year follow-up survey = 18.8 $\pm$ 9.3). For example because many of these youth were no longer living with parents or guardians, or dependent on others financially, "My parents had problems with money" was changed to "I did not have enough money for basics (like food)" and "I had a lot of arguments with my parents" was changed to "There were a lot of arguments that happened at home." Participants were given the checklist of the 8 life events and asked to indicate which events they had experienced within the past two years (*yes/no* response to each). A ninth question allowed for participants to indicate that they had experienced other events not listed in the checklist with a free-entry field for them to write in the event or multiple events. Responses were summed to get a nominal total for the stressful life events experienced within the past two years. Relevant for assessing PTG, participants were asked to indicate which of the events listed (including anything they wrote into the "Other" category) affected their life the most.

Post-traumatic Growth—The instrument used to assess PTG at 2-year follow-up was an 8-item self-report scale. Due to constraints on space and time, these items were derived from an 11-item version of the Post-traumatic Growth Inventory (PTGI), which was modified from the original inventory by Tedeschi and Calhoun (Tedeschi, 1995; Tedeschi & Calhoun, 1996) and used among diverse adolescent and adult samples previously (Arpawong et al., 2013; Milam, 2006; Milam, et al., 2005; Milam, 2004). We selected 8 items from the 11-item PTGI (used in Arpawong, et al., 2013) in order to both maximize the variation that would be captured by the items and preserve statistical reliability and validity. First, we removed an item asking about "my religious faith" because it correlated highly ($r=0.81$) with another item on "understanding of spiritual matters" and the factor loading was lower. Second, we removed an item on "priorities about what is important" as it had the lowest

factor loading of all items in the 11-item scale. Third, we removed an item on “willingness to express my emotions” because among the three items representing PTG domain of relationships with others, it had the lowest factor loading. Overall, the 8 items used reflected a single dominant global factor. In a factor analysis, each item had high factor loadings on the first unrotated factor, all at or above 0.61, with an eigenvalue of 5.44. The means calculated for the 8-item and 11-item scale correlated at $r=0.98$. The internal reliability/consistency (Cronbach's alpha) for the mean of the 8-items used in this study was 0.81.

Participants were asked to respond to the PTG items in reference to the single SLE that they designated as most life-altering of the past two years. To avoid the potential bias from participants only being able to report positive valenced change that may have resulted from their stressful event, the response format for this scale allowed participants to endorse both negative and positive change. Responses range from 1 (“Negative change”) to 3 (“Positive change”), with 2 indicating “No change”. Although the response options were restricted from 1 to 3, in contrast to prior assessments of PTG in which responses were allowed on a broader range (from 1 to 5), prior analyses comparing the use of mean PTG scores for the full format to the restricted format yielded similar results (data not shown).

Similar to previous research on PTG (e.g., Antoni et al., 2001; Milam, 2004; Milam, et al., 2004), a factor analysis suggests that a unitary score is appropriate for the measure. Although two factors had eigenvalues greater than 1 (3.40 for factor 1), the eigenvalue of the second value was only 1.01, and all items loaded at or above 0.61 on the first unrotated factor. Thus, a composite score, averaging responses on all 8 items. Because the distribution of the PTG variable had negative skewness, PTG was reflected to convert the distribution to positive skewness, log-transformed, and re-reflected for use as a continuous variable for all analyses.

Peer Substance Use—Perceived peer substance use is a well-established indicator of maladaptive adjustment by its relationship with health-compromising behaviors (Sussman, Dent, & McCullar, 2000). Four items were used at baseline to assess perceptions of use among five closest peers for each of the subcategories (cigarettes, alcohol, marijuana, and hard drugs) with response options of 1 (0 friends) to 6 (5 friends). The four items were averaged yielding a scale with high internal consistency (Cronbach's alpha=0.85).

Substance Use—Items assessing past month substance use were used to create dependent variables as well as baseline control variables. At both baseline and two-year follow-up, the item “How many times have you used each of these drugs in the last month (last 30 days)?” was posed, with a list of 12 substance categories: cigarettes, alcohol, getting drunk on alcohol, marijuana, cocaine, hallucinogens, stimulants, inhalants, ecstasy, pain killers, tranquilizers, and other hard drugs. For each category, response options were provided on a 12-point scale to indicate use between 0 to over 100 times (1=0 times, 2=1-10 times, 3=11-20 times,..., 12=Over 100 times). The reliability of the substance use item format has been established previously (Graham et al., 1984; Needle et al., 1983; Stacy et al., 1990). Responses to the first 4 substance categories were used to create continuous, ordinal variables for frequency of past month cigarette use, alcohol use, getting drunk on alcohol, and marijuana use, respectively. Responses to the last 8 substance categories (cocaine

through other hard drugs) were summed to create an index for frequency of past month hard drug use (Cronbach's $\alpha=0.73$). Average number of cigarettes smoked daily was assessed through a single item, "How many cigarettes do you smoke per day on average?" Responses were used to create a continuous variable for average daily cigarette use. Lastly, participants were asked "How many days have you had 5 or more alcoholic drinks within a 5 hour period over the last 30 days?". Responses used to create a continuous variable for past month number of times reported binge drinking. For analysis, all substance use variables were coded as log-transformed use levels.

Substance abuse—An index for past year substance abuse was created using 4 questions (e.g., "In the last 12 months, have you kept using alcohol or drugs even though it was keeping you from meeting your responsibilities at work, school, or home?", "In the last 12 months, has your alcohol or drug use caused you to have repeated problems with the law?"), serving as proxy items of the DSM-IV substance abuse disorder categories. Responses from the 4 items were summed into a single variable (Cronbach's $\alpha=0.66$), and if the score was 1 or more, the participant was coded as having abused substances in the past year. The sum score for level of past year substance abuse was used as a continuous variable.

Statistical Analysis

Of the 1,676 students who completed a survey at baseline, 703 students completed the 2-year follow-up survey (58.1% attrition rate). To account for the effect of possible differential study attrition on important baseline variables in the analytic models, a propensity-for-attrition score was calculated for each participant retained in the sample (vs. those lost-to-follow-up at 2 years) and included as a covariate in regression models such that results could be interpreted as if there was no imbalance in attrition within the sample. First, the difference on key variables (18 variables) by actual attrition status (0=not retained in the sample, 1=retained in the sample) from baseline to 2-year follow-up was assessed using logistic regression analysis. The variables that were significantly associated with attrition were age, whether the participant lived with both parents, and a 4-item scale on attitudes of drug use (i.e., if they used drugs, they would feel wrong, guilty or ashamed; see Sussman, Dent, & Galaif, 1997); these three variables were included in the calculation of the propensity-for-attrition score. This method has been used previously to control for the effects of differential attrition (Berger, 2005; Grunkemeier et al., 2002; Sun et al., 2007). Additionally, when the analytic sample ($n=564$) was compared to those who did not report an SLE at two-year follow-up ($n=139$), there were no significant differences in baseline age, gender, ethnicity, parents' education, or treatment group ($p's>.05$). All analyses were performed using the SAS (v.9.1.3) statistical package.

Multilevel linear regression (PROC MIXED) models were run in order to examine the primary study hypothesis (whether higher PTG is associated with lower levels of substance use behaviors over time). In order to assess each substance use outcome, the frequency of use (or level for substance abuse) at two-year follow-up was used as the dependent variable and baseline use was included as a covariate. The number of SLEs and PTG were both entered as continuous variables as correlates of substance use behavior at two-year follow-up. An interaction term was created between standardized variables (number of SLEs $\times$

PTG) to assess whether PTG moderated the effect of cumulative stress from SLEs and substance use. All models included a propensity-for-attrition score, intervention condition, socio-demographic variables (i.e., age, gender, and race/ethnicity, parents' education as a proxy for socio-economic status), and perceived peer substance use as covariates. Additionally, models included a school variable as a random effect to allow for the statistical accounting of intraclass correlation (ICC) of students within clustered units (schools) on computed significance levels, and for greater generalizability of findings.

Results

Participant Characteristics

Table 1 provides characteristics of the sample. Every student reported at least one stressful life experience over the past two years (mean number of SLEs = 3.14, SD=1.70). Of the sample, 20% reported experiencing only 1 event, 21% reported 2 events, while the majority (59%) reported experiencing 3 or more events over the two-year assessment period. Overall, 22% reported experiencing 5 or more events. The most-life altering SLEs reported, in order of greatest to least frequency, were the following: someone in the family having a serious illness, accident, or injury (28%); conflict at home (13%); relationship problem (12%); being or having someone in the family be arrested (11%); having a new person join the household (11%); not having enough money for basics such as food (6%); job or school change/problem (6%); being a victim of a violent or abusive crime (4%); personal injury, illness, accident or change in health status (2%); death of an extended family member (2%); being displaced from home (2%); injury or death of a friend (2%); and other SLEs, of which each was reported by less than 1% of participants (pregnancy, miscarriage of self or partner; change in religious faith; death of a parent or both; witnessing a violent crime; getting robbed).

The majority of students reported that some aspect of their life had improved in the aftermath of having experienced the most-life altering SLE of the past two years, demonstrated by a mean PTG score of 2.64 (SD=0.38), on a scale of 1 to 3. Participants were most likely to report positive changes on items, in order of greatest to least frequency, my own inner strength (83%), appreciation for the value of my own life (77%), direction for my life (75%), handling my difficulties (72%), involvement in things that interest me (69%), my compassion for others (69%), my sense of closeness with others (65%), and my understanding of spiritual matters (56%).

Table 2 provides means, standard deviations, and frequencies for substance use behaviors assessed at baseline. Alcohol and hard drugs were most and least prevalently used among all substances, respectively. Table 3 provides zero-order correlation coefficients between all substance use outcomes, PTG, number of SLEs, and model covariates.

Multi-level Regression Models

Table 4 presents results of multi-level regression models. Although testing of intervention group (treatment versus control) effects on substance use at two-year follow-up was not a central research question, it was crucial to demonstrate that treatment group did not affect

final model outcomes. For sensitivity analyses, interactions for treatment*PTG and treatment*SLE number were tested and these were significant only for the outcome of average daily cigarette use ($p=.04$ and $p=.03$, respectively). Also the final regression models for all substance use outcomes were run in stratified samples for the treatment and control groups separately yielding the same pattern of results found as presented in Table 4.

With regard to main effects tested, as shown in Table 4, several socio-demographic characteristics predicted greater use of certain substances at two-year follow-up. Older age predicted greater frequency in past month use of cigarettes, alcohol, marijuana, getting drunk and binge drinking, and past year substance abuse. Being male predicted greater frequency in use of all substances and more substance abuse; being of non-Hispanic ethnicity predicted greater frequency in daily and past month cigarette and past month marijuana use; and higher parental education predicted more frequent binge drinking ($p's<.05$). The perception of having more substance-using peers predicted greater frequencies in past month use of alcohol and marijuana ($p's<.05$). For all substances, use at baseline was a positive predictor of use at two-year follow-up ($p's<.05$). Lastly, experiencing more SLEs between baseline and two-year follow-up was associated with greater past month use of cigarettes, alcohol, marijuana, and hard drugs, greater frequency of getting drunk on alcohol in the past month among those who used alcohol, as well as greater substance abuse in the past year ($p's<.05$).

With regard to hypothesis testing, results supported the assertion that greater PTG was associated with less frequent alcohol and marijuana use in the past month, as well as less substance abuse in the past year. Also, among those who used alcohol, higher PTG scores were associated with a lower frequency of past month drunkenness and binge drinking ($p's<.05$). However, higher PTG scores were not associated with frequency of use of cigarettes, either average daily use or past month use, or past month hard drug use. These results were further supported by sensitivity analysis, in which we examined differences in mean PTG scores when the dependent substance use variable was coded categorically with respect to differences in use from baseline to two-year follow-up (0=no use maintained, 1=reduced/quit use, 2=stayed at the same level of use, and 3=increased/initiated use). Relationships between substance use and PTG were as hypothesized such that participants categorized as 'increasing/initiating use' had lower mean PTG scores than those categorized as 'reducing/quitting use.' This pattern of relationships was true for level of use for all substances. Lastly, interaction terms exploring PTG as a moderator of cumulative stress from SLEs on substance use were not included in the final models because they were not significant.

Discussion

To our knowledge, this is the first prospective study to demonstrate that PTG is associated with less use of alcohol and marijuana, and substance abuse behaviors among alternative high school students. We found that positive psychosocial adjustment to a particular life-altering stressor may counteract the negative impact of event-related distress on use of health-compromising substances. Our results corroborate findings from prior studies that were mostly cross-sectional, and therefore did not control for baseline substance use levels, and were conducted among on younger adolescent and older adult samples. Further, these

results support the notion that PTG includes a functional component such that individuals who report PTG demonstrate congruence between improved psychological functioning and behavioral benefits. Although we did not find that PTG moderates the relationship between cumulative number of stressors and substance use, this study draws attention to health behavior benefits of PTG.

Developing a higher level of PTG, as a result of a life-altering event, was associated with lower past month use of alcohol and marijuana, getting drunk on alcohol, binge drinking and past year substance abuse. Because PTG was associated with changes in behaviors that occurred over a two-year period, this suggests that positive perceptions of the post-SLE self in the present sample represented some element of functional change and were not merely illusory self-enhancements. Prior studies have initiated questions with regard to the functional component of PTG, since perceived positive change has not always correlated with demonstrated changes in well-being, actual PTG domains, or decreased distress (e.g., Frazier et al., 2009; Frazier & Kaler, 2006; Tomich & Helgeson, 2004). Nevertheless, results of our study and cross-sectional predecessors provide compelling evidence that the functional component of PTG may manifest as demonstrated changes in behavior. Hence, successfully managing the stress from a life-altering event can facilitate one's ability to become more highly functional behaviorally, post-crisis.

Even though some of our results supported the hypothesis that greater PTG is associated with less substance use, we found no associations between PTG and cigarette or hard drug use at two-year follow-up. With regard to cigarettes, this corroborates a study of younger adolescents that showed an inverse but non-significant relationship between PTG and cigarette use (Milam, et al., 2005). In that study, the prevalence of past month cigarette use was very low (5.8%) and thus there may have been too few cigarette smokers to detect any significant statistical relationship. In the present study, the lack of relationship between PTG and frequency of past month cigarette use may be due to their being very little change in prevalence from baseline to two-year follow-up (non-significant difference of 2.9%, shown in Table 2). Otherwise, the research thus far indicates that PTG does not associate strongly with youth cigarette smoking behaviors in particular.

With regard to hard drug use, the lack of relationship is more difficult to explain, particularly given that the prevalence of hard drug use from baseline to two-year follow-up was reduced by half, from 28% to 14%. One explanation is that proximal factors that were not assessed in this study (e.g., access to hard drugs, money to buy them, and a place to use them) may be more salient to hard drug use behavior among the older adolescents than is PTG. Another explanation is that those who continue to engage in hard drug use over the long-term have experienced more severe stressors earlier in life, prior to the two-year period for SLEs assessed in this study. This explanation coincides with prior research demonstrating that experiencing more severe events in childhood (e.g., sexual abuse, physical assault) is related to hard drug use/dependence in later adolescence (Kilpatrick et al., 2000; Schafer, Schnack, & Soyka, 2000).

Of note, PTG was associated with less binge drinking while the number of SLEs was not. This corroborates prior research (N. C. Low et al., 2012) that binge drinking may be used as

a coping response elicited by a single acute event (e.g., romantic break-up, loss of a job), rather than by the accumulation of lower level stressors (e.g., financial, or school-related). Further, our finding extends prior work in which PTG was found to be negatively associated with binge drinking among university students in a cross-sectional study (Foster et al., 2013). These results provide evidence for a promising approach to combat binge drinking, the pattern of alcohol use that has been deemed the greatest concern from a public health perspective (Johnston et al., 2010). Encouraging the use of alternative coping mechanisms (e.g., problem solving, spiritual coping) and cognitive processing towards thoughts of positive life change post-SLE may be a useful target for intervention to combat episodic heavy drinking.

The exploratory hypothesis of this study, that PTG would moderate the relationship between cumulative number of SLEs and frequencies of substance use through a stress-buffering process, was not supported. Yet, consistent with prior research among adolescents (e.g., Booker, et al., 2004; Dube, et al., 2006; N. C. Low, et al., 2012; Newcomb & Harlow, 1986), we found that a higher number of SLEs was related to higher substance use rates. Taken together, this suggests that the negative relationship between PTG and substance use occurs independently of the relationship between cumulative stress and substance use. The question remains on whether developing PTG at one point in time would result in increased stress-buffering to future life events. For instance, research has demonstrated that PTG predicts meaning-making at a future time-point, which is then related to greater overall psychological well-being (Park et al., 2008). Thus, a future study would be needed to answer the question of whether greater PTG confers a stress-buffering benefit to long-term changes in substance use behaviors.

A common approach of efficacious school-based programs for at-risk, older youth is the incorporation of modules that focus on coping with stress and decreasing general stress levels (Sussman et al., 2004; Sussman & Sun, 2009). Future modules may increase efficacy if they include recognizing cues to emotional and mental distress stemming from a highly impactful SLE, facilitating cognitive processing that fosters PTG, as well as enhancing skills to engage in activities that have demonstrated effect on promoting PTG, such as expressive writing, physical activity, or meditation (Marlo & Wagner, 1999; Sabiston, McDonough, & Crocker, 2007; Smyth, Hockemeyer, & Tulloch, 2008).

Limitations

The generalizability of these findings is applicable to older, mostly Hispanic youth who attend alternative high schools. Evidence shows Hispanic students have higher prevalence rates of substance use behaviors when compared to White/Caucasian, Black/African-American, and Asian American students (CDHS, 2010; Johnston, et al., 2013) although variations exist by grade level, state, and school type. Some research connects acculturation factors (e.g., discord between child and parent expectations, recentness of immigration), social factors related to culture (e.g., social self-control, precociousness), and Hispanic subgroup (i.e., Spanish, Cuban, Puerto Rican, Mexican, Central or South American, Dominican, or mixed) to varying prevalence rates (e.g., Johnston, et al., 2013; Pokhrel et al., 2013; SAMHSA, 2011; Unger et al., 2009). Given this heterogeneity in the Hispanic group

and factors related to substance use behaviors, examination of how these factors influence PTG and the response to acute stressors warrants a subsequent study designed to capture and analyze the relationships. Such analyses would be timely in that the proportion of Hispanic students is increasing in cities nationwide, particularly in alternative high schools.

An additional limitation is that the study findings are based on self-reported behaviors, cognitions, and experiences, any of which may be influenced by multiple factors. Self-reports of the number and types of SLEs one has experienced are subject to memory lapses or selective disclosure (Dohrenwend, 2006). Not all participants reported experiencing an SLE, and thus could not be included in the analytic sample. It is uncertain whether those who did not report experiencing an SLE selectively chose not to; however, those who did and did not report an SLE were comparable on baseline characteristics. Thus, the analytic group does not appear to represent a biased sample. Also, because we modified an existing checklist, there are concerns with regard to the reliability and validity. The purpose of the checklist was to capture variability and identify a single life-altering SLE in relation to which participants would answer PTG questions. Because we did not use it to make comparisons with other samples, with regard to prevalence or stressfulness ratings of each item, and 20% of SLEs were written into the "Other" field, the checklist served the goals of this study. To address the hypothesis that more stressors positively influences substance use, it is also plausible that substance use results in more SLEs. Thus, future work may consider assessing a bidirectional hypothesis utilizing a study design with multiple assessment points for SLEs and substance use. With regard to the substance abuse variable, it did not indicate a clinical diagnosis of substance abuse, rather can be interpreted as probable substance abuse. With further regard to self-report, PTG represents a construct of perceived positive change post-SLE. There is no evidence validating the veracity of the high levels of positive growth reported by participants (e.g., reports by significant others, a trusted family member) or that levels of growth were not reflecting issues of social desirability, which was not measured in the present study. Also, our use of a modified PTG scale with a narrow range for responses was not expected to compromise construct validity or internal consistency of the measure, yet restricting response options may have limited our ability to detect greater variation in the response levels of participants, and potentially stronger effects. Lastly, the effect sizes for PTG were small in this study, and it is likely other variables not examined in this study have more proximal salience to changes in substance use behaviors. However, the associations between greater PTG and less substance use suggest that positive growth was evident and, even if externally motivated, manifested in healthier behaviors.

Future Research

Future directions for this research include examining these relationships among different samples of youth comprised of varying age ranges and race/ethnic backgrounds. Including more extensive checklists of both positive and negative valenced SLEs or using a semi-structured interview format to assess SLEs may be useful. Also, there may be other factors contributing to substance use behaviors that need to be accounted for in future studies, given the lack of association between PTG and use of cigarettes and hard drugs, and low variance explained by the variables included in the models. For example, taking into account the level of addiction to particular substances (i.e., nicotine tolerance, opiate dependence) may

explain some level of differences in substance use over a two-year period. Lastly, an additional avenue of research that may help explain the relationship between PTG and substance use behaviors among high-risk youth would be to conduct a temporal examination on whether prior use of certain substances (i.e., alcohol vs. tobacco or marijuana vs. alcohol) impairs or promotes the development of PTG, and whether prior PTG effects changes in substance use behaviors over time as a potentially interrelated process.

In conclusion, greater levels of positive psychosocial adjustment to a life-altering SLE, indicated by higher PTG scores, was associated with lower levels of alcohol and marijuana use, and substance abuse over two years. Also, the finding that PTG did not moderate the relationship between number of SLEs and substance use behaviors suggests that PTG provides a protective effect on substance use behaviors in relation to a specific SLE (i.e., the most life-altering SLE), irrespective of the cumulative number of SLEs experienced. These results have implications for substance use interventions. Because PTG can be augmented through brief cognitive-behavioral stress reduction approaches (Cryder et al., 2006; Garland et al., 2007; Lechner & Antoni, 2004), PTG represents a unique, salutogenic intervention target that may help to counteract the negative impact of a particularly salient SLE on substance use among high-risk youth.

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Table 1Selected sample characteristics (*n*=564)

Variable	% or Mean (SD)
Gender	
Male	54.4
Female	45.6
Age^a	16.78 (0.90)
Race/Ethnicity	
Asian or Asian American	2.9
Latino or Hispanic	65.3
African American or Black	3.4
White, Caucasian, Anglo, European American; not Hispanic	11.9
American Indian or Native American	0.4
Mixed: My parents are from two different groups	14.5
Other	1.6
Highest education completed by either mother or father	
Did not complete 8th grade	9.6
Did not complete high school (12th grade)	25.0
Completed high school (received a diploma)	26.5
Some college or job training (1 to 3 years)	20.2
Completed college (4 years)	13.9
Attended or completed graduate school (Doctor, Lawyer)	4.8
Peer Substance Use^b	2.71 (0.55)
Number of Stressful Life Events	3.14 (1.70)
Post-traumatic Growth	2.64 (0.38)

Notes:

Number of stressful life events, and Post-traumatic Growth were assessed at 2-year follow-up. All other variables were assessed at baseline.

^a Age ranged from 14 to 20 years at baseline.^b Number of friends, out of the participant's 5 closest friends, who had used cigarettes, alcohol, marijuana, or hard drugs in the last 30 days (range 0 to 5).

Table 2

Prevalence of substance use behaviors at baseline and two-year follow-up

Substance Use Variable	Baseline %	Two-year Follow-up %
Cigarette use (past month)	40.4	37.5
Alcohol use (past month)	60.0	58.0 **
Drunk on alcohol (past month)	44.7	34.1 ***
Binge drinking (past month)	35.1	36.3 *
Marijuana use (past month)	47.0	34.1 ***
Hard drug use (past month)	28.0	13.5 ***
Substance abuse (past year)	49.0	30.5 ***

Among those who reported past month use of the substance at each assessment point ^{a,b}	Baseline Mean (SD)	Two-year Follow-up Mean (SD)
Average number of cigarettes smoked per day	3.09 (4.56)	6.07 (5.95)
Number of times smoked cigarettes	26.04 (16.49)	32.71 (19.46)
Number of times used alcohol	7.57 (1.78)	4.78 (2.34)
Number of times drunk on alcohol	2.71 (1.58)	6.66 (0.86)
Number of times binge drinking	3.60 (5.90)	4.68 (5.38)
Number of times used marijuana	25.95 (16.04)	19.10 (11.63)
Number of times used hard drugs	21.00 (8.02)	8.29 (3.43)
Level of substance abuse	2.03 (0.93)	1.77 (0.89)

Notes.

*
 $p < .05$

**
 $p < .01$

 $p < .001$ for change in prevalence compared to baseline

^a P-value for difference between two-year and baseline is not calculated because of the different denominators per variable.

^b Range for average number of cigarettes smoked per day is 1 to 40, for number of times smoked cigarettes is 1 to 90, used alcohol is 1 to 100, drunk on alcohol is 1 to 50, binge drinking is 1 to 30, used marijuana is 1 to 100, used hard drugs is 1 to 100. Range for past year levels of substance abuse is 1 to 4.

Table 3
Bivariate correlations between PTG, number of stressful life events (SLEs), substance use behaviors, and correlates

	Cigarette Use: Past Month	Cigarette Use: Average Daily	Alcohol Use: Past Month	Alcohol Use: Getting Drunk	Alcohol Use: Binge Drinking	Marijuana Use: Past Month	Hard Drug Use: Past Month	Substance Abuse: Past Year
Treatment	−0.004	−0.012	−0.102 *	−0.063	−0.058	−0.041	−0.081 #	−0.097 *
Age	−0.054	0.044	0.002	0.009	0.074	−0.049	0.048	−0.054
Male	−0.185 ***	−0.237 **	−0.151 ***	−0.145 ***	−0.174 **	−0.248 ***	−0.064	−0.180 ***
Hispanic Ethnicity	−0.251 ***	−0.335 ***	−0.036	−0.065	0.054	−0.141 ***	−0.002	0.036
Parents' Education	0.105 *	0.088	0.022	0.042	0.062	0.101 *	−0.027	−0.048
Peer Substance Use	0.173 ***	0.177 *	0.183 ***	0.148 ***	0.194 **	0.243 ***	0.043	0.169 ***
Number of SLEs	0.181 ***	0.144 #	0.175 ***	0.189 ***	0.071	0.217 ***	0.139 ***	0.276 ***
PTG	−0.030	−0.011	−0.125 **	−0.139 ***	−0.164 *	−0.137 **	−0.116 **	−0.152 ***

Notes.

Coding for dichotomous variables are as follows: Treatment=1 vs. Control=0; Male=1 vs. Female=0; Hispanic=1 vs. Other=0.

Substance use variables were assessed as past month frequency of use at two-year follow-up (number of times) except for average daily cigarettes (assessed average number of cigarettes smoked per day) and past year substance abuse (assessed as level of substance abuse).

$p < .10$

* $p < .05$

** $p < .01$

*** $p < .001$.

Table 4

Impact of SLEs and PTG on substance use behaviors at two-year follow-up

Variable	Cigarettes		Alcohol			Marijuana	Hard Drugs	Substance Abuse
	Past Month Use	Average Daily Use	Past Month Use	Getting Drunk	Binge Drinking	Past Month Use	Past Month Use	Past Year Abuse
Treatment Group	0.03 (0.08)	0.23* (0.15)	-0.20 (0.09)	-0.08 (0.10)	-0.02 (0.15)	0.05 (0.08)	-0.13 (0.10)	0.14 (0.10)
Age	0.01*** (0.04)	0.16 [#] (0.09)	0.01*** (0.05)	0.01** (0.05)	0.03* (0.08)	0.01*** (0.04)	0.08 [#] (0.05)	0.05*** (0.05)
Male	0.25*** (0.07)	0.31* (0.14)	0.31*** (0.09)	0.27** (0.09)	0.33* (0.14)	0.33*** (0.08)	0.17 [#] (0.09)	0.41*** (0.09)
Hispanic Ethnicity	-0.26** (0.09)	-0.33* (0.15)	-0.03 (0.10)	-0.05 (0.11)	0.14 (0.15)	-0.24** (0.09)	0.03 (0.11)	0.12 (0.10)
Parents' Education	-0.01 (0.03)	-0.03 (0.05)	0.04 (0.03)	0.03 (0.04)	0.11* (0.06)	0.03 (0.03)	0.01 (0.04)	-0.01 (0.04)
Peer Substance Use	0.01 (0.03)	0.02 (0.05)	0.06* (0.03)	0.04 (0.03)	0.09 [#] (0.05)	0.06* (0.03)	-0.04 (0.03)	0.03 (0.03)
Baseline Use	0.96*** (0.07)	0.12*** (0.01)	0.57*** (0.13)	0.75*** (0.15)	0.06*** (0.01)	0.76*** (0.08)	0.64*** (0.12)	0.18*** (0.04)
Number of Stressful Life Events	0.08*** (0.02)	0.07 [#] (0.04)	0.08** (0.03)	0.06* (0.03)	-0.02 (0.04)	0.08*** (0.02)	0.07* (0.03)	0.13*** (0.03)
Post-traumatic Growth	0.13 (0.22)	0.02 (0.39)	-0.60* (0.26)	-0.70** (0.28)	-1.38*** (0.44)	-0.61** (0.24)	-0.33 (0.28)	-0.75** (0.27)
Model F	28.19***	13.52***	7.79***	6.84***	5.22***	23.05***	4.92***	10.79***
Adjusted R ²	0.36	0.48	0.12	0.11	0.17	0.32	0.08	0.17

Notes.

Coding for dichotomous variables are as follows: Treatment=1 vs. Control=0; Male=1 vs. Female=0; Hispanic=1 vs. Other=0.

Dependent variables for substance use were modeled as past month frequency of use at two-year follow-up (number of times except for average daily cigarettes (assessed average number of cigarettes smoked per day) and past year substance abuse (assessed as level of substance abuse). All models are controlled for propensity-for-attrition.

Estimates are standardized beta coefficients. Standard Errors are in parenthesis.

[#] $p < .10$

* $p < .05$

** $p < .01$

*** $p < .001$.