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POSTTRUAMTIC GROWTH AS A MODEATOR OF THE RELATIONSHIP
BETWEEN PTSD SYMPTOMS AND SUBSTANCE MISUSE AMONG
YOUNG ADULTS

By

Madeline Adele Voss

A Thesis

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Abstract

While PTSD has been the primary focus of the trauma literature, some studies have investigated posttraumatic changes, such as posttraumatic growth (PTG), but research has not clearly defined the relation between PTSD and PTG. Insufficient research has investigated the relationship between PTG and substance misuse. Consequently, this study aims to contribute to this literature by further investigating the relations between PTG and PTSD and substance misuse and assess PTG as a moderator of the relation between PTSD symptoms and substance misuse among young adults ($N = 167$). PTG was positively correlated with both PTSD symptoms and drinking consumption, and among substance users, PTG moderated the hypothesized relation, such that at those who reported high PTSD symptoms reported the highest substance misuse at high PTG. Though not conclusive, these results increase understanding of posttrauma responses and merit further investigation among those experiencing greater distress, heavier substance users, and older adults.

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Exposure to traumatic events is common among young adults, with research showing that between 67% (Bernat, Ronfeldt, Calhoun, & Arias, 1998) and 84% (Frazier et al., 2009) of students have reported experiencing at least one traumatic event that is consistent with the *Diagnostic Statistical Manual of Mental Disorders (DSM; American Psychiatric Association, 1980, 1987, 1994, 2013)* definition. One study found that 84% of a sample of 440 students had experienced at least one traumatic event, and 9% ($n = 39$) had experienced seven or more discrete events (Vrana & Lauterbach, 1994). In a more recent study by Read et al. (2012), 74% ($n = 738$) of sampled undergraduates reported exposure to at least one criterion A event, based on *DSM-5* (APA, 2013), and on average, participants had experienced 3.1 ($SD = 2.2$) traumatic events. Furthermore, among their 997 participants, Read et al. (2012) found that 15% reported PTSD symptoms consistent with full *DSM-5* PTSD diagnostic criteria.

While most people who experience trauma do not go on to develop PTSD, those who do tend to report considerable functional impairment (Kuhn, Blanchard, & Hickling, 2003; Rona et al., 2009), and there is a large body of research on the deleterious effects of trauma exposure. In recent years, however, research on the positive changes that can occur in the aftermath of traumatic experiences has grown (Tedeschi & Calhoun, 2004).

Posttraumatic Growth

Tedeschi and Calhoun (1996) coined the term posttraumatic growth (PTG) to describe these positive posttraumatic changes or benefits following trauma. PTG differs from resiliency in that it implies a transformative component that enables a person to not simply return to pre-trauma functioning but also evolve and revise previously formed schemas (Tedeschi & Calhoun, 2004). PTG comprises five domains, which Tedeschi and Calhoun (1996) derived from previous literature on positive posttraumatic changes: relating to others, new possibilities, personal

strength, spiritual change, and appreciation of life. Tedeschi and Calhoun (1996) created the Posttraumatic Growth Inventory (PTGI), the most widely used measure to assess PTG with subscales corresponding to each of the domains; this measure has been used to assess posttraumatic growth in numerous populations, including young adults and undergraduate students.

McDiarmid, Taku, and Philips (2017) assessed PTG within a sample of undergraduate students ($N = 390$), who had experienced significant, although not necessarily “traumatic” by the *DSM* definition, experiences, such as the death of a loved one. Results of this study indicated appreciation for life ($M = 2.71, SD = .93$) as the most commonly reported area of growth, followed by personal strength ($M = 2.61, SD = .86$), relating to others ($M = 2.29, SD = .87$), new possibilities ($M = 2.13, SD = .99$); and, spiritual change ($M = 1.70, SD = 1.30$) was reported the least. Although this study did not use a criterion A definition for stressful or impactful experiences, it does lend support to Tedeschi and Calhoun’s (1996) domains of PTG.

Posttraumatic Growth and Posttraumatic Stress Disorder Symptoms

Tedeschi and Calhoun (2004) posited that potentially traumatic events can disrupt or even shatter one’s world views, causing psychological distress, and that the struggle to construct new world views and schemas creates an opportunity for PTG to occur; thus, some level of distress, such as PTSD symptoms, is theoretically necessary for the possibility of PTG, and research has suggested that there is a relation between PTG and PTSD symptoms, although findings have not been consistent. A few studies have indicated a negative linear relation (e.g., Frazier, Conlon, & Glaser, 2001), but primarily, research has indicated either a positive linear relation (e.g., Strasshofer, Peterson, Beagley, & Galovski, 2018; Cadell, Regehr, & Hemsworth, 2003; Taku,

Calhoun, Cann, & Tedeschi, 2008; Arıkan, Stopa, Carnelley, & Karl, 2016; Magruder, Kılıç, & Koryürek, 2015; Birkeland, Hafstad, Blix, & Heir, 2015) or a curvilinear relations (e.g., Butler et al., 2005; McCaslin et al., 2009; Levine, Laufer, Hamama-Raz, Stein, & Solomon, 2008; Solomon & Dekel, 2007; Kleim & Ehlers, 2009), such that PTG and PTSD symptoms are positively correlated until the apex of PTG, where the relation becomes negative and PTG decreases as PTSD symptoms continue to increase. Despite the numerous studies supporting a positive linear relation—including a cross-sectional study of Kashmiri young adults' (19-24 years) exposure to armed conflict in Kashmir, India that indicated a positive linear relations ($r = .38$) between PTG and PTSD symptoms to be significant at the .01 level compared to a quadratic or curvilinear relation (Bhat & Rangaiah, 2016)—the literature seems to favor a curvilinear or quadratic relation over a positive linear one. A meta-analysis of 42 studies that utilized the PTGI and a measure of PTSD symptoms with adult samples found the strength of quadratic relation ($r = .29$) between PTG and PTSD symptoms to be stronger than positive linear relation ($r = .21$; Shakespeare-Finch & Lurie-Beck, 2014). These results suggest that the relation between PTG and PTSD symptoms may be curvilinear, such that PTG and PTSD symptoms are positively associated at low and moderate levels of PTSD, but higher levels of PTSD severity may be associated with diminishing levels of PTG.

In a study of 9/11 survivors, Butler et al. (2005) found the apogee of PTG corresponded to a composite score of 50 on the PTSD Checklist- specific, a 17-item version (Weathers & Ford, 1996). Of note, this corresponds to a commonly used cutoff for the designation of clinically significant PTSD symptoms (Weathers, Litz, Herman, Huska, & Keane, 1993). Thus, these results support the notion that some experience of distress is necessary for the possibility of growth, but too much distress can stifle PTG (Baker et al., 2005). Furthermore, Butler and

colleagues (2005) suggest that discrepancies in the literature on the nature of this relation may be due to less frequent testing of curvilinear relation or restricted sampling of trauma exposure or symptoms severity. The latter may be the more influential cause given that many studies in the meta-analysis by Shakespeare-Finch & Lurie-Beck (2014) tested for both linear and curvilinear relation. Clearly, further research is necessary to better characterize the relation between PTG and PTSD, and if shown to be curvilinear, the point of divergence should be pinpointed.

Posttraumatic Growth and Substance Misuse

Although a plethora of research has established a positive relation between PTSD symptoms and substance misuse (Avant, Davis, & Cranston, 2011; Edwards et al., 2006; Read et al., 2012; Read, Radomski, & Wardell, 2017; Read, Wardell, & Colder, 2013; McDevitt-Murphy, Murphy, Monahan, Flood, & Weathers, 2010; Tripp, McDevitt-Murphy, Avery, & Bracken, 2015; Tripp et al., 2015; Murphy et al., 2013) among undergraduate students, few studies have investigated the relation between PTG and substance misuse ($N = 6$). Cumulatively, these limited results suggest there are negative associations between both alcohol and drug misuse and PTG. A study of adolescents ($N = 564$) enrolled in a drug treatment program found PTG to be inversely related to past month binge drinking (i.e., consuming five or more drinks within five hours) and alcohol and marijuana use; however, PTG was not significantly related to past month cigarette or hard drug use (Arpawong et al., 2015). Similar results were found in another sample of adolescents ($N = 435$, $M_{\text{age}} = 15.8$, $SD = 1.3$), specifically PTG was significantly negatively correlated with substance use—past month cigarette, alcohol, and marijuana use— ($r = -.13$, $p < .01$), and substance use was a significant predictor of low PTG ($\beta = -$

.14, $t = 2.4$, $p < .01$; Milam, Ritt-Olson, & Unger, 2004). In another study, alcohol use was also a significant predictor of lower levels of PTG ($\beta = -.10$, $t = 2.4$, $p < .05$) among eighth-graders who had been exposed to the events of 9/11 through television ($N = 512$; Milam, Ritt-Olson, Tan, Unger, & Nezami, 2005). This relation between PTG and substance use has also been researched among adults living with HIV/AIDS ($N = 835$; Milam, Ritt-Olson, & Unger, 2004) and trauma-exposed homeless women ($N = 50$; Stump & Smith, 2008); results from both studies indicate a negative relation between PTG and alcohol use, and among homeless women, PTG was also negatively correlated with frequent drug use. Of note, the studies by Arpawong et al. (2015), Milam et al. (2005), and Milam et al. (2004), used shortened versions of the PTGI to assess growth that included responses for participants to indicate negative and no change in addition to positive change. These short forms (11 items: Arpawong et al., 2005 & Milam, Ritt-Olson, & Unger, 2004; 16 items: Milam et al., 2005) have not been psychometrically assessed to ensure the remaining items still capture the full scope of the PTGI, so although results suggest an inverse relation between PTG and substance use, conclusions from the studies cannot be directly compared to results of studies that used the full measures.

Research on PTG and substance misuse among undergraduates or young adults (18 – 25 years) is more limited, and only two studies were identified. The first of these (Bianchini et al., 2015) reported group differences (e.g., female vs. male, indirect vs. direct exposure) in experiences of PTG and substance use (i.e., alcohol, tobacco, and cannabis) in a sample of undergraduate students ($N = 411$) two years after the L'Aquila earthquake, but did not report specifics on the relation between PTG and substance use in this sample. The second (Foster et al., 2013), also assessed PTG and alcohol use in a sample of undergraduate students ($N = 700$) but did not report on the strength of relation between PTG and alcohol use. Consequently, the

negative association between PTG and substance misuse found in other populations has not been confirmed among young adults and specifically among those who have experienced traumatic events.

This lack of research among young adults is astonishing, given that substance use among emerging adults is common. A Monitoring the Future study ($n = 3,990$) found that 63% of young adults had tried an illicit drug in their lifetime and 37% had tried an illicit drug other than marijuana (Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2016). Furthermore, an estimated 6.8% smoked marijuana daily, 8.7% had used an illicit drug other than marijuana in the last 30 days, and 34.2% reported being drunk in the last 30 days (Johnston et al., 2016). Such national surveys indicate that substance use, both drug and alcohol, continues to be a public health issue among young adults. Consequently, research should focus on the relations between substance use and PTG in this group.

Furthermore, the effects of posttraumatic growth on the relation between PTSD symptoms and substance use have not been investigated. One study assessed PTG as a moderator between cumulative stress (i.e., number of stressful life events) and frequency of substance use (Arpawong et al., 2015), but the model was not significant. A possible reason is that stressful life events do not elicit the same level of distress that results from exposure to traumatic events, as described by Tedeschi & Calhoun (1996) and that is necessary to foster PTG (for further discussion on stressful life events and PTG see Grasso et al., 2012) Additionally, this study did not utilize a *DSM*-based definition of stressful event(s) nor was psychological distress measured; consequently, the impact of reported events cannot be determined. Furthermore, this study used an unofficial shortened version of the PTGI that also enabled participants to indicated negative and no change as the result of their stressful events. Including non-traumatic events and utilizing

a short form version may explain why the reported mean experience of PTG ($M = 2.6$, $SD = .38$, possible range 0 – 105) was low, resulting in an insignificant moderation model. Consequently, further research on the moderating role of posttraumatic growth on the relations between PTSD symptoms and substance misuse is warranted, as it has not been adequately investigated.

The Present Study

This study sought to address the apparent gap in research by investigating the intersection between posttraumatic growth, posttraumatic stress disorder symptoms, and substance misuse in emerging adults who have experienced traumatic events.

Hypotheses. 1a) In congruence with previous research, we hypothesized PTG and PTSD symptoms will be positively, linearly correlated and did not anticipate detecting a curvilinear relation between these constructs.

2a) We hypothesized that, consistent with previous literature, PTG would be negatively associated with both alcohol and drug misuse.

2b) Furthermore, we anticipated that PTG would moderate the relation between PTSD symptoms and substance misuse (examined separately for both alcohol and drug misuse).

Specifically, the relation between PTSD symptoms and substance misuse was predicted to be stronger at lower levels of PTG. Conversely, we expected the relation to be weaker at higher levels of PTG. Figures 1 and 2 depict the conceptualization of PTG as a moderator.

Method

Participants

Participants were young adults ($N = 167$, 18 – 25 years) who reported having experienced a traumatic event that satisfied criterion A for PTSD in *DSM-5* (American Psychiatric Association, 2013). Participants ($M_{age} = 22.22$, $SD = 2.37$) were 50.9% ($n = 85$) female and

majority white from European ancestry (68.3%, $n = 114$). The full demographics are presented in table 1.

Measures

Trauma exposure. The Life Events Checklist (LEC; Gray, Litz, Hsu, & Lombardo, 2004) is a widely used measure to assess the degree to which participants have been exposed to various types of potentially traumatic experiences. Part I consists of 16 potentially traumatic events, and item 17 asks about “any other very stressful event or experience”, and for each, participants can indicate “1” happened to me, “2” witnessed it, “3” learned about it, “4” part of my job, “5” not sure, or “6” doesn’t apply. If participants indicate they had experienced any other very stressful event or experience, they are asked to briefly describe the event. In Part II, participants are asked to think of the worst event experience (i.e., the event that still causes distress) and answer eight follow-up questions about the event to assess if the event meets criterion A. The first item asks participants to briefly describe the event, and examples of subsequent questions are “How long ago did it happen?”, “How did you experience it?”, “Was someone’s life in danger?”, “How many times altogether have you experienced a similar event as stressful or nearly as stressful as the worst event?”. As the purpose of this measure is to gather information on a person’s exposure to various types of potentially traumatic events, there is no composite score or range for scoring (“Life Events Checklist for *DSM-5* (LEC-5) – PTSD”, n.d.). In an undergraduate sample, the measure showed strong inter-rater reliability for individual items and the overall assessment—mean kappa for items was .61 and $r = .81$, $p < .001$ for the retest correlation (Gray et al., 2004).

Posttraumatic stress Disorder (PTSD). The PTSD Checklist for *DSM-5* (PCL-5 Blevins, Weathers, Davis, Witte, & Domino, 2015; Weathers, Litz, Keane, Palmieri, Marx, &

Schnurr, 2013) is the revised version of the PTSD Checklist for use with the most recent edition of the *DSM*. Like the original PCL and its versions, the PCL-5 is a 17-item self-report questionnaire that measures the degree to which participants have experienced specific PTSD symptoms over the past 30 days. Items are rated on a 5-point Likert scale, which ranges from 0= “not at all” to 4= “extremely”. The range for this measure is 0 to 68, with higher scores indicating greater experience of symptoms. In an undergraduate sample, the PCL-5 was found to have high internal consistency ($\alpha = .94$) and strong retest reliability ($r = .82$; Belvins et al., 2015).

Posttraumatic Growth. The Posttraumatic Growth Inventory (PTGI; Tedeschi & Calhoun, 1996) includes 21 items that are rated on a 6-point Likert scale, from 0= “I did not experience this change as a result of my crisis” to 5= “I experienced this change to a very great degree as a result of my crisis”. Items are totaled to create a composite score (0 – 105), with higher scores indicating greater experience of growth. In their pilot study, Tedeschi and Calhoun (1996) found the measure showed high internal consistency ($\alpha = .90$) and strong retest reliability ($r = .71$) within an adult sample.

Substance misuse. Alcohol consumption was assessed using the Daily Drinking Questionnaire (DDQ; Collins, Parks, & Marlatt, 1985). For each day of the week (i.e., Sunday through Saturday), participants report how many drinks they typically consume in week in the past month. A composite score reflecting average drinks per a week is created by summing the estimated typical drinks from each day. The measure correlates highly with other measures of alcohol use (Kivlahan, Marlatt, Fromme, Coppel, & Williams, 1990) and is frequently used with young adults (Acuff et al., 2018; Borsari, Neal, Collins, & Carey, 2001; Geisner et al., 2015; Joyner, Acuff, Meshesha, Patrick, & Murphy, 2018).

Negative consequences associated with alcohol use were assessed with the Young Adults Alcohol Consequence Questionnaire (YAACQ; Read, Kahler, Strong, & Colder, 2006). This measure includes 48 dichotomously scored items to assess young adults' experiences of alcohol related consequences. Items are totaled to create a composite score, and higher scores correspond with greater experience of consequences. Examples of items are "I have become very rude, obnoxious or insulting after drinking", "I have neglected my obligations to family, work or school because of my drinking", "I have taken foolish risks when I have been drinking", "I have often drank more than I originally had planned". This measure has been found to have high internal consistency ($\alpha = .84$) among college students (Joyner, Acuff, Meshesha, Patrick, & Murphy, 2018) and has shown evidence of convergent validity with other measures of alcohol problems (Read, Merrill, Kahler, & Strong, 2007).

The Drug Use Disorders Identification Test (DUDIT; Berman, Bergman, Palmstierna, & Schlyter, 2005) is an 11-item self-report questionnaire that measures the frequency of use for common illicit drugs, which are presented in tables at the beginning of the measure. Frequency is indicated by rating items, such as "How many times do you take drugs on a typical day when you use drugs?", on a scale ranging from "Never" to "4 times a week or more often."

Procedure

Data were collected via the University of Memphis Department of Psychology undergraduate research participant pool, (referred to as the "student sample" throughout this paper), and via Amazon Mechanical Turk (Mturk)—a commonly used online crowdsourcing marketplace that enables online data collection through surveys, known as HITs, from participants, known as workers, from around the world for low costs

(Amazon Mechanical Turk, n.d.). For the student sample, individuals elected to participate in the present study as one option on a list of studies, and the following description was provided: “This project involves answering a set of questions online about your experiences, thoughts, feelings and behaviors, including exposure to traumatic events. To be eligible for this study, you must have experienced a traumatic event—which for this study refers to an event that involved threatened or actual death, injury, or sexual violence and that you experienced directly or witnessed. The purpose of this study is to learn more about college students’ experiences and emotional responses. Participation should take about 30 minutes, and you’ll receive .5 credit for completing this online survey. This project is being conducted by Madeline Voss, a graduate student in the Department of Psychology, and Dr. Meghan McDevitt-Murphy, Professor of Psychology at The University of Memphis. This study has been approved by the University’s Institutional Review Board.” Those who chose to continue study were redirected to Qualtrics, the external site that housed the study. Prior to answering in questions, however, participants were shown the informed consent. SONA participants received course credit for participating.

Participants were also recruited using Mturk. Inclusion criteria for this sample included living in the United States and being between the ages of 18 and 25 years. A similar description to the one presented to the student sample via SONA was displayed prior to entering the study; except Mturk participants received \$2.00 instead of course credit and ‘young adults’ instead of ‘college students’ were mentioned as the target population because not all Mturk participants would be students. In Qualtrics, those who completed the informed consent and indicated their age as greater than 25 were not shown the full battery of questions and were redirected to a message that stated they were not eligible to complete the study and should return to Mturk to view other studies they may be eligible for. Only those who completed the informed consent and

met age eligibility requirements were shown the questionnaire, and of these, those who met eligibility received \$2.00. This amount was selected based on a study of the economics of crowdsourcing that found an average rate of \$4.25 per an hour of work (Horton & Clinton, 2010); thus, \$2.00 was deemed acceptable for 30 minutes of labor.

No identifying information was collected from either the student or Mturk samples. Randomly generated numbers were assigned to all participants, and SONA ensured that the participants recruited from that system did not complete the study multiple times, while Mturk participants were manually excluded from participating again. Within the survey, five validity checks were in place to ensure participants provided quality data (e.g., “Please select C as the answer”, “How many days are in a year?”, “Please select 2 as the answer”), and for Mturk participants, only those who correctly answered at least two of these questions were deemed eligible and received payment. After responding to the survey, participants were thanked for their participation and provided debriefing materials: local community and campus resources list for student participants and national mental health resources for Mturk participants.

Participants were included in the final data set if they reported having experienced an event that met the definition of a traumatic event given in criterion A in the DSM-5 (APA, 2013). To be considered a traumatic event the described experience included a) direct experience of or witnessing actual or threatened death, injury, or sexual violence b) learning about actual or threatened death, injury, or sexual violence happening to a close family member or friend (Silverstein, Lee, Witte, & Weathers, 2017). Descriptions that were not verifiable (e.g., copied from the internet, not a complete sentence, stream of sentences did not semantically go together, responses to the follow-up questions could not verify the description) or no response to the

qualitative question excluded participants because the description was not comprehensible to ensure the experience met the specific criteria for a traumatic event. However, brief descriptions were not excluded if the description clearly communicated that a potentially traumatic event occurred (e.g., death of son) and responses to the follow-up questions met criteria.

Data analysis

Prior to analyses, data was screened for outliers, values more than 3.29 standard deviations outside of the mean, and subsequently, outliers were corrected to be one unit about the next extreme score (Tabachnick & Fidell, 2013). Additionally, those older than 25 years, those whose traumatic event did not meet Criterion A, and those who incorrectly answered or skipped two or more validity check questions were excluded from the final data set. As the DDQ was more skewed than the acceptable value of three (Kline, 2011) with a value greater than 5 and this was not corrected by addressing outliers, the DDQ was transformed using square root transformation, which brought the measure's skewness to less than one. Consequently, the PCL-5, YAACQ, and DUDIT were also transformed using the same method for consistency although these measures were only slight skewed (i.e., less than 3). The PTGI, however, was not transformed because its negative skewness approximated normally. Following cleaning, self-reported worst events were coded according to the LEC event types, and type frequency was assessed. Subsequently, correlations between the key variables were conducted to assess how these constructs are inter-related. Finally, version 3.3 Process Macro for SPSS (Hayes, 2019) was used to test PTGI as a moderator between PTSD symptoms PCL-5 score and both YAACQ and DUDIT. Moderation models were tested both in the full sample and among substance users. Alcohol users were defined as those who reported consuming at least one drink per a week on the DDQ, and drug users are those who scored one or higher on the DUDIT thus indicated using

drugs at some point even if not current users. All data screening and analyses were conducted using IBM SPSS version 26.

Results

Table 2 presents mean scores of key measures (i.e., PCL-5, PTGI, YAACQ, DUDIT) as well as the PTGI subscales for the total sample as well as the subgroups. Regarding substance misuse, 83 participants (50%) scored at least one on the DDQ, indicating current alcohol use, and 63 participants (37.7%) scored at least one on the DUDIT, indicated drug use in their lifetime.

Results of this study supported the hypothesized positive relation between the PCL-5 and PTGI but not the predicted inverse relation between PTGI and substance misuse measures, YAACQ and DUDIT. PTGI was, however, positively correlated with DDQ ($r = .43, p = .01$) despite not being related with the YAACQ. Table 4 includes correlation coefficients for all measures.

Trauma Exposure

The most commonly reported worst event type was transportation accident ($n = 34, 20.9%$), of which 52.9% ($n = 18$) were directly experienced and 32.4% ($n = 11$) were witnessed. Sudden accidental death ($n = 24$) was the second most commonly reported worst event, with 45.8% ($n = 11$) witnessed. The third most frequent worst event was sexual assault ($n = 20, 12.3%$); the majority (80%, $n = 16$) of these instances were experienced directly. Table 3 depicts the distribution of self-reported worst events according to the list of LEC event types. Most of the categories were reported at least once, except for combat or exposure to a war zone; captivity; and serious injury, harm, or death you caused to someone else. Additionally, the average reported number of years since the event was 4.7 ($SD = 5.3$), with a range of 1.2 weeks to 20 years. Additionally,

61.7% ($n = 103$) of participants reported their worst event happening in the last five years, and time since worst event did not significantly differ between the student and Mturk samples ($t(134) = .17, p = .87$). Most participants ($n = 150, 89.9\%$) reported PTSD symptoms below the recommend PCL-5 cutoff, score of 33, with 89.8% ($n = 150$) of Mturk participants and all student participants below this score.

Moderation Analyses

We tested our hypothesis that PTGI would moderate the relation between PCL-5 and the measures of substance misuse, but in the full sample, PTGI was not a moderator of these relations. However, when we tested these models with only participants who reported any substance use, both models showed a significant moderating effect of PTGI. Table 5 presents the contributions of the PCL-5, PTGI, and interactions as predictors of the YAACQ and DUDIT, among alcohol ($n = 83$) and drug users ($n = 63$). In predicting both the YAACQ and DUDIT, there was a positive correlation between PCL-5 and both YAACQ and DUDIT, which differed in strength based on level of PTGI. The magnitude of the relation between PCL-5 score and the substance misuse measures was weakest among those with the lowest PTGI scores and strongest among those with higher PTGI scores.

Discussion

The aims of this study were to understand the relations between posttraumatic growth, PTSD symptoms, and substance misuse among trauma-exposed young adults. In general, the experience of posttraumatic growth reported by this sample was akin to that of other young adult studies (Orejuela-Dávila et al., 2017: $M = 2.8, SD = .52$; Bianchini et al., 2015: $M = 35.23, SD = 21.1$; Owens, 2016: $M = 74.1, SD = 224.6$). Furthermore, this sample's experience of growth, including all five domains, was higher than that of McDiarmid et al. (2017), who investigated

posttraumatic growth in a mixed sample of bereaved and not bereaved undergraduates. This lends support to the theory that the experience of PTSD symptoms is necessary for the possibility of PTG to occur and that growth occurs primarily after exposure to traumatic compared to stressful (e.g., a test, losing a job) events (Tedeschi & Calhoun, 1996; Baker et al., 2008). As this is the first study we know of in the area that utilizes a mixed sample of crowd-sourcing (i.e., Mturk) and undergraduate participants, it is worth noting that Mturk participants reported significantly higher experience on all constructs, except for alcohol consequences, which was higher but not significantly. External factors, such as student status, may be at play here, and studies that include only undergraduates, although convenient, may inadvertently limit the assessed range of experiences by excluding young adults not enrolled in a university and post-graduate young adults.

In accordance with previous research and as hypothesized, PTG and PTSD symptoms were positive correlated. This finding adds strength to Tedeschi and Calhoun's (1996) characterization of growth as stemming from the struggle to integrate traumatic events into new schemas and finding meaning. This relation is not conclusive, however, as the experience of PTSD symptoms was subclinical for most participants in the current study and more severe distress may alter this relation.

Based on limited previous research, the hypothesized relations between posttraumatic growth and alcohol and drug misuse were not confirmed, but surprisingly, growth was positively related with drinking consumption. This suggests that among trauma exposed young adults, drinking consumption does not hinder growth, and they can even co-occur. However, this finding contradicts previous studies that have found negative relations between alcohol use and growth (Arpawong et al., 2015; Milam et al.,

2005; Milam et al., 2004; Stump & Smith, 2008). One potential reason is that these prior studies assessed the experiences of adolescents (Arpawong et al., 2015; Milam et al., 2005), HIV positive adults (Milam et al., 2004), and homeless women (Stump & Smith, 2008). Additionally, the studies with adolescents and people living with HIV utilized unofficial modified versions of the PTGI that were less than the standard 21 questions and included responses that indicated no change and negative in addition to typical positive changes. Thus, it is not wholly unexpected that the same relation between alcohol use and PTG did not emerge. Lastly, drinking is often a social activity, and young adulthood is a developmental period where alcohol use is at its highest levels. Thus, young adults who are functioning well and are socially connected may report higher levels of alcohol consumption, and this may not be driven by distress. Thus, drinking occasions may signal social connectedness, which may reflect young adults' posttraumatic growth journey.

The most complicated findings from this study were related to the moderation tests. Contrary to our hypothesis, posttraumatic growth did not moderate the relations between PTSD symptoms and substance misuse, which we expected based on the limited research that has indicated an inverse relation between growth and substance misuse (Arpawong et al., 2015; Milam et al., 2005; Milam et al., 2004; Stump & Smith, 2008). Posttraumatic growth did function as a moderator among substance using participants but in the opposite direction as we expected. Had posttraumatic growth functioned as a protective factor, PTSD severity would not have been positively correlated with substance misuse. However, we found the opposite pattern, in that the positive relation between PTSD and substance misuse was strongest at the highest levels of posttraumatic growth. This suggests that substance abuse may be multiply determined among trauma-exposed young adults, which both PTSD severity and posttraumatic growth contribute to.

Limitations

A primary limitation of this study is that it is cross-sectional. Consequently, inferences about causation are not possible. It is unknown whether participants experienced changes in substance misuse following trauma exposure and how these potential changes would alter the relation between posttraumatic growth and substance misuse and, by extension, the moderation models. The measure of alcohol consumption provides a snapshot of current drinking consumption, which may have differed if assessed at other points in the recent past. Consequently, those who were removed from the moderation analyses as alcohol abstainers (i.e., did not report alcohol consumption) may have reported drinking at another point in time, but because of the study's cross-sectional nature it is unknown how this would have altered the results. This measure limitation was not a factor in assessing drug use because the DUDIT assesses lifetime drug use, and those who were categorized as drug abstainers have never used drugs. Overall PTSD symptoms severity was well below the maximum PCL-5 score and mostly below the clinical significance score. Consequently, PTG at highly extreme PTSD symptoms could not be assessed either correlational or in the moderation models. A wider range of PTSD symptoms may yield a different relation between PTSD symptoms and posttraumatic growth and different moderation results. Additionally, the range of time since the event was broad, and time since event likely has unforeseen effects on the interactions between PTSD symptoms, PTG, and substance misuse. Furthermore, the sample consisted of a mix of Mturk and student participants, and the significantly elevated scores of the Mturk group may have inadvertently altered the results.

Future Directions

While this study certainly adds to the understanding of potential posttraumatic experiences, it is not conclusive, and several veins of research warrant further investigation. Firstly, a longitudinal design would be able to assess changes in not only substance misuse but also posttraumatic growth and PTSD symptoms. Utilizing a minimum score on the PCL-5 as a screener for eligibility would also ensure a higher level of symptoms in the sample so that relations could be assessed in a sample that better approximates a clinical sample. Additionally, assessing motivations for substance use could potentially parse apart high substance users to better understand how some high users are still able to experience significant growth while others do not. Finally, investigation among various adult age groups would help show if these results are particular to this cohort or if similar relations emerge among older adults as well. Potentially, growth is protective in mitigating potentially harmful behavior, such as substance misuse, for more mature adult for whom responsibilities and consequently consequences of substance misuse are greater, compared to young adults.

Conclusion

There is still much that is unknown about how posttraumatic growth relates to PTSD symptoms and substance misuse, but this study sheds a glimmer of light on how these factors interact as the first to investigate the relations between posttraumatic growth, and alcohol and drug misuse and to investigate growth as a moderator between PTSD symptoms and substance misuse. Surprisingly, growth was related with drinking consumption, which may be unique to young adults. Additionally, posttraumatic growth moderated the relation among substance users, suggesting that among trauma exposed young adults, growth is not protective in mitigating substance misuse and that use may have positive effects, such as social connections. Again, these

results may be unique to young adults, who typically follow different patterns of substance use than more mature adults. Further research is crucial, to explore these results among other age groups, and to continue investigating the interactions between substance misuse and growth among emerging adults, who are at a vulnerable age, as they transition from adolescences to adulthood.

References

- Amazon Mechanical Turk. (n.d.). Retrieved June 22, 2019, from <https://www.mturk.com/>
- American Psychiatric Association. (2013). Trauma- and stressor-related disorders. In *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.).
- Arikan, G., Stopa, L., Carnelley, K. B., & Karl, A. (2016). The associations between adult attachment, posttraumatic symptoms, and posttraumatic growth. *Anxiety, Stress & Coping, 29*(1), 1–20.
- Arpawong, T. E., Sussman, S., Milam, J. E., Unger, J. B., Land, H., Sun, P., & Rohrbach, L. A. (2015). Post-traumatic growth, stressful life events, and relationships with substance use behaviors among alternative high school students: A prospective study. *Psychology & Health, 30*(4), 475–494.
- Avant, E. M., Davis, J. L., & Cranston, C. C. (2011). Posttraumatic stress symptom clusters, trauma history, and substance use among under students. *Journal of Aggression, Maltreatment & Trauma, 20*(5), 539–555. <https://doi.org/10.1080/10926771.2011.588153>
- Baker, J. M., Kelly, C., Calhoun, L. G., Cann, A., & Tedeschi, R. G. (2008). An examination of posttraumatic growth and posttraumatic depreciation: two exploratory studies. *Journal of Loss & Trauma, 13*(5), 450–465.
- Barrington, A., & Shakespeare-Finch, J. (2013). Posttraumatic growth and posttraumatic depreciation as predictors of psychological adjustment. *Journal of Loss & Trauma, 18*(5), 429–443. <https://doi.org/10.1080/15325024.2012.714210>
- Berman, A., Bergman, H., Palmstierna, T., & Schlyter, F. (2003). The Drug Use Disorders Identification Test (DUDIT) Manual. *Stockholm, Sweden: Karolinska Institutet.*

- Bernat, J. A., Ronfeldt, H. M., Calhoun, K. S., & Arias, I. (1998). Prevalence of traumatic Events and peritraumatic predictors of posttraumatic stress symptoms in a nonclinical sample of College Students. *Journal of Traumatic Stress, 11*(4), 645.
- Bhat, R. M., & Rangaiah, B. (2016). The relationship of trauma exposure and posttraumatic stress with posttraumatic growth: Linear or curvilinear. *Indian Journal of Health & Wellbeing, 7*(3), 296–301.
- Bianchini, V., Roncone, R., Giusti, L., Casacchia, M., Cifone, M. G., & Pollice, R. (2015). PTSD growth and substance abuse among a college student community: Coping strategies after 2009 L'Aquila earthquake. *Clinical Practice and Epidemiology in Mental Health, 11*.
<https://doi.org/10.2174/1745017901511010140>
- Birkeland, M. S., Hafstad, G. S., Blix, I., & Heir, T. (2015). Latent classes of posttraumatic stress and growth. *Anxiety, Stress & Coping, 28*(3), 272–286.
- Blevins, C. A., Weathers, F. W., Davis, M. T., Witte, T. K., & Domino, J. L. (2015). The Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5): Development and Initial Psychometric Evaluation. *Journal of Traumatic Stress, 28*(6), 489–498. <https://doi.org/10.1002/jts.22059>
- Butler, L. D., Blasey, C. M., Garlan, R. W., McCaslin, S. E., Azarow, J., Chen, X.-H., ... Spiegel, D. (2005). Posttraumatic growth following the terrorist attacks of September 11, 2001: Cognitive, coping, and trauma symptom predictors in an internet convenience Sample. *Traumatology, 11*(4), 247–267. <https://doi.org/10.1177/153476560501100405>
- Cadell, S., Regehr, C., & Hemsworth, D. (2003). Factors contributing to posttraumatic growth: A proposed structural equation model. *American Journal of Orthopsychiatry, 73*(3), 279–287. <https://doi.org/10.1037/0002-9432.73.3.279>

- Cann, A., Calhoun, L. G., Tedeschi, R. G., & Solomon, D.T. (2010). Posttraumatic growth and depreciation as independent experiences and predictors of well-being. *Journal of Loss & Trauma, 15*(3), 151–166. <https://doi.org/10.1080/15325020903375826>
- Carlson, E.B., Smith, S.R., Palmieri, P.A., Dalenberg, C.J., Ruzek, J.I., Kimerling, R., Burling, T.A., & Spain, D.A. (2011). Development and validation of a brief self-report measure of trauma exposure: The Trauma History Screen. *Psychological Assessment, 23*, 463-477.
doi: 10.1037/a0022294
- Collins, R. L., Parks, G. A., & Marlatt, G. A. (1985). Social determinants of alcohol consumption: The effects of social interaction and model status on the self-administration of alcohol. *Journal of Consulting and Clinical Psychology, 53*(2), 189–200.
<https://doi.org/10.1037/0022-006X.53.2.189>
- Edwards, C., Dunham, D. N., Ries, A., & Barnett, J. (2006). Symptoms of traumatic stress and substance use in a non-clinical sample of young adults. *Addictive Behaviors 31*(11), 2094–2104.
- Frazier, P., Anders, S., Perera, S., Tomich, P., Tennen, H., Park, C., & Tashiro, T. (2009). Traumatic events among undergraduate students: Prevalence and associated symptoms. *Journal of Counseling Psychology, 56*(3), 450–460. <https://doi.org/10.1037/a0016412>
- Frazier, P., Conlon, A., & Glaser, T. (2001). Positive and negative life changes following sexual assault. *Journal of Consulting and Clinical Psychology, 69*(6), 1048–1055.
<https://doi.org/10.1037/0022-006X.69.6.1048>
- Foster, D. W., Quist, M. C., Young, C. M., Bryan, J. L., Nguyen, M. L., & Neighbors, C. (2013). Benefit finding as a moderator of the relationship between spirituality/religiosity and

drinking. *Addictive Behaviors*, 38(11), 2647–2652.

<https://doi.org/10.1016/j.addbeh.2013.06.019>

Foster, I. M., Varvil-Weld, L., Mittmann, A. J., Mallett, K., & Turrisi, R. (2015). Brief web-based intervention for college students with comorbid risky alcohol use and depressed mood: Does it work and for whom? *Addictive Behaviors*, 42, 36–43. <https://doi-org.ezproxy.memphis.edu/10.1016/j.addbeh.2014.10.030>

Grasso, D. J., Cohen, L. H., Moser, J. S., Hajcak, G., Foa, E. B., & Simons, R. F. (2012). Seeing the silver lining: potential benefits of trauma exposure in college students. *Anxiety, Stress & Coping*, 25(2), 117–136.

Gray, M. J., Litz, B. T., Hsu, J. L., & Lombardo, T. W. (2004). Psychometric properties of the Life Events Checklist. *Assessment*, 11(4), 330–341. <https://doi.org/10.1177/1073191104269954>

Hayes, A. F. (2019). PROCESS macro for SPSS and SAS. Retrieved June 13, 2019, from <http://processmacro.org/index.html>

Hooper, L., Stockton, P., Krupnick, J., & Green, B., (2011). Development, use, and psychometric properties of the Trauma History Questionnaire. *Journal of Loss and Trauma*, 16, 258–283. doi: 10.1080/15325024.2011.572035

Horton, J., & Chilton, L. (2010). The Labor Economics of Paid Crowdsourcing. *Association for Computing Machinery 2017 Conference*, Cambridge, Massachusetts. Retrieved from <http://arxiv.org/abs/1001.0627>

Johnston, L. D., O'Malley, P. M., Bachman, J. G., & Schulenberg, J. E. (2013). Monitoring the Future national survey results on drug use, 1975–2011: Vol. 2. College students and

adults ages 19–50 (NIH Publication No. 10–7585). Bethesda, MD: National Institute on Drug Abuse.

Johnston, L. D., O'Malley, P. M., Bachman, J. G., Schulenberg, J. E. & Miech, R. A. (2016).

Monitoring the Future national survey results on drug use, 1975–2015: Volume 2, College students and adults ages 19–55. Ann Arbor: Institute for Social Research, The University of Michigan. Available at

<http://monitoringthefuture.org/pubs.html#monographs>

Joyner, K. J., Acuff, S. F., Meshesha, L. Z., Patrick, C. J., & Murphy, J. G. (2018). Alcohol

family history moderates the association between evening substance-free reinforcement and alcohol problems. *Experimental and Clinical Psychopharmacology*.

<https://doi.org/10.1037/pha0000223>

Kleim, B., & Ehlers, A. (2009). Evidence for a curvilinear relationship between posttraumatic

growth and posttrauma depression and PTSD in assault survivors. *Journal of Traumatic Stress*, 22(1), 45–52. <https://doi.org/10.1002/jts.20378>

Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3rd ed.). New York: The Guilford Press.

Kuhn, E., Blanchard, E. B., & Hickling, E. J. (2003). Posttraumatic stress disorder and

psychosocial functioning within two samples of MVA survivors. *Behaviour Research and Therapy*, 41(9), 1105–1112. [https://doi.org/10.1016/S0005-7967\(03\)00071-8](https://doi.org/10.1016/S0005-7967(03)00071-8)

Kivlahan, D. R., Marlatt, G. A., Fromme, K., Coppel, D. B., & Williams, E. (1990). Secondary prevention with college drinkers: evaluation of an alcohol skills training program. *Journal of Consulting and Clinical Psychology*, (6), 805. Retrieved from

<http://search.ebscohost.com.ezproxy.memphis.edu/login.aspx?direct=true&db=edsgao&AN=edsgcl.10335589&site=eds-live&scope=site>

Levine, S. Z., Laufer, A., Hamama-Raz, Y., Stein, E., & Solomon, Z. (2008). Posttraumatic growth in adolescence: Examining its components and relationship with PTSD. *Journal of Traumatic Stress, 21*(5), 492–496. <https://doi.org/10.1002/jts.20361>

Life Events Checklist for DSM-5 (LEC-5) - PTSD: National Center for PTSD. (n.d.). [General Information]. Retrieved July 2, 2018, from https://www.ptsd.va.gov/professional/assessment/te-measures/life_events_checklist.asp

Magruder, K. M., Kılıç, C., & Koryürek, M. M. (2015). Relationship of posttraumatic growth to symptoms of posttraumatic stress disorder and depression: A pilot study of Iraqi students. *International Journal of Psychology, 50*(5), 402–406.

McCaslin, S. E., de Zoysa, P., Butler, L. D., Hart, S., Marmar, C. R., Metzler, T. J., & Koopman, C. (2009). The relationship of posttraumatic growth to peritraumatic reactions and posttraumatic stress symptoms among Sri Lankan university students. *Journal of Traumatic Stress, 22*(4), 334–339.

McDevitt-Murphy, M. E., Murphy, J. G., Monahan, C. J., Flood, A. M., & Weathers, F. W. (2010). Unique patterns of substance misuse associated with PTSD, depression, and social phobia. *Journal of Dual Diagnosis, 6*, 94-110. doi:10.1080/15504261003701445

McDiarmid, L., Taku, K., & Phillips, M. (2017). Posttraumatic growth associated with perceived changes in health values and reduced alcohol use among bereaved college students. *Traumatology, 23*(4), 309–316. <https://doi.org/10.1037/trm0000120>

Milam, J., Ritt-Olson, A., Tan, S., Unger, J., & Nezami, E. (2005). The September 11th 2001 terrorist attacks and reports of posttraumatic growth among a multi-ethnic sample of adolescents. *Traumatology, 11*(4), 233–246.

<https://doi.org/10.1177/153476560501100404>

Milam, J. E., Ritt-Olson, A., & Unger, J. B. (2004). Posttraumatic growth among adolescents. *Journal of Adolescent Research, 19*(2), 192–204.

<https://doi.org/10.1177/0743558403258273>

Murphy, J. G., Yurasek, A. M., Dennhardt, A. A., Skidmore, J. R., McDevitt-Murphy, M. E., MacKillop, J., & Martens, M. P. (2013). Symptoms of depression and PTSD are associated with elevated alcohol demand. *Drug and Alcohol Dependence, 127*(1–3),

129–136. <https://doi.org/10.1016/j.drugalcdep.2012.06.022>

National Center for PTSD. (2018, September 24). Retrieved June 14, 2019, from

<https://www.ptsd.va.gov/professional/assessment/adult-sr/ptsd-checklist.asp>

Office of Institutional Research (2018, February 7). Enrollment Table Generator. Retrieved September 1, 2018, from

<https://oirs.memphis.edu/oirweb/webreports/enrollmentprofiles/EnrollmentByTerm/spring18/EM18ssection18.PDF>

Orejuela-Dávila, A. I., Cann, A., & Tedeschi, R. G. (2017). Alexithymia predicts posttraumatic growth and distress after trauma. *Journal of Loss & Trauma, 22*(3), 171–182.

<https://doi.org/10.1080/15325024.2017.1284468>

Owens, G. P. (2016). Predictors of posttraumatic growth and posttraumatic stress symptom severity in undergraduates reporting potentially traumatic events. *Journal of Clinical Psychology, 72*(10), 1064–1076. <https://doi.org/10.1002/jclp.22309>

- Read, J. P., Colder, C. R., Merrill, J. E., Ouimette, P., White, J., & Swartout, A. (2012). Trauma and posttraumatic stress symptoms predict alcohol and other drug consequence trajectories in the first year of college. *Journal of Consulting and Clinical Psychology*, 80(3), 426.
- Read, J. P., Kahler, C. W., & Strong, D. R. (2006). Development and preliminary validation of the young adult alcohol consequences questionnaire. *Journal of Studies on Alcohol*, 67(1), 169–177.
- Read, J. P., Radomski, S., & Wardell, J. D. (2017). Posttraumatic stress and problem drinking at the transition out of college. *Prevention Science*, (4), 440.
<https://doi.org/10.1007/s11121-017-0778-0>
- Read, J. P., Wardell, J. D., & Colder, C. R. (2013). Reciprocal associations between PTSD symptoms and alcohol involvement in college: A three-year trait-state-error analysis. *Journal of Abnormal Psychology*, 122(4), 984–997. <https://doi.org/10.1037/a0034918>
- Rona, R. J., Jones, M., Iversen, A., Hull, L., Greenberg, N., Fear, N. T., ... Wessely, S. (2009). The impact of posttraumatic stress disorder on impairment in the UK military at the time of the Iraq war. *Journal of Psychiatric Research*, 43(6), 649–655.
<https://doi.org/10.1016/j.jpsychires.2008.09.006>
- Russell, D. W., Russell, C. A., Riviere, L. A., Thomas, J. L., Wilk, J. E., & Bliese, P. D. (2014). Changes in alcohol use after traumatic experiences: The impact of combat on Army National Guardsmen. *Drug and Alcohol Dependence*, 139, 47–52.
<https://doi.org/10.1016/j.drugalcdep.2014.03.004>

- Shakespeare-Finch, J., & Lurie-Beck, J. (2014). A meta-analytic clarification of the relationship between posttraumatic growth and symptoms of posttraumatic distress disorder. *Journal of Anxiety Disorders*, 28(2), 223–229. <https://doi.org/10.1016/j.janxdis.2013.10.005>
- Silverstein, M. W., Lee, D. J., Witte, T. K., & Weathers, F. W. (2017). Is posttraumatic growth trauma-specific? Invariance across trauma- and stressor-exposed groups. *Psychological Trauma: Theory, Research, Practice, and Policy*, 9(5), 553–560. <https://doi.org/10.1037/tra0000236>
- Solomon, Z., & Dekel, R. (2007). Posttraumatic stress disorder and posttraumatic growth among Israeli ex-POWs. *Journal of Traumatic Stress*, 20(3), 303–312. <https://doi.org/10.1002/jts.20216>
- Stump, M. J., & Smith, J. E. (2008). The Relationship between posttraumatic growth and substance use in homeless women with histories of traumatic experience. *American Journal on Addictions*, 17(6), 478–487.
- Strasshofer, D. R., Peterson, Z. D., Beagley, M. C., & Galovski, T. E. (2018). Investigating the relationship between posttraumatic stress symptoms and posttraumatic growth following community violence: The role of anger. *Psychological Trauma: Theory, Research, Practice, and Policy*, 10(5), 515–522. <https://doi.org/10.1037/tra0000314>
- Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). Boston, MA: Pearson.
- Taku, K., Calhoun, L.G., Cann, A., & Tedeschi, R.G. (2008). The role of rumination in the coexistence of distress and posttraumatic growth among bereaved Japanese university students. *Death Studies*, 32(5), 428–444.

- Tedeschi, R. G., & Calhoun, L. G. (1996). The Posttraumatic Growth Inventory: Measuring the positive legacy of trauma. *Journal of Traumatic Stress, 9*(3), 455–471.
- Tedeschi, R. G., & Calhoun, L. G. (2004). Posttraumatic growth: Conceptual foundations and empirical evidence. *Psychological Inquiry, 15*(1), 1–18.
- Tripp, J. C., McDevitt-Murphy, M. E., Avery, M. L., & Bracken, K. L. (2015). PTSD symptoms, emotion dysregulation, and alcohol-related consequences among college students with a trauma history. *Journal of Dual Diagnosis, 11*(2), 107–117.
<https://doi.org/10.1080/15504263.2015.1025013>
- Tripp, J. C., Meshesha, L. Z., Teeters, J. B., Pickover, A., McDevitt-Murphy, M. E., & Murphy, J. G. (2015). Alcohol craving and demand mediate the relation between posttraumatic stress symptoms and alcohol-related consequences. *Experimental and Clinical Psychopharmacology, 23*(5), 324–331. <https://doi.org/10.1037/pha0000040>
- Vrana, S., & Lauterbach, D. (1994). Prevalence of traumatic events and post-traumatic psychological symptoms in a nonclinical sample of college students. *Journal of Traumatic Stress, 7*(2), 289–302. <https://doi.org/10.1002/jts.2490070209>
- Weathers, F. & Ford, J. (1996). Psychometric properties of the PTSD checklist (PCL-C, PCL-S, PCL-M, PCL-PR). In H. Stamm (Ed.), *Measurement of stress, trauma, and adaptation*. Lutherville, MD: Sidran Press.
- Weathers, F. W., Litz, B. T., Herman, J. A., Huska, J. A., & Keane, T. M. (1993, November). *The PTSD Checklist (PCL): Reliability, validity and diagnostic utility*. Paper presented at the annual conference of the International Society of Traumatic Stress Studies, San Antonio, TX.

Weathers, F.W., Litz, B. T., Keane, T. M., Palmieri, P. A., Marx, B. P., & Schnurr, P. P. (2013).

The PTSD Checklist for DSM-5 (PCL-5). Retrieved from the National Center for PTSD

website: <http://www.ptsd.va.gov>.

Appendix A

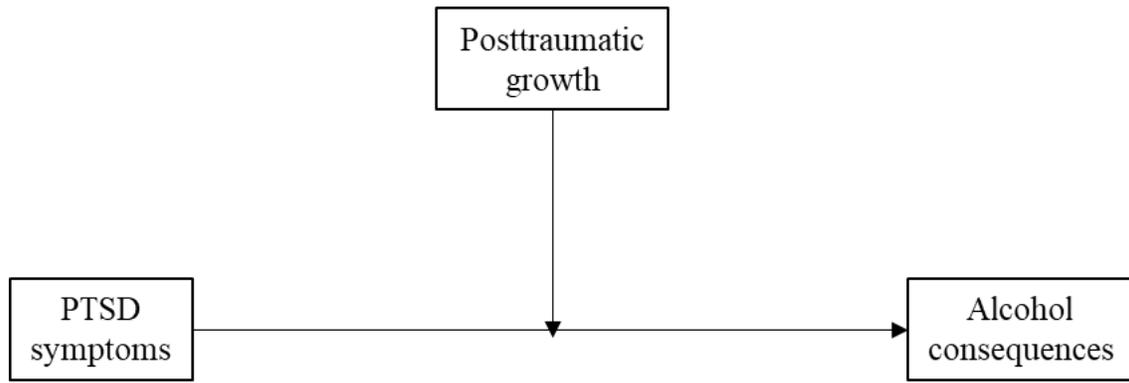


Figure 1: PTG as a moderator of the relation between PTSD symptoms and alcohol misuse

Appendix B

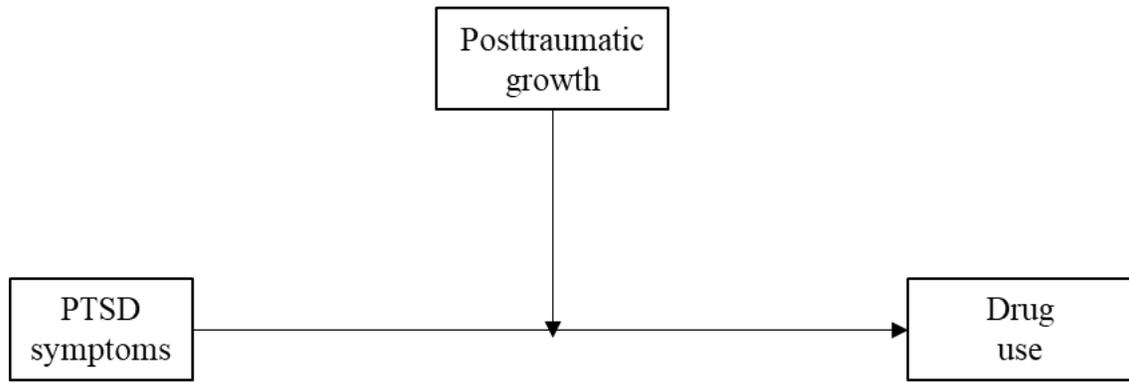


Figure 2: PTG as a moderator of the relation between PTSD symptoms and drug use

Appendix C

Table 1: Full sample and subgroup demographics

	<u>Full sample</u> <i>N</i> = 167	<u>Student sample</u> <i>N</i> = 57	<u>Mturk</u> <i>N</i> = 110
	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)
Age (years)	22.22 (2.37)	19.84 (1.65)	23.55 (1.52)
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
Gender			
Female	85 (50.9)	43 (75.4)	42 (38.2)
Male	81 (48.3)	14 (24.6)	67 (60.9)
Non-binary	1 (.6)	0	1 (.9)
Race			
White/European ancestry	114 (68.3)	29 (50.9)	85 (77.3)
Black/from African ancestry	30 (18)	21 (36.8)	9 (8.2)
Southeast Asian	5 (3)	2 (3.5)	3 (2.7)
More than one ethnicity	5 (3)	3 (5.3)	2 (1.8)
Pacific Islander	4 (2.4)	0	4 (3.6)
American Indian/Alaskan Native	3 (1.8)	0	3 (2.7)
East Asian	2 (1.2)	0	2 (1.8)
Hispanic/Latino	2 (1.2)	1 (1.8)	1 (.9)
South Asian	1 (.6)	0	1 (.9)
Middle Eastern/West Asian	1 (.6)	1 (1.8)	0
Religion			
Catholic	49 (29.3)	4 (7.0)	45 (40.9)
Protestant	47 (28.1)	27 (47.4)	20 (18.2)
No religion	32 (19.2)	6 (10.5)	26 (23.6)
Non-denominational Christian	13 (7.8)	12 (21.1)	1 (.9)
Atheist	12 (7.2)	1 (1.8)	11 (10)
Jewish	3 (1.8)	1 (1.8)	2 (1.8)
Buddhist	1 (.6)	1 (1.8)	0
Mormon	1 (.6)	0	1 (.9)
Other	7 (4.2)	3 (5.3)	4 (3.6)
Relationship status			
In a relationship; not married or living together	59 (35.3)	32 (56.1)	27 (24.5)
Single; not currently in a romantic relationship	58 (34.7)	18 (31.6)	40 (36.4)
In a relationship; living together	22 (13.2)	4 (7)	18 (16.4)
Married; living together	20 (12)	2 (3.5)	18 (16.4)
Engaged to be married; living together	7 (4.2)	1 (1.8)	6 (5.5)
Married; separated	1 (.6)	0	1 (.9)

Table 1: Continued

	<u>Full sample</u> <i>N</i> = 167 <i>n</i> (%)	<u>Student sample</u> <i>N</i> = 57 <i>n</i> (%)	<u>Mturk</u> <i>N</i> = 110 <i>n</i> (%)
Sexuality			
Straight/heterosexual	142 (85)	49 (86)	90 (84.5)
Bisexual	21 (12.6)	7 (12.3)	14 (12.7)
Gay	3 (1.8)	0	3 (2.7)
Lesbian	1 (.6)	1 (1.8)	0
Student status			
Full-time	82 (49.1)	57 (100)	25 (22.7)
Part-time	21 (12.6)	0	21 (19.1)
Less than part-time	4 (2.4)	0	4 (3.6)
Not enrolled	60 (35.9)	0	60 (54.5)
Program			
Bachelors (e.g., BS, BA)	109 (64.1)	46 (80.7)	55 (51.4)
High school graduate/GED	35 (20.6)	8 (14.0)	29 (27.1)
Master's degree (e.g., MA, MS)	13 (7.6)	1 (1.8)	12 (11.2)
Community college/technical degree	10 (5.9)	0	9 (8.4)
Professional degree (e.g., PhD, MD)	3 (1.8)	1 (1.8)	2 (1.9)
Currently employed ¹	—	—	20 (18.2)
Household income			
Less than \$15,000	23 (13.8)	12 (21.1)	11 (10)
\$15,000 – \$29,999	28 (16.8)	8 (14)	20 (18.2)
\$30,000 – \$44,999	32 (19.2)	10 (17.5)	22 (20)
\$45,000 – \$59,999	26 (15.6)	6 (10.5)	20 (18.2)
\$60,000 – \$74,999	19 (11.4)	5 (8.8)	14 (12.7)
\$75,000 – \$104,999	24 (14.5)	7 (12.3)	17 (15.5)
Greater than \$105,000	14 (8.4)	8 (14)	6 (5.5)

¹ As SONA participants are full-time students, only Mturk participants were asked about employment

Appendix D

Table 2: Means and standard deviations of total sample and sub-groups

	<u>Full sample</u> <i>M (SD)</i>	<u>Student Sample</u> <i>M (SD)</i>	<u>Mturk</u> <i>M (SD)</i>	<u>t-test</u> <i>t (df)</i>
PTGI ^a (Max: 105)	52.95 (26.22)	42.07 (24.76)	58.59 (25.51)	3.67 (165)**
PCL-5 ^b (Max: 80)	12.81 (13.11)	7.12 (8.60)	15.75 (14.47)	4.04 (134.35)**
DDQ ^c (no max)	6.03 (10.02)	3.32 (4.81)	7.36 (11.53)	2.26 (148.22)*
YAACQ ^d (Max: 48)	7.37 (10.95)	5.50 (7.87)	8.32 (12.01)	.86 (138.26)
DUDIT ^e (Max: 44)	5.12 (8.50)	3.47 (5.91)	6.75 (9.71)	3.24 (159.85)**
Relating to others (Max: 35)	17.56 (9.83)	12.74 (8.92)	20.05 (9.37)	4.86 (165)**
New possibilities (Max: 20)	8.99 (5.82)	6.98 (5.58)	10.04 (5.70)	3.31 (165)**
Personal strength (Max: 20)	10.49 (5.41)	8.56 (5.41)	11.49 (5.17)	3.42 (165)**
Spiritual change (Max: 10)	4.44 (3.36)	4.35 (3.03)	4.49 (3.53)	.27 (129.51)
Appreciation for life (Max: 15)	8.74 (3.92)	7.16 (3.83)	9.56 (3.71)	3.93 (165)**

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

^a Posttraumatic Growth Inventory

^b PTSD Symptoms Checklist

^c Daily Drinking Questionnaire

^d Young Adults Alcohol Consequences Questionnaire

^e Drug Use Disorder Identification Test

Appendix E

Table 3: Life Events Checklist event frequencies

Event	<i>n</i>	%
Natural disaster (e.g., flood, hurricane, tornado, earthquake)	16	9.8
Fire or explosion	5	3.1
Transportation accident (e.g., car, boat, train, plane)	34	20.9
Serious accident at work, home, or during recreational activity	2	1.2
Exposure to toxic substance (e.g., dangerous chemicals, radiation)	1	.6
Physical assault (e.g., being attacked, hit, slapped, kicked, beaten up)	15	9.2
Assault with a weapon (e.g., being shot, stabbed, threatened with a knife, gun, bomb)	10	6.1
Sexual assault (e.g., rape, attempted rape, made to perform any type of sexual act through force or threat of harm)	20	12.3
Other unwanted or uncomfortable sexual experience	1	.6
Life-threatening illness or injury	15	9.2
Severe human suffering	3	1.8
Sudden, violent death (e.g., homicide, suicide)	17	10.4
Sudden accidental death	24	14.7

Appendix F

Table 4: Correlations among key variables

Variable	PTGI	PCL-5	DDQ	YAACQ	DUDIT
PTGI ^a	-				
PCL-5 ^b	.34**	-			
DDQ ^c	.20*	.24**	-		
YAACQ ^d	.13	.32**	.74**	-	
DUDIT ^e	.05	.35**	.50**	.65**	-

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

^a Posttraumatic Growth Inventory

^b PTSD Symptoms Checklist

^c Daily Drinking Questionnaire

^d Young Adults Alcohol Consequences Questionnaire

^e Drug Use Disorder Identification Test

Appendix G

Table 5: Summary of PTGI as a moderator of PCL-5 and substance misuse

Prediction of Alcohol Consequences^a	β	<i>p</i>	95% CI
Predictor			
PCL-5 ^c	.05	.76	[-.29, .39]
PTGI ^d	-.02	.09	[-.03, .002]
PCL-5 X PTGI	.006	.04	[.0002, .01]
Prediction of Drug Use^b	β	<i>p</i>	95% CI
Predictor			
PCL-5	-.21	.18	[-.52, .1]
PTGI	-.02	.04	[-.04, -.001]
PCL-5 X PTGI	.009	.001	[.0036, .01]

^a Among alcohol users ($n = 83$)

^b Among drug users ($n = 63$)

^c PTSD Symptoms Checklist

^d Posttraumatic Growth Inventory

Appendix H

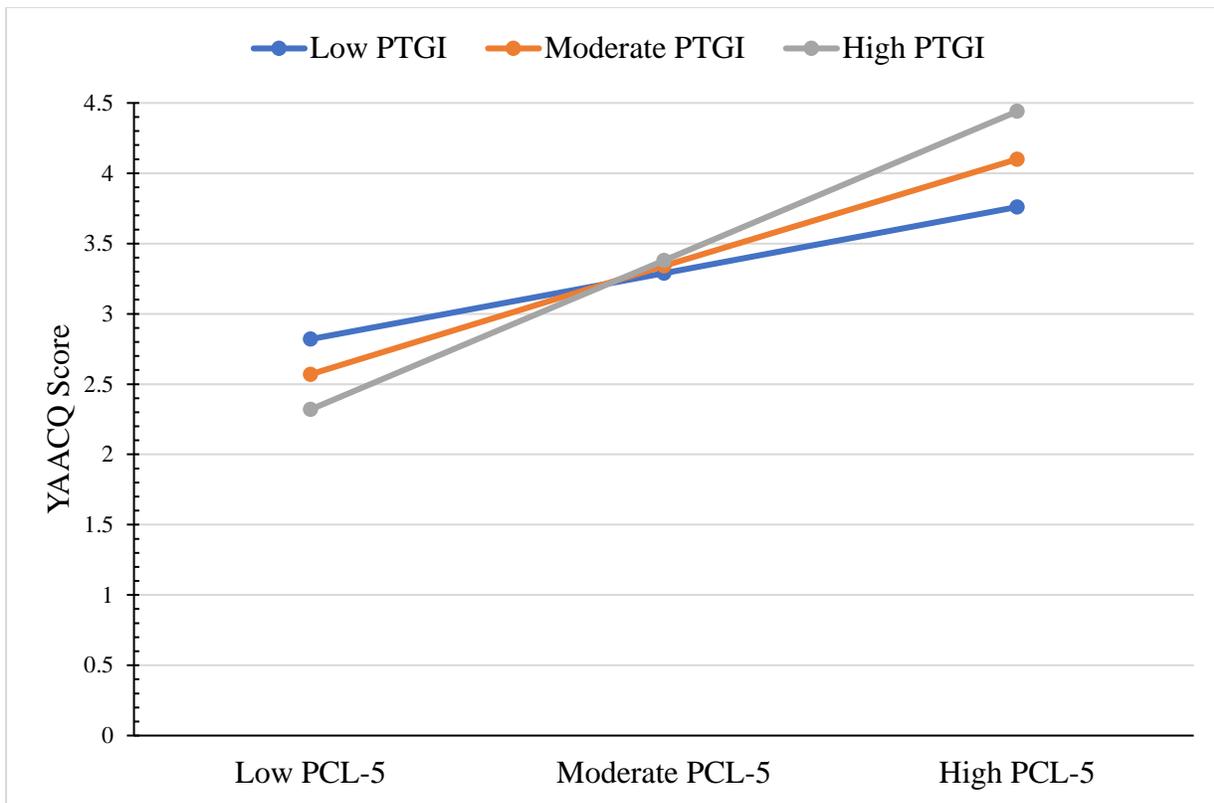


Figure 3: Interactions of PTGI as a moderator of the relation between PCL-5 and YAACQ

Appendix I

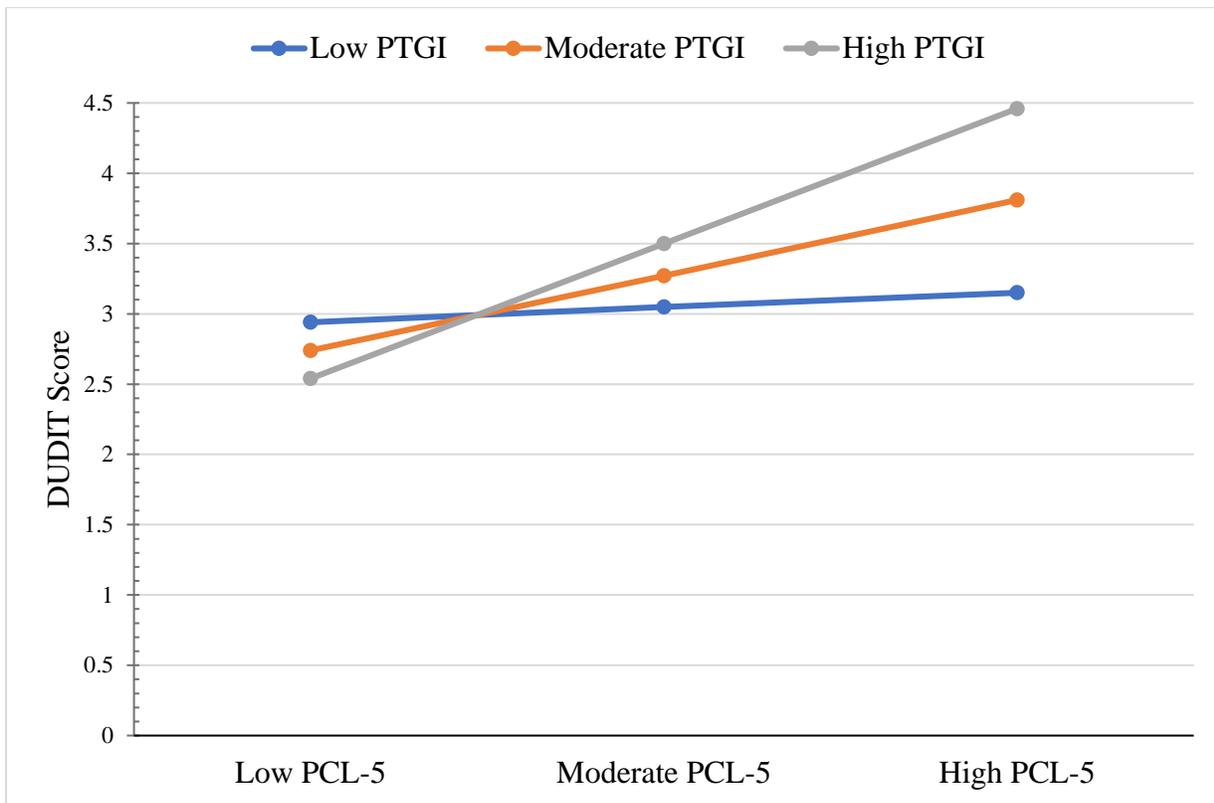


Figure 4: Interactions of PTGI as a moderator of the relation between PCL-5 and DUDIT