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A LONGITUDINAL STUDY OF THE STRESS-BUFFERING EFFECTS OF ROMANTIC RELATIONSHIPS ON ALCOHOL OUTCOMES IN COLLEGE STUDENTS EXPOSED TO TRAUMA

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science at Virginia Commonwealth University

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Abstract

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This study examined interplay between interpersonal trauma (IPT), relationship status, relationship satisfaction (SAT), and partner substance use (PSU), and whether these relationship dimensions moderated associations between IPT and alcohol outcomes. Data came from a longitudinal study of college students (N=9,911; 61%female; 49%White). Precollege IPT increased the likelihood of being in a relationship, while college-onset IPT decreased the likelihood. IPT predicted lower SAT and higher PSU. Individuals with precollege IPT consumed more alcohol than those without IPT, but this was mitigated for those in relationships. Individuals with college-onset IPT consumed more alcohol than those without IPT, and this was more pronounced with higher PSU. Effects changed modestly when controlling for PTSD. Findings suggest timing of IPT impacts its effects on relationship dimensions, and their interactive effects on alcohol. Involvement in relationships, but not relationship satisfaction, buffers against the effects of IPT on alcohol use, while high PSU partner exacerbates it.

A Longitudinal Study of the Stress-Buffering Effects of Romantic Relationships on Alcohol

Outcomes in College Students Exposed to Trauma

Statement of Purpose

College students engage in high levels of alcohol use, and this is costly to both

individuals and to society (Hingson, Zha, & Weitzman, 2009). It is well established that the

experience of potentially traumatic events, particularly those interpersonal in nature, is

associated with elevated levels of risky alcohol use (Keyes, Hatzenbuehler, & Hasin, 2011;

Overstreet, Berenz, Kendler, Dick, & Amstadter, 2017) and alcohol problems (Keyes et al.,

2011; Stewart, 1996). This association between trauma exposure and alcohol use is often

explained in terms of using alcohol as a coping strategy (Cooper, 1994), such that individuals use

alcohol to regulate negative affect resulting from the trauma (Berenz et al., 2016b; Keyes,

Hatzenbuehler, & Hasin, 2011; O'Hare & Sherrer, 2011). However, not all individuals who have

a trauma history go on to misuse alcohol or experience alcohol-related problems, underscoring

the need to understand the factors that mitigate or amplify the pathogenic effects of trauma.

Romantic relationships are an increasingly salient interpersonal context for college

students, and may thus represent an important factor for moderating the associations between

trauma and alcohol use. Of particular relevance are previous findings that relationships may

buffer against the effects of trauma (Cohen, 2004; Cohen & Wills, 1985; Ditzen & Heinrichs,

2014; Umberson, Crosnoe, & Reczek, 2010) through the provision of social support, which can

reduce the burden of stress and increase one's ability to cope (Cohen, 2004). At the same time,

however, stressful experiences may undermine one's ability to form and maintain high quality

romantic relationships (Karney & Bradbury, 1995; Marshall & Kuijer, 2017; Taft, Watkins,

Stafford, Street, & Monson, 2011), highlighting the need to understand whether trauma-exposed

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individuals are likely to find themselves in the types of high quality relationships that buffer stress. The purpose of this study was to examine the interplay between romantic relationships and trauma on alcohol use and alcohol problems among college students.

Introduction

College students engage in high levels of risky alcohol use, which can have negative personal and social ramifications (Hingson et al., 2009). In 2015, 58.0% of college students drank alcohol and 37.9% engaged in binge drinking in the past 30 days (Substance Abuse and Mental Health Services Administration, 2015). Moreover, a substantial minority of students meet criteria for alcohol use disorders, with approximately 7.9% of students qualifying for past year alcohol abuse and 12.5% qualifying for past year alcohol dependence (Blanco et al., 2008). College students can experience many negative alcohol-related outcomes, including missing and falling behind in class (Wechsler, Lee, Kuo, & Lee, 2000), memory blackouts, legal trouble, and personal injuries (Hingson et al., 2009; Wechsler et al., 2000). College students who engage in high levels of alcohol use are also at greater risk of physical and sexual victimization (Hingson et al., 2009). In light of the high rates of risky drinking among college students and its negative consequences, it is important to better understand the interplay between the factors that mitigate and exacerbate alcohol use.

Along these lines, the goal of the current study was to examine the interplay between romantic relationships, trauma, and alcohol use and problems. The current paper is organized into a literature review with five key sections followed by information on the completed study and methodology. First, background information is provided on interpersonal trauma exposure as it relates to college students, alcohol use, and motives for drinking. Next, the current literature on social support as a buffer against the negative repercussions of stress is reviewed, highlighting

the role of romantic relationships as a salient context for social support. In particular, three dimensions of relationships that are relevant when considering the protective effect of relationships on alcohol use and problems are outlined: relationship status, relationship satisfaction, and partner substance use. Finally, the interplay between trauma exposure and romantic relationships is discussed, suggesting that individuals exposed to trauma may be less likely to find themselves in the types of relationships that buffer against trauma exposure on alcohol outcomes. After a review of the relevant literature, the research aims, hypotheses, methods, analysis plan, and results are outlined. The paper concludes with a discussion of findings, including limitations and directions for future research.

Literature Review

Effects of Interpersonal Trauma Exposure on Alcohol Outcomes

Exposure to trauma, typically defined as any event that evokes an emotional response (e.g., accidents, natural disasters, physical abuse, sexual assault), is a well-established risk factor for alcohol misuse among college students. Trauma exposure both prior to and during college is common among college students (Breslau, Peterson, & Schultz, 2008; Kessler, 2000). Many students enter college having experienced trauma, with estimates of precollege trauma exposure (i.e., prior to age 18) ranging from approximately 62% (McLaughlin et al., 2013) to 82% (Overstreet et al., 2017). Moreover, many students experience trauma during college (Berenz et al., 2016b; Conley et al., 2017; Hawn et al., 2018); however, most studies focus on specific subtypes of trauma and on traumatic experiences that occur immediately upon arrival at campus. Given these methodological limitations, overall rates of college-onset trauma are difficult to establish. One of the few studies to examine college-onset trauma found that approximately 21% of students experienced a new traumatic event during a two-month period since coming to

college (Frazier et al., 2009). Importantly, exposure to trauma is associated with subsequent revictimization (Chiu et al., 2013; Coid et al., 2001; Hawn et al., 2018), meaning students who experienced trauma prior to college may be more likely to experience re-victimization during college.

Experiencing traumatic events, particularly interpersonal trauma (IPT), is associated with elevated levels of substance and alcohol use in adolescence and adulthood (Begle et al., 2011; Berenz et al., 2016a; Berenz et al., 2016b; Breslau, 2009; Keyes, Hatzenbuehler, & Hasin, 2011; Overstreet, Berenz, Kendler, Dick, & Amstadter, 2017). IPT refers to a traumatic event in which another person is responsible for perpetrating the event (as opposed to a natural disaster or trauma resulting from combat or war), including unwanted or uncomfortable sexual experiences, sexual assault, and physical assault (Kessler, 1995; McLaughlin et al., 2013). Of college students with a lifetime exposure to trauma, approximately 39% reported exposure to IPT (Overstreet et al., 2017), with physical assault more common among men and sexual assault more common among women (Conley et al., 2017; Finkelhor, Turner, Shattuck, & Hamby, 2015; Overstreet et al., 2017). Individuals exposed to IPT, relative to other forms of trauma, are more likely to develop Post-Traumatic Stress Disorder (PTSD; Kessler, 1995). This is significant because individuals whose post-traumatic stress symptoms are severe and pervasive enough to meet the clinical threshold for PTSD are 1.6 times more likely be to diagnosed with alcohol abuse disorders compared to individuals without PTSD (Stewart, 1996). Even for individuals who do not necessarily meet criteria for a clinical diagnosis of PTSD, however, alcohol use following trauma exposure is elevated (Berenz et al., 2016a; Breslau, 2009; Keyes, Hatzenbuehler, & Hasin, 2011; Overstreet, Berenz, Kendler, Dick, & Amstadter, 2017). These latter findings

highlight the significance of trauma exposure, even in the absence of PTSD, for alcohol outcomes.

Longitudinal studies provide insight into how IPT exposure impacts college students' alcohol use trajectories. College students with precollege trauma drink more alcohol when they start college relative to peers not exposed to trauma (Berenz et al., 2016a; Read et al., 2012). Moreover, compared to those who do not experience trauma, women who experience college-onset IPT drink alcohol in greater quantities and with greater frequency over time, while men's alcohol use trajectories are unchanged (Berenz et al., 2016a). Thus, trauma exposure impacts college students' alcohol use trajectories and places them at greater risk for alcohol misuse and alcohol-related problems. Such findings highlight the impact of trauma exposure on college students' alcohol use and problems, particularly among women. These findings also underscore the need for a longitudinal approach to fully characterize the impact of trauma on alcohol outcomes.

The drinking to cope theory, which comes out of the motivational models of alcohol use (Cox & Klinger, 1988), is often used to explain the association between traumatic experiences and alcohol use (Cooper, 1994). The concept that individuals have different motivations for alcohol use is based on the notion that drinking can serve different functions for different individuals, and can thus have different antecedents and consequences depending on the motivation for use (Cooper, 1994; Cox & Klinger, 1988; Kuntsche, Knibbe, Gmel, & Engels, 2005). These motivations are based on individuals' rational and emotional needs and whether they expect alcohol use to meet those needs (Cooper, 1994; Cox & Klinger, 1988; Kuntsche et al., 2005). Moreover, all individuals' motivations to drink are embedded within historical factors and current contexts (Cooper, 1994; Cox & Klinger, 1988; Kuntsche et al., 2005). Historical

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factors can include genetic predisposition, personality traits, and past reinforcement of alcohol use, whereas current contexts include current positive and negative incentives to drink and situational factors, such as presence of drinking peers (Kuntsche et al., 2005). For this reason, the motivational model of alcohol use is widely used to classify reasons for drinking and to better understand the pathways towards alcohol misuse (Kuntsche et al., 2005).

According to Cooper's (1994) theory of coping-motivated drinking, individuals use alcohol in order to regulate negative affect or avoid unpleasant stimuli. Individuals who are predisposed to or diagnosed with affect- and mood-related mental health disorders (e.g., depression, anxiety) tend to engage in more coping-motivated alcohol use, compared to social- or enhancement- motivated alcohol use (Cooper, Frone, Russell, & Mudar, 1995; Mackie, Conrod, Rijsdijk, & Eley, 2011; Stapinski et al., 2016). Consistent with the idea that those with internalizing disorders drink to regulate mood, Bravo, Pearson, and Henson (2017) found that drinking to cope fully mediated the association between both problem-focused thoughts (a component of rumination) and depressive symptoms to alcohol-related problems. Coping-related alcohol use is associated with an increase in heavy drinking and alcohol-related problems (Cooper et al., 1995; Kuntsche et al., 2005; Mackie et al., 2011; O'Hare & Sherrer, 2011), and drinking to cope is positively associated with alcohol dependence in adulthood (Kuntsche et al., 2005). This supports the idea that individuals use alcohol to cope with negative affect, which can easily be expanded to include individuals with a history of traumatic experiences drinking to cope with their negative emotions (Berenz et al., 2016b; Keyes, Hatzenbuehler, & Hasin, 2011; O'Hare & Sherrer, 2011).

Stress-Buffering Effects of Social Support

Although IPT is linked to elevated alcohol use and more alcohol problems, not everyone who experiences a traumatic event goes on to misuse alcohol; therefore, it is important to identify factors that mitigate the risk associated with trauma on alcohol outcomes. One such mitigating factor often cited in the literature is social support, as social support can buffer against the negative effects of stress (Cohen, 2004; Cohen & Hoberman, 1983; Cohen & Wills, 1985; Ditzen & Heinrichs, 2014; Kiecolt-Glaser & Wilson, 2017; Shorey, Rhatigan, Fite, & Stuart, 2011; Umberson et al., 2010). Social support includes instrumental, material, informational, or emotional resources one can provide in order to reduce the burden of stress or increase the ability of another to cope with stress (Cohen, 2004). According to the stress-buffering hypothesis (Cohen & Wills, 1985), receiving social support can reduce the effects of stress and improve individuals' health outcomes at both physiological and psychological levels (Ditzen & Heinrichs, 2014; Umberson et al., 2010).

Physiologically, social support impacts autonomic and central nervous system activation. Specifically, social support can reduce autonomic nervous system activation, including skin conductance, heart rate, blood pressure, and norepinephrine levels, as well as impact the central nervous system through the release of neuropeptides and increased or decreased activation of certain areas of the brain (e.g., amygdala, hypothalamic-pituitary-adrenal axis; Ditzen & Heinrichs, 2014; Robles, Slatcher, Trombello, & McGinn, 2014; Uchino, 2006). Experimental research documents reductions in physiological manifestations of stress in the presence of a supportive individual (House, Landis, & Umberson, 1988; Uchino, 2006). In sum, social support impacts multiple physiological processes that decrease the stress response.

Psychologically, supportive individuals can buffer against the effects of stress and promote health behaviors by reducing psychological distress, promoting positive coping, and fostering wellbeing (Umberson et al., 2010). Supportive individuals can also buffer against the negative influence of more deviant peers and promote healthy habit development via social control processes (Umberson et al., 2010; Umberson & Montez, 2010). Moreover, they can increase individuals' sense of security, connectedness, purpose, and autonomy (Robles et al., 2014), all of which help foster healthy coping strategies and wellbeing in the face of stress.

Romantic relationships as context for social support. Romantic relationships become one of the most salient relationships in young adulthood, and romantic partners become key providers of social support (Arnett, 2004; Shulman, Scharf, Livne, & Barr, 2013; Umberson et al., 2010). It is well established that being in a romantic relationship is associated with reductions in both stress (Kiecolt-Glaser & Wilson, 2017; Ozer, Best, Lipsey, & Weiss, 2003; Williams & Umberson, 2004) and alcohol use (Bachman, O'Malley, & Johnston, 1984; Fleming, White, & Catalano, 2010; Kendler, Lönn, Salvatore, Sundquist, & Sundquist, 2016; Leonard & Rothbard, 1999; Rhule-Louie & McMahon, 2007). Of relevance, romantic relationships have a protective effect against alcohol use, such that individuals who are in committed relationships, compared to being single, drink less alcohol and experience fewer alcohol-related negative outcomes (Bachman et al., 1984; Leonard & Rothbard, 1999; Rhule-Louie & McMahon, 2007). Thus, romantic relationships are likely to play an important role in buffering the effects of trauma to predict alcohol outcomes.

In general, romantic relationships have a protective effect against stress and its negative impacts (Fleming et al., 2010; Kiecolt-Glaser & Wilson, 2017; Rhule-Louie & McMahon, 2007; Williams & Umberson, 2004). However, these protective effects may differ as a function of

characteristics of the relationship, including status, satisfaction, and the partner's own substance use. Additionally, there is prior evidence that protective effect of relationships may be stronger for men than for women (Ditzen & Heinrichs, 2014; House et al., 1988; Leonard & Rothbard, 1999), underscoring the need to attend to sex differences in potential effects. Each of these relationship dimensions is considered in turn below with the caveat that much of the previous work in this area was conducted with married couples; thus, many of the studies mentioned throughout this section necessarily focus on that research. However, instances where there are data on college students are cited.

   Dimensions of relationships that potentially moderate the impact of stress on alcohol use. There is a robust literature suggesting that the stress-buffering effects of relationships depend on level of commitment (Fleming et al., 2010; Salvatore et al., 2016). In young adult samples, increasingly committed relationships are typically associated with greater protective effects. For example, adults who are cohabitating (Duncan, Wilkerson, & England, 2006; Fleming et al., 2010) and who are engaged to be married demonstrate greater reductions in alcohol use compared to individuals who are in a single or in a committed, non-cohabitating relationship (Bachman et al., 1984; Leonard & Rothbard, 1999; Rhule-Louie & McMahon, 2007; Yamaguchi & Kandel, 1985). Despite these consistent effects in adult samples, among young adults specifically there is mixed evidence regarding the associations between relationship status and alcohol, with some studies finding that involvement in committed relationships is associated with reduced alcohol use (Duncan et al., 2006; Fleming et al., 2010), and others finding no such effect (Rauer et al., 2016; Salvatore, Kendler, & Dick, 2014). Thus, although relationship status is an established protective factor against alcohol use, it is unclear if this pattern of effects extends to college students.

Beyond relationship status, the protective effect of romantic relationships against alcohol use can vary as a function of relationship satisfaction (Karney & Bradbury, 1995; Marshal, 2003; Marshall & Kuijer, 2017; Robles et al., 2014; Umberson et al., 2010). Satisfying relationships are associated with higher levels of social support from partners, which promotes positive coping strategies and engagement in healthy behaviors (Uchino, 2006; Umberson & Montez, 2010). Similarly, individuals in satisfactory relationships tend to be more motivated to reduce alcohol consumption (Khaddouma et al., 2016). In contrast, dissatisfying relationships are associated with increased psychological distress, negative affect, and hostility (Karney & Bradbury, 1995; Lewis et al., 2006; Robles et al., 2014), as well as less willingness to engage in problem-solving behaviors (Marshal, 2003). Involvement in dissatisfying relationships can also increase both partners' risk for alcohol problems, as individuals may drink to cope with dissatisfying relationships (Rodriguez, Knee, & Neighbors, 2014). This pattern of increased alcohol problems further hurts the relationship (Karney & Bradbury, 1995; Leonard & Eiden, 2007; Marshal, 2003; Rhule-Louie & McMahon, 2007). One of the few studies to examine the effects of relationship dimensions among young adults found that overall satisfaction did not moderate alcohol use (Rauer et al., 2016). Thus, depending on the satisfaction they provide, relationships can protect against stress and reduce alcohol use and problems or compound stressors and negate any buffering effects. However, additional research is needed to determine if relationship satisfaction is relevant for college student alcohol outcomes.

Partner substance use is a third dimension of relationships that can influence the extent to which relationships protect against alcohol outcomes (Homish & Leonard, 2007; Homish, Leonard, Kozlowski, & Cornelius, 2009; Marshal, 2003; Rodriguez, Overup, & Neighbors, 2013). Partner substance use affects both the drinker and his or her significant other, such that

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higher partner substance use is associated with decreased relationship satisfaction (Fleming et al., 2010; Kearns-Bodkin & Leonard, 2005; Kiecolt-Glaser & Wilson, 2017; Leonard & Eiden, 2007; Marshal, 2003; Rodriguez, DiBello, & Neighbors, 2013; Rodriguez et al., 2014) and increased rates of depression, anxiety, and psychological distress (Homish, Leonard, & Kearns-Bodkin, 2006; Rodriguez et al., 2014). Moreover, partner substance use may influence individual alcohol use, as individuals involved with a heavy-drinking partner tend to increase their own alcohol use over time (Fleming et al., 2010; Homish & Leonard, 2007; Leonard & Eiden, 2007; Leonard & Mudar, 2003; Rosenquist, 2010), and this pattern of convergence is observed even when controlling for assortative mating (Fleming et al., 2010; Rosenquist, 2010). However, a recent longitudinal study of the influence of romantic relationship dimensions among young adults found no effect of partner substance use on one's own alcohol use (Rauer et al., 2016). In sum, instead of buffering against alcohol outcomes, involvement with a heavy-drinking partner may actually put individuals at greater risk.

Effects of Interpersonal Trauma Exposure on Romantic Relationships

An important consideration when thinking about the stress-buffering effects of romantic relationships is whether trauma exposure itself may impact the likelihood that individuals will end up the type of relationships that buffer against stress. At present, much of the work in this area to date focuses on veterans and PTSD, so not much is known about how IPT impacts specific relationship dimensions within civilian populations or for those who do not meet the clinical threshold for a diagnosis of PTSD. For example, a recent meta-analysis found that PTSD symptomatology was positively associated with relationship discord, psychological aggression, and physical aggression; however, 19 of the 31 included studies focused on military populations (Taft et al., 2011). Thus, much of what is described below about the impact of trauma on

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relationships will draw on literature related to potentially traumatic events and stressful experiences more broadly.

Exposure to stressful experiences may impact individuals' ability to form protective relationships in the first place (Karney & Bradbury, 1995; Marshall & Kuijer, 2017; Taft et al., 2011). Owen, Quirk, and Manthos (2012) found that IPT perpetrated by someone to whom the victim was close was associated with lower psychological wellbeing and having an insecure (i.e., anxious or avoidant) attachment style. Other studies support the finding that trauma exposure is associated with an avoidant attachment style (McCarthy & Taylor, 1999; Morina, Schnyder, Schick, Nickerson, & Bryant, 2016), and find that avoidant attachment mediates the association between childhood maltreatment and both relationship satisfaction (Lassri, Luyten, Cohen, & Shahar, 2016) and relationship difficulties (McCarthy & Taylor, 1999) in emerging adulthood. These findings suggest that exposure to stressful life events negatively impact the ways in which individuals connect with potential romantic partners, such that individuals exposed to trauma or maltreatment may be less likely to form secure romantic partnerships.

For those in a relationship, experiencing stressors may impede individuals' ability to maintain a high-quality and stable partnerships with prosocial partners (Karney & Bradbury, 1995; Marshall & Kuijer, 2017; Taft et al., 2011). For example, individuals from high-risk backgrounds are more likely to assortatively pair with deviant partners (Quinton, Pickles, Maughan, & Rutter, 1993; Zoccolillo, Pickles, Quinton, & Rutter, 1992) who tend to use more substances. Moreover, when individuals experience a traumatic event, they may become less positively engaged and have more negative interactions with their partners, which can negatively impact the couple and lead to decreased satisfaction over time (Karney & Bradbury, 1995; Marshall & Kuijer, 2017; Randall & Bodenmann, 2009; Robles et al., 2014; Whisman, 2014).

Symptoms of post-traumatic stress can negatively impact relationship quality and undermine

relationship processes that serve to buffer stressful situations (e.g., increases in anger, anxiety,

and blood pressure; poorer communication; Marshall & Kuijer, 2017). For example, individuals

with a history of childhood maltreatment are more likely to engage in negative verbal and

physical behavior towards their partners and perceive that their partners engage in more negative

verbal and physical behaviors towards them (Wolfe, Wekerle, Reitzeljaffe, & Lefebvre, 1998).

Thus, individuals exposed to early stressors and traumatic events may be less able to engage in

and maintain the types of relationships that typically buffer against the effects of stress.

Statement of the Problem

Exposure to IPT is common among college students (Kessler, 2000; Breslau et al., 2008;

Overstreet et al., 2017) and is associated with increased alcohol use and alcohol problems

(Berenz et al., 2016a; Berenz et al., 2016b; Breslau, 2009; Keyes et al., 2011; Overstreet et al.,

2017). Social support can buffer against the negative repercussions of stress (Cohen, 2004;

Cohen & Hoberman, 1983; Cohen & Wills, 1985; Ditzen & Heinrichs, 2014; Kiecolt-Glaser &

Wilson, 2017; Shorey et al., 2011; Umberson et al., 2010), and romantic relationships can serve

as a salient context for social support among college students. However, particular dimensions of

relationships (i.e., relationship status, relationship satisfaction, partner substance use) can

differentially interface with trauma exposure to buffer against alcohol outcomes. Additionally,

trauma exposure may impact relationships such that individuals exposed to trauma may be less

likely to find themselves in the types of relationships that buffer against stress (Karney &

Bradbury, 1995; Marshall & Kuijer, 2017; Taft et al., 2011). In view of the high rates of alcohol

misuse and negative consequences associated with alcohol use among college students (Blanco

et al., 2008; Hingson et al., 2009; Wechsler et al., 2000), it is imperative to better understand whether relationship dimensions are likely to buffer against trauma exposure in this population.

Current Study

The goal of this study was to examine the interplay between romantic relationships and trauma exposure on alcohol outcomes among college students. Specifically, the current study investigated the associations between IPT and romantic relationship dimensions (i.e., status, satisfaction, and partner substance use) and whether romantic relationship dimensions moderated the associations between trauma and alcohol use and problems. The study aims were as follows:

Aim 1. Characterize the associations between interpersonal trauma and relationship dimensions.

1. Examine the associations between precollege trauma exposure and relationship dimensions.

2. Examine the concurrent and lagged associations between college-onset trauma exposure and relationship dimensions.

Hypothesis 1.1. It was hypothesized that precollege trauma exposure would be significantly associated with relationship status, relationship satisfaction, and partner substance use. College students exposed to precollege trauma would have a greater likelihood of being single versus being in a committed relationship. If in a relationship, college students exposed to precollege trauma, relative to those not exposed to trauma, would report lower relationship satisfaction and higher partner substance use.

Hypothesis 1.2. It was hypothesized that concurrent and lagged college-onset trauma exposure would be significantly associated with relationship status, relationship satisfaction, and partner substance use. Individuals exposed to college-onset trauma would have a greater

likelihood of being single versus being in a relationship. For those in relationships, individuals exposed to trauma would report lower relationship satisfaction and higher partner substance use compared to those without college-onset trauma.

Aim 2. Examine whether relationship dimensions moderate the associations between precollege or college-onset trauma and alcohol use and alcohol problems.

Hypothesis 2. It was hypothesized that relationship status, relationship satisfaction, and partner substance use would moderate the associations between 1) precollege trauma and alcohol use and problems and 2) college-onset trauma and alcohol use and problems. College students with a history of trauma who were in a relationship, were more satisfied with their relationship, and had a partner with lower substance use would consume less alcohol and report fewer alcohol problems.

Aim 3. Examine whether the effects from Aims 1 and 2 differ as a function of sex.

Hypothesis 3.1. In view of findings that women experience more adverse outcomes following trauma exposure compared to men (Berenz et al., 2016a; Keyes et al., 2011), it was hypothesized that the pattern of effects for Aim 1 would be stronger for women compared to men.

Hypothesis 3.2. In view of findings that men benefit more from the protective effects of relationships compared to women (Ditzen & Heinrichs, 2014; House et al., 1988; Leonard & Rothbard, 1999), it was hypothesized that the pattern of effects for Aim 2 would be stronger for men compared to women.

Methods

Participants

Data were from the Spit for Science project, a university-wide longitudinal study focused on substance use and behavioral health among college students at a large, urban, four-year university (Dick et al., 2014). The study began in fall 2011, with new cohorts recruited in 2012, 2013, 2014, and 2017, resulting in a total of five cohorts as of spring 2017. Each year, all incoming freshmen over age 18 were invited to participate in the Spit for Science study. Those who consented to participate completed the baseline survey during the fall or spring of their freshman year and were invited to complete follow-up surveys every spring thereafter until graduating. Cohort five was excluded from the present study to ensure that all participants had at least one follow-up assessment. Participants from the first four cohorts were eligible to be included in the analytic sample if they completed surveys at baseline and at least one follow-up assessment ($n = 7,305$).

Measures

Interpersonal trauma exposure. IPT exposure was measured as participants' self-reported exposure to potentially traumatic events, assessed via the following items from the abbreviated Life Events Checklist (Gray, Litz, Hsu, & Lombardo, 2004): physical assault, sexual assault, and other unwanted or uncomfortable sexual experiences. Participants were assessed for precollege trauma exposure at baseline and for college-onset trauma at each follow-up.

IPT was coded dichotomously. Participants were coded as having precollege IPT (1) if they endorsed experiencing any potentially traumatic interpersonal events "before the past 12 months," "during the past 12 months," or "before starting college" at baseline (Berenz et al., 2016a; Hawn et al., 2018; Overstreet et al., 2017). Those who did not experience any of the

potentially traumatic events were coded as not having precollege IPT (0). Participants were

coded as having college-onset IPT (1) if they endorsed experiencing any potentially traumatic

events "since starting college" during the spring of their freshman year, or "in the last 12

months" at any subsequent follow-ups (i.e., years two through four; Berenz et al., 2016a; Hawn

et al., 2018; Overstreet et al., 2017). Those who did not experience any of the potentially

traumatic events during follow-up were coded as not having college-onset IPT (0).

Relationship status. At each follow-up, participants described their current relationship

status by selecting one of the following: "not dating," "dating several people," "dating one

person exclusively," "engaged," "married," or "married but separated." Relationship status was

collapsed into two categories: in a committed relationship (1) and not in a committed relationship

(0). Participants who identified as dating one person exclusively, being engaged, or being

married were coded as being in a committed relationship. Those who identified as not dating,

dating several people, and married but separated were coded as not in a committed relationship.

Relationship satisfaction. Relationship satisfaction was measured via three items from

the Relationship Assessment Scale (Hendrick, Dicke, & Hendrick, 1998) at each follow-up.

Participants in a committed relationship for three months or longer at the time of assessment

reported on their general relationship satisfaction, how well their partner meets their needs, and

how good their relationship is compared to most. Response options ranged from "not at all" (0)

to "a lot/very much" (100) and were presented on a slider scale that participants could move to

indicate their response. Responses were averaged across all three items and transformed to a one

to seven scale to be consistent with the original measure. Higher scores indicated higher relationship satisfaction.

Partner substance use. At each follow-up, participants in a committed relationship for three months or longer at the time of assessment reported how often they perceived their partner engaged in each of the following three behaviors: drinks alcohol, has a problem with alcohol (like hangovers, fights, accidents), and smokes cigarettes. Participants responded to each of the four stems using a Likert-type scale ranging from "never" (1) to "every day" (5). A composite score for partner substance use was created from the sum of the endorsed items, with higher totals indicating higher levels of partner substance use (Kendler, Jacobson, Myers, & Eaves, 2008).

Alcohol use. Alcohol use was calculated as an approximation of the grams of ethanol consumed per month based on participants' self-reported quantity and frequency of drinking (Salvatore et al., 2016). For the first cohort's baseline assessment, grams of alcohol consumed was calculated by multiplying the frequency and quantity of alcohol use by 14 (i.e., Frequency x Quantity x 14), as one standard drink contains 14 grams of pure alcohol. Participants indicated their frequency of alcohol use by responding to the alcohol frequency item, "During the past 30 days, on how many days did you drink one or more drinks of an alcohol beverage?" with one day interval response ranging from 0 through 30. Those who indicated they consumed zero drinks in the past 30 days were coded as zero for alcohol quantity. Participants responded to the alcohol quantity item, "On the days you drank during the last 30 days, how many drinks did you usually have each day?" with one drink interval responses ranging from 1 through 20, or "more than 20."

Those who consumed at least one day during the past 30 days but did not want to indicate or did not know how many drinks they consumed each day were coded as missing data.

For subsequent cohorts and follow-up assessments, grams of alcohol consumed was calculated by using participants' responses on their frequency and quantity of alcohol use as measured by the Alcohol Use Disorders Identification Test (AUDIT; Saunders et al., 1993). Participants indicated their frequency of alcohol use by responding to the AUDIT frequency item, "How often do you have a drink containing alcohol?" with the following ordinal response options: (a) never, (b) monthly or less, (c) 2 to 4 times a month, (d) 2 to 3 times a week, (e) four or more times a week, and (f) I choose not to answer. Responses were converted to the midpoints of the range for each option, resulting in the following corresponding range of responses: (a) 0, (b) 0.5, (c) 3, (d) 10.7, (e) 23.54, and (f) missing. Participants indicated their quantity of alcohol use by responding to the AUDIT quantity item, "How many drinks containing alcohol do you have on a typical day when you are drinking?" with the following ordinal response options: (a) 1 or 2; (b) 3 or 4; (c) 5 or 6; (d) 7, 8, or 9; (e) 10 or more; and (f) I choose not to answer. Once again, responses were converted to the midpoints of the range for each option, resulting in the following corresponding range of responses: (a) 1.5, (b) 3.5, (c) 5.5, (d) 8, (e) 15.5 (21 was used as the upper bound to match that of the first cohort), and (f) missing.

Alcohol problems. Alcohol problems was measured at baseline and each follow-up. It was assessed via 15 items adapted from the Semi-Structured Assessment for the Genetics of Alcoholism (SSAGA; Bucholz et al., 1994). Items from the SSAGA correspond to the 11 alcohol use disorder criteria based on the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5). Total symptom counts were calculated for all participants who endorsed alcohol use. Scores ranged from 0 to 11 symptoms.

Covariates. Covariates included age, race/ethnicity, time in school, and cohort. Sex was

included as a covariate when testing Aims 1 and 2, and used as a moderator when testing Aim 3.

All covariates, except time in school and cohort, were self-report items, measured at baseline.

Age was measured in years. Race/ethnicity was coded into six categories. The first four

categories reflected the four largest groups: White, African American/Black, Asian, and

Hispanic/Latino. The two remaining groups were individuals who identified as any other

race/ethnicity and as more than one race/ethnicity. Participants who reported their race/ethnicity

as unknown or chose not to answer were coded as missing. Sex was coded as male (0) or female

(1). Because of the longitudinal nature of the study, time in school was measured in years to

correspond to each year in college at which participants were assessed. Finally, cohort

corresponded to the year in which participants were recruited.

Data Analysis Plan

Preliminary analyses and descriptive statistics. Prior to data analysis, study hypotheses

were preregistered on the Open Science Framework at https://osf.io/7t5mf. By preregistering

hypotheses, the risk of false positives is minimized and the standard p-value threshold (i.e., $p <$

.05) retains its diagnostic value (Center for Open Science, 2018), thereby assuaging concerns

regarding multiple testing. (Of note, post-hoc examination of findings relative to a more stringent

p-value threshold was conducted. Three different relationship domains were examined in the

present study; thus, a Bonferroni correction was calculated by dividing the $p < .05$ threshold by

three to obtain a corrected alpha level of $p < .017$. The majority of findings across all aims were

still significant at this conservative threshold.)

All variables were examined to ensure they met the appropriate assumptions and to

identify any outliers. Means, standard deviations, skewness, and kurtosis were calculated on the

cross-sectional data for all continuous variables, as well as frequency distributions for all categorical variables. Alcohol use and alcohol problems were log-transformed after adding a constant of one to adjust for positive skew and to retain participants who consumed zero grams of ethanol or endorsed no problems with alcohol. Finally, zero-order correlations were run on the long data to characterize the associations between all key study variables.

Aim 1 analysis plan - Characterizing the associations between trauma and relationship dimensions. To address this aim, a series of longitudinal models was run to examine 1) whether precollege IPT predicted relationship status, relationship satisfaction, and partner substance use; and 2) whether college-onset IPT had lagged or concurrent associations with those relationship dimensions. Figure 1 represents the conceptual model for this aim. Although represented as one single model in this figure, a parallel series of models was run for each relationship dimension (relationship status, relationship satisfaction, partner substance use) because each dimension represents a unique construct. The pathway denoted by subscript a represents the effect of precollege IPT on each relationship dimension. The pathway denoted by subscript b represents the lagged associations between college-onset IPT and each relationship dimension. Finally, the pathway denoted by subscript c represents the concurrent associations between college-onset IPT and each relationship dimension when controlling for effects of lagged IPT. College-onset IPT and all three relationship dimensions were treated as time-varying variables in these analyses, while precollege IPT was a time-invariant variable. Cohort, age, race/ethnicity, and sex were included as time-invariant covariates, and time in school was included as a time-varying covariate in these analyses.

Because of the dichotomous nature of relationship status, a generalized estimating equation (GEE) model was used for the first analysis of Aim 1, the goal of which was to examine

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the associations between IPT exposure and relationship status. GEE modeling represents an alternative method to maximum likelihood estimation that does not rely on the assumption of a normal joint distribution of data (Fitzmaurice, Laird, & Ware, 2011). This lack of assumption of a normal distribution makes GEE modeling a suitable method for examining dichotomous outcomes in longitudinal data. Importantly, GEE models are based on the assumption that missing data is missing at random (Fitzmaurice et al., 2011). Because this assumption was not met (see Representativeness Analyses below), this analysis was limited to only those cases with complete data on all variables that were included in this model.

For the GEE model run as part of Aim 1, effect sizes are reported as odds ratios (ORs) converted to percentages. ORs greater than one were interpreted as evidence of increased likelihood of being in a relationship, transformed into a percentage by (OR – 1) x 100. ORs less than one were interpreted as evidence of decreased likelihood of being in a relationship, transformed into a percentage by (1 – OR) x 100. All other analyses for this aim were conducted using a linear mixed modeling approach. For the linear mixed models, effect sizes for the unique variance accounted for by predictors and interaction terms are represented by marginal R_2 (also referred to as ΔR_2). This was calculated by subtracting the R_2 of the model without the parameter of interest from the R_2 of the overall model with all variables included.

Aim 2 analysis plan – Examining whether relationship dimensions moderate the associations between trauma and alcohol outcomes. To address this aim, a series of linear mixed models was run to examine whether relationship status, relationship satisfaction, and partner substance use moderated the associations between IPT exposure and alcohol use and alcohol problems. Figure 2 represents the conceptual model for this aim. Although represented as one single model in this figure, a parallel series of six models were run, with one model for each

relationship dimension (relationship status, relationship satisfaction, partner substance use) and for each alcohol outcome (alcohol use, alcohol problems). Each relationship dimension and each alcohol outcome were examined in separate models because each dimension and outcome represent a unique construct.

In Figure 2, the pathway denoted by subscript *a* represents the two-way interaction between each relationship dimension and precollege IPT in predicting each alcohol outcome. The pathway denoted by subscript *b* represents the two-way interaction between each relationship dimension and college-onset IPT in predicting each alcohol outcome. College-onset IPT, all three relationship dimensions, and both alcohol outcomes were treated as time-varying variables in these analyses, while precollege IPT was a time-invariant variable. Cohort, age, race/ethnicity, and sex were included as time-invariant covariates, and time in school was included as a time-varying covariate in these analyses.

As the goal of this aim was to examine the moderating effect of relationship dimensions on the associations between IPT exposure and alcohol outcomes, the parameters of interest are the two-way interactions between trauma exposure and each relationship dimension. The main effects of each relationship dimension and IPT exposure as predictors of each alcohol outcome were examined first. Next, the two-way interactions between each relationship dimension and IPT exposure were added to their respective models. Effect sizes for the unique variance accounted for by predictors and interaction terms are represented by the marginal R_2. This was calculated in the same manner described above.

Aim 3 analysis plan – Examining sex differences. The goal of this aim was to investigate whether the first two aims differed as a function of sex. Each aim was examined separately. First, for Aim 3.1, a series of longitudinal models was run to examine 1) whether

precollege IPT exposure predicted relationship status, relationship satisfaction, and partner substance use in a sex-specific manner, and 2) whether college-onset IPT had sex-specific lagged or concurrent associations with these relationship dimensions. Figure 3 represents the conceptual model for this aim. Although represented as one single model in this figure, a parallel series of models was run for each relationship dimension (relationship status, relationship satisfaction, partner substance use).

In Figure 3, the pathway denoted by subscript *a* represents the two-way interaction between sex and precollege IPT predicting each relationship dimension. The pathway denoted by subscript *b* represents the two-way interaction between sex and lagged college-onset IPT to predict each relationship dimension. Finally, subscript *c* represents the pathway examining the effects of the two-way interaction between sex and college-onset IPT on each relationship dimension when controlling for the effects of lagged college-onset IPT. College-onset IPT and all three relationship dimensions were treated as time-varying variables in these analyses, while sex and precollege IPT were treated as time-invariant variables. Cohort, age, and race/ethnicity were included as time-invariant covariates, and time in school was included as a time-varying covariate in these analyses.

Because of the dichotomous nature of relationship status, a GEE model was used for the first analysis of Aim 3.1, which focused on whether the associations between trauma exposure and relationship status differed in a sex-specific manner. As with the previous GEE model, this analysis was limited to only those cases with complete data on all variables included in this model. For this GEE model, effect sizes are reported as ORs converted to percentages in the same manner described above. All other analyses for this aim were conducted using a linear mixed modeling approach. For the linear mixed models, effect sizes for the unique variance

accounted for by predictors and interaction terms are represented by marginal R^2, calculated in the same manner described above. As the focus of this aim was to examine whether the associations between trauma exposure and relationship dimensions varied in a sex-specific manner, the parameters of interest are the two-way interactions between sex and trauma exposure. The main effects of all predictors and covariates are identical to those observed in Aim 1.

Next, for Aim 3.2, a series of linear mixed models was run to examine whether relationship status, relationship satisfaction, and partner substance use moderated the associations between trauma exposure and alcohol outcomes in a sex-specific manner. Figure 4 represents the conceptual model for this aim. A parallel series of six models were run, with a separate model for each relationship dimension (relationship status, relationship satisfaction, partner substance use) and for each alcohol outcome (alcohol use, alcohol problems). In Figure 4, the pathway denoted by subscript a represents the three-way interaction between sex, each relationship dimension, and precollege IPT in predicting each alcohol outcome. The pathway denoted by subscript b represents the three-way interaction between sex, each relationship dimension, and college-onset IPT in predicting each alcohol outcome. College-onset IPT, all three relationship dimensions, and both alcohol outcomes were treated as time-varying variables in these analyses, while sex and precollege IPT were treated as time-invariant variables. Cohort, age, and race/ethnicity were included as time-invariant covariates, and time in school was included as a time-varying covariate in these analyses.

As the goal of this aim was to examine sex-specific differences in the interplay between trauma exposure, relationship dimensions, and alcohol outcomes, the parameters of interest are the three-way interactions between sex, IPT exposure, and each relationship dimension. The

main effects of all variables and the two-way interactions between trauma and each relationship dimension are identical to those observed in Aim 2. Effect sizes for the unique variance accounted for by predictors and interaction terms are represented by marginal R_2. This was calculated in the same manner described above.

Results

Preliminary Analyses and Descriptive Statistics

The first four cohorts of the Spit for Science sample included 9,911 individuals, of whom 60.9% identified as female and 38.1% identified as male (1.0% did not provide sex information). Approximately half (49.2%) of participants self-identified as White, followed by 18.9% who identified as African American/Black, 16.3% as Asian, 6.2% as more than one race, 6.0% as Hispanic/Latino, 1.2% as another race/ethnicity, and 2.3% did not provide race/ethnicity information. The average age of participants at baseline was 18.5 years ($SD = .43$). Table 1 contains means and standard deviations for all continuous variables, as well as frequencies and percentages for all categorical variables. Less than half of all respondents were in a relationship at each assessment, but the percentage of students in relationships increased between freshman and senior year (39.4% to 47.0%). Approximately 38.2% of respondents reported a history of precollege IPT. The percentage of respondents who reported college-onset IPT at each assessment ranged from 17.7% to 20.7%.

The correlations shown below were calculated using longitudinal data. Being in a relationship, relative to being single, was associated with higher alcohol use ($r = .05, p < .001$) but fewer alcohol problems ($r = -.07, p < .001$). Higher relationship satisfaction was associated with lower alcohol use ($r = -.07, p < .001$) and fewer problems ($r = -.13, p < .001$). In contrast, higher partner substance use was associated with both higher alcohol use ($r = .42, p < .001$) and

greater problems ($r = .32$, $p < .001$). Exposure to both precollege IPT and college-onset IPT were correlated with higher alcohol use (precollege: $r = .09$, $p < .001$; college-onset: $r = .14$, $p < .001$) and greater alcohol problems (precollege: $r = .15$, $p < .001$; college-onset: $r = .21$, $p < .001$).

Representativeness Analyses

The analytic subsample was derived from the full Spit for Science sample. A series of representativeness analyses was conducted to examine whether the analytic subsample differed systematically from the overall sample ($n = 9,911$) in terms the variables identified below. Demographic variables (i.e., age, sex, race/ethnicity) were measured at baseline, and all other variables were measured during spring of freshman year. As the study aims made use of different subsets of the data, two subsamples were defined for this purpose.

The first subsample included individuals who were part of the analyses focused on relationship status as an outcome of IPT exposure and as a moderator of the association between IPT and alcohol outcomes ($n = 5,673$). This subsample was compared to the full Spit for Science sample in terms of age, sex, race/ethnicity, precollege IPT, college-onset IPT, relationship status, alcohol use, and alcohol problems. Based on a series of t-tests and chi-square tests comparing the full sample to this subsample, several differences, each of small effect (measured via Cohen's d), emerged. The subsample was slightly younger ($t(13000) = 2.3$, $M_{\text{diff}} = -0.02$, $p = .020$, Cohen's $d = .04$) and was comprised of more females than the full sample (64.6% versus 60.9%, $\chi^2(1) = 54.00$, $p < .001$, Cohen's $d = .15$). There were also more participants in the subsample who reported precollege IPT (59.4% versus 29.2%, $\chi^2(1) = 8.6$, $p = .003$, Cohen's $d = .06$) and college-onset IPT during their freshman year (19.1% versus 14.0%, $\chi^2(1) = 60.0$, $p < .001$, Cohen's $d = .16$) compared to the full sample. Finally, there were more participants in the subsample who were in a relationship than in the full sample (35.9% versus 22.1%, $\chi^2(1) = 5.90$,

$p = .010$, Cohen's $d = .05$). In contrast, there were no differences in race/ethnicity ($\chi_2(5) = 5.4$, $p = .400$), alcohol use ($t(11000) = 0.29$, $p = .800$), or alcohol problems ($t(5881) = 0.08$, $p = .900$) between the full Spit for Science sample and the first subsample.

The second subsample included those who were part of the analyses focused on relationship satisfaction and partner substance use as consequences of IPT exposure and as moderators of the association between IPT and alcohol outcomes. This subsample was limited to those individuals who were in a relationship at one or more assessments and were thus eligible to answer questions about their relationships ($n = 3,193$). This subsample was compared to the full Spit for Science sample in terms of age, sex, race/ethnicity, precollege IPT, college-onset IPT, alcohol use, and alcohol problems. Based on a series of t-tests and chi-square tests comparing the full sample to this subsample, several differences of small effect emerged. The subsample was comprised of more females (69.6% versus 60.9%, χ_2 (1) $= 130.0$, $p < .001$, Cohen's $d = .23$) and more White students than the full sample (53.6% versus 49.3%, χ_2 (5) $= 34.0$, $p < .001$, Cohen's $d = .12$). The subsample was more likely than the full sample to report precollege IPT (39.8% versus 29.2%, $\chi_2(1) = 6.0$, $p = .010$, Cohen's $d = .05$) and college-onset IPT during freshman year (20.1% versus 14.0%, $\chi_2(1) = 32.0$, $p < .001$, Cohen's $d = .11$). There were no differences in age ($t(5800) = 1.7$, $p = .100$)), alcohol use ($t(5500) = -1.4$, $p = .200$), or alcohol problems ($t(3683) = 2.0$, $p = .080$) between the full Spit for Science sample and the second subsample.

Aim 1 Analyses – Characterizing the Associations between Trauma and Relationship Dimensions

The goal of this aim was to examine whether precollege IPT exposure predicted relationship status, relationship satisfaction, and partner substance use, and whether college-onset IPT had lagged or concurrent associations with these relationship dimensions. Each

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relationship dimension was examined separately in a series of parallel models. Table 2 contains

the ORs and confidence intervals (CIs) for the associations between IPT exposure (precollege,

lagged college-onset, and concurrent college-onset) and relationship status, as well as the

standardized beta weights and CIs for the associations between trauma exposure and both

relationship satisfaction and partner substance use. The main effects of all covariates were

examined first, followed by the main effects of IPT exposure on each relationship dimension, the

parameters of interest for this aim.

Results of the full GEE model, including all covariates, are presented in Table 2, block 1.

A description of how ORs were transformed to percentages is outlined above (see Data Analysis

Plan). Individuals were 10% more likely to be in a relationship in later years of college compared

to earlier years. Females, relative to males, were 46% more likely to be in a relationship.

Compared to individuals who identified as White, African American/Blacks were 42% less

likely to be in a relationship, and Asians were 35% less likely to be in a relationship. IPT

exposure emerged as a significant main effect. Individuals who reported precollege IPT were

approximately 39% (OR = 1.39; 95% CI [1.13, 1.70]) more likely to be in a relationship during

college compared to those without a history of precollege IPT. In contrast, individuals who

experienced college-onset IPT were 27% (OR = 0.73; 95% CI [0.60, 0.89]) less likely to be in a

relationship than those without college-onset IPT, when controlling for the effects of lagged IPT.

Finally, there was not a significant effect of lagged college-onset IPT on relationship status,

meaning that experiencing college-onset IPT was not associated with individuals' relationship

status the following year.

Table 2, block 2 contains the results from the linear mixed model focused on the

associations between IPT exposure and relationship satisfaction, controlling for all covariates.

Relative to those in the first cohort, individuals in cohorts two through four reported lower relationship satisfaction. Those who identified as African American/Black reported lower relationship satisfaction compared to their White counterparts. IPT exposure emerged as a significant main effect. Individuals exposed to precollege IPT reported lower relationship satisfaction compared to those without IPT exposure, with precollege IPT accounting for 0.81% of the variance in relationship satisfaction. Individuals exposed to college-onset IPT reported lower relationship satisfaction than those without college-onset IPT, accounting for 1.17% of the variance in relationship satisfaction. Furthermore, there was a lagged effect of college-onset IPT, such that those with college-onset IPT (compared to those without) reported lower relationship satisfaction the following year. Lagged college-onset IPT accounted for 0.98% of the variance in relationship satisfaction.

Results of the final linear mixed model focused on the associations between IPT exposure and partner substance use, as well as all covariates, are presented in Table 2, block 3. Individuals reported higher partner substance use in later years of college compared to earlier years, and females (relative to males) reported higher partner substance use. In contrast, those who identified as African American/Black and Asian reported lower partner substance use than Whites. IPT exposure emerged as a significant main effect. Individuals exposed to precollege IPT reported higher partner substance use compared to those without a history of precollege IPT, accounting for 0.54% of the variance in partner substance use. Individuals with college-onset IPT reported higher partner substance use compared to those without college-onset IPT, accounting for 1.45% of the variance in partner substance use. There was also a lagged effect of college-onset IPT, such that those with college-onset IPT (compared to those without) reported

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higher partner substance use the following year. Lagged college-onset IPT accounted for 0.33% of the variance in partner substance use.

Aim 2 Analyses – Examining whether Relationship Dimensions Moderate the Associations between Trauma and Alcohol Outcomes

  Alcohol use. The goal of this aim was to examine whether relationship status, relationship satisfaction, and partner substance use moderated the associations between precollege IPT and college-onset IPT and alcohol use. A series of parallel linear mixed models was run for each relationship dimension. All models controlled for time in school, cohort, race/ethnicity, sex, and age. The main effects of all covariates, IPT exposure, and each relationship dimension on alcohol use were examined first and are summarized in Table 3A. This table contains three blocks of columns, each representing a model examining the main effects of a different relationship dimension on alcohol use. The two-way interactions between IPT and each relationship dimension, the parameters of interest for this aim, were added to their respective models and examined next, summarized in Table 3B. This table contains three blocks of columns, with each block representing a model examining the moderating effect of a different relationship dimension on the associations between IPT and alcohol use. For Tables 3A and 3B, the variables listed along the top of the table under each block correspond to the relationship dimension included in that model. Each block of columns displays the standardized beta weights and CIs for the variables included in the model.

  Table 3A, block 1 contains the results of the linear mixed model examining the main effects of all covariates, IPT exposure, and relationship status on alcohol use. Individuals reported higher alcohol use in later years of college compared to earlier years. Those in cohorts two through four (relative to the first cohort) reported higher alcohol use. Compared to males,

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females reported lower alcohol use, and relative to their White counterparts, individuals who identified as African American/Black, Asian, Hispanic/Latino, and more than one race consumed less alcohol. There were also significant main effects of IPT exposure and relationship status. Individuals exposed to precollege and college-onset IPT, relative to those with no IPT history, reported higher alcohol use. Individuals in relationships reported lower alcohol use than those who were single. The results of the linear mixed model examining relationship status as a moderator of the associations between IPT exposure and alcohol use are presented in Table 3B, block 1. Relationship status significantly moderated the association between precollege IPT and alcohol use, accounting for approximately 0.10% of the variance in alcohol use. Individuals exposed to precollege IPT reported higher alcohol use than those not exposed to precollege IPT, but this effect was mitigated among those in relationships (see Figure 5).

Table 3A, block 2 contains the results of the linear mixed model examining the main effects of all covariates, IPT exposure, and relationship satisfaction on alcohol use. Individuals reported higher alcohol use in later years of college compared to earlier years. Females reported lower alcohol use than males. Those who identified as African American/Black and Asian reported lower alcohol use than their White counterparts. IPT exposure and relationship satisfaction also emerged as significant main effects. Individuals exposed to precollege and college-onset IPT, relative to those with no IPT history, reported higher alcohol use. Individuals who endorsed higher relationship satisfaction reported lower alcohol use than those with lower relationship satisfaction. Table 3B, block 2 summarizes the results of the linear mixed model examining relationship satisfaction as a moderator of the associations between IPT and alcohol use. Relationship satisfaction did not significantly moderate the associations between IPT (precollege or college-onset) and alcohol use, evidenced by ps > .05 and CIs that included zero.

Finally, results of the linear mixed model examining the main effects of all covariates, IPT exposure, and partner substance use on alcohol use are presented in Table 3A, block 3. Individuals reported higher alcohol use in later years of college relative to earlier years. Those in cohorts three and four (relative to the first cohort) reported higher alcohol use, and females reported lower alcohol use than males. Relative to their White counterparts, individuals who identified as African American/Black and Asian reported lower alcohol use. College-onset IPT and partner substance use emerged as significant main effects. Individuals with college-onset IPT (relative to those without) and those with higher partner substance use (compared to lower partner substance use) reported higher alcohol use. Lastly, the results of the linear mixed model examining partner substance use as a moderator of the associations between IPT and alcohol use are presented in Table 3B, block 3. Partner substance use moderated the association between college-onset IPT and alcohol use, accounting for 0.10% of the variance in alcohol use. Individuals with college-onset IPT consumed more alcohol compared to those without college-onset IPT, and this effect was more pronounced among those who reported higher partner substance use (see Figure 6).

Alcohol problems. A parallel series of separate linear mixed models was run to examine whether relationship status, relationship satisfaction, and partner substance use moderated the associations between IPT exposure and alcohol problems. As with previous analyses, separate models were run for each relationship dimension. All models controlled for time in school, cohort, race/ethnicity, sex, and age. The main effects of all covariates, IPT exposure, and each relationship dimension on alcohol problems were examined first, summarized in Table 4A. This table contains three blocks of columns, each representing a model examining the main effects of a different relationship dimension on alcohol problems. The two-way interactions between IPT

and each relationship dimension, the parameters of interest for this aim, were added to their respective models and examined next, summarized in Table 4B. This table also contains three blocks of columns, with each block representing a model examining the moderating effect of a different relationship dimension on the associations between IPT and alcohol problems. For Tables 4A and 4B, the variables listed along the top of the table under each block correspond to the relationship dimension included in that model. Each block of columns displays the standardized beta weights and CIs for the variables included in the model.

Table 4A, block 1 contains the results of the linear mixed model examining the main effects of all covariates, IPT exposure, and relationship status on alcohol problems. Individuals reported greater alcohol problems during later years of college compared to earlier years, and females reported fewer alcohol problems than males. Relative to their White counterparts, individuals who identified as African American/Black and Asian endorsed fewer alcohol problems. IPT exposure and relationship status emerged as significant main effects. Individuals with a history of precollege IPT and college-onset IPT reported greater alcohol problems than those without a history of IPT. Individuals in relationships reported fewer alcohol problems than those who were single. The results of the linear mixed model examining relationship status as a moderator of the associations between IPT and alcohol problems are summarized in Table 4B, block 1. Relationship status did not significantly moderate the associations between IPT (precollege or college-onset) and alcohol problems, indicated by ps > .05 and CIs that included zero.

The results of the linear mixed model examining the main effects of all covariates, IPT exposure, and relationship satisfaction on alcohol problems are shown in Table 4A, block 2. Individuals reported greater alcohol problems during later years of college compared to earlier

years. Females (relative to males) and those who identified as African American/Black (relative to White) reported fewer alcohol problems. IPT exposure and relationship satisfaction emerged as significant main effects. Individuals with a history of precollege IPT and college-onset IPT reported greater alcohol problems than those without a history of IPT. Those who endorsed higher relationship satisfaction reported fewer alcohol problems than those with lower relationship satisfaction. Table 4B, block 2 contains the results of the linear mixed model examining relationship satisfaction as a moderator of the associations between IPT and alcohol problems. As evidenced by ps > .05 and CIs that included zero, relationship satisfaction did not moderate the associations between IPT and alcohol problems.

Finally, Table 4A, block 3 shows the results of the linear mixed model examining the main effects of all covariates, IPT exposure, and partner substance use on alcohol problems. Individuals reported greater alcohol problems during later years of college compared to earlier years, and females reported fewer alcohol problems than males. IPT exposure and partner substance use emerged as significant main effects. Individuals with a history of precollege IPT and college-onset IPT reported greater alcohol problems than those without a history of IPT. Those who reported higher partner substance use also reported greater alcohol problems compared to those with lower partner substance use. The results of the linear mixed model examining partner substance use as a moderator of the associations between IPT and alcohol problems are presented in Table 4B, block 3. Partner substance use did not moderate the associations between IPT and alcohol problems, indicated by ps > .05 and CIs that included zero.

Aim 3 Analyses – Examining Sex Differences

       Aim 3.1 – Sex differences in the associations between trauma and relationship dimensions. The goal of this aim was to examine whether precollege IPT exposure predicted

relationship status, relationship satisfaction, and partner substance use in a sex-specific manner, and whether college-onset IPT had sex-specific lagged or concurrent associations with these relationship dimensions. Covariates included time in school, cohort, race/ethnicity, and age. Each relationship dimension was examined in a separate model parallel to those run for Aim 1, except these models included sex as a moderator instead of as a covariate. Because the main effects of covariates and IPT exposure on relationship dimensions are the same as those described above in Aim 1 (also see Table 2), only the two-way interactions between sex and IPT exposure, which are the parameters of interest for this aim, are interpreted below.

Table 5 displays the results of the GEE and linear mixed models examining the associations between sex, IPT exposure (precollege, lagged college-onset, and concurrent college-onset), each relationship dimension, and the two-way interactions between sex and IPT exposure. There are three blocks of columns in Table 5, each representing a model examining the moderating effect of sex on the associations between IPT exposure and a different relationship dimension. Block 1 contains the ORs and CIs from the model examining sex, IPT, and relationship status; block 2 contains the standardized beta weights and CIs from the model examining sex, IPT, and relationship satisfaction; and block 3 contains the standardized beta weights and CIs from the model examining sex, IPT, and partner substance use. None of the two-way interactions between sex and IPT exposure (precollege, lagged college-onset, and concurrent college-onset) to predict relationship dimensions (relationship status, relationship satisfaction, or partner substance) were significant, as evidenced by ps > .05 and CIs that included zero. Thus, the associations between IPT and relationship dimensions did not vary in a sex-specific manner.

Aim 3.2 – Sex differences in relationship dimensions as moderators of the associations between trauma and alcohol outcomes. The goal of this aim was to examine whether relationship status, relationship satisfaction, and partner substance use moderated the associations between IPT and alcohol use and alcohol problems in a sex-specific manner. Covariates included time in school, cohort, race/ethnicity, and age. Each relationship dimension and each outcome was examined in a separate model parallel to those run for Aim 2, except these models included sex as a moderator instead of as a covariate. The main effects of covariates and predictors, as well as the two-way interactions between IPT exposure and each relationship dimension, on the respective alcohol outcome are the same as those described above in Aim 2 (also see Tables 3A/3B for alcohol use and Tables 4A/4B for alcohol problems). Therefore, only the three-way interactions between sex, IPT exposure, and each relationship dimension, which are the parameters of interest for this aim, are interpreted below.

Results of the linear mixed models examining the three-way interactions between sex, IPT exposure, and each relationship dimension are presented in Table 6 for alcohol use and Table 7 for alcohol problems. There are three blocks of columns in the tables, each representing a model examining the moderating effect of a different relationship dimension on the associations between IPT and the respective alcohol outcome. The variables listed along the top of the table under each block correspond to the relationship dimension included as the moderator in that model. In both tables, block 1 contains the results from the model examining relationship status; block 2 contains the results from the model examining relationship satisfaction; and block 3 contains the results from the model examining partner substance use. Each block of columns displays the standardized beta weights and CIs for the variables included in the model. None of the three-way interactions between sex, IPT exposure (precollege, lagged college-onset, and

concurrent college-onset), and relationship dimensions (relationship status, relationship satisfaction, and partner substance) to predict alcohol use or alcohol problems were significant, as evidenced by ps > .05 and CIs that included zero. Thus, none of the relationship dimensions moderated the associations between IPT and alcohol use or problems in a sex-specific manner.

Sensitivity Analyses

Although IPT exposure is linked to increased distress and alcohol use (Begle et al., 2011; Berenz et al., 2016a; Berenz et al., 2016b; Breslau, 2009; Keyes et al., 2011; Overstreet et al., 2017), not all individuals who experience IPT are adversely affected (Keyes et al., 2011; Stewart, 1996). This suggests that it is important to consider individuals' responses to traumatic events. One indicator of the impact of the traumatic event on an individual is whether he or she endorses PTSD symptoms. PTSD symptoms, as measured by the DSM-5, include reexperiencing the traumatic event, avoidance of trauma-related stimuli, negative alterations in cognitions and or mood, and increased physiological arousal (Weathers et al., 2013).

In order to account for the effect of PTSD, probable PTSD diagnosis was examined. Participants in cohorts two through four who endorsed a history of trauma were administered four items from the Primary Care PTSD Screen (PC-PTSD; Prins et al., 2003). Participants in the present study were categorized as having probable PTSD (1), as defined by DSM-IV, at each follow-up assessment if they endorsed three or more symptoms on the PC-PTSD. Participants were coded as having no PTSD (0) if they endorsed fewer than three symptoms. Participants were coded as missing if they met any of the following criteria: 1) were missing data on all four items of the PC-PTSD (i.e., participants in cohorts one and earlier waves of cohorts two-three); or 2) did not endorse any history of trauma, regardless of type.

Across all assessments, a cumulative total of 514 individuals met criteria for a probable

diagnosis of PTSD (1,287 did not meet the criteria for PTSD). All inferential analyses were

reanalyzed including probable PTSD as a covariate to statistically control for variance

attributable to PTSD. Because of the dichotomous nature of relationship status, the effects of

concurrent and lagged college-onset IPT on relationship status (Aim 1) and whether those effects

varied in a sex-specific manner (Aim 3.1) were examined using GEE models. As with previous

GEE models, these analyses were limited to only those cases with complete data on all variables

included in the model. After limiting analyses to cases with complete data, observed cell sizes

for the other race/ethnicity category were extremely small ($n < 5$), which resulted in inflated and

biased ORs (e.g., OR = 9.72 x 10_{16}; Devika, Jeyaseelan, & Sebastian, 2016; Nemes, Jonasson,

Genell, & Steineck, 2009). Thus, the other race/ethnicity and more than one race/ethnicity

categories were combined in sensitivity analyses using GEE models.

As the purpose of these analyses was to examine whether the pattern of effects changed

when controlling for PTSD, the sensitivity analyses for each aim are described below as they

contrast to the primary analyses in which PTSD was not included as a covariate (henceforth

referred to as the primary analyses). For each aim, any differences in the effects of the

parameters of interest between the sensitivity analyses and the primary analyses are reported

first, followed by the main effects of PTSD. The effects of all other covariates and predictors are

described above in the respective primary analyses sections. Effect sizes for the unique variance

accounted for by predictors and interaction terms are represented by marginal R_2. This was

calculated in the same manner described above.

Sensitivity analyses for Aim 1 – Characterizing the associations between trauma and

relationship dimensions. Table 8 contains the results of the sensitivity analyses examining the

effects of IPT exposure on each relationship dimension (Aim 1). In this table, block 1 contains the results from the model examining relationship status; block 2 contains the results from the model examining relationship satisfaction; and block 3 contains the results from the model examining partner substance use. In addition to controlling for probable PTSD diagnosis, each of the three models also controlled for time in school, cohort, race/ethnicity, sex, and age. In contrast to the primary analyses (see Table 2), the associations between precollege and college-onset IPT and relationship status became non-significant (see Table 8, block 1). The concurrent and lagged associations between college-onset IPT and relationship satisfaction also became non-significant (see Table 8, block 2). Lastly, the association between precollege and college-onset IPT and partner substance use became non-significant (see Table 8, block 3). The effects of all other covariates and predictors are described above (see Aim 1 analyses and Table 2). No other differences in the effect of IPT exposure on relationship dimensions emerged between the sensitivity and primary analyses.

Sensitivity analyses for Aim 2 – Examining whether relationship dimensions moderate the associations between trauma and alcohol outcomes. Results of the sensitivity analyses examining the main effects of all covariates, IPT exposure, and each relationship dimension on alcohol use are summarized in Table 9A, and the two-way interactions between IPT and each relationship dimension to predict alcohol use are summarized in Table 9B. Likewise, Table 10A contains the results of the sensitivity analyses examining the main effects of all covariates, IPT exposure, and each relationship dimension on alcohol problems, and Table 10B contains the results of the two-way interactions between IPT and each relationship dimension to predict alcohol problems. The variables listed along the top of the tables under each block correspond to the relationship dimension included in that model. In all tables, block 1

contains the results from the models examining relationship status; block 2 contains the results from the models examining relationship satisfaction; and block 3 contains the results from the models examining partner substance use. Each relationship dimension and each alcohol outcome was examined in a separate model. All models controlled for time in school, cohort, race/ethnicity, sex, age, and probable PTSD diagnosis.

In contrast to the primary analyses (see Table 3B, block 1), relationship status was not a significant moderator of the association between precollege IPT and alcohol use (see Table 9B, block 1). Further, partner substance use was not a significant moderator of the association between college-onset IPT and alcohol use (see Table 9B, block 3). Probable PTSD was not significantly associated with alcohol use. The effects of all other covariates and predictors are described above (see Aim 2 analyses and Tables 3A/3B). Turning to alcohol problems, there were no differences in the moderating effects of relationship dimensions on the associations between IPT and alcohol problems between the sensitivity and primary analyses. Probable PTSD was not significantly associated with alcohol problems.

Sensitivity analyses for Aim 3 – Examining sex differences. Table 11 contains the sensitivity analyses examining the sex-specific effects of IPT exposure on each relationship dimension (Aim 3.1). In this table, block 1 contains the results from the model examining relationship status. Block 2 contains the results from the model examining relationship satisfaction. Block 3 contains the results from the model examining partner substance use. These analyses included time in school, cohort, race/ethnicity, age, and probable PTSD as covariates. Each relationship dimension was examined in a separate model parallel to those run for the sensitivity analyses for Aim 1, except these models included sex as a moderator instead of as a

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covariate. There were no differences in the sex-specific influence of IPT on relationship

dimensions between the sensitivity and primary analyses (see Table 5).

Finally, results of the sensitivity analyses examining the moderating effects of each

relationship dimension on the associations between IPT and alcohol use and alcohol problems in

a sex-specific manner are presented in Tables 12 and 13, respectively (Aim 3.2). The variables

listed along the top of the tables under each block correspond to the relationship dimension

included as the moderator in that model. In both tables, block 1 contains the results from the

models examining relationship status; block 2 contains the results from the models examining

relationship satisfaction; and block 3 contains the results from the models examining partner

substance use. These analyses included time in school, cohort, race/ethnicity, age, and probable

PTSD as covariates. Each relationship dimension and each alcohol outcome was examined in a

separate model parallel to those run for sensitivity analyses for Aim 2, except these models

included sex as a moderator instead of as a covariate.

In contrast to the primary analyses in which there was no variation as a function of sex

(see Table 6), relationship satisfaction moderated the association between college-onset IPT and

alcohol use in a sex-specific manner when controlling for PTSD (see Table 12, block 2),

accounting for 2.42% of the variance in alcohol use. As illustrated in Figure 7, men exposed to

college-onset IPT consumed more alcohol than those not exposed to IPT, and this association

was stronger among men who reported higher relationship satisfaction. Women with college-

onset IPT consumed more alcohol than those without IPT, but their patterns of alcohol

consumption did not change as a function of relationship satisfaction. The main effects of

covariates and predictors, as well as the two-way interactions between IPT exposure and each

relationship dimension, on the respective alcohol outcome are the same as those described above

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in sensitivity analyses for Aim 2 (see Tables 9A/9B for alcohol use and Tables 10A/10B for alcohol problems). There were no other differences in the sex-specific effects of relationship dimensions on the associations between IPT and alcohol use or problems between the sensitivity and primary analyses.

Discussion

The present study had three aims which focused on the interplay between romantic relationships and IPT exposure on alcohol outcomes among college students. The first aim was to characterize the associations between trauma (precollege and college-onset) and relationship dimensions (relationship status, relationship satisfaction, and partner substance use). The second aim was to examine whether these relationship dimensions moderated the associations between IPT and alcohol use and alcohol problems. Finally, the third aim was to examine whether the effects from the first two aims differed as a function of sex. In a series of sensitivity analyses, inferential analyses from each of the aims were re-analyzed including probable PTSD as a covariate. A summary for each of the aims and relevant sensitivity analyses is provided below (see Table 14 for an overview of this information), followed by an integration of the findings with previous literature and a discussion of the implications.

Summary, Integration, and Implications of Findings

Aim 1 - Characterizing the associations between trauma and relationship dimensions. First, the associations between IPT and relationship status, relationship satisfaction, and partner substance use were examined. It was hypothesized that college students exposed to precollege IPT and college-onset IPT would likely be single instead of in a relationship. For precollege IPT, the opposite pattern of effects was found, such that individuals exposed to precollege IPT were more likely to be in a relationship. For college-onset IPT, there was partial

support for the hypotheses. College-onset IPT was concurrently associated with a decreased likelihood of being in a relationship, but there was no lagged effect of college-onset IPT on relationship status. In other words, individuals exposed to college-onset IPT were more likely to be single, but college-onset IPT was unrelated to individual's relationship status the following year. Next, consistent with hypotheses for those in relationships, individuals with any history of IPT (precollege, lagged college-onset, concurrent college-onset) reported lower relationship satisfaction and higher partner substance use.

Taken together, the findings from the first aim add to the body of literature to suggest that IPT exposure can influence the formation and perceptions of romantic relationships among emerging adults. The influence of IPT on perceptions of romantic relationships is consistent with previous studies conducted with adults which suggest that individuals who experienced a traumatic event become less connected, less satisfied, and more negative with their partners (Karney & Bradbury, 1995; Marshall & Kuijer, 2017; Randall & Bodenmann, 2009; Robles et al., 2014; Whisman, 2014). Additionally, previous research indicates that individuals from high-risk backgrounds, such as those with a history of trauma exposure, are more likely to choose deviant partners with higher levels of substance use (Quinton et al., 1993; Zoccolillo et al., 1992).

The observed differential pattern of effects of precollege versus college-onset IPT on the formation of romantic relationships underscores the importance of developmental timing of IPT exposure. Importantly, the finding that individuals exposed to precollege IPT were more likely to be in relationships was surprising. One speculation for this unexpected effect is that precollege IPT has several negative implications that form a cascade of downstream effects. According to extant literature, individuals exposed to precollege trauma are at increased risk of a wide range of

different adverse outcomes compared to those exposed to trauma later in life (Cloitre et al., 2009; Ogle, Rubin, & Siegler, 2013). As it pertains to outcomes relevant to the formation of romantic relationships, precollege trauma leads to long-term maladaptive changes in affective, relational, and self-regulatory functioning (Cloitre et al., 2019; van der Kolk, Roth, Pelcovitz, Sunday, & Spinazzola, 2005) and is associated with an anxious-preoccupied adult attachment style (Mickelson, Kessler, & Shaver, 1997; Riggs, Cusimano, & Benson, 2011). Thus, individuals exposed to precollege IPT may be more likely to enter into relationships because they fear being alone and depend on romantic partners to help with their own self-regulation (Riggs et al., 2011), even if the relationship is dissatisfying and involves partners with higher levels of substance use.

On the other hand, the influence of college-onset IPT on relationship formation was expected, such that individuals exposed to college-onset IPT were less likely to be in a relationship. The ways that individuals cope with stressful life events, such as IPT exposure, vary based on their appraisal of the event and the psychosocial resources available (Moos, 1992). Therefore, individuals exposed to college-onset IPT may be less likely to form romantic partnerships because they are instead focused on coping with the recent traumatic event and have fewer resources to devote to forming a relationship. This is consistent with previous research that suggests that exposure to stressful experiences may impact individuals' ability to form protective relationships in the first place (Karney & Bradbury, 1995; Marshall & Kuijer, 2017; Taft et al., 2011). Although the direction of influence between college-onset IPT and relationship status cannot be immediately resolved in the present study, supplementary analyses (see Appendix) indicated that there was no lagged effect of relationship status on college-onset IPT. This supports the present interpretation that college-onset IPT is likely to influence relationship status rather than the reverse.

Lastly, the effects of precollege and college-onset IPT on relationship status, the concurrent and lagged effects of college-onset IPT on relationship satisfaction, and the concurrent effects of college-onset IPT on partner substance use were not observed when statistically controlling for variance due to probable PTSD diagnosis. Further, PTSD was not significantly associated with relationship status, relationship satisfaction, or partner substance use, which was unexpected. Previous research suggests that PTSD is associated with worse mental health, lower perceived social support, poorer interpersonal functioning, and higher relationship discord (Beck et al., 2009; Marshall & Kuijer, 2017; Riggs et al., 1998; Taft et al., 2011). Thus, it is surprising that PTSD was not associated with any of the relationship dimensions. Importantly, the sample size for sensitivity analyses was small and, as observed in the primary analyses, IPT (precollege, concurrent college-onset, lagged college-onset) only accounted for small proportions of variance in relationship status, relationship satisfaction, and partner substance use. Therefore, the non-significant effects of IPT on relationship dimensions is likely attributable to a lack of statistical power to detect an association.

In summary, romantic relationships are especially salient during emerging adulthood (Arnett, 2004; Shulman et al., 2013; Umberson et al., 2010) and trauma exposure is common among college students (Berenz et al., 2016b; Breslau et al., 2008; Overstreet et al., 2017), so the influence of IPT on the formation and perceptions of romantic relationships is concerning. As relationship challenges are one of the most common reasons that college students seek counseling services (Mistler, Reetz, Krylowicz, & Barr, 2012), clinicians should be aware that a history of IPT, as well as clients' reactions to traumatic events, can influence the type of relationship an individual enters into. Moreover, clinicians should understand the implications of being in a relationship following precollege IPT, as it may not always be beneficial. By using

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this information to inform and guide treatment planning as well as educate their clients on the potential cascade of effects following IPT, clinicians can work to minimize relationship stress and promote healthy methods of managing relationship conflicts.

Aim 2 - Examining whether relationship dimensions moderate the associations between trauma and alcohol outcomes. First, the main effects of IPT exposure and relationship dimensions (relationship status, relationship satisfaction, and partner substance use) on alcohol use and alcohol problems were examined. As expected based on prior literature (Begle et al., 2011; Berenz et al., 2016a; Berenz et al., 2016b; Breslau, 2009; Keyes et al., 2011; Overstreet et al., 2017), IPT exposure was associated with elevated alcohol use and greater alcohol problems in the present study. Although the direction of influence cannot be immediately resolved, this aligns with research suggesting that individuals with a history of traumatic experiences drink to cope with their negative emotions (Cooper, 1994; Cox & Klinger, 1988). Moreover, consistent with studies conducted with adult samples (Fleming et al., 2010; Leonard & Rothbard, 1999; Marshal, 2003), findings from the present study indicated that being in a relationship and reporting higher relationship satisfaction were associated with lower alcohol use and fewer alcohol problems. In contrast, higher partner substance use was associated with higher alcohol use and greater alcohol problems.

Second, relationship status, relationship satisfaction, and partner substance use were examined as moderators of the associations between IPT exposure and alcohol use and alcohol problems. It was hypothesized that college students with a history of IPT who were in a satisfying committed relationship with a partner with lower substance use would report lower alcohol use and fewer alcohol problems. There was partial support for this hypothesis. Relationship status was the only relationship dimension that moderated the effect of precollege

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IPT on alcohol use. Individuals exposed to precollege IPT consumed more alcohol than those not exposed to IPT, but this pattern was mitigated among those in relationships. This is consistent with previous research conducted with adults suggesting that involvement in a committed romantic relationship (Fleming et al., 2010; Leonard & Rothbard, 1999; Rhule-Louie & McMahon, 2007) buffers against increased alcohol use following from stressful life events.

Contrary to hypotheses, relationship status did not moderate the association between college-onset IPT and alcohol use. This observed pattern of effects again highlights the importance of developmental timing when considering the role of risk and protective factors. One potential explanation for this finding is that individuals exposed to college-onset IPT may still be coping with the recent event; therefore, being in a relationship may not be protective enough to offset the increased alcohol use associated with IPT exposure. Additionally, although examined in separate models, individuals exposed to college-onset IPT were more likely to report lower relationship satisfaction, and previous research suggests that involvement in a dissatisfying relationship is associated with increased alcohol use (Karney & Bradbury, 1995; Marshal, 2003; Robles et al., 2014). Thus, these dissatisfying relationships may not confer the same protection to buffer against increased alcohol use observed among individuals coping with recent college-onset IPT.

Next, it was hypothesized that partner substance use would moderate the association between IPT and alcohol use. There was partial support for this hypothesis. Individuals with college-onset IPT reported higher alcohol use compared to those without IPT, and this effect was more pronounced among those who reported higher partner substance use. This aligns with previous research demonstrating that individuals involved with a heavy-drinking partner increased their own alcohol use over time to match that of their partner (Fleming et al., 2010;

Homish & Leonard, 2007; Leonard & Eiden, 2007; Leonard & Mudar, 2003; Rosenquist, 2010).

Among college students, this association may be driven by social norms of peer drinking, which

is one of the most robust predictors of college student alcohol use (Borsari, Murphy, & Barnett,

2007; Perkins, 2002). Individuals spend a significant amount of time with their partners (Collins,

Welsh, & Furman, 2008; Fein, 2009; Flood & Genadek, 2016; Kongar & Price, 2017; Zimmer-

Gembeck, 1999), so it follows that romantic partners likely shape individuals' perceptions of

social norms surrounding substance use as well as the alcohol-related activities in which they

participate.

Importantly, however, the moderating effects of relationship status and partner substance

use were not observed when accounting for probable PTSD. Further, PTSD was not significantly

associated with alcohol use. This non-significant main effect of PTSD was unexpected in light of

previous research suggesting that individuals with PTSD are significantly more to likely misuse

alcohol than those without PTSD (Stewart, 1996). These non-significant effects are likely

attributable to the reduced sample size for sensitivity analyses and the small sizes of the

interaction effects observed in the primary analyses. Thus, it follows that there was not sufficient

power to detect the moderating effects of relationship status on precollege IPT and partner

substance use on college-onset IPT to predict alcohol use.

Finally, contrary to hypotheses, relationship satisfaction was not a significant moderator

of the associations between IPT and alcohol use, and none of the relationship dimensions

moderated the associations between IPT and alcohol problems. As found in the first aim,

individuals with a history of IPT were more likely to be dissatisfied in their relationships, and

generally, individuals involved in dissatisfying relationships are less likely to engage in problem-

solving behaviors and tend to withdraw from their partner (Karney & Bradbury, 1995; Marshal,

2003; Rhule-Louie & McMahon, 2007). Thus, the impact of stress on relationship satisfaction might serve to undermine relationships that would otherwise be protective against increased alcohol use (Umberson et al., 2010). Moreover, college students have other salient interpersonal relationships who influence alcohol use and alcohol problems following stressful events, such as peers and parents (Arnett, 2004; Rauer, Pettit, Lansford, Bates, & Dodge, 2013)12/4/2019 5:17:00 PM. After experiencing a traumatic event, individuals may withdraw from their partners and rely more on others. This further supports extant literature demonstrating that other interpersonal relationships should be considered for their role in influencing the impact of IPT exposure on alcohol outcomes among college students (Hawn et al., 2018).

Taken together, romantic relationships and the characteristics of those relationships can influence the effect of IPT exposure on college students' alcohol use. Specifically, involvement in romantic relationships, but not relationship satisfaction, buffers against the effects of IPT on alcohol use, while involvement with a partner high in substance use exacerbates those effects. However, the buffering effect of relationship status against precollege IPT and the exacerbating effect of partner substance use on college-onset IPT to predict alcohol use was not observed when statistically controlling for PTSD. Clinicians can use this information in their practice to educate survivors of IPT, as well as their partners, about both the positive and negative effects conferred by romantic relationships during this developmental stage. Such conversations could potentially facilitate larger discussions about what it means to have a healthy relationship, as well as the ways in which clients' exposure to IPT can negatively affect relationship characteristics. More broadly, these positive and negative effects of relationships can inform awareness campaigns on college campuses by educating students about the ways in which social ties can improve or undermine their health habits, particularly concerning alcohol consumption.

Aim 3 – Examining sex differences. To address Aim 3, the first two aims were reanalyzed with sex included as a moderator. It was hypothesized that the effects of IPT exposure on relationship dimensions would be stronger for women compared to men (Aim 1), and the moderating effect of relationship dimensions on the associations between IPT and alcohol outcomes would be stronger for men compared to women (Aim 2). However, the effects from the first two aims did not differ as a function of sex. Interestingly, sex differences emerged only when accounting for probable PTSD.

In sensitivity analyses controlling for probable PTSD, relationship satisfaction moderated the association between college-onset IPT and alcohol use in a sex-specific manner (Aim 3.2). However, the direction of this effect was opposite than hypothesized. Men exposed to IPT reported higher alcohol use than those not exposed to IPT, and this association was stronger among men who reported higher levels of relationship satisfaction. Women with IPT exposure also reported higher alcohol use than those who reported no IPT, but their patterns of alcohol consumption did not change as a function of relationship satisfaction. This suggests that, after accounting for individuals' responses to IPT, a different pattern of effects emerges, such that PTSD alters the effect of IPT on alcohol use for men, but not for women.

This finding adds to extant literature suggesting that men and women experience different consequences following IPT exposure (Berenz et al., 2017; Danielson et al., 2009). Moreover, this highlights one of the ways in which satisfaction may not be protective against alcohol use following stressful events, such as trauma. By recognizing that individuals' responses to traumatic events can alter the effect of IPT exposure on relationship dimensions to predict alcohol use, particularly among men, clinicians can adapt treatment plans for those exhibiting symptoms of PTSD.

Limitations

Results from the present study should be interpreted in the context of its limitations. First, data were collected via self-report, and are thus subject to measurement error. Although participants were reminded of the confidential nature of their responses, they could have felt uncomfortable answering questions truthfully, particularly those related to sensitive topics such as IPT exposure. Second, the present study did not account for other relationship characteristics. For example, the type of romantic relationship (e.g., "friends with benefits," casually dating, open relationships) may influence the extent to which individuals are satisfied and the types of activities the couples engage in, all of which could affect the stress-buffering effects conferred by the relationship. Third, only IPT was examined in the present study; therefore, the present findings may not generalize to other types of traumatic events. Additionally, the present study did not account for IPT perpetrated by a romantic partner, which could have negative implications for relationship status, relationship satisfaction, and partner substance use. Fourth, there were high levels of attrition across the later waves of the sample. Further, the four-item PC-PTSD screener was only administered to some cohorts across certain assessments. Because some models (i.e., GEE models) were limited to only those cases with no missing data, sample size and power were decreased. Fifth, the present study only included college students from a large, urban university, so the findings may not generalize to a wider population.

In addition to the limitations mentioned above, representativeness analyses suggested that the sample included in the present study differed systematically from the larger Spit for Science sample. Participants in the present study were more likely than those in the full sample to be female, be in a relationship, and endorse a history of IPT before and during their first year of college. Participants in the committed relationship subset, specifically, were more likely to

identify as White than the full sample. Although it is common for women to be overrepresented in survey research (Dickinson, Adelson, & Owen, 2012; Smith, 2008), this may have limited the power to detect sex differences (Dickinson et al., 2012). On the other hand, it was somewhat surprising that the participants in the present study were more likely to endorse a history of IPT. It is possible that individuals with a history of IPT may have been more motivated than those without IPT to participate in at least one follow-up survey within the Spit for Science study because they understood that one benefit of their participation was an opportunity to inform behavioral health and substance use research. If this is the case, individuals in the present study may represent a more prosocial and conscientious sample of participants. Thus, this sample may not be representative of the larger population from which it was drawn, which could limit the generalizability of the present findings.

Conclusions and Future Directions

The present study contributes to the understanding of the interplay between IPT exposure, romantic relationships, and alcohol outcomes among young adult college students. Involvement in satisfying romantic relationships with partners with low levels of substance use is generally protective against alcohol outcomes among adults and can buffer against the increase in problematic alcohol use observed following trauma. However, much of the research in this area was conducted with married couples, and relatively little was known about the stress-buffering effects of romantic relationships among college students. The present study adds to the body of literature suggesting that IPT exposure can influence both the formation and perceptions of romantic relationships. Further, romantic relationships and the characteristics of those relationships can influence the effect of IPT on college students' alcohol use. This study underscores the importance of developmental timing and individuals' reactions to the traumatic

event, as both the timing of the traumatic event and individuals' PTSD symptoms can influence its effects on relationship dimensions, and the way they come together to influence alcohol outcomes.

In light of the disparate findings from the present study and those associated with the extant literature from older adult samples, additional research is warranted. Future research should attempt to replicate the current study with greater focus on other relationship dimensions that might lead to the observed differences in the stress-buffering effects of romantic relationships. For example, research should incorporate individuals' perceptions of commitment, future orientation, and stability as it pertains to their romantic relationships, as these factors may influence the extent to which individuals feel like they can rely on their partners in times of stress. Finally, studies should more fully investigate the implications of PTSD in order to illuminate the mechanisms by which it alters or drives the impact of IPT exposure. Specifically, ecological momentary assessment methods could provide key insights into individuals' post-traumatic stress symptoms, interactions with their partners, general perceptions of their relationships, and motives for alcohol use in real time. Better understanding and consideration of romantic relationships as part of efforts to reduce problematic alcohol use following trauma is critical, as it represents a potentially useful component of treatment and the promotion of wellbeing.

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Tables

Table 1

Means, standard deviations, frequencies, and percentages by year for all continuous and categorical variables.

	Year 1		Year 2		Year 3		Year 4		Overall	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Age	18.50	0.43								
Relationship Satisfaction	6.39	1.07	6.20	1.09	6.17	1.13	6.16	1.16	6.25	1.11
Partner Substance Use	5.47	2.26	5.62	2.07	5.79	2.11	5.89	2.12	5.66	2.15
Alcohol Use (raw)	219.00	488.00	219.00	469.00	253.00	481.00	291.00	509.00	235.29	485.06
Alcohol Use (log+1)	3.31	2.46	3.50	2.34	3.93	2.20	4.25	2.09	3.61	2.36
Alcohol Problems (raw)	2.31	2.28	2.48	2.40	2.42	2.37	2.74	2.52	2.46	2.38
Alcohol Problems (log+1)	0.96	0.70	1.00	0.72	0.99	0.72	1.07	0.73	1.00	0.71
	Year 1		Year 2		Year 3		Year 4			
Variable	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*		
Precollege IPT	2895	38.22								
College-Onset IPT	1391	18.94	963	20.71	651	17.66	450	19.34		
Relationship Status	2190	39.44	1982	41.90	1713	45.70	1113	46.98		

Note. IPT = Interpersonal trauma; *M* = Mean; *SD* = Standard deviation. *N* = Frequency of respondents who positively endorsed that variable. *%* = Percentage of respondents who positively endorsed that variable. Means and standard deviations were calculated using longitudinal data, and frequencies and percentages were calculated using cross-sectional data.

Table 2

Associations between precollege IPT and college-onset IPT exposure and relationship status, relationship satisfaction, and partner substance use (Aim 1).

	Block 1		Block 2		Block 3	
	Relationship Status		Relationship Satisfaction		Partner Substance Use	
Predictors	*OR*	*CI*	*β*	*CI*	*β*	*CI*
(Intercept)	0.77	[0.00, 121.51]	1.79	[-0.20, 3.78]	-0.83	[-2.79, 1.13]
Time	*1.10*	*[1.03, 1.18]*	-0.03	[-0.08, 0.01]	*0.06*	*[0.03, 0.09]*
Cohort						
Cohort 2	0.98	[0.77, 1.24]	*-0.19*	*[-0.30, -0.08]*	0.01	[-0.10, 0.12]
Cohort 3	1.03	[0.82, 1.30]	*-0.21*	*[-0.32, -0.10]*	0.01	[-0.10, 0.12]
Cohort 4	-	-	*-0.24*	*[-0.37, -0.11]*	-0.05	[-0.18, 0.07]
Race/Ethnicity (0 = White)						
African American/Black	*0.58*	*[0.45, 0.75]*	*-0.25*	*[-0.37, -0.14]*	*-0.30*	*[-0.41, -0.19]*
Asian	*0.65*	*[0.50, 0.84]*	-0.04	[-0.16, 0.08]	*-0.34*	*[-0.46, -0.23]*
More than one race	1.26	[0.85, 1.88]	-0.12	[-0.29, 0.05]	-0.08	[-0.25, 0.09]
Hispanic/Latino	1.28	[0.81, 2.03]	-0.03	[-0.20, 0.14]	-0.15	[-0.32, 0.02]
Other race/ethnicity	1.25	[0.62, 2.50]	0.00	[-0.35, 0.35]	-0.19	[-0.53, 0.15]
Sex (0 = Male)	*1.46*	*[1.17, 1.80]*	0.06	[-0.04, 0.15]	*0.17*	*[0.08, 0.26]*
Age	0.98	[0.75, 1.29]	-0.08	[-0.18, 0.03]	0.03	[-0.07, 0.14]
Precollege IPT	*1.39*	*[1.13, 1.70]*	*-0.16*	*[-0.25, -0.07]*	*0.12*	*[0.03, 0.21]*
Concurrent College-Onset IPT	*0.73*	*[0.60, 0.89]*	*-0.31*	*[-0.41, -0.21]*	*0.24*	*[0.16, 0.32]*
Lagged College-Onset IPT	1.01	[0.84, 1.22]	**-0.11**	**[-0.21, -0.02]**	*0.21*	*[0.13, 0.28]*
Observations	3396		2637		3063	

Note. IPT = interpersonal trauma. **Bold** type indicates $p < .05$. ***Bold italic*** type indicates $p < .01$. The effect of IPT on each relationship dimension was examined separately in a series of parallel models and is represented in a separate block. Relationship satisfaction and partner substance use were standardized. The Generalized Estimating Equation model examining relationship status did not include cohort four because no participants in this cohort had complete data on PTSD at all follow-up assessments.

Table 3A

Main effects of relationship status, relationship satisfaction, partner substance use, and IPT exposure on alcohol use (Aim 2).

Predictors	Block 1		Block 2		Block 3	
	Main Effects Model					
	Relationship Dimension					
	Relationship Status		Relationship Satisfaction		Partner Substance Use	
	β	*CI*	*β*	*CI*	*β*	*CI*
(Intercept)	*3.30*	*[0.90 , 5.71]*	2.56	[-0.51 , 5.64]	**3.36**	**[0.69 , 6.04]**
Time	*0.40*	*[0.38 , 0.43]*	0.42	*[0.38 , 0.47]*	0.36	*[0.32 , 0.40]*
Cohort						
Cohort 2	**0.17**	**[0.02 , 0.31]**	0.05	[-0.15 , 0.25]	0.13	[-0.05 , 0.30]
Cohort 3	**0.17**	**[0.02 , 0.31]**	0.13	[-0.07 , 0.33]	*0.23*	*[0.06 , 0.40]*
Cohort 4	*0.21*	*[0.06 , 0.37]*	0.20	[-0.02 , 0.41]	*0.28*	*[0.10 , 0.47]*
Race/Ethnicity (0 = White)						
African American/Black	*-0.88*	*[-1.02 , -0.74]*	*-0.86*	*[-1.06 , -0.65]*	*-0.55*	*[-0.72 , -0.38]*
Asian	*-1.38*	*[-1.53 , -1.24]*	*-1.03*	*[-1.24 , -0.82]*	*-0.78*	*[-0.97 , -0.60]*
More than one race	*-0.32*	*[-0.54 , -0.09]*	-0.23	[-0.52 , 0.05]	-0.16	[-0.41 , 0.10]
Hispanic/Latino	*-0.32*	*[-0.55 , -0.09]*	-0.19	[-0.49 , 0.12]	-0.17	[-0.43 , 0.09]
Other race/ethnicity	-0.33	*[-0.83 , 0.16]*	-0.24	[-0.87 , 0.38]	-0.11	[-0.65 , 0.42]
Sex (0 = Male)	*-0.53*	*[-0.64 , -0.42]*	*-0.45*	*[-0.61 , -0.29]*	*-0.61*	*[-0.75 , -0.48]*
Age	0.00	[-0.12 , 0.13]	0.04	[-0.13 , 0.20]	0.00	[-0.14 , 0.15]
Relationship Dimension	*-0.10*	*[-0.17 , -0.03]*	-0.09	[-0.15 , -0.04]	*0.70*	*[0.65 , 0.75]*
Precollege IPT	*0.35*	*[0.24 , 0.46]*	**0.17**	**[0.02 , 0.32]**	0.05	[-0.08 , 0.18]
College-Onset IPT	*0.31*	*[0.23 , 0.39]*	0.30	*[0.16 , 0.44]*	0.20	*[0.08 , 0.31]*
Observations	13019		4744		5607	

Note. IPT = interpersonal trauma. **Bold** type indicates *p* < .05. ***Bold italic*** type indicates *p* < .01. Each block represents a model examining the main effects of a different relationship dimension on alcohol use. The variables listed along the top of the table under each block correspond to the relationship dimension included in that model. Relationship satisfaction and partner substance use were standardized. Alcohol use was log-transformed and added to a constant of one.

Table 3B

Alcohol use as a function of relationship status, relationship satisfaction, partner substance use, IPT exposure, and their interactions

(Aim 2).

	Block 1		Block 2		Block 3	
			Interaction Effects Model			
			Relationship Dimension			
	Relationship Status		Relationship Satisfaction		Partner Substance Use	
Predictors	*β*	*CI*	*β*	*CI*	*β*	*CI*
(Intercept)	**3.27**	**[0.87, 5.68]**	2.59	[-0.48, 5.67]	**3.28**	**[0.62, 5.95]**
Time	**0.40**	**[0.38, 0.43]**	**0.42**	**[0.38, 0.47]**	0.36	[0.32, 0.40]
Cohort						
Cohort 2	**0.17**	**[0.02, 0.31]**	0.05	[-0.15, 0.25]	0.12	[-0.05, 0.29]
Cohort 3	**0.17**	**[0.02, 0.31]**	0.13	[-0.07, 0.33]	**0.23**	**[0.06, 0.40]**
Cohort 4	**0.22**	**[0.06, 0.37]**	0.20	[-0.02, 0.41]	**0.28**	**[0.09, 0.46]**
Race/Ethnicity (0 = White)						
African American/Black	**-0.88**	**[-1.02, -0.74]**	**-0.85**	**[-1.06, -0.65]**	**-0.55**	**[-0.72, -0.38]**
Asian	**-1.38**	**[-1.53, -1.23]**	**-1.03**	**[-1.24, -0.82]**	**-0.78**	**[-0.96, -0.59]**
More than one race	**-0.32**	**[-0.54, -0.09]**	-0.23	[-0.52, 0.06]	-0.15	[-0.40, 0.10]
Hispanic/Latino	**-0.32**	**[-0.54, -0.09]**	-0.18	[-0.48, 0.12]	-0.16	[-0.42, 0.09]
Other race/ethnicity	-0.33	[-0.82, 0.16]	-0.23	[-0.86, 0.39]	-0.09	[-0.63, 0.44]
Sex (0 = Male)	**-0.52**	**[-0.64, -0.41]**	**-0.45**	**[-0.61, -0.29]**	-0.62	[-0.75, -0.48]
Age	0.00	[-0.12, 0.13]	0.04	[-0.13, 0.20]	0.01	[-0.13, 0.15]
Relationship Dimension	-0.04	[-0.13, 0.05]	-0.07	[-0.15, 0.01]	**0.79**	**[0.71, 0.86]**
Precollege IPT	**0.43**	**[0.30, 0.56]**	**0.17**	**[0.02, 0.32]**	0.05	[-0.08, 0.18]
College-Onset IPT	**0.30**	**[0.20, 0.40]**	**0.29**	**[0.15, 0.43]**	**0.24**	**[0.12, 0.36]**
Relationship Dimension*Precollege IPT	**-0.17**	**[-0.31, -0.03]**	0.00	[-0.11, 0.11]	-0.08	[-0.18, 0.02]
Relationship Dimension*College-Onset IPT	0.02	[-0.14, 0.17]	-0.08	[-0.20, 0.04]	**-0.17**	**[-0.28, -0.06]**
Observations	13019		4744		5607	

Note. IPT = interpersonal trauma. **Bold** type indicates *p* < .05. ***Bold italic*** type indicates *p* < .01. Each block represents a model examining the moderating effect of a different relationship dimension on the associations between IPT and alcohol use. The variables listed along the top of the table under each block correspond to the relationship dimension included as the moderator in that model. Relationship satisfaction and partner substance use were standardized. Alcohol use was log-transformed and added to a constant of one.

Table 4A

Main effects of relationship status, relationship satisfaction, partner substance use, and IPT exposure on alcohol problems (Aim 2).

	Block 1		Block 2		Block 3	
	Main Effects Model					
	Relationship Dimension					
	Relationship Status		Relationship Satisfaction		Partner Substance Use	
Predictors	*β*	*CI*	*β*	*CI*	*β*	*CI*
(Intercept)	0.58	[-0.26 , 1.42]	0.32	[-0.83 , 1.48]	0.40	[-0.65 , 1.45]
Time	*0.06*	*[0.05 , 0.07]*	*0.04*	*[0.02 , 0.06]*	*0.04*	*[0.02 , 0.06]*
Cohort						
Cohort 2	0.02	[-0.03 , 0.07]	-0.01	[-0.09 , 0.07]	-0.01	[-0.07 , 0.06]
Cohort 3	0.03	[-0.02 , 0.08]	-0.01	[-0.09 , 0.06]	0.00	[-0.06 , 0.07]
Cohort 4	0.01	[-0.04 , 0.07]	-0.05	[-0.13 , 0.04]	-0.03	[-0.11 , 0.04]
Race/Ethnicity (0 = White)						
African American/Black	*-0.13*	*[-0.19 , -0.08]*	**-0.09**	**[-0.17 , -0.01]**	-0.05	[-0.12 , 0.02]
Asian	*-0.16*	*[-0.22 , -0.11]*	-0.07	[-0.16 , 0.01]	-0.05	[-0.13 , 0.03]
More than one race	-0.01	[-0.09 , 0.07]	0.04	[-0.07 , 0.14]	0.02	[-0.08 , 0.12]
Hispanic/Latino	0.02	[-0.06 , 0.11]	0.05	[-0.07 , 0.17]	0.06	[-0.05 , 0.16]
Other race/ethnicity	-0.03	[-0.21 , 0.15]	0.01	[-0.24 , 0.27]	0.03	[-0.20 , 0.25]
Sex (0 = Male)	*-0.05*	*[-0.10 , -0.01]*	*-0.10*	*[-0.16 , -0.03]*	*-0.13*	*[-0.18 , -0.07]*
Age	0.01	[-0.03 , 0.06]	0.03	[-0.03 , 0.09]	0.02	[-0.03 , 0.08]
Relationship Dimension	*-0.11*	*[-0.14 , -0.08]*	*-0.06*	*[-0.08 , -0.03]*	*0.18*	*[0.16 , 0.20]*
Precollege IPT	*0.18*	*[0.14 , 0.22]*	*0.15*	*[0.09 , 0.21]*	*0.14*	*[0.09 , 0.19]*
College-Onset IPT	*0.22*	*[0.19 , 0.26]*	*0.23*	*[0.17 , 0.29]*	*0.21*	*[0.16 , 0.27]*
Observations	8186		3185		3789	

Note. IPT = interpersonal trauma. **Bold** type indicates *p* < .05. ***Bold italic*** type indicates *p* < .01. Each block represents a model examining the main effects of a different relationship dimension on alcohol problems. The variables listed along the top of the table under each block correspond to the relationship dimension included in that model. Relationship satisfaction and partner substance use were standardized. Alcohol problems was log-transformed and added to a constant of one.

Table 4B

Alcohol problems as a function of relationship status, relationship satisfaction, partner substance use, IPT exposure, and their interactions (Aim 2).

	Block 1		Block 2		Block 3	
			Interaction Effects Model			
			Relationship Dimension			
	Relationship Status		Relationship Satisfaction		Partner Substance Use	
Predictors	*β*	*CI*	*β*	*CI*	*β*	*CI*
(Intercept)	0.59	[-0.25, 1.43]	0.35	[-0.81, 1.50]	0.40	[-0.65, 1.44]
Time	*0.06*	*[0.05, 0.07]*	*0.04*	*[0.02, 0.06]*	*0.04*	*[0.02, 0.06]*
Cohort						
Cohort 2	0.02	[-0.03, 0.08]	-0.01	[-0.09, 0.07]	-0.01	[-0.07, 0.06]
Cohort 3	0.03	[-0.02, 0.08]	-0.02	[-0.09, 0.06]	0.00	[-0.06, 0.07]
Cohort 4	0.01	[-0.04, 0.07]	-0.05	[-0.13, 0.04]	-0.04	[-0.11, 0.04]
Race/Ethnicity (0 = White)						
African American/Black	*-0.13*	*[-0.19, -0.08]*	**-0.09**	**[-0.17, -0.01]**	-0.05	[-0.12, 0.02]
Asian	*-0.16*	*[-0.22, -0.11]*	-0.07	[-0.16, 0.01]	-0.05	[-0.12, 0.03]
More than one race	-0.01	[-0.09, 0.07]	0.04	[-0.07, 0.14]	0.02	[-0.07, 0.12]
Hispanic/Latino	0.02	[-0.06, 0.10]	0.06	[-0.06, 0.17]	0.06	[-0.05, 0.16]
Other race/ethnicity	-0.03	[-0.21, 0.15]	0.02	[-0.24, 0.27]	0.03	[-0.19, 0.25]
Sex (0 = Male)	**-0.06**	**[-0.10, -0.01]**	*-0.10*	*[-0.16, -0.03]*	*-0.13*	*[-0.19, -0.08]*
Age	0.01	[-0.03, 0.06]	0.03	[-0.04, 0.09]	0.02	[-0.03, 0.08]
Relationship Dimension	*-0.12*	*[-0.16, -0.08]*	**-0.04**	**[-0.08, -0.01]**	*0.20*	*[0.17, 0.23]*
Precollege IPT	*0.17*	*[0.13, 0.22]*	*0.15*	*[0.09, 0.21]*	*0.15*	*[0.09, 0.20]*
College-Onset IPT	*0.22*	*[0.17, 0.26]*	*0.23*	*[0.16, 0.29]*	*0.22*	*[0.17, 0.28]*
Relationship Dimension*Precollege IPT	0.02	[-0.04, 0.08]	0.00	[-0.05, 0.05]	-0.03	[-0.08, 0.01]
Relationship Dimension*College-Onset IPT	0.02	[-0.05, 0.08]	-0.04	[-0.09, 0.01]	-0.02	[-0.06, 0.03]
Observations		8186		3185		3789

Note. IPT = interpersonal trauma. **Bold** type indicates *p* < .05. ***Bold italic*** type indicates *p* < .01. Each block represents a model examining the moderating effect of a different relationship dimension on the associations between IPT and alcohol problems. The variables listed along the top of the table under each block correspond to the relationship dimension included as the moderator in that model. Relationship satisfaction and partner substance use were standardized. Alcohol problems was log-transformed and added to a constant of one.

Table 5

Associations between precollege IPT and college-onset IPT exposure and relationship status, relationship satisfaction, and partner substance use as a function of sex (Aim 3.1).

	Block 1		Block 2		Block 3	
			Interaction Effects Model			
	Relationship Status		Relationship Satisfaction		Partner Substance Use	
Predictors	*OR*	*CI*	*β*	*CI*	*β*	*CI*
(Intercept)	0.88	[0.01, 140.12]	1.81	[-0.18, 3.81]	-0.89	[-2.86, 1.08]
Time	*1.10*	*[1.03, 1.18]*	-0.03	[-0.08, 0.01]	*0.06*	*[0.03, 0.09]*
Cohort						
Cohort 2	0.97	[0.77, 1.23]	*-0.19*	*[-0.30, -0.08]*	0.01	[-0.10, 0.13]
Cohort 3	1.02	[0.81, 1.29]	*-0.21*	*[-0.32, -0.10]*	0.01	[-0.10, 0.12]
Cohort 4	-	-	*-0.24*	*[-0.37, -0.11]*	-0.05	[-0.18, 0.07]
Race/Ethnicity (0 = White)						
African American/Black	*0.58*	*[0.45, 0.74]*	*-0.25*	*[-0.37, -0.14]*	*-0.30*	*[-0.41, -0.19]*
Asian	*0.65*	*[0.50, 0.84]*	-0.04	[-0.15, 0.08]	*-0.35*	*[-0.46, -0.23]*
More than one race	1.28	[0.85, 1.91]	-0.11	[-0.29, 0.06]	-0.08	[-0.25, 0.09]
Hispanic/Latino	1.27	[0.80, 2.02]	-0.02	[-0.20, 0.15]	-0.15	[-0.32, 0.01]
Other race/ethnicity	1.26	[0.64, 2.50]	0.00	[-0.36, 0.35]	-0.19	[-0.53, 0.15]
Sex (0 = Male)	**1.41**	**[1.08, 1.85]**	0.06	[-0.06, 0.18]	*0.21*	*[0.09, 0.33]*
Age	0.98	[0.74, 1.28]	-0.08	[-0.19, 0.03]	0.03	[-0.07, 0.14]
Precollege IPT	1.16	[0.79, 1.69]	-0.16	[-0.34, 0.02]	0.16	[-0.01, 0.34]
Lagged College-Onset IPT	1.03	[0.68, 1.55]	-0.05	[-0.27, 0.17]	**0.19**	**[0.01, 0.37]**
Concurrent College-Onset IPT	1.01	[0.68, 1.48]	*-0.36*	*[-0.59, -0.13]*	0.35	[0.17, 0.53]
Sex*Precollege IPT	1.29	[0.83, 2.02]	0.00	[-0.21, 0.21]	-0.06	[-0.26, 0.14]
Sex*Lagged College-Onset IPT	0.98	[0.62, 1.55]	-0.08	[-0.32, 0.17]	0.02	[-0.18, 0.22]
Sex*Concurrent College-Onset IPT	0.66	[0.42, 1.03]	0.06	[-0.19, 0.32]	-0.14	[-0.34, 0.06]
Observations	3396		2637		3063	

Note. IPT = interpersonal trauma. **Bold** type indicates *p* < .05. ***Bold italic*** type indicates *p* < .01. The effect of IPT on each relationship dimension was examined separately in a series of parallel models and is represented in a separate block. Relationship satisfaction and partner substance use were standardized. The Generalized Estimating Equation model examining relationship status did not include cohort four because no participants in this cohort had complete data on PTSD at all follow-up assessments. The main effects of

covariates and IPT exposure on relationship dimensions are the same as those presented in Table 2; therefore, only the two-way interactions between sex and IPT exposure, which are the parameters of interest for this aim, are included in this table.

Table 6

Alcohol use as a function of relationship status, relationship satisfaction, partner substance use, IPT exposure, sex, and their

interactions (Aim 3.2).

	Block 1		Block 2		Block 3	
			Interaction Effects Model			
			Relationship Dimension			
	Relationship Status		Relationship Satisfaction		Partner Substance Use	
Predictors	*β*	*CI*	*β*	*CI*	*β*	*CI*
(Intercept)	*3.30*	*[0.90, 5.70]*	2.47	[-0.61, 5.54]	**3.27**	**[0.60, 5.93]**
Time	*0.40*	*[0.38, 0.43]*	*0.42*	*[0.38, 0.47]*	*0.36*	*[0.32, 0.40]*
Cohort						
Cohort 2	**0.17**	**[0.02, 0.31]**	0.05	[-0.15, 0.25]	0.12	[-0.05, 0.29]
Cohort 3	**0.17**	**[0.02, 0.31]**	0.13	[-0.07, 0.33]	*0.23*	*[0.06, 0.40]*
Cohort 4	*0.21*	*[0.06, 0.37]*	0.20	[-0.02, 0.41]	*0.27*	*[0.08, 0.45]*
Race/Ethnicity (0 = White)						
African American/Black	*-0.88*	*[-1.02, -0.74]*	*-0.84*	*[-1.05, -0.64]*	*-0.56*	*[-0.73, -0.39]*
Asian	*-1.38*	*[-1.53, -1.23]*	*-1.03*	*[-1.25, -0.82]*	*-0.77*	*[-0.96, -0.59]*
More than one race	*-0.32*	*[-0.55, -0.10]*	-0.23	[-0.52, 0.06]	-0.16	[-0.41, 0.09]
Hispanic/Latino	*-0.32*	*[-0.54, -0.09]*	-0.19	[-0.49, 0.11]	-0.17	[-0.43, 0.09]
Other race/ethnicity	-0.32	[-0.81, 0.17]	-0.25	[-0.87, 0.37]	-0.11	[-0.65, 0.42]
Sex (0 = Male)	*-0.64*	*[-0.80, -0.48]*	*-0.43*	*[-0.64, -0.23]*	*-0.68*	*[-0.85, -0.51]*
Age	0.01	[-0.12, 0.14]	0.04	[-0.12, 0.21]	0.01	[-0.13, 0.16]
Relationship Dimension	-0.07	[-0.22, 0.09]	*-0.23*	*[-0.37, -0.08]*	*0.95*	*[0.82, 1.09]*
Precollege IPT	**0.27**	**[0.06, 0.49]**	0.25	[-0.04, 0.54]	0.04	[-0.20, 0.29]
College-Onset IPT	**0.20**	**[0.01, 0.39]**	0.23	[-0.07, 0.54]	0.08	[-0.17, 0.34]
Relationship Dimension *Precollege IPT	-0.06	[-0.32, 0.20]	-0.15	[-0.37, 0.08]	-0.16	[-0.37, 0.05]
Relationship Dimension *College-Onset IPT	-0.06	[-0.36, 0.25]	0.10	[-0.18, 0.38]	**-0.29**	**[-0.52, -0.06]**
Sex*Precollege IPT	0.24	[-0.03, 0.51]	-0.09	[-0.44, 0.25]	0.00	[-0.28, 0.29]
Sex*College-Onset IPT	0.14	[-0.09, 0.36]	0.07	[-0.27, 0.41]	0.20	[-0.10, 0.49]
Sex* Relationship Dimension	0.05	[-0.14, 0.24]	**0.22**	**[0.05, 0.39]**	*-0.23*	*[-0.39, -0.07]*
Sex*Precollege IPT* Relationship Dimension	-0.16	[-0.48, 0.15]	0.17	[-0.09, 0.43]	0.11	[-0.13, 0.36]
Sex*College-Onset IPT* Relationship Dimension	0.09	[-0.27, 0.44]	-0.25	[-0.56, 0.06]	0.16	[-0.10, 0.42]
Observations	13019		4744		5607	

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Note. IPT = interpersonal trauma. **Bold** type indicates *p* < .05. ***Bold italic*** type indicates *p* < .01. Each block represents a model examining the moderating effect of a different relationship dimension on the associations between IPT and alcohol use. The variables listed along the top of the table under each block correspond to the relationship dimension included as the moderator in that model. Relationship satisfaction and partner substance use were standardized. Alcohol use was log-transformed and added to a constant of one. The main effects of covariates and predictors, as well as the two-way interactions between IPT exposure and each relationship dimension, on alcohol use are the same as those presented in Table 3; therefore, only the three-way interactions between sex, IPT exposure, and each relationship dimension, which are the parameters of interest for this aim, are included in this table.

Table 7

Alcohol problems as a function of relationship status, relationship satisfaction, partner substance use, IPT exposure, sex, and their interactions (Aim 3.2).

	Block 1		Block 2		Block 3	
			Interaction Effects Model			
			Relationship Dimension			
	Relationship Status		Relationship Satisfaction		Partner Substance Use	
Predictors	*β*	*CI*	*β*	*CI*	*β*	*CI*
(Intercept)	0.58	[-0.27, 1.42]	0.37	[-0.79, 1.52]	0.4	[-0.65, 1.45]
Time	*0.06*	*[0.05, 0.07]*	*0.04*	*[0.02, 0.06]*	*0.04*	*[0.02, 0.06]*
Cohort						
Cohort 2	0.02	[-0.03, 0.07]	-0.01	[-0.09, 0.07]	-0.01	[-0.07, 0.06]
Cohort 3	0.03	[-0.02, 0.09]	-0.01	[-0.09, 0.07]	0.01	[-0.06, 0.07]
Cohort 4	0.02	[-0.04, 0.07]	-0.04	[-0.12, 0.04]	-0.04	[-0.11, 0.04]
Race/Ethnicity (0 = White)						
African American/Black	*-0.14*	*[-0.19, -0.09]*	**-0.08**	**[-0.16, -0.01]**	-0.05	[-0.12, 0.02]
Asian	*-0.16*	*[-0.22, -0.11]*	-0.08	[-0.16, 0.01]	-0.05	[-0.12, 0.03]
More than one race	-0.01	[-0.09, 0.07]	0.04	[-0.07, 0.14]	0.02	[-0.08, 0.12]
Hispanic/Latino	0.02	[-0.06, 0.10]	0.05	[-0.07, 0.17]	0.06	[-0.05, 0.16]
Other race/ethnicity	-0.03	[-0.21, 0.15]	0.02	[-0.24, 0.27]	0.03	[-0.19, 0.25]
Sex (0 = Male)	-0.04	[-0.10, 0.02]	-0.04	[-0.12, 0.04]	**-0.09**	**[-0.16, -0.02]**
Age	0.01	[-0.03, 0.06]	0.02	[-0.04, 0.09]	0.02	[-0.03, 0.08]
Relationship Dimension	*-0.10*	*[-0.16, -0.03]*	*-0.11*	*[-0.17, -0.04]*	*0.24*	*[0.18, 0.30]*
Precollege IPT	*0.16*	*[0.08, 0.24]*	*0.26*	*[0.14, 0.37]*	*0.24*	*[0.14, 0.34]*
College-Onset IPT	*0.19*	*[0.10, 0.27]*	*0.25*	*[0.11, 0.38]*	*0.20*	*[0.08, 0.31]*
Relationship Dimension*Precollege IPT	0.10	[-0.01, 0.21]	0.03	[-0.07, 0.12]	-0.04	[-0.14, 0.05]
Relationship Dimension*College-Onset IPT	0.02	[-0.12, 0.15]	-0.08	[-0.21, 0.04]	-0.02	[-0.13, 0.08]
Sex*Precollege IPT	0.02	[-0.08, 0.12]	**-0.14**	**[-0.27, -0.01]**	**-0.13**	**[-0.25, -0.01]**
Sex*College-Onset IPT	0.03	[-0.06, 0.13]	-0.03	[-0.18, 0.12]	0.03	[-0.10, 0.16]
Sex*Relationship Dimension	-0.03	[-0.11, 0.04]	**0.09**	**[0.02, 0.17]**	-0.05	[-0.12, 0.02]
Sex*Precollege IPT*Relationship Dimension	-0.10	[-0.24, 0.03]	-0.05	[-0.16, 0.06]	0.03	[-0.08, 0.13]
Sex*College-Onset IPT*Relationship Dimension	0.00	[-0.15, 0.16]	0.05	[-0.09, 0.18]	0.01	[-0.11, 0.13]
Observations	8186		3185		3789	

Note. IPT = interpersonal trauma. **Bold** type indicates *p* < .05. ***Bold italic*** type indicates *p* < .01. Each block represents a model examining the moderating effect of a different relationship dimension on the associations between IPT and alcohol problems. The variables listed along the top of the table under each block correspond to the relationship dimension included as the moderator in that model. Relationship satisfaction and partner substance use were standardized. Alcohol problems was log-transformed and added to a constant of one. The main effects of covariates and predictors, as well as the two-way interactions between IPT exposure and each relationship dimension, on alcohol problems are the same as those presented in Table 4; therefore, only the three-way interactions between sex, IPT exposure, and each relationship dimension, which are the parameters of interest for this aim, are included in this table.

Table 8

Sensitivity analyses examining the associations between precollege IPT and college-onset IPT exposure and relationship status,

relationship satisfaction, and partner substance use controlling for PTSD (Aim 1).

	Block 1		Block 2		Block 3	
	Relationship Status		Relationship Satisfaction		Partner Substance Use	
Predictors	*OR*	*CI*	*β*	*CI*	*β*	*CI*
(Intercept)	0.37	[0.00, 5619.22]	0.53	[-0.46, 1.52]	-0.59	[-1.42, 0.23]
Time	**1.19**	**[1.04, 1.37]**	-0.12	[-0.44, 0.20]	0.16	[-0.09, 0.42]
Cohort						
Cohort 2	1.05	[0.60, 1.85]	**-**	-	-	-
Cohort 3	0.86	[0.50, 1.49]	**-**	-	-	-
Cohort 4	-	-	-0.16	[-0.69, 0.38]	0.15	[-0.31, 0.60]
Race/Ethnicity (0 = White)						
African American/Black	**0.54**	**[0.32, 0.90]**	-0.30	[-0.78, 0.18]	0.02	[-0.36, 0.40]
Asian	***0.52***	***[0.32, 0.85]***	0.04	[-0.37, 0.45]	-0.36	[-0.73, 0.01]
More than one race	0.59	[0.25, 1.36]	0.27	[-0.33, 0.88]	-0.28	[-0.84, 0.27]
Hispanic/Latino	1.42	[0.59, 3.46]	0.25	[-0.38, 0.88]	0.41	[-0.14, 0.97]
Other race/ethnicity			0.37	[-1.05, 1.80]	-0.53	[-1.90, 0.84]
Sex (0 = Male)	1.30	[0.87, 1.93]	0.07	[-0.31, 0.45]	0.00	[-0.33, 0.33]
Age	1.03	[0.61, 1.73]	-0.10	[-0.23, 0.03]	0.06	[-0.06, 0.18]
Probable PTSD	1.35	[0.30, 5.97]	0.12	[-0.23, 0.46]	0.14	[-0.15, 0.43]
Precollege IPT	1.15	[0.75, 1.76]	**-0.34**	**[-0.66, -0.03]**	0.10	[-0.18, 0.37]
Concurrent College-Onset IPT	1.20	[0.61, 2.36]	-0.09	[-0.42, 0.24]	0.22	[-0.05, 0.48]
Lagged College-Onset IPT	0.42	[0.12, 1.47]	-0.30	[-0.63, 0.02]	**0.37**	**[0.10, 0.64]**
Observations	894		208		248	

Note. IPT = interpersonal trauma. **Bold** type indicates $p < .05$. ***Bold italic*** type indicates $p < .01$. The effect of IPT on each relationship dimension was examined separately in a series of parallel models and is represented in a separate block. Relationship satisfaction and partner substance use were standardized. Certain cohorts were not included in each of the models because data on all four items of the PC-PTSD screener, used to calculate probable PTSD, were not available across all cohorts or all assessments. For the Generalized Estimating Equation model, the other race/ethnicity and more than one race/ethnicity categories were combined due to small cell sizes.

Table 9A

Sensitivity analyses examining the main effects of relationship status, relationship satisfaction, partner substance use, and IPT

exposure on alcohol use controlling for PTSD (Aim 2).

	Block 1		Block 2		Block 3	
	Main Effects Model					
	Relationship Dimension					
	Relationship Status		Relationship Satisfaction		Partner Substance Use	
Predictors	*β*	*CI*	*β*	*CI*	*β*	*CI*
(Intercept)	*4.35*	*[3.67, 5.02]*	*3.78*	*[2.70, 4.87]*	*3.75*	*[2.80, 4.71]*
Time	**0.15**	**[0.01, 0.29]**	**0.26**	**[0.02, 0.50]**	**0.25**	**[0.04, 0.46]**
Cohort						
Cohort 2	-	-	-	-	-	-
Cohort 3	-0.16	[-0.52, 0.19]	-0.15	[-0.68, 0.38]	0.31	[-0.16, 0.78]
Cohort 4	**-0.53**	**[-0.97, -0.10]**	-0.15	[-0.85, 0.54]	0.18	[-0.44, 0.80]
Race/Ethnicity (0 = White)						
African American/Black	*-0.76*	*[-1.07, -0.45]*	*-0.82*	*[-1.32, -0.33]*	-0.32	[-0.74, 0.10]
Asian	*-1.07*	*[-1.40, -0.74]*	**-0.49**	**[-0.97, -0.01]**	-0.4	[-0.83, 0.02]
More than one race	-0.28	[-0.75, 0.20]	-0.45	[-1.12, 0.22]	-0.31	[-0.92, 0.29]
Hispanic/Latino	-0.15	[-0.67, 0.37]	-0.13	[-0.84, 0.58]	-0.29	[-0.88, 0.31]
Other race/ethnicity	*-2.05*	*[-3.27, -0.84]*	*-2.56*	*[-4.07, -1.06]*	*-1.56*	*[-2.91, -0.22]*
Sex (0 = Male)	*-0.52*	*[-0.79, -0.25]*	-0.39	[-0.82, 0.03]	*-0.74*	*[-1.10, -0.39]*
Age	-0.02	[-0.14, 0.10]	-0.11	[-0.26, 0.04]	-0.1	[-0.23, 0.03]
Probable PTSD	0.07	[-0.17, 0.30]	0.18	[-0.19, 0.56]	0.06	[-0.26, 0.38]
Relationship Dimension	0.08	[-0.13, 0.29]	-0.1	[-0.25, 0.05]	*0.59*	*[0.45, 0.73]*
Precollege IPT	**0.27**	**[0.02, 0.51]**	0.12	[-0.24, 0.47]	0.17	[-0.13, 0.48]
College-Onset IPT	*0.45*	*[0.23, 0.67]*	**0.41**	**[0.06, 0.75]**	0.21	[-0.09, 0.52]
Observations	1441		523		651	

Note. IPT = interpersonal trauma. **Bold** type indicates *p* < .05. ***Bold italic*** type indicates *p* < .01. Each block represents a model examining the main effects of a different relationship dimension on alcohol use. The variables listed along the top of the table under each block correspond to the relationship dimension included in that model. Cohort two was not included in each of the models because data on all four items of the PC-PTSD screener, used to calculate probable PTSD, were not available. Relationship satisfaction and partner substance use were standardized. Alcohol use was log-transformed and added to a constant of one.

Table 9B

Sensitivity analyses examining alcohol use as a function of relationship status, relationship satisfaction, partner substance use, IPT exposure, and their interactions controlling for PTSD (Aim 2).

	Block 1		Block 2		Block 3	
			Interaction Effects Model			
			Relationship Dimension			
	Relationship Status		Relationship Satisfaction		Partner Substance Use	
Predictors	*β*	*CI*	*β*	*CI*	*β*	*CI*
(Intercept)	*4.27*	*[3.58, 4.96]*	*3.79*	*[2.71, 4.88]*	*3.83*	*[2.88, 4.79]*
Time	**0.15**	**[0.01, 0.29]**	**0.26**	**[0.02, 0.50]**	**0.22**	**[0.02, 0.43]**
Cohort						
Cohort 2	-	-	-	-	-	-
Cohort 3	-0.17	[-0.52, 0.19]	-0.16	[-0.69, 0.38]	0.3	[-0.17, 0.77]
Cohort 4	**-0.53**	**[-0.97, -0.10]**	-0.17	[-0.87, 0.53]	0.12	[-0.50, 0.74]
Race/Ethnicity (0 = White)						
African American/Black	*-0.76*	*[-1.06, -0.45]*	*-0.78*	*[-1.28, -0.28]*	-0.31	[-0.73, 0.11]
Asian	*-1.06*	*[-1.39, -0.73]*	**-0.5**	**[-0.97, -0.02]**	-0.36	[-0.79, 0.06]
More than one race	-0.27	[-0.74, 0.20]	-0.45	[-1.12, 0.22]	-0.25	[-0.85, 0.36]
Hispanic/Latino	-0.14	[-0.67, 0.38]	-0.09	[-0.80, 0.63]	-0.22	[-0.82, 0.37]
Other race/ethnicity	*-2.03*	*[-3.24, -0.82]*	*-2.59*	*[-4.09, -1.08]*	**-1.55**	**[-2.90, -0.21]**
Sex (0 = Male)	*-0.52*	*[-0.79, -0.25]*	-0.4	[-0.83, 0.02]	*-0.73*	*[-1.09, -0.37]*
Age	-0.02	[-0.14, 0.10]	-0.12	[-0.27, 0.03]	-0.08	[-0.22, 0.05]
Probable PTSD	0.07	[-0.16, 0.31]	0.19	[-0.19, 0.57]	0.06	[-0.26, 0.38]
Relationship Dimension	0.23	[-0.12, 0.59]	0.09	[-0.19, 0.37]	*0.86*	*[0.61, 1.12]*
Precollege IPT	0.31	[-0.01, 0.62]	0.11	[-0.25, 0.47]	0.21	[-0.10, 0.52]
College-Onset IPT	*0.54*	*[0.24, 0.34]*	**0.39**	**[0.04, 0.75]**	0.23	[-0.07, 0.54]
Relationship Dimension*Precollege IPT	-0.10	[-0.53, 0.34]	-0.14	[-0.44, 0.16]	-0.24	[-0.53, 0.05]
Relationship Dimension*College-Onset IPT	-0.18	[-0.61, 0.24]	-0.19	[-0.50, 0.12]	-0.23	[-0.53, 0.07]
Observations	1441		523		651	

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Note. IPT = interpersonal trauma. **Bold** type indicates *p* < .05. ***Bold italic*** type indicates *p* < .01. Each block represents a model examining the moderating effect of a different relationship dimension on the associations between IPT and alcohol use. The variables listed along the top of the table under each block correspond to the relationship dimension included as the moderator in that model. Cohort two was not included in each of the models because data on all four items of the PC-PTSD screener, used to calculate probable PTSD, were not available. Relationship satisfaction and partner substance use were standardized. Alcohol use was log-transformed and added to a constant of one.

Table 10A

Sensitivity analyses examining the main effects of relationship status, relationship satisfaction, partner substance use, and IPT

exposure on alcohol problems controlling for PTSD (Aim 2).

	Block 1		Block 2		Block 3	
	Main Effects Model					
	Relationship Dimension					
	Relationship Status		Relationship Satisfaction		Partner Substance Use	
Predictors	*β*	*CI*	*β*	*CI*	*β*	*CI*
(Intercept)	**0.87**	**[0.59, 1.15]**	**0.82**	**[0.32, 1.32]**	**0.76**	**[0.33, 1.19]**
Time	0.07	[0.01, 0.13]	0.05	[-0.06, 0.17]	0.07	[-0.03, 0.16]
Cohort						
Cohort 2	-	-	-	-	-	-
Cohort 3	-0.02	[-0.16, 0.12]	-0.11	[-0.34, 0.12]	-0.01	[-0.22, 0.20]
Cohort 4	-0.01	[-0.19, 0.17]	-0.12	[-0.42, 0.19]	-0.07	[-0.34, 0.21]
Race/Ethnicity (0 = White)						
African American/Black	-0.11	[-0.23, 0.02]	-0.11	[-0.33, 0.11]	-0.01	[-0.20, 0.17]
Asian	**-0.17**	**[-0.30, -0.03]**	-0.09	[-0.31, 0.13]	-0.11	[-0.31, 0.08]
More than one race	0.06	[-0.13, 0.25]	0.16	[-0.15, 0.46]	0.14	[-0.13, 0.41]
Hispanic/Latino	-0.02	[-0.23, 0.19]	-0.03	[-0.36, 0.30]	-0.17	[-0.44, 0.11]
Other race/ethnicity	0.32	[-0.29, 0.93]	0.14	[-0.86, 1.14]	0.33	[-0.45, 1.11]
Sex (0 = Male)	**-0.14**	**[-0.25, -0.03]**	-0.10	[-0.29, 0.09]	**-0.18**	**[-0.33, -0.02]**
Age	-0.01	[-0.05, 0.04]	-0.05	[-0.12, 0.02]	-0.05	[-0.11, 0.01]
Probable PTSD	0.10	[-0.00, 0.20]	0.09	[-0.09, 0.27]	0.01	[-0.13, 0.16]
Relationship Dimension	**-0.10**	**[-0.18, -0.01]**	-0.04	[-0.11, 0.03]	**0.17**	**[0.11, 0.24]**
Precollege IPT	**0.10**	**[0.00, 0.19]**	0.11	[-0.05, 0.26]	**0.15**	**[0.02, 0.29]**

College-Onset IPT	*0.35*	*[0.26, 0.45]*	*0.38*	*[0.22, 0.55]*	*0.36*	*[0.23, 0.50]*
Observations	984		379		472	

Note. IPT = interpersonal trauma. **Bold** type indicates *p* < .05. ***Bold italic*** type indicates *p* < .01. Each block represents a model examining the main effect of a different relationship dimension on alcohol problems. The variables listed along the top of the table under each block correspond to the relationship dimension included in that model. Cohort two was not included in each of the models because data on all four items of the PC-PTSD screener, used to calculate probable PTSD, were not available. Relationship satisfaction and partner substance use were standardized. Alcohol problems was log-transformed and added to a constant of one.

Table 10B

Sensitivity analyses examining alcohol problems as a function of relationship status, relationship satisfaction, partner substance use, IPT exposure, and their interactions controlling for PTSD (Aim 2).

	Block 1		Block 2		Block 3	
	Interaction Effects Model					
	Relationship Dimension					
	Relationship Status		Relationship Satisfaction		Partner Substance Use	
Predictors	*β*	*CI*	*β*	*CI*	*β*	*CI*
(Intercept)	*0.90*	*[0.62, 1.19]*	*0.81*	*[0.31, 1.31]*	*0.78*	*[0.35, 1.21]*
Time	**0.07**	**[0.01, 0.13]**	0.05	[-0.06, 0.17]	0.06	[-0.04, 0.16]
Cohort						
Cohort 2	-	-	-	-	-	-
Cohort 3	-0.02	[-0.16, 0.12]	-0.11	[-0.35, 0.12]	-0.02	[-0.23, 0.19]
Cohort 4	-0.01	[-0.19, 0.17]	-0.11	[-0.42, 0.19]	-0.08	[-0.36, 0.19]
Race/Ethnicity (0 = White)						
African American/Black	-0.11	[-0.23, 0.02]	-0.09	[-0.31, 0.13]	-0.01	[-0.20, 0.17]
Asian	**-0.17**	**[-0.31, -0.03]**	-0.09	[-0.31, 0.13]	-0.11	[-0.30, 0.08]
More than one race	0.05	[-0.14, 0.24]	0.15	[-0.15, 0.46]	0.18	[-0.10, 0.45]
Hispanic/Latino	-0.03	[-0.24, 0.18]	0.01	[-0.33, 0.34]	-0.15	[-0.42, 0.12]
Other race/ethnicity	0.31	[-0.31, 0.92]	0.13	[-0.87, 1.14]	0.32	[-0.46, 1.10]
Sex (0 = Male)	**-0.14**	**[-0.25, -0.03]**	-0.10	[-0.30, 0.09]	**-0.18**	**[-0.33, -0.02]**
Age	-0.01	[-0.06, 0.04]	-0.05	[-0.12, 0.02]	-0.04	[-0.10, 0.02]
Probable PTSD	0.09	[-0.01, 0.19]	0.09	[-0.09, 0.27]	0.01	[-0.14, 0.16]
Relationship Dimension	**-0.15**	**[-0.30, -0.00]**	0.00	[-0.13, 0.13]	*0.26*	*[0.14, 0.38]*
Precollege IPT	0.07	[-0.06, 0.20]	0.13	[-0.03, 0.29]	**0.17**	**[0.03, 0.31]**
College-Onset IPT	*0.34*	*[0.21, 0.47]*	*0.35*	*[0.18, 0.52]*	*0.38*	*[0.24, 0.52]*

Relationship Dimension*Precollege IPT	0.07	[-0.11, 0.24]	0.03	[-0.11, 0.17]	-0.08	[-0.21, 0.05]
Relationship Dimension*College-Onset IPT	0.04	[-0.14, 0.22]	-0.09	[-0.24, 0.05]	-0.07	[-0.21, 0.06]
Observations	984		379		472	

Note. IPT = interpersonal trauma. **Bold** type indicates *p* < .05. ***Bold italic*** type indicates *p* < .01. Each block represents a model examining the moderating effect of a different relationship dimension on the associations between IPT and alcohol problems. The variables listed along the top of the table under each block correspond to the relationship dimension included as the moderator in that model. Cohort two was not included in each of the models because data on all four items of the PC-PTSD screener, used to calculate probable PTSD, were not available. Relationship satisfaction and partner substance use were standardized. Alcohol problems was log-transformed and added to a constant of one.

Table 11

Sensitivity analyses examining associations between precollege IPT and college-onset IPT exposure and relationship status,

relationship satisfaction, and partners substance use as a function of sex, controlling for PTSD (Aim 3.1).

	Block 1		Block 2		Block 3	
			Interaction Effects Model			
	Relationship Status		Relationship Satisfaction		Partner Substance Use	
Predictors	*OR*	*CI*	*β*	*CI*	*β*	*CI*
(Intercept)	0.43	[0.00, 7163.73]	0.32	[-0.75, 1.38]	-0.59	[-1.49, 0.31]
Time	**1.19**	**[1.04, 1.37]**	-0.13	[-0.45, 0.20]	0.16	[-0.10, 0.42]
Cohort						
Cohort 2	1.07	[0.61, 1.90]	-	-	-	-
Cohort 3	0.87	[0.51, 1.51]	-	-	-	-
Cohort 4	-	-	-0.16	[-0.70, 0.37]	0.15	[-0.31, 0.60]
Race/Ethnicity (0 = White)						
African American/Black	**0.53**	**[0.32, 0.89]**	-0.33	[-0.81, 0.16]	0.01	[-0.38, 0.40]
Asian	*0.52*	*[0.32, 0.85]*	0.03	[-0.39, 0.44]	-0.35	[-0.73, 0.03]
More than one race	0.59	[0.25, 1.37]	0.3	[-0.31, 0.92]	-0.29	[-0.86, 0.27]
Hispanic/Latino	1.4	[0.57, 3.45]	0.25	[-0.38, 0.88]	0.41	[-0.15, 0.97]
Other race/ethnicity	-	-	0.35	[-1.11, 1.81]	-0.45	[-1.85, 0.95]
Sex (0 = Male)	1.25	[0.79, 1.97]	0.36	[-0.26, 0.98]	-0.01	[-0.57, 0.54]
Age	1.02	[0.60, 1.72]	-0.1	[-0.23, 0.03]	0.06	[-0.06, 0.18]
Probable PTSD	1.52	[0.33, 6.96]	0.11	[-0.25, 0.47]	0.12	[-0.17, 0.42]
Precollege IPT	0.96	[0.44, 2.11]	-0.1	[-0.83, 0.64]	0.31	[-0.32, 0.94]
Concurrent College-Onset IPT	1.12	[0.27, 4.64]	-0.09	[-0.95, 0.78]	0.01	[-0.71, 0.73]
Lagged College-Onset IPT	0.69	[0.09, 5.45]	-0.01	[-0.73, 0.71]	0.25	[-0.36, 0.86]
Sex*Precollege IPT	1.28	[0.50, 3.29]	-0.29	[-1.10, 0.53]	-0.26	[-0.96, 0.45]
Sex*Lagged College-Onset IPT	0.45	[0.04, 4.70]	-0.34	[-1.15, 0.46]	0.14	[-0.53, 0.82]
Sex*Concurrent College-Onset IPT	1.08	[0.21, 5.42]	0.01	[-0.93, 0.95]	0.23	[-0.54, 1.01]
Observations	894		208		248	

Note. IPT = interpersonal trauma. **Bold** type indicates *p* < .05. ***Bold italic*** type indicates *p* < .01. Relationship satisfaction and partner substance use were standardized. Certain cohorts were not included in each of the models because data on all four items of the PC-PTSD screener, used to calculate probable PTSD, were not available across all cohorts or all assessments. For the Generalized Estimating Equation model, the other race/ethnicity and more than one race/ethnicity categories were combined due to small cell sizes. The main effects of covariates and IPT exposure on relationship dimensions are the same as those presented in Table 8; therefore, only the two-way interactions between sex and IPT exposure, which are the parameters of interest for this aim, are included in this table.

Table 12

Sensitivity analyses examining alcohol use as a function of relationship status, relationship satisfaction, partner substance use, IPT exposure, sex, and their interactions controlling for PTSD (Aim 3.2).

	Block 1		Block 2		Block 3	
	Interaction Effects Model					
	Relationship Dimension					
	Relationship Status		Relationship Satisfaction		Partner Substance Use	
Predictors	*β*	*CI*	*β*	*CI*	*β*	*CI*
(Intercept)	*4.60*	*[3.84, 5.35]*	*3.80*	*[2.66, 4.93]*	*3.81*	*[2.80, 4.81]*
Time	**0.15**	**[0.01, 0.29]**	**0.27**	**[0.03, 0.51]**	**0.22**	**[0.02, 0.43]**
Cohort						
Cohort 2	-	-	-	-	-	-
Cohort 3	-0.16	[-0.52, 0.19]	-0.14	[-0.67, 0.39]	0.33	[-0.14, 0.80]
Cohort 4	**-0.53**	**[-0.96, -0.09]**	-0.14	[-0.84, 0.55]	0.14	[-0.48, 0.76]
Race/Ethnicity (0 = White)						
African American/Black	*-0.73*	*[-1.04, -0.43]*	*-0.71*	*[-1.21, -0.21]*	-0.31	[-0.73, 0.11]
Asian	*-1.04*	*[-1.38, -0.71]*	**-0.50**	**[-0.97, -0.02]**	-0.35	[-0.78, 0.08]
More than one race	-0.26	[-0.73, 0.21]	-0.55	[-1.22, 0.12]	-0.25	[-0.86, 0.36]
Hispanic/Latino	-0.15	[-0.67, 0.37]	-0.20	[-0.91, 0.51]	-0.18	[-0.77, 0.42]
Other race/ethnicity	*-2.05*	*[-3.27, -0.83]*	*-2.63*	*[-4.12, -1.13]*	*-1.59*	*[-2.93, -0.24]*
Sex (0 = Male)	*-0.99*	*[-1.52, -0.46]*	-0.46	[-1.07, 0.16]	*-0.73*	*[-1.27, -0.19]*
Age	-0.02	[-0.14, 0.10]	-0.10	[-0.25, 0.05]	-0.09	[-0.22, 0.04]
Probable PTSD	0.06	[-0.18, 0.29]	0.19	[-0.18, 0.57]	0.06	[-0.26, 0.38]
Relationship Dimension	-0.04	[-0.72, 0.65]	-0.68	[-1.41, 0.04]	*0.88*	*[0.41, 1.36]*
Precollege IPT	0.00	[-0.58, 0.59]	-0.25	[-1.07, 0.57]	0.09	[-0.57, 0.76]
College-Onset IPT	0.08	[-0.46, 0.62]	0.76	[-0.05, 1.58]	0.16	[-0.49, 0.81]
Relationship Dimension*Precollege IPT	0.24	[-0.63, 1.11]	-0.39	[-1.13, 0.36]	-0.21	[-0.88, 0.46]
Relationship Dimension*College-Onset IPT	0.23	[-0.62, 1.09]	*1.07*	*[0.27, 1.87]*	0.21	[-0.45, 0.86]
Sex*Precollege IPT	0.40	[-0.29, 1.10]	0.41	[-0.50, 1.32]	0.16	[-0.60, 0.91]
Sex*College-Onset IPT	**0.64**	**[0.00, 1.29]**	-0.43	[-1.32, 0.47]	0.09	[-0.64, 0.81]

Sex*Relationship Dimension	0.39	[-0.41, 1.18]	**0.89**	**[0.10, 1.68]**	-0.04	[-0.61, 0.52]
Sex*Precollege IPT*Relationship Dimension	-0.42	[-1.43, 0.58]	0.33	[-0.48, 1.15]	0.00	[-0.74, 0.74]
Sex*College-Onset IPT*Relationship Dimension	-0.59	[-1.57, 0.40]	*-1.50*	*[-2.37, -0.63]*	-0.53	[-1.26, 0.21]
Observations		1441		523		651

Note. IPT = interpersonal trauma. **Bold** type indicates $p < .05$. ***Bold italic*** type indicates $p < .01$. Each block represents a model examining the moderating effect of a different relationship dimension on the associations between IPT and alcohol use. The variables listed along the top of the table under each block correspond to the relationship dimension included as the moderator in that model. Cohort two was not included in each of the models because data on all four items of the PC-PTSD screener, used to calculate probable PTSD, were not available. Relationship satisfaction and partner substance use were standardized. Alcohol use was log-transformed and added to a constant of one. The main effects of covariates and predictors, as well as the two-way interactions between IPT exposure and each relationship dimension, on alcohol use are the same as those presented in Table 9; therefore, only the three-way interactions between sex, IPT exposure, and each relationship dimension, which are the parameters of interest for this aim, are included in this table.

Table 13

Sensitivity analyses examining alcohol problems as a function of relationship status, relationship satisfaction, partner substance use, IPT exposure, sex, and their interactions controlling for PTSD (Aim 3.2).

	Block 1		Block 2		Block 3	
			Interaction Effects Model			
			Relationship Dimension			
	Relationship Status		Relationship Satisfaction		Partner Substance Use	
Predictors	*β*	*CI*	*β*	*CI*	*β*	*CI*
(Intercept)	*0.93*	*[0.61, 1.25]*	*0.71*	*[0.19, 1.23]*	*0.65*	*[0.20, 1.11]*
Time	**0.07**	**[0.01, 0.13]**	0.05	[-0.06, 0.17]	0.06	[-0.04, 0.16]
Cohort						
Cohort 2						
Cohort 3	-0.01	[-0.16, 0.13]	-0.10	[-0.34, 0.14]	-0.01	[-0.22, 0.20]
Cohort 4	-0.01	[-0.19, 0.17]	-0.10	[-0.41, 0.21]	-0.07	[-0.34, 0.21]
Race/Ethnicity (0 = White)						
African American/Black	-0.11	[-0.23, 0.01]	-0.10	[-0.32, 0.12]	-0.03	[-0.21, 0.16]
Asian	**-0.17**	**[-0.31, -0.04]**	-0.10	[-0.32, 0.12]	-0.12	[-0.31, 0.08]
More than one race	0.05	[-0.14, 0.24]	0.12	[-0.18, 0.43]	0.18	[-0.10, 0.45]
Hispanic/Latino	-0.03	[-0.24, 0.18]	0.01	[-0.32, 0.35]	-0.14	[-0.42, 0.13]
Other race/ethnicity	0.32	[-0.30, 0.93]	0.17	[-0.84, 1.17]	0.37	[-0.42, 1.15]
Sex (0 = Male)	-0.18	[-0.40, 0.05]	0.03	[-0.25, 0.31]	-0.03	[-0.27, 0.22]
Age	-0.01	[-0.06, 0.04]	-0.05	[-0.12, 0.02]	-0.04	[-0.10, 0.02]
Probable PTSD	0.09	[-0.01, 0.19]	0.09	[-0.09, 0.27]	0.01	[-0.14, 0.16]
Relationship Dimension	-0.27	[-0.55, 0.01]	-0.29	[-0.61, 0.03]	**0.26**	**[0.04, 0.48]**
Precollege IPT	0.08	[-0.17, 0.33]	**0.46**	**[0.07, 0.85]**	**0.37**	**[0.06, 0.68]**
College-Onset IPT	**0.27**	**[0.03, 0.51]**	0.23	[-0.19, 0.64]	**0.38**	**[0.07, 0.70]**
Relationship Dimension*Precollege IPT	0.22	[-0.14, 0.59]	0.30	[-0.06, 0.67]	-0.04	[-0.35, 0.27]
Relationship Dimension*College-Onset IPT	0.17	[-0.19, 0.54]	-0.07	[-0.45, 0.30]	0.00	[-0.31, 0.31]
Sex*Precollege IPT	-0.02	[-0.31, 0.27]	-0.40	[-0.82, 0.03]	-0.26	[-0.60, 0.09]
Sex*College-Onset IPT	0.09	[-0.20, 0.37]	0.13	[-0.32, 0.58]	-0.02	[-0.36, 0.33]

Sex*Relationship Dimension	0.16	[-0.17, 0.49]	0.34	[-0.01, 0.69]	-0.01	[-0.27, 0.25]
Sex*Precollege IPT*Relationship Dimension	-0.20	[-0.62, 0.22]	-0.31	[-0.71, 0.09]	-0.04	[-0.38, 0.30]
Sex*College-Onset IPT*Relationship Dimension	-0.17	[-0.59, 0.24]	-0.04	[-0.44, 0.37]	-0.08	[-0.42, 0.27]
Observations		984		379		472

Note. IPT = interpersonal trauma. **Bold** type indicates $p < .05$. ***Bold italic*** type indicates $p < .01$. Each block represents a model examining the moderating effect of a different relationship dimension on the associations between IPT and alcohol problems. The variables listed along the top of the table under each block correspond to the relationship dimension included as the moderator in that model. Relationship satisfaction and partner substance use were standardized. Alcohol problems was log-transformed and added to a constant of one. The main effects of covariates and predictors, as well as the two-way interactions between IPT exposure and each relationship dimension, on alcohol problems are the same as those presented in Table 10; therefore, only the three-way interactions between sex, IPT exposure, and each relationship dimension, which are the parameters of interest for this aim, are included in this table.

Table 14

Overview of findings by study aim relative to hypotheses and sensitivity analyses.

	Aim 1			Aim 3		
	Hypotheses	**Supported?**	**w/ PTSD?**	**Stronger Effects for Women?**	**Sex Effects w/ PTSD?**	
	Precollege IPT exposure would be associated with:					
1.1	↓ likelihood of being in a relationship	✳	✗	✗	✗	3.1.1
	↓ relationship satisfaction	✔	✔			
	↑ partner substance use	✔	✗			
	College-onset IPT would be associated with:					
	↓ likelihood of being in a relationship					
	at concurrent assessments	✔	✗		✗	
	at subsequent assessments	✗	✗		✗	
1.2	↓ relationship satisfaction			✗		3.1.2
	at concurrent assessments	✔	✗		✗	
	at subsequent assessments	✔	✗		✗	
	↑ partner substance use					
	at concurrent assessments	✔	✗		✗	
	at subsequent assessments	✔	✔		✗	
	Aim 2			Aim 3		
	Hypotheses	**Supported?**	**w/ PTSD?**	**Stronger Effects for Men?**	**Sex Effects w/ PTSD?**	
	The association between **precollege IPT** and alcohol outcomes would be moderated by:					
2.1	↑ relationship status			✗	✗	3.2.1
	↓ alcohol use	✔	✗			
	↓ alcohol problems	✗	✗			
	↑ relationship satisfaction					

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2.2						3.2.2
	↓ alcohol use	✗	✗			
	↓ alcohol problems	✗	✗			
	↓ partner substance use					
	↓ alcohol use	✗	✗			
	↓ alcohol problems	✗	✗			
	The association between **college-onset IPT** and alcohol outcomes would be moderated by:					
	↑ relationship status					
	↓ alcohol use	✗	✗		✗	
	↓ alcohol problems	✗	✗		✗	
	↑ relationship satisfaction					
	↓ alcohol use	✗	✗	✗	✔	
	↓ alcohol problems	✗	✗		✗	
	↓ partner substance use					
	↓ alcohol use	✔	✗		✗	
	↓ alcohol problems	✗	✗		✗	

Note. IPT = interpersonal trauma; ✔ = Hypothesis was supported (shaded in green); ✗ = Hypothesis was not supported (shaded in pink); ✱ = Significant finding in the opposite direction of hypothesis (shaded in yellow). As part of the sensitivity analyses, all inferential analyses were reanalyzed including probable Post-Traumatic Stress Disorder (PTSD) as a covariate to account for any variance explained by PTSD diagnosis.
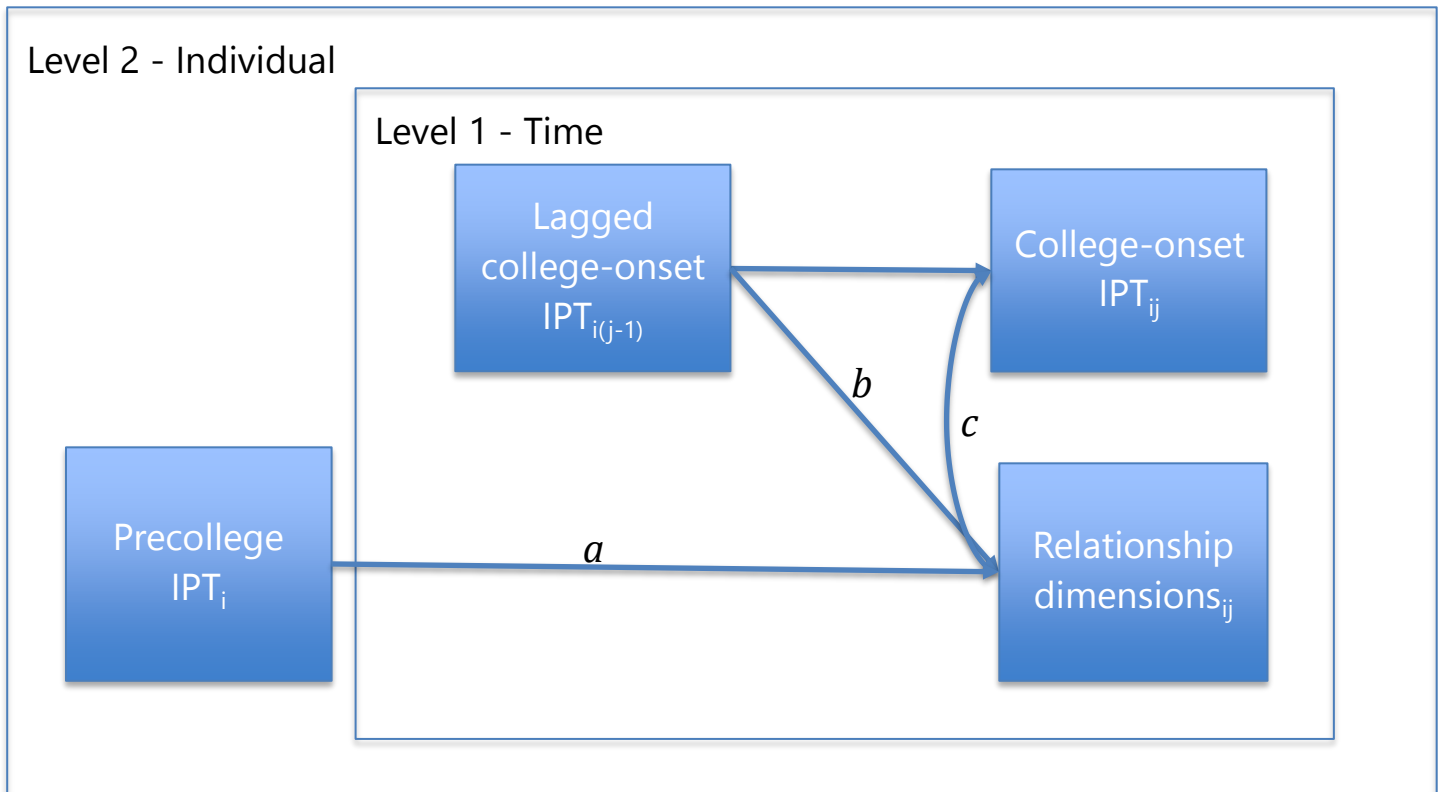
Figure 1. Conceptual model for Aim 1 analyses focused on characterizing the associations between interpersonal trauma (IPT) exposure and relationship dimensions. Although represented as one single model in this figure, a parallel series of models was run for each relationship dimension (relationship status, relationship satisfaction, partner substance use). The pathway denoted by subscript *a* represents the effect of precollege IPT on each relationship dimension. The pathway denoted by subscript *b* represents the lagged associations between college-onset IPT and each relationship dimension. Finally, the pathway denoted by subscript *c* represents the concurrent associations between college-onset IPT and each relationship dimension when controlling for effects of lagged IPT. College-onset IPT and all three relationship dimensions were treated as time-varying variables in these analyses (denoted by the subscripts *ij*), while precollege IPT was a time-invariant variable (denoted by the subscript *i*).
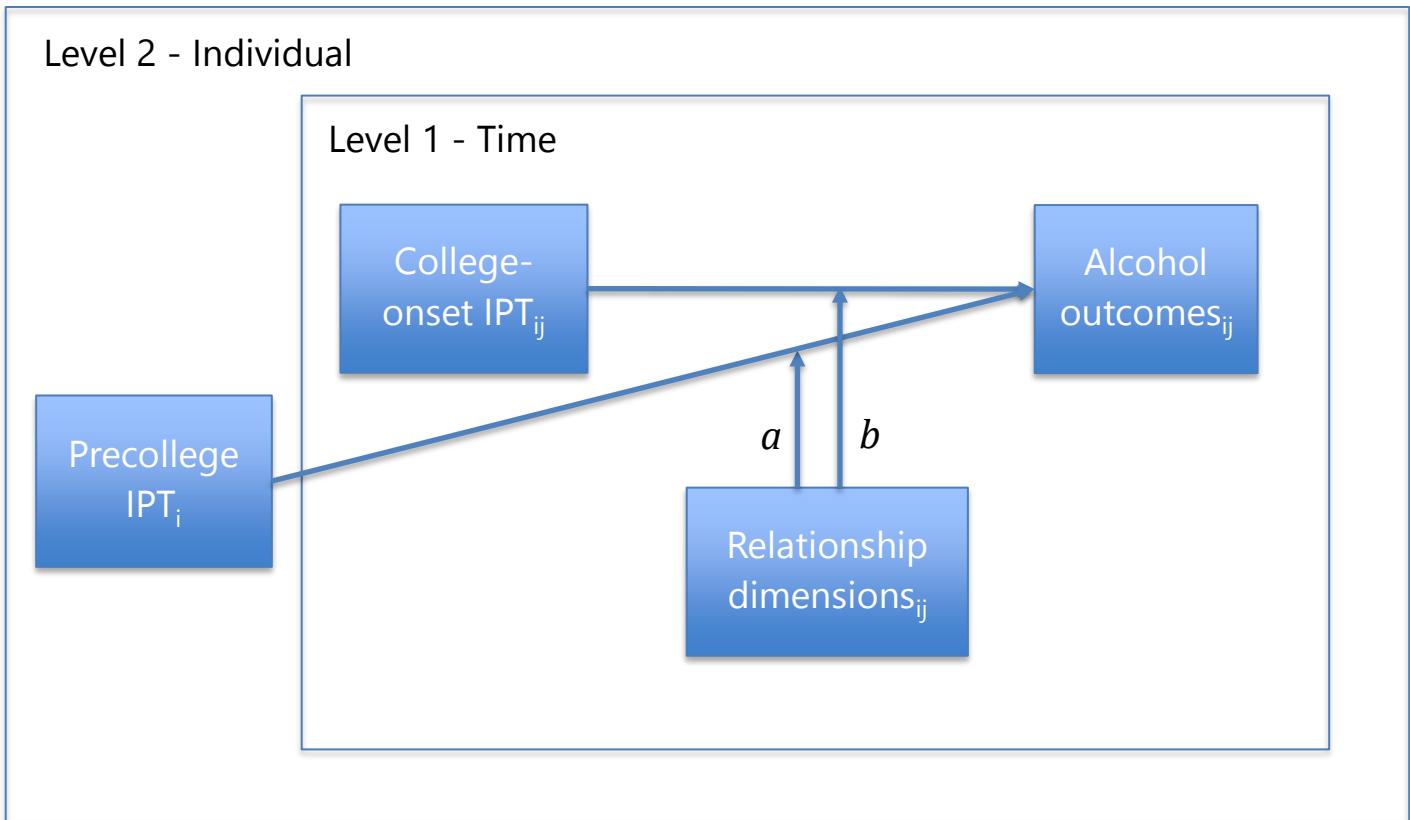
Figure 2. Conceptual model for Aim 2 analyses focused on examining whether relationship dimensions moderated the associations between interpersonal trauma (IPT) exposure and alcohol use and alcohol problems. Although represented as one single model in this figure, a parallel series of six models were run, with one model for each relationship dimension (relationship status, relationship satisfaction, partner substance use) and for each alcohol outcome (alcohol use, alcohol problems). The pathway denoted by subscript *a* represents the two-way interaction between each relationship dimension and precollege IPT in predicting each alcohol outcome. The pathway denoted by subscript *b* represents the two-way interaction between each relationship dimension and college-onset IPT in predicting each alcohol outcome. College-onset IPT, all three relationship dimensions, and both alcohol outcomes were treated as time-varying variables in these analyses (denoted by the subscripts *ij*), while precollege IPT was a time-invariant variable (denoted by the subscript *i*).
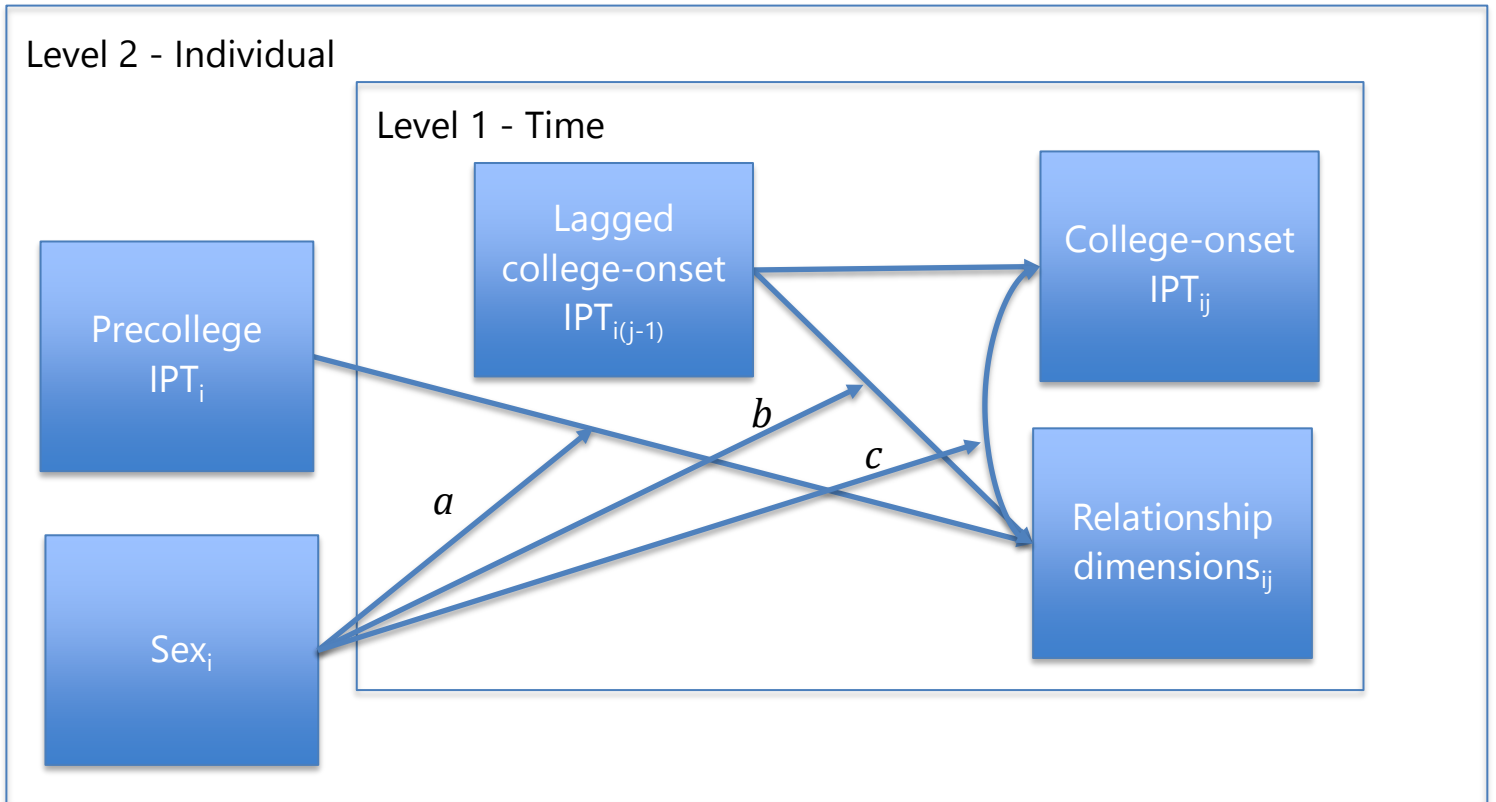
Figure 3. Conceptual model for Aim 3.1 analyses focused on examining whether the associations between interpersonal trauma (IPT) exposure and relationship dimensions vary in a sex-specific manner. Although represented as one single model in this figure, a parallel series of models was run for each relationship dimension (relationship status, relationship satisfaction, partner substance use). The pathway denoted by subscript *a* represents the two-way interaction between sex and precollege IPT predicting each relationship dimension. The pathway denoted by subscript *b* represents the two-way interaction between sex and lagged college-onset IPT to predict each relationship dimension. Finally, subscript *c* represents the pathway examining the effects of the two-way interaction between sex and college-onset IPT on each relationship dimension when controlling for the effects of lagged college-onset IPT. College-onset IPT and all three relationship dimensions were treated as time-varying variables in these analyses (denoted by the subscripts *ij*), while sex and precollege IPT were treated as time-invariant variables (denoted by the subscript *i*).
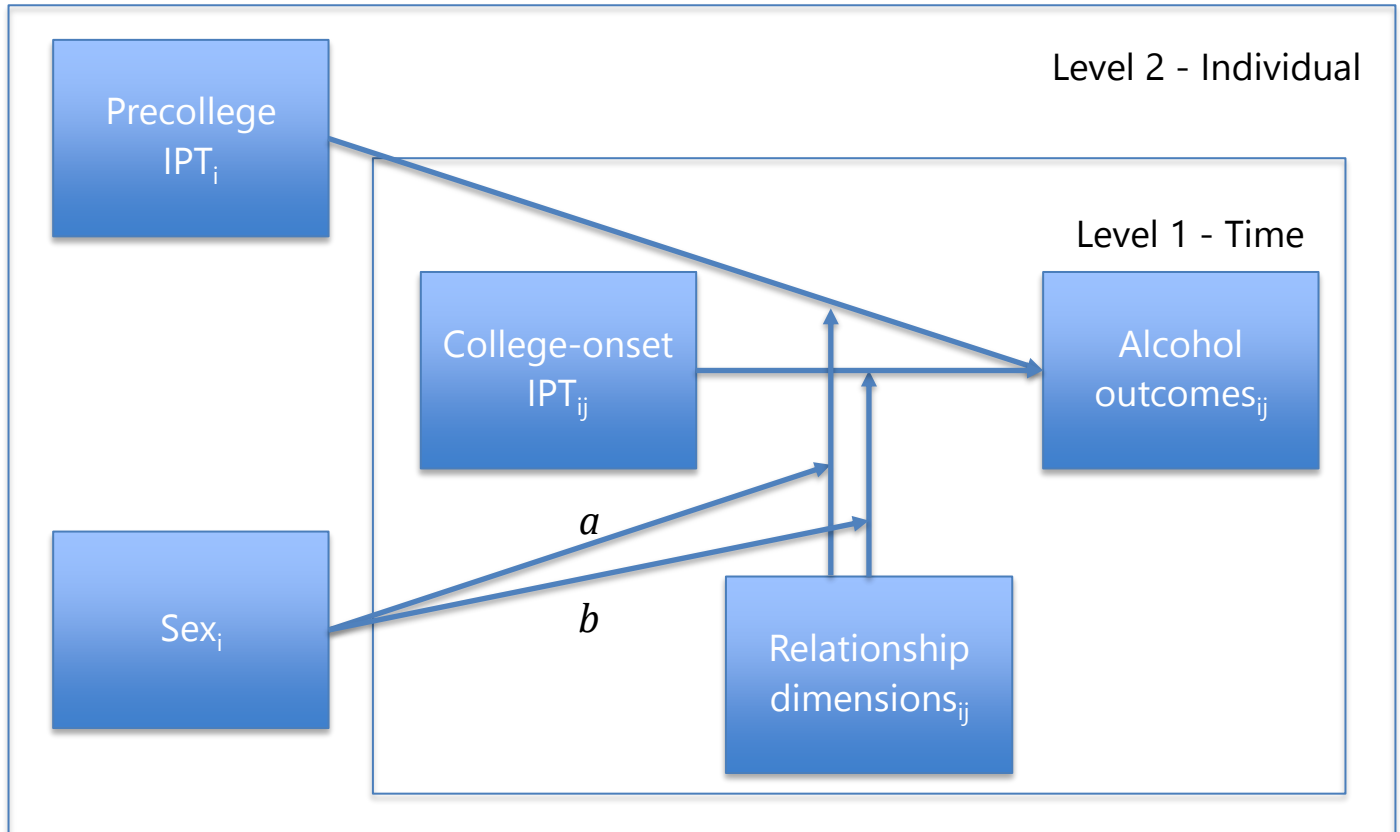
Figure 4. Conceptual model for Aim 3.2 analyses focused on examining whether relationship dimensions moderated the associations between interpersonal trauma (IPT) exposure and alcohol use and alcohol problems in a sex-specific manner. Although represented as one single model in this figure, a parallel series of six models were run, with a separate model for each relationship dimension (relationship status, relationship satisfaction, partner substance use) and for each alcohol outcome (alcohol use, alcohol problems). The pathway denoted by subscript *a* represents the three-way interaction between sex, each relationship dimension, and precollege IPT in predicting each alcohol outcome. The pathway denoted by subscript *b* represents the three-way interaction between sex, each relationship dimension, and college-onset IPT in predicting each alcohol outcome. College-onset IPT, all three relationship dimensions, and both alcohol outcomes were treated as time-varying variables in these analyses (denoted by the subscripts *ij*), while sex and precollege IPT were treated as time-invariant variables (denoted by the subscript *i*).
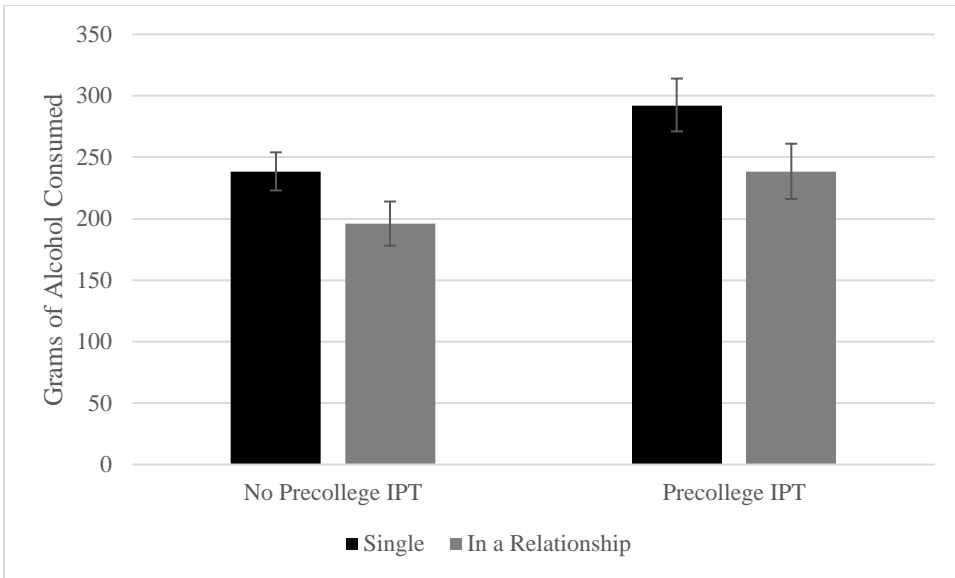
Figure 5. Alcohol use as a function of the interaction between relationship status and precollege interpersonal trauma exposure (IPT).
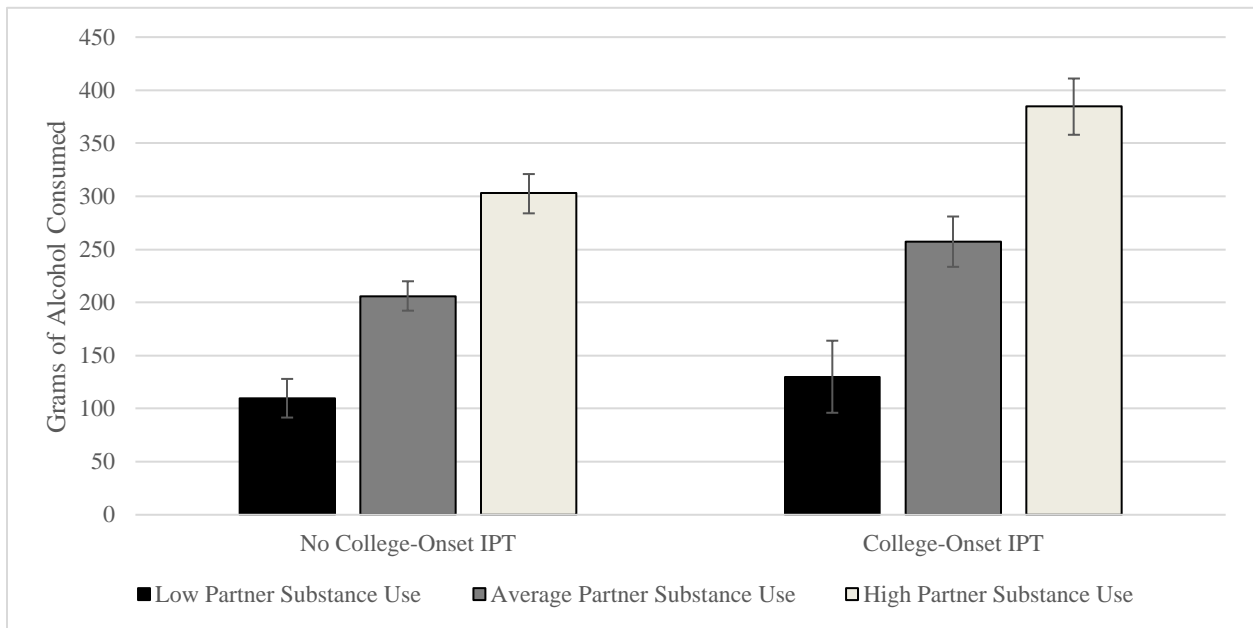
Figure 6. Alcohol use as a function of the interaction between partner substance use and college-

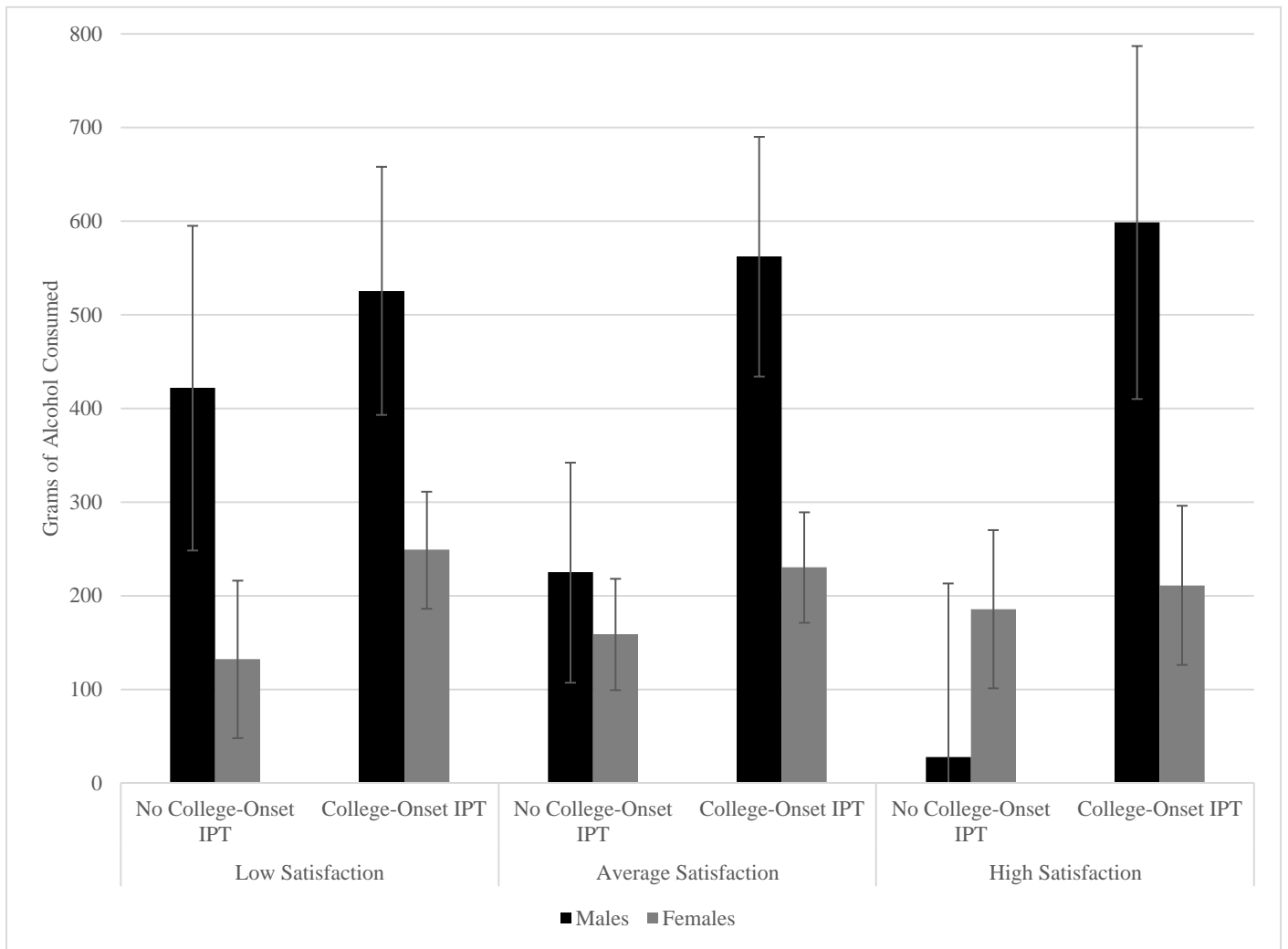onset interpersonal trauma exposure (IPT).

Figure 7. Sensitivity analyses examining alcohol use as a function of the interaction between sex,

relationship satisfaction, and college-onset interpersonal trauma (IPT) exposure controlling for

PTSD.

Appendix

Table 1

Associations relationship status (lagged and concurrent) on college-onset IPT exposure.

	Concurrent College-Onset Trauma	
Predictors	*OR*	*CI*
(Intercept)	1.17	[0.00, 475.31]
Time	1.07	[0.97, 1.18]
Cohort		
Cohort 2	1.02	[0.76, 1.37]
Cohort 3	1.05	[0.79, 1.40]
Cohort 4	-	-
Race/Ethnicity (0 = White)		
African American/Black	0.81	[0.60, 1.10]
Asian	***0.50***	***[0.35, 0.72]***
More than one race	1.02	[0.63, 1.67]
Hispanic/Latino	0.77	[0.44, 1.36]
Other race/ethnicity	0.74	[0.33, 1.66]
Sex (0 = Male)	***1.76***	***[1.32, 2.35]***
Age	0.89	[0.64, 1.24]
Lagged Relationship Status	0.98	[0.79, 1.22]
Concurrent Relationship Status	**0.76**	**[0.60, 0.96]**
Observations	3396	

Note. IPT = interpersonal trauma. **Bold** type indicates $p < .05$. ***Bold italic*** type indicates $p < .01$. This table shows results of a supplementary analysis examining the association between lagged relationship status and concurrent relationship status on college-onset IPT. The Generalized Estimating Equation model examining relationship status did not include cohort four because no participants in this cohort had complete data on PTSD at all follow-up assessments.

Vita

Rebecca Lynne Smith was born on May 20, 1991, in Toledo, Ohio. She graduated from Woodbridge Senior High School in Woodbridge, Virginia in 2009. She received her Bachelor of Science in Psychology from the University of Mary Washington in 2013 and her Master of Social Work with a concentration in Clinical Social Work from Virginia Commonwealth University in 2015. After graduate school, she worked as a clinical social worker at Tucker Psychiatric Pavilion and as a research analyst at the Virginia Department of Juvenile Justice. In 2017, Rebecca returned to Virginia Commonwealth University to pursue her doctoral degree in Developmental Psychology.