**Relationships Among PTSD, Preventive and Risky Behaviors, and Health Outcomes in Trauma-Exposed College Students**

by

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Abstract

Individuals with posttraumatic stress disorder (PTSD) are more likely to demonstrate increases in self-reported physical health complaints, objective markers of poor health, health care utilization, and mortality. Although this relationship has been well-established in trauma literature, the mechanisms underlying this association are not well understood. One proposed hypothesis to account for this relationship is the behavioral pathway, which suggests that individuals with PTSD are more likely to engage in risky health behaviors (e.g., substance use) that, in turn, result in poor health outcomes. The current study proposed to expand the behavioral pathway to include preventive health behaviors (e.g., regular exercise). It was hypothesized that (1) PTSD would be highly correlated with poor health outcomes, (2) PTSD would be positively correlated with engagement in risky health behaviors and negatively correlated with engagement in preventive health behaviors, (3) risky health behaviors would mediate the relationship between PTSD and poor health outcomes, and (4) the absence of preventive health behaviors would serve as a mediator between PTSD and physical health outcomes. One hundred and sixty trauma-exposed undergraduates completed a self-report battery including measures assessing PTSD symptoms, risky and preventive health behaviors, and health outcomes. Consistent with hypothesis 1, PTSD was significantly correlated with poor physical health outcomes, though PTSD symptoms did not predict engagement in risky or preventive health behaviors and meditational hypotheses were not supported. These findings call attention to the well-known relationship between PTSD and physical health. However, the mechanisms by which physical health is impacted by PTSD remain unclear.

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## Introduction

Exposure to traumatic events is associated with poor physical health outcomes (e.g., Friedman & Schnurr, 1995; Green & Kimerling, 2004; Friedman & McEwen, 2004), even though most individuals are not seriously injured or exposed to disease during a traumatic event (e.g., Kulka et al., 1990; Resnick, Kilpatrick, Dansky, Saunders, & Best, 1993). Furthermore, the types of physical health outcomes reported by trauma survivors are not necessarily associated with the type of trauma experienced (e.g., a survivor of childhood sexual abuse may not report gynecological difficulties, but may instead report significant head or back aches; Felitti et al., 1998). There appears, therefore, to be a component of trauma exposure, and more specifically of posttraumatic stress disorder (PTSD), that results in poorer physical health outcomes, despite the lack of physical injury or illness directly related to the trauma.

The link between PTSD and health has been examined across a variety of clinical populations, including combat veterans, physical and sexual assault survivors, childhood sexual abuse victims, natural disaster survivors, parents who have lost a child, refugees, and civilian internees (Beckham et al., 1998; Ciechanowski, Walker, Russo, Newman, & Katon, 2004; McFarland, Atchison, Rafalowicz, & Papay, 1994; Murphy et al., 1999; Schnurr, Spiro, & Paris, 2000; Schnurr & Spiro, 1999; Uba & Chung, 1991). Across diverse clinical populations, trauma survivors have reported poorer functional health and self-reported physical health, as well as higher mortality and health care utilization rates.

Although the link between trauma exposure and poor physical health outcomes is well established, the mechanisms that explain the relationship are not well understood. Three pathways have been suggested to account for the connection between PTSD and adverse health outcomes (Friedman & Schnurr, 1995). The biological pathway suggests that the biological changes that occur in response to stress (e.g., autonomic system changes) affect immune system arousal, resulting in hyperarousal of bodily systems, which may lead to acute or long-term physical health problems (Ritchie & Nemeroff, 1991). The psychological pathway postulates that it is the psychological disorders that occur comorbidly with PTSD (e.g., depression, anxiety, somatoform disorders) that are related to increased somatic complaints. The behavioral pathway, which will be examined in the current study, suggests that trauma survivors have poorer physical health outcomes because they engage in risky health behaviors that contribute to health problems over time.

The current study investigated the connection between PTSD and physical health outcomes in a sample of male and female college students with three primary goals. One goal of the current study was to replicate findings that link PTSD symptom severity with increased self-reported somatic complaints and conditions and functional health impairment. A second goal of the study was to examine the impact of preventive health behaviors on physical health outcomes, as a limited number of studies (Buckley, Mozley, Bedard, Dewulf, & Grief, 2004; Beckham et al., 1997) have considered the effect of positive health behaviors (e.g., exercise, sensible diet, seatbelt use). Lastly, while past studies have used meditational analyses to understand the relationship between PTSD and physical health, the current study used structural equation modeling to analyze the relationships between variables, which has many advantages when compared to multiple regression (see Byrne, 2001). The following literature review will inform

hypotheses about the relationships between PTSD symptoms, risky and preventive health behaviors, and health outcomes.

**Trauma Exposure versus PTSD Symptoms**

Research findings link both trauma exposure and PTSD to poor physical health outcomes, and a limited number of studies have attempted to determine which variable is a more powerful predictor of adverse health outcomes. Most studies have focused on either trauma exposure or PTSD symptoms and have not examined the role each variable plays in the relationship with physical health; however, studies that have considered the role of both trauma exposure and PTSD on physical health emphasize the importance of PTSD in the relationship.

Schnurr and Spiro (1999) refer to PTSD symptoms as the "active ingredient" that results in poor health outcomes following trauma. Examining the effects of combat exposure, PTSD symptoms, and health behaviors on physical health in a sample of veterans, they found that both combat exposure and PTSD were correlated with poorer health outcomes. However, when utilizing path analysis, combat exposure had only an indirect effect on health outcomes, whereas PTSD symptoms demonstrated a direct effect. Additional studies have also supported the finding that PTSD symptom severity is a stronger predictor of physical health outcomes than trauma exposure alone (Wolfe, Schnurr, Brown, & Furey, 1994; Taft, Stern, King, & King, 1999), and therefore, the current study will examine PTSD symptom severity as it relates to physical health outcomes.

**PTSD and Physical Health**

The relationship between PTSD symptoms and physical health has been examined across multiple trauma types, including combat veterans (e.g., Baker, Simbartal, Magean, & Steinberg,

1997; Kimerling, Clum, & Wolfe, 2000), natural disaster survivors (e.g., Lutgendorf et al., 1995; Murphy et al., 1999), physical and sexual assault victims (e.g., Golding, 1994; Golding, Cooper, & George, 1997), childhood sexual abuse victims (e.g., Lechner, Vogel, Garcia-Shelton, Leichter, & Steibel, 1993; Walker et al., 1992), and refugees (Uba & Chung, 1991). Individuals with PTSD have reported increases in self-reported health problems (Sledjeski, Speisman, & Dierker, 2008; Flett, Kazantzis, Long, MacDonald & Millar, 2002; Martin, Rosen, Durand, Knudson, & Stretch, 2000; Barrett et al., 2002; Kulka et al., 1990; Neria & Koenen, 2003; Kimerling et al., 1999; Zatzick, Jurkovich, Gentillelo, Wisner, & Rivara, 2002; Iowa Persian Gulf Group Study, 1997; Sareen, Cox, Clara, & Asmundson, 2005; Lechner et al., 1993; Lawler, Ouimette, & Dahlstedt, 2005), objective markers of poor health (e.g., medical records, lab results; Schnurr et al., 2000; Ouimette et al., 2004; Boscarino & Chang, 1999; Shalev, Bleich, & Ursano, 1990; Kang, Bullman, & Taylor, 2006; Walker et al., 1999; Buckley et al., 2004), health care utilization (Walker, Newman, & Koss, 2004; Berger et al., 2007; Deykin et al., 2001; Walker et al., 2003; McFarland et al., 1994; Toole & Catts, 2008), and mortality, due to both external causes (e.g., accidents, suicide) and disease (Visinainer, Barone, McGee, & Peterson, 1995; Catlin-Boehmer, Flanders, McGeehin, Boyle, & Barrett, 2004; Schnurr, Green, & Kaltman, 2007; Bullman & Kang, 1994; Boscarino, 2006). Regardless of how health outcomes are measured, and despite differing trauma types, PTSD symptoms are associated with poorer physical health outcomes.

**Self-Reported Health Problems.** In both veteran and non-veteran samples, PTSD has been linked to poorer perceived health, chronic health conditions, and self-reported functional status (e.g., Barrett et al., 2002; Kulka et al., 1990; Neria & Koenen, 2003; Kimerling et al., 1999; Zatzick et al., 2002; Calhoun, Wiley, Dennis, & Beckman, 2009). Two large scale studies

utilizing veteran populations (i.e., Boscarino, 1997; Iowa Persian Gulf Group Study, 1997) found that veterans diagnosed with PTSD had higher rates of self-reported circulatory, digestive, musculoskeletal, endocrine, and respiratory disorders, non-sexually transmitted diseases, chronic fatigue, and fibromyalgia than did a sample without PTSD. Non-veteran studies have yielded similar results. In non-veterans, PTSD has been associated with higher rates of self-reported neurological, vascular, gastrointestinal, metabolic, respiratory, musculoskeletal, and autoimmune disorders (Sareen et al., 2005; Lechner et al., 1993). A study of college students found that increases in PTSD symptoms was associated with poorer self-reported physical health status (Lawler et al., 2005).

**Objective Markers of Poor Health.** PTSD is also related to poor health outcomes when measured by objective markers of health (e.g., medical records, lab work). In a longitudinal study of Korean Conflict and World War II veterans, PTSD diagnoses were correlated with physician-diagnosed medical conditions including arterial, gastrointestinal, musculoskeletal, and dermatological problems, even after controlling for participant age, smoking, alcohol use, and body mass index (BMI; Schnurr et al., 2000). Additional studies of non-veteran populations have shown PTSD symptoms to be correlated with an increase in the total number of physician-diagnosed medical problems, electrocardiograph abnormalities, myocardial infarctions, and hypertension after controlling for demographic characteristics, drug, alcohol, and tobacco use, and BMI (Boscarino & Chang, 1999; Kang et al., 2006; Seng, Clark, McCarthy, & Ronis, 2006).

**Health Care Utilization.** Individuals with PTSD have demonstrated higher rates of health care utilization than individuals without PTSD (e.g., McFarland et al., 1994), and individuals with high rates of health care utilization are more likely to meet diagnostic criteria for PTSD (e.g., Deykin et al., 2001; Toole & Catts, 2008). Even after controlling for depression,

chronic medical illness, and psychological distress, Walker and colleagues (2003) found that PTSD was associated with increased health care costs.

**Mortality.** Few studies have examined mortality among individuals with PTSD, although those that have report excess mortality in individuals with PTSD (Schnurr et al., 2007). Some studies report that excess mortality in individuals with a diagnosis of PTSD is due primarily to external causes (e.g., suicide, accidents), although study results are mixed. Bullman and Kang (1994) found that mortality rates for Vietnam War veterans with PTSD were 71% higher than for veterans without PTSD, and higher mortality rates were more frequently due to accidents and suicide. However, this same sample also demonstrated higher mortality rates due to digestive system diseases, including cirrhosis of the liver. In addition, data from another sample of Vietnam Era veterans was examined and PTSD diagnostic status was associated with increased mortality due to cardiovascular disease, cancer, and external causes (Boscarino, 2006).

## Mediation Models

Research has demonstrated a clear link between PTSD and physical health; however, factors contributing to this relationship are not well understood. Three meditation models have been proposed to account for the relationship: biological, psychological, and behavioral. A variable is said to function as a mediator to the extent that it accounts for the relationship between the independent (e.g., PTSD) and dependent variables (e.g., physical health; Baron & Kenny, 1986) and is said to explain the relationship between the variables (Frazier, Tix, & Barron, 2004). The current study expands on the behavioral mediation model; therefore, the biological and psychological models will be reviewed in brief.

**Biological.** The biological mediation model suggests that stress-related, physiological changes occur in the body at the time of trauma exposure, resulting in both immediate and long-term health problems. Research has clearly established that biological changes occur with trauma exposure, but the extent that these lasting changes affect susceptibility to disease, infection, and illness has not yet been resolved (Dougall & Baum, 2001).

The human "stress system" (Friedman & McEwen, 2004) has evolved to assist the body in responding to stress. The stress system consists of the nervous, endocrine, and immunological systems. The primary components of the nervous system affected in times of stress and responsible for biological changes are the sympathetic-adrenal medullary (SAM) system and the hypothalamic-pituitary-adrenal (HPA) system (Friedman & McEwen, 2004; Carlson, 1998; Hafen, Karren, Frandsen, & Smith, 1996).

In response to stress, the SAM system is activated and results in increases in heart rate and blood pressure, as well as constriction of blood vessels and increased levels of epinephrine and norepinephrine. Researchers hypothesize that if the SAM system is activated for a significant amount of time, it can lead to bodily changes that cause disease and adverse physical health outcomes (Carlson, 1998). With chronic exposure to stress or traumatic events, minor problems such as tics and muscle tremors may occur; however, more serious health problems may also emerge, including ulcers, heart attack, and stroke (Friedman & McEwen, 2004). HPA system activation results in increased levels of the hormone cortisol. Too much cortisol in the body can cause nerve loss in the hippocampus, as well as increased cholesterol and damage to the lining of the heart and blood vessels. One of the most serious complication resulting from high cortisol levels is immune system suppression (Carlson, 1998). Therefore, biological changes that occur

as a result of stress exposure may lead to long-term physical health problems among trauma survivors.

**Psychological.** Researchers have also proposed a psychological pathway to mediate the relationship between PTSD and negative physical health outcomes. Research regarding the psychological pathway suggests that trauma exposure leads to decreased mental well-being and often the development of mental health disorders (e.g., Koss, Koss, & Woodruff, 1991; Murphy et al., 1999). Further, the risk for development of PTSD is significantly greater among individuals with preexisting or comorbid psychiatric conditions (Ullman & Siegel, 1996). For example, many individuals with a diagnosis of PTSD also suffer from a depressive disorder (e.g., Bunce, Larson, & Peterson, 1995; Iowa Persian Gulf Study Group, 1997), anxiety disorders (e.g., Follingstad, Brennan, Hause, Poles, & Rutledge, 1991; Walker et al., 1992), and somatization disorders (Walker et al., 1992). Studies have found that nearly 80% of participants with PTSD also met criteria for other psychiatric conditions (e.g., Helzer, Robins, & McEvoy, 1987; Breslau, Davis, Andreski, & Peterson, 1991).

Depression and anxiety disorders, frequently diagnosed comorbidly with PTSD, significantly impact the frequency with which individuals get sick and how often they visit their physician (Hafen et al., 1996). Examples of common physical problems associated with depression and anxiety include headache, chest, back, and joint pains, shortness of breath, unspecified body aches, and gastrointestinal discomfort. These physical problems are not imagined and result from real physiological problems caused by these disorders (Barlow, 1993). Individuals with somatoform disorders are likely to mislabel minor physical symptoms as indicative of serious health conditions. Due to misinterpretations and hypersensitivity to physiological changes, these individuals are likely to over-report symptoms and seek medical

care at increased rates (Hafen et al., 1996). Although proponents of the psychological pathway suggest that comorbid psychiatric conditions account for the increase in health problems among individuals with PTSD, research has demonstrated that PTSD has a distinct effect on physical health, beyond what is associated with comorbid conditions. This relationship remained event after accounting for over-reporting of symptoms by individuals with somatoform disorders (Schnurr et al., 2007).

A second facet of the psychological mediation model of PTSD and health deficits is poor coping skills (Schnurr et al., 2007). Research indicates that individuals exposed to traumatic events demonstrate marked differences in how they cope with stress (Aldwin, 1999). PTSD has been associated with decreased use of problem-focused (e.g., pursuing psychotherapy services) and increased use of emotion-focused (e.g., avoiding anxiety-provoking situations) coping strategies, and this coping pattern has been associated with less favorable health outcomes (e.g., Schnurr & Green, 2003). For instance, a study conducted by Lawler and colleagues (2005) found that among college students exposed to traumatic events, trauma-specific emotion-focused coping behaviors (avoiding people or places that remind you of the traumatic events) were uniquely associated with poorer health status, even after accounting for coping related to health problems (e.g., use of pain relievers). In sum, the psychological pathway postulates that comorbid psychiatric conditions and poor coping skills results in negative health outcomes for individuals with PTSD.

**Behavioral Pathway**

The focus of the current study is on the behavioral pathway. Literature supporting the behavioral pathway suggests that risky health behaviors among individuals with PTSD

contribute to poor health, increased health care utilization, and increased mortality rates. Researchers have proposed several hypotheses to account for the increase in risky health behaviors among individuals with PTSD. First, risky health behaviors can be viewed as a means of self-medicating to cope with PTSD symptoms. For example, trauma-exposed individuals may use alcohol excessively to control hyperarousal (e.g., irritability) and reexperiencing (e.g., nightmares that disrupt sleep) symptoms. Herman (1997) proposed that these behaviors serve as the survivor's attempt at regulating their internal emotional state. Second, risky health behaviors may be the result of psychopathology that can result from PTSD. For instance, a survivor of childhood sexual abuse who dissociates may not adequately attend to danger signals, which may result in poor judgment and engagement in risky health behaviors. Lastly, individuals with PTSD may engage in risky health behaviors as a result of guilt or shame and may experience suicidal ideation leading to risky behaviors (e.g., drug overdose, driving without a seatbelt; Herman , 1997).

The following risky health behaviors have all been reported at increased rates among individuals with PTSD when compared to individuals without PTSD: alcohol use (e.g., Kaysen et al., 2008; Beckham et al., 1998; Koss et al., 1991; Schnurr et al., 1999), illicit drug use (e.g., Read, Stern, Wolfe, & Ouimette, 1997; Centers for Disease Control Vietnam Experience Study, 1987), cigarette smoking (e.g., Walker et al., 2003, Beckham et al., 1995; Schnurr et al., 1999; Koss et al., 1991), disordered eating (e.g., Koss et al., 1991; Murphy et al., 1999), and number of sexual partners (Green et al., 2005). Decreased seatbelt use has also been noted (Koss et al., 1991).

The association between risky health behaviors and negative health outcomes is clear. Tobacco use is associated with multiple cancers and cardiovascular disease (Jacobs et al., 1999).

Heavy alcohol consumption may lead to diseases of the endocrine, cardiovascular, and nervous systems (Rheingold, Acierno, & Resnick, 2003) and may contribute to death or injury as a result of accidents or violence (Rutledge & Messick, 1992). Physical health problems resulting from illicit drug abuse include physical and psychological dependence, overdose, tremors, and memory loss, and if substances are administered intravenously there is an increased risk of HIV transmission as a result of sharing contaminated needles (Carlson, 1998). Additionally, specific substances induce their own health complications (e.g., cannabis use can lead to elevations in hear rate and blood pressure and increased risk for lung cancer; Nevid, Rathus, & Greene, 1997). Engaging in risky sexual behaviors (i.e., having multiple sexual partners and engaging in unprotected intercourse) increases one's risk of health problems including HIV, pelvic inflammatory disease, sexually transmitted diseases, and cervical cancer (McGinnis & Forge, 1993).

As well, the leading causes of mortality and morbidity in the United States (US) are a result of one's own actions. The most prominent behavioral influences on mortality rates in 2000 included tobacco use (435,000 deaths, 18.1% of total US deaths), alcohol consumption (85,000 deaths, 3.5% of total US deaths), risky sexual behaviors (20,000 deaths, 0.8% of total US deaths), and illicit drug use (17,000 deaths, 0.7% of total US deaths; Mokdad, Marks, Stroup, & Gerberding, 2004).

Researchers suggest that the aforementioned risky health behaviors may mediate the relationship between PTSD and poor physical health and the examination of these behaviors is particularly relevant in a college student sample given the rates of alcohol consumption (84.5%), tobacco use (41.0%), and illicit drug use (30.1%) within this population (Werch et al., 2008).

Additional research suggests that the majority of college students have engaged in unprotected sexual intercourse (Sturges et al., 2009).

One recent study demonstrated the behavioral pathway in college students, examining substance abuse behaviors as a mediator between PTSD and poor physical health outcomes (Flood, McDevitt-Murphy, Weathers, Eakin, & Benson, 2009). Flood and colleagues (2009) replicated the finding that PTSD is associated with adverse physical health outcomes, even in a presumably healthy college student sample. Additionally, researchers found that this relationship was mediated by alcohol and drug use. The current study seeks to replicate and expand these findings by adding preventive health behaviors as a component of the behavioral pathway.

**Preventive Health Behaviors**

As it is currently conceptualized, the behavioral pathway linking PTSD and poor physical health outcomes focuses on individuals' engagement in risky health behaviors. The current study proposes that the absence of preventive health behaviors may be a second component of the behavioral pathway contributing to the relationship between PTSD and poor physical health.

Engagement in regular exercise, maintaining a sensible diet, and physician follow-up have all been shown to have a positive impact on physical health (McEwen, 1998). However, research demonstrates that individuals with PTSD underutilize preventive health care options and are less engaged in healthy behaviors, such as proper diet and exercise (Schnurr & Green, 2003). The relationship between PTSD, preventive health behaviors, and physical health has been examined in a limited number of studies (e.g., Buckley et al., 2004; Beckham et al., 1997).

Studies have demonstrated that sexually abused women who develop PTSD schedule Pap smears less frequently than those without PTSD (Springs & Friedrich, 1992). A separate study

found that among rape victims who reported symptoms of PTSD and completed an acute sexual assault medical examination, only 31% returned for scheduled follow-up medical appointments six weeks later.

Research examining the relationship between PTSD, diet, and exercise has demonstrated significant relationships. Felitti and colleagues (1998) reported that adults who had been exposed to traumatic childhood experiences and reported current symptoms of PTSD had significantly higher BMIs than adults who denied symptoms of PTSD. Additionally, individuals reporting PTSD symptoms also engaged in less leisure time physical activity. Larson (2006) reported that among humanitarian aid workers, PTSD symptoms were associated with lower levels of fruit and vegetable intake and lower frequency of physical activity after controlling for demographic variables (age, gender, race, and marital status). Similarity, Lang and colleagues (2003) found that PTSD symptoms reported by victims of sexual abuse were associated with less frequent and less vigorous exercise.

Among a sample of combat veterans, PTSD symptoms were significantly correlated with BMI scores (Schnurr et al., 2000), such that the more PTSD symptoms were endorsed, the higher the BMI. Shalev and colleagues (1990) found that extreme obesity was more common among veterans who had PTSD, as compared to veterans who did not report a history of PTSD. Interestingly, Shalev and colleagues (1990) also reported a significant proportion of veterans who were underweight, suggesting that, in addition to obesity, various eating related problems (e.g., eating disorders) should be considered in future research. This link may be particularly important in college student samples given the prevalence of disordered eating within the college student population. Studies have shown that approximately 60% of college students report

disordered eating behaviors, and nearly 20% acknowledge some form of eating disorder (Mazzeo, 1999).

Only one study utilizing a college student population was found to examine the role of preventive health behaviors. Lawler and colleagues (2005) sampled undergraduates reporting PTSD symptoms. Participants were within normal weight range according to BMIs and exercised about two days each week. PTSD symptoms were significantly associated with poorer physical health status, even after controlling for the effects of exercise; however, no other preventive health behaviors were accounted for.

## Current Study

The absence of preventive health behaviors in individuals with PTSD has been documented in limited research, and even fewer studies have accounted for PTSD, preventive health behaviors, and physical outcomes. Research into the importance of preventive health behaviors among individuals with PTSD requires further assessment, and the current study aims to address this need. Correlations, mediational analyses, and structural equation modeling were used to test the following hypotheses and within the context of current theory and empirical literature, the following hypotheses were posited regarding the relationship between PTSD, risky health behaviors, preventive health behaviors, and health outcomes:

**Hypothesis 1.** The relationship between PTSD and poor physical health, which has been repeatedly demonstrated in research studies, will be replicated. Higher PCL total scores will have moderate, positive correlations with self-reported somatic complaints and conditions and functional health impairment.

**Hypothesis 2.** Higher PCL scores will be positively correlated with engagement in risky health behaviors, particularly substance use, as suggested by a large body of research, and negatively correlated with preventive health behaviors.

**Hypothesis 3.** The relationship between PTSD, risky health behaviors, and physical health will be replicated, such that risky health behaviors will mediate the relationship between PTSD and physical health.

**Hypothesis 4.** The absence of preventive health behaviors will also serve as a mediator between PTSD and poor physical health outcomes, and preventive health behaviors will mediate the relationship above what is accounted for by risky health behaviors.

It was the intent of this researcher to utilize structural equation modeling (SEM) to examine both measurement and structural models. SEM allows testing of measurement models by allowing the modeling of latent constructs (e.g., poor physical health) underlying multiple indicators of the construct (e.g., self-reported somatic complaints and conditions and functional health impairment). SEM techniques also allow for testing of structural models. In the current study, however, SEM measurement models did not support evaluation of the conceptualized structural model (see Figure 1). Therefore, simple path analysis was utilized to test both direct and indirect effects of exogenous variables (i.e., PCL total scores, risky health behaviors) on endogenous variables (i.e., health outcomes).

## Method

### Participants

Participants were students enrolled in undergraduate psychology courses offering extra credit for research participation. They were recruited by announcement through the SONA extra credit system and self-identified as eligible for the study if they had "directly experienced a very stressful event (for example, a natural disaster, motor vehicle accident, or physical or sexual assault) and continue to be affected by it." Participants attended one questionnaire session and were compensated with documentation of their participation that could be used for extra credit. The Auburn University Institutional Review Board approved the study.

A total of 277 students completed the questionnaire session. Of those, 117 were excluded based on the following criteria: participant did not write an event narrative ($n$ = 2); participant did not complete more than 10% of a measure ($n$ = 5); participant's Personality Assessment Inventory (PAI; Morey, 1991) profile was presumed to be invalid due to random responding, carelessness, reading difficulty, confusion, or neglecting to follow instructions, as measured by Infrequency scale score $\geq$ 75 T and/or Inconsistency scale score $\geq$ 73 T ($n$ = 44; Morey, 1991); participant event description was not descriptive enough to make a Criterion A1 rating ($n$ = 25); participant event was coded as not meeting Criterion A1 (see explanation of coding procedures below; $n$ = 41). The remaining participants also met Criterion A2, based on their LEC responses, and the final sample consisted of 160 participants. For cases in which less than 10% of a measure was left blank, the lowest value of the measure was substituted for the missing response,

following the guidelines outlined in the PAI (Morey, 1991) and assuming the most conservative approach.

Of the final sample, participants were mostly female (66.2%) and Caucasian (80.6%) or African American (12.5%). Nearly all participants identified as single (94.4%). Participants' ages ranged from 18 to 26 years ($M$ = 20.0, $SD$ = 1.6).

## Measures

Participants completed a demographics form, followed by a measure of trauma exposure and a measure of PTSD symptoms. The other measures were counterbalanced such that the longest measures (PAI, not relevant to this study except in participant exclusion, see above; Morey, 1991) was always presented last, health and health behavior measures (three) were randomized within a block, and depersonalization measures (three, not relevant to this study) were randomized within a block. The presentation of the two blocks was also randomized. Descriptions of the measures assessing trauma exposure, health, and health behaviors are discussed below.

**Trauma Exposure.** Trauma exposure was assessed using the Life Events Checklist, (LEC; Blake et al., 1995). The LEC is the self-report trauma assessment portion of the Clinician Administered PTSD Scale (CAPS; Blake et al., 1990), the most widely used structured interview for PTSD. The LEC consists of 17 items, including 16 items that assess exposure to specific categories of traumatic events (e.g., natural disaster, sexual assault) and one item, labeled "other," that assesses exposure to events that do not fit into one of the specific categories. Respondents indicated their lifetime exposure to each of the categories of events by checking one or more of the following options: happened to me, witnessed it, learned about it, not sure, and

does not apply. Next, they identified the worst event (the one that has caused the most problems), and reported whether that event met the *DSM-IV-TR* Criterion A1 (actual or threatened death or serious injury, or a threat to the physical integrity of self or others) and Criterion A2 (intense fear, helplessness, or horror). Finally, they provided a brief narrative of their worst event.

A research team composed of a doctoral level supervisor and two graduate students employed a coding system to determine whether participants' index events provided enough information to code for Criterion A1, and if so whether the event "definitely meets Criterion A1" or "does not meet Criterion A1." Ratings of whether there was enough narrative information to code Criterion A1 were made for 226 participants (after removing participants who did not have narratives, left more than 10% of a measure blank, or had invalid PAI profiles). Both graduate student raters made consistent ratings regarding the amount of information provided for 208 of the 226 cases (92.04% agreement). Post-coding discussions were conducted with the doctoral supervisor and graduate students and consensus was reached for the 18 cases for which there had not previously been agreement. A total of 201 participants were judged to have provided enough information to code Criterion A1.

Graduate student raters next coded this subset of narratives as definite Criterion A1 or non-Criterion A1. Of the 201 narrative coded, 75.12% were rated by both rates as definitely Criterion A1 ($n$ = 151) and 16.42% were rated by both as non-Criterion A1 ($n$ = 33). Kappa coefficients for inter-rater reliability (kappa = .74) indicated acceptable agreement. For discrepancies ($n$ = 17), a consensus decision was reached among the graduate students and doctoral supervisor. Of these discrepancy cases, nine additional cases were determined to meet Criterion A1 and eight were not. Only participants with events meeting Criterion A1 by both raters or by consensus ($n$ = 160) were included in the analyses.

**PTSD Symptoms.** The PTSD Checklist (PCL; Weathers, 1993) is a 17-item self-report measure that assesses each of the 17 *DSM-IV-TR* symptoms of PTSD. On the specific version (PCL-S) that was used in the present study, respondents first identified an index event and then referred to this event as they completed the items. Respondents indicated how much they were bothered by each PTSD symptom in the past month, using a five-point scale (1 = not at all to 5 = extremely). The PCL has been used extensively in a wide variety of trauma populations and has been shown to possess excellent psychometric properties (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996; Ruggerio, Del Ben, Scotti & Rabalais, 2003).

**Preventive and Risky Health Behaviors.** The Multidimensional Health Profile – Health Functioning (MHP-H; Ruehlman, Lanyon, & Karoly, 1998) was administered to assess various aspects of participants' health. The MHP-H contains 69 items and provides information regarding response to illness (self-help, professional help, help from friends, spiritual help), health habits (preventive health habits, risky health habits), adult health history (overall health, recent health, presence of a chronic illness, impairment due to a chronic illness), health care utilization patterns (office visits, overnight hospital treatment, emergency room treatment, and over-the-counter medication), and health beliefs and attitudes (self-efficacy, health vigilance, health values, trust in health care personnel, trust in the health care system, and hypochondriasis).

For the current study, the Positive Health Habits score and Negative Health Habits score were used in data analyses. The Positive Health Habits scale measures multiple healthful behaviors including exercise, healthy eating habits, dental hygiene, and seatbelt use, among others. The Negative Health Habits scale measures substance use, unhealthy eating habits, cigarette use, and speeding, among others.

The MHP-H was developed for use with individuals 18 years or older, is written on a fourth-grade reading level, and typically takes 15 minutes to complete. MHP-H normative data was derived from a representative sample of 2,411 participants, stratified by gender and age. When examining the psychometric characteristics of the MHP-H, the modules have displayed excellent test-retest reliability and validity using both a national development sample and a supplemental undergraduate sample (Ruehlman et al., 1998).

**Physical Health Symptoms and Conditions.** The Physical Health Symptoms and Conditions Checklist (National Center for PTSD, 1993) was used to assess physical health symptoms. The measure contains a list of symptoms from the following system areas: cardiovascular, neurological, ear-nose-and-throat, musculoskeletal, genitourinary, skin, respiratory, gastrointestinal, and sleeping and eating habits. Participants indicated if these symptoms (e.g., shortness of breath, headaches) had been a problem for them in the past six months, and if so, how frequently the symptoms occurred. Similarly, participants were given a list of physical health conditions (e.g., asthma, diabetes) and asked to indicate if they had ever had the condition, if it had been a problem for them during the past six months, whether it was diagnosed by themselves or a physician, and if they were taking any medication to assist in dealing with the condition. In the current study, this information was utilized to create three variables: total current health symptoms endorsed, total health problems lifetime, and total health problems in the past six months.

**Functional Health Impairment.** The Short-Form-36 Health Survey (SF-36; Ware & Sherbourne, 1992) was used to measure functional impairment (e.g., problems completing activities such as running or lifting heavy objects) that participants have experienced due to their physical health status. The SF-36 has been widely used as a generic indicator of health status for

population surveys, a tool in evaluative studies of health policy, and an outcome measure in clinical practice and research. The SF-36 was derived from Rand's Medical Outcome Study (Tarlov, Ware, & Greenfield, 1989), a study that was initially designed to compare the impact of alternative health insurance systems on health status and health care utilization. The SF-36 is a generic measure that assesses both physical and mental concepts of health, including behavioral functioning, perceived well-being, social and role disability, and personal evaluations of general health status. The questionnaire contains 36 items, each with a 5-point Likert scale that ranges from 'poor' to 'excellent.' It includes multi-item scales to measure the following eight dimensions of health functioning: physical functioning; role limitations due to physical health problems; bodily pain; social functioning; general mental health (psychological distress and well-being); role limitations due to emotional problems; vitality, energy, or fatigue; and general health perceptions. In the current study, only the following four health dimension scales were used: physical functioning, role limitations due to physical health problems, bodily pain, and vitality, energy, or fatigue. Findings regarding the reliability and validity of the SF-36 are excellent (McHorney, Ware, & Lu, 1994; McHorney, Ware, & Raczek, 1993), and this measure is widely used in the trauma literature.

**Alcohol and Substance Use/Abuse.** To evaluate substance abuse, a quantity/frequency measure of alcohol and drug consumption (over the past six months) was included. In addition, participants completed the Rutgers Alcohol Problem Inventory (RAPI; White & Labouvie, 1989) and the Drug Abuse Screening Test (DAST; Skinner, 1982). The RAPI is 23-item questionnaire that assesses consequences related to drinking over a six-month period. Participants were asked to indicate the frequency of various consequences (e.g., caused shame or embarrassment to someone, drove shortly after having more than two drinks) related to alcohol use. The number of

consequences endorsed, as well as the total RAPI score, which takes into account the frequency with which the consequence was endorsed, was used in the current data analyses. The RAPI is a widely used assessment instrument in the substance abuse field with good reliability and validity; many studies have utilized this measure in college samples. The DAST is a 28-item, forced-choice questionnaire that assesses use and abuse of substances other than alcohol. It addresses many different topics related to abuse and dependence, including negative consequences, tolerance, and withdrawal symptoms. The total DAST score was used in the following analyses.

**Smoking.** To evaluate nicotine use, a quantity/frequency measure of smoking (over the past six months) was included in the assessment of each participant. In addition, the Revised Tolerance Questionnaire (RTQ; Tate & Schmitz, 1993) was administered to assess levels of nicotine dependence. The RTQ is 10-item revision of the original Fagerstrom Tolerance Questionnaire (FTQ; Fagerstrom & Schneider, 1989); seven of the original FTQ questions were retained in altered form and three new items were added to more accurately assess nicotine dependence. When examining the psychometric properties of the FTQ and the RTQ, the RTQ displays improved internal consistency, improved temporal stability, and seems to be measuring a unidimensional construct of nicotine dependence (Tate & Schmitz, 1993). The RTQ average score was used in the current analyses.

# Results

## Descriptive Statistics

LEC event categories for primary traumatic events are presented in Table 1. The means, standard deviations, and observed ranges for all measures, as well as alpha coefficients when relevant, are presented in Table 2. Using a scoring rule in which PCL items rated a three or higher are considered endorsed symptoms, 34.4% of the sample was estimated to meet criteria for PTSD (*n* = 55 of 160 participants; Blanchard et al., 1996) based on *DSM-IV-TR* diagnostic requirements. These PCL results are comparable to or higher than results reported in other published studies using samples of trauma-exposed college students (e.g., Ruggiero et al., 2003; Flack, Milanak, & Kimble, 2005; Frazier et al., 2009).

## Correlations

Table 3 presents the zero-order correlations between the PCL and PCL subscales, preventive health behaviors, risky health behaviors, and health outcomes. Consistent with hypothesis 1, significant moderately sized correlations were found between PCL subscales and total self-reported physical health problems and energy. However, in contrast with hypothesis 1, no significant relationships were found between PCL subscales and lifetime or six month self-reported diagnoses and PCL total, numbing, and hyperarousal showed small to moderately sized significant correlations with pain.

Hypothesis 2 proposed that significant positive relationships would be found between PCL subscales and risky health behaviors, and that a significant negative relationship would be

found between PTSD symptoms and engagement in preventive health behaviors. Notably, no significant relationships were found between any of the PCL subscales and engagement in preventive health behaviors as measured by the MHP-H PHH scale. Additionally, PCL total, numbing, and hyperarousal symptoms showed only small significant correlations with DAST total scores. No significant correlations were found between PCL total or subscale scores and the RAPI or RTQ, which measure problems associated with alcohol use and tobacco use, respectively.

Overall, the results depicted in Table 3 suggested that many proposed relationships were not demonstrated in the current data set. As well, the lack of significant relationships suggested that measurement and structural models were unlikely to demonstrate good fit. Additionally, hypotheses 3 and 4 relate to mediation effects and, as demonstrated in Table 3, the first requirement to demonstrate mediation effects is not met (i.e., significant relationships between variables were not found). Therefore, meditational analyses were not conducted as had been planned.

**Measurement Models**

Despite correlational data that suggested the measurement models were unlikely to be supported by the data, measurement models were examined in order to remain consistent with proposed data analyses. The measurement model for risky health behaviors was supported by the data. However, measurement models for PTSD, preventive health behaviors, and health outcomes were not supported by the data, as evidenced by poor model fit indices.

**PTSD.** Standardized coefficients for the DSM model of PTSD were as follows: .90 for reexperiencing, .79 for avoidance, .82 for numbing, and .77 for hyperarousal. CFA results did

not consistently indicated acceptable fit for the DSM-based model of PTSD (RMSEA = .14; CFI = .99; Chi squared / df = 3.95), as the RMSEA was in the poor fit range and Chi squared / df was in the moderate fit range. As suggested by this data, the PTSD measurement model should not be entered into the conceptualized structural model.

**Preventive Health Behaviors.** Item parcels were created for the 14 items of the Preventive Health Habits (PHH) subscale to increase degrees of freedom (see Little, Cunningham, Shahar, & Widaman (2002) for the rational, pros, and cons of parceling). The 14 PHH items were submitted to a principal component factor analysis with varimax rotation to determine item loadings, and items with loadings < .30 were dropped. A total of four items were dropped leaving 10 items, which were randomly assigned to one of three parcels. The three parcels were entered into CFA and standardized coefficients were as follows: .66 for parcel 1, .65 for parcel 2, and .69 for parcel 3. The CFI indicated a good fit (CFI = 1.00); however, the RMSEA suggested a poor fit (RMSEA = .29). Due to inadequate fit indices, the measurement model of preventive health behaviors should not be entered into the hypothesized structural model.

**Health Outcomes.** The latent factor of health outcomes was initially estimated by both self-reported health problems and perceived functional impairment. The seven variables that were initially used were: lifetime physical symptoms, lifetime diagnoses, diagnoses in the past six months, physical functioning, physical role limitations, pain, energy/fatigue. Two of the seven variables were deleted from the measurement model based on standardized estimates and principal component factor analysis (physical functioning and physical role limitations). For the five remaining variables, standardized coefficients were as follows: .70 for pain, .78 for energy, .52 for total symptoms, .32 for lifetime diagnoses, and .47 for diagnoses in the past six months.

The CFI for the final measurement model of health outcomes demonstrated moderate to good fit (CFI = .94). Again, the RMSEA suggested a less than adequate fit (RMSEA = .21), and therefore, the measurement model of health outcomes should not be entered into the structural model.

**Risky Health Habits.** The following scales were used to estimate the latent factor of risky health habits: RAPI Total, RTQ Total, DAST Total, Negative Health Habits (NHH). Each of the four factor were entered into the CFA and standardized coefficients were as follows: .81 for the RAPI, .53 for the DAST, .55 for the RTQ, and .57 for NHH. Fit indices suggested a good fit (CFI = 1.00; RMSEA = .00; chi squared / df = .08). However, as no other measurement models demonstrated good fit, a required prerequisite to testing a structural model, the structural model was not tested.

**Path Analysis**

After examining the correlational data, as well as the measurement models, it was evident that in the current sample preventive health behaviors was not a relevant variable. Therefore, preventive health behaviors were not examined in the following path analyses. PCL total scores were used to indicate PTSD. A composite z-score was created to represent an overall risky health behavior rating. This was justified by the moderate correlations between the four indicators of risky health behavior (i.e., RAPI, DAST, RTQ, NHH). Each of the four indicator scores was transformed to a z-score and the four z-scores were added to create a risky health behaviors composite z-score. All five indicators of health outcomes remained as individual outcome indicators.

**Direct Effects.** The path analysis examining direct effects of PTSD and risky health behaviors (composite z-score) on health outcome measures (Figure 2) demonstrated several significant effects. PTSD had a significant effect on total physical health symptoms reported (β = .33), energy (β = .42), and pain (β = .19). The composite risky health behaviors score had a direct effect on diagnoses in the past six months (β = .20).

**Indirect Effects.** The path analysis examining indirect effects of risky health behaviors (composite z-score) on the relationship between PTSD and health outcome measures (Figure 3) revealed that PTSD had a significant direct effect on the composite risky health behaviors score (β = .21). Additionally, the composite risky health behaviors score had an indirect effect on total health symptoms reported (β = .17) and diagnoses in the past six months (β = .18).

## Discussion

This study examined the relationships between PTSD, risky and preventive health behaviors, and health outcomes in a sample of trauma-exposed college students. Given the established relationship between PTSD and poor physical health outcomes, as well as the established relationship of risky health behaviors as a mediator between PTSD and physical health outcomes, it was hypothesized that (1) PTSD would be highly correlated with poor health outcomes, (2) PTSD would be positively correlated with engagement in risky health behaviors and negatively correlated with engagement in preventive health behaviors, (3) risky health behaviors would mediate the relationship between PTSD and poor health outcomes, and (4) the absence of preventive health behaviors would also serve as a mediator between PTSD and poor physical health outcomes.

Results partially supported the first hypothesis. Significant correlations were found between measures of energy, pain, and self-reported health symptoms, suggesting that PTSD symptom endorsement was related to experiencing low energy and fatigue, bodily pain, and self-reported health symptoms. This finding is consistent with a large body of literature that suggests PTSD is related to poor physical health outcomes. However, no significant relationships were found between PTSD symptom endorsement and lifetime medical diagnoses or diagnoses in the past six months.

Results partially supported the second hypothesis. However, total PTSD symptoms, numbing symptoms, and hyperarousal symptoms were only significantly associated with

substance use. PTSD symptoms were not significantly associated with cigarette or alcohol use, nor were they associated with preventive health behaviors. These findings are inconsistent with past research using college student samples that suggests PTSD symptom endorsement is also related to increased alcohol use. Additionally, a primary goal of the current study was to demonstrate a relationship between PTSD and preventive health behaviors, and this link was not supported.

Hypotheses three and four were unsupported. Meditational analyses were not reported, as significant correlations between proposed variables were not supported and hypotheses one and two received only partial support. This finding is in contrast with other literature that demonstrates risky health behaviors may mediate the relationship between PTSD and poor physical health outcomes.

When PTSD, risky and preventive health behaviors, and health outcomes were modeled using SEM, measurement models did not support further testing of the structural model as data did not support the measurement models for PTSD, preventive health behaviors, or health outcomes. Therefore, the structural model was not tested and instead simple path analyses were conducted.

Path analyses examining direct effects of PTSD and risky health behaviors (composite z-score) on indicators of health outcomes were not supported by the current data, although PTSD demonstrated a significant, direct effect on total physical health symptoms reported, energy, and pain. The composite risky health behaviors score had a direct effect on diagnoses in the past six months. The path analysis examining indirect effects of risky health behaviors (composite z-score) on the relationship between PTSD and health outcome measures was also not supported

by the data. However, PTSD had a significant direct effect on the composite risky health behaviors score, and the composite risky health behaviors score had an indirect effect on total health symptoms reported and diagnoses in the past six months.

**Study Limitations**

Several limitations of the current study exist and may, in part, account for the general lack of significant findings. First, the study utilized a group of non-treatment seeking, college students. This sample is potentially problematic for several reasons. The sample consisted of primarily young, Caucasian, females and there was a lack of diversity with regards to gender, ethnicity, marital status, and other relevant demographic variables, which may significantly impact the generalizability of the results. As the sample was primarily comprised of young adults, participants also reported relatively few health concerns, and it is possible that participants have not yet encountered the physical health problems that can result from prolonged engagement in risky health behaviors such as substance abuse. In sum, the relative youth and good physical health of participants may have resulted in limited or weak correlations and difficulty detecting mediation effects due to restriction of range in measures of physical health.

As data analyses were strictly correlation in nature, no causal statements can be made regarding the nature of relationships between PTSD, health behaviors, and physical health. No efforts were made to control for directionality of the relationships. That is, no measure was included to indicate when physical health problems began in relation to exposure to traumatic events and development of PTSD symptoms. Longitudinal studies would be informative to investigate important questions assessed in this study. Ideally, participants would be assessed

immediately following exposure to a traumatic event to determine (1) how many participants develop PTSD symptoms, (2) the development of physical health problems in participants who do and those who do not develop PTSD, and (3) rates of engagement in risky and preventive health behaviors before and after individuals encounter trauma.

As well, the relatively small sample size (N = 160) following strict exclusion criteria may have impacted results of the measurement and structural models. SEM is an inherently large sample technique, and some have suggested a minimum of 200 participants (e.g., Baldwin 1989). Future research should attempt to obtain substantially larger sample sizes to ensure that significant findings will be highlighted, should they exist. However, it is notable that analyses were also conducted with a larger data set ($N$ = 277) with less restrictive inclusion criteria and results were not impacted.

Measurement difficulties may have played a role in limiting significant findings. Measurement of all constructs was conducted via anonymous, computerized self-report measures. Although one may speculate that collection of anonymous data may encourage more open and honest responding, collection of data in such a manner may also result in participants feeling little responsibility or sense of obligation to the integrity of the data collection. Future studies would also benefit from collection of additional reports of health and health behaviors. This may include obtaining collateral reports of health behaviors, review of medical records, or physiological measurements. These suggestions, however, would be difficult, expensive, and time-consuming to implement, and future research should weigh the costs and benefits of collecting such data.

Lastly, it is worth noting that although the lack of significant results in the current study is presumed to be the effect of the aforementioned study limitations, the null hypothesis should also be considered. It is possible that engagement in preventive health behaviors may have little or no impact on the relationship between PTSD and physical health outcomes.

**Significance of Findings**

Findings from the current study provide further support for the connection between PTSD and poor physical health outcomes, specifically increased pain, fatigue, and self-reported physical functioning. However, no further understanding of the mechanisms that account for this relationship was attained, as findings from the current study are not consistent with other published research which demonstrates engagement in risky health behaviors as a mediator between PTSD and health outcomes.

Several implications emerge from the results of this study. First, although college student samples are often assumed to be poor candidates for PTSD research, participants in this study endorsed a range of traumatic life events covering nearly every category on the LEC. Additionally, using a well-validated scoring rule in which PCL items rated a three or higher were considered endorsed symptoms, 34.4% of the sample was estimated to meet criteria for PTSD (*n* = 55 of 160 participants; Blanchard et al., 1996) based on *DSM-IV-TR* diagnostic requirements. The current study sample suggests that although researchers frequently overlook college student samples in PTSD research, the prevalence of trauma exposure and PTSD symptom development should not be underestimated.

Despite limited significant findings, this study highlights the consistent research finding that individuals endorsing symptoms of PTSD often also report poor physical health. This

finding has important public health implications and emphasizes the importance of prevention and early treatment of PTSD. As PTSD is often linked with reports of physical complaints, it is likely that individuals with PTSD may first come to the attention of medical providers. Physicians should be careful to asses for trauma exposure and the presence of PTSD symptoms in order to initiate appropriate mental health referrals. Patients, as well, may benefit from increased education about the relationship between trauma exposure, PTSD, and physical health outcomes. Finally, psychologists and other mental health providers should be aware that they may be required to attend to both the psychological and physical health needs of their patients, as both can have a significant impact on daily functioning.

**Suggestions for Future Research**

Additional research is necessary to further understand the complex relationship between PTSD and physical health. First, although preventive health behaviors did not prove to be significantly related to PTSD or physical health outcomes, this is not a construct that published research has frequently evaluated. Future research should continue to include measures of preventive health behaviors to examine this potential relationship. Specifically, it may be useful to replicate this study in a clinical population that includes a more diverse group of participants. Second, as previously mentioned, future studies should obtain objective reports of physical health which may include lab results, physiological measurements, or medical records. Studies should also consider collecting collateral, in addition to self-report, data to verify or clarify participant engagement in risky and preventive health behaviors. Similarly, PTSD symptoms were assessed via self-report measures as well, and the homogeneity of the PTSD sample, and therefore clarity of results, may be improved by using a structured clinical interview to assess PTSD symptoms (e.g., CAPS). Third, researchers should ensure that a large enough sample size

will be available to allow for evaluation of the relationships between study constructs in an SEM framework. Fourth, longitudinal studies of the relationship between PTSD and physical health outcomes are necessary if we are to develop a comprehensive understanding of these complex relationships. In order to confidently state that these relationships exist, causality should be demonstrated. Finally, researchers should continue to examine the mechanisms by which physical health is impacted following exposure to traumatic events. This may include the biological, psychological, and behavioral pathways, as well as interactions between theses pathways as it is unlikely that their impact exists in isolation. The psychological impact of trauma exposure has been extensively examined; however, further research is necessary to improve the understanding of the relationship between trauma exposure, PTSD development, and physical health outcomes.

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# APPENDIX 1: TABLES

Table 1

*Frequency of Criterion A1 Index Traumatic Events by LEC Trauma Type*

| LEC Trauma Types | Full Sample ($n$ = 160) | | Men ($n$ = 54) | | Women ($n$ = 106) | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| Natural disaster | 11 | 6.9 | 4 | 7.4 | 7 | 6.6 |
| Fire or explosion | 3 | 1.9 | 1 | 1.9 | 2 | 1.9 |
| Transportation accident | 35 | 21.9 | 17 | 31.5 | 18 | 17.0 |
| Other serious accident | 8 | 5.0 | 4 | 7.4 | 4 | 3.8 |
| Physical assault | 11 | 6.9 | 2 | 3.7 | 9 | 8.5 |
| Assault with a weapon | 5 | 3.1 | 3 | 5.6 | 2 | 1.9 |
| Sexual assault | 21 | 13.1 | 1 | 1.9 | 20 | 18.9 |
| Combat exposure | 5 | 3.1 | 3 | 5.6 | 2 | 1.9 |
| Life-threatening illness or injury | 14 | 8.8 | 7 | 13.0 | 7 | 6.6 |
| Sudden, violent death | 14 | 8.8 | 5 | 9.3 | 9 | 8.5 |
| Sudden, unexpected death | 29 | 18.1 | 5 | 9.3 | 24 | 22.6 |
| Any other stressful event | 4 | 2.5 | 2 | 3.7 | 2 | 1.9 |
| Total | 160 | 100.0 | 54 | 100.0 | 106 | 100.0 |

*Note.* LEC = Life Events Checklist. LEC categories for Sexual Assault and Other Unwanted or Uncomfortable Sexual Experience were combined. No events from LEC categories Exposure to Toxic Substance, Captivity, Severe Human Suffering, or Serious Injury, Harm, or Death you caused to Someone Else were reported.

Table 2

*Descriptive Statistics for Latent and Observed Variables*

| Variable | Items (*n*) | α | Possible Range | Obs. Range | *M* | *SD* |
|---|---|---|---|---|---|---|
| *PTSD Checklist* | 17 | .93 | 17-85 | 17-83 | 38.55 | 15.35 |
| PCL Reexperiencing | 5 | .89 | 5-25 | 5-25 | 12.27 | 5.18 |
| PCL Avoidance | 2 | .64 | 2-10 | 2-10 | 5.30 | 2.39 |
| PCL Numbing | 5 | .79 | 5-25 | 5-23 | 9.81 | 4.69 |
| PCL Hyperarousal | 5 | .87 | 5-25 | 5-25 | 11.18 | 5.56 |
| *Preventive Health Bx* | | | | | | |
| MHP-H PHH Scale | 14 | .65 | 14-70 | 20-58 | 39.93 | 6.84 |
| *Risky Health Bx* | | | | | | |
| RAPI Total | 25 | .89 | 25-125 | 25-65 | 33.72 | 9.15 |
| RTQ Total | 10 | .88 | 1-5 | 1-4 | 1.32 | 0.60 |
| DAST Total | 28 | .87 | 0-28 | 0-13 | 1.35 | 2.69 |
| MPH-H NHH Scale | 10 | .62 | 10-50 | 20-44 | 31.11 | 5.17 |
| *Physical Health* | | | | | | |
| Health Problems | | | | | | |
| Total Health Sx | 89 | N/A | 0-89 | 0-68 | 20.86 | 11.98 |
| Lifetime Dx | 36 | N/A | 0-36 | 0-36 | 2.57 | 3.84 |
| Six-month Dx | 36 | N/A | 0-36 | 0-12 | 1.59 | 1.90 |
| SF-36 | | | | | | |
| Physical Function | 10 | .93 | 0-100 | 5-100 | 93.45 | 15.67 |

(table continues)

| Variable | Items (*n*) | α | Possible Range | Obs. Range | *M* | *SD* |
|---|---|---|---|---|---|---|
| Role Limitations | 4 | .88 | 0-100 | 0-100 | 82.44 | 32.17 |
| Pain | 2 | .79 | 0-100 | 0-100 | 78.98 | 19.24 |
| Energy | 4 | .78 | 0-100 | 0-90 | 49.45 | 19.64 |

*Note:* PTSD = Posttraumatic Stress Disorder; PCL = PTSD Checklist; Bx = Behaviors; MHP-H PHH = Multidimensional Health Profile – Health Functioning, Positive Health Habits; RAPI = Rutgers Alcohol Problem Inventory; RTQ = Revised Tolerance Questionnaire; DAST = Drug Abuse Screening Test; MHP-H NHH = Multidimensional Health Profile – Health Functioning, Negative Health Habits; Sx = Symptoms; Dx = Diagnoses; SF-36 = 36-Item Short Form Health Survey.

Table 3

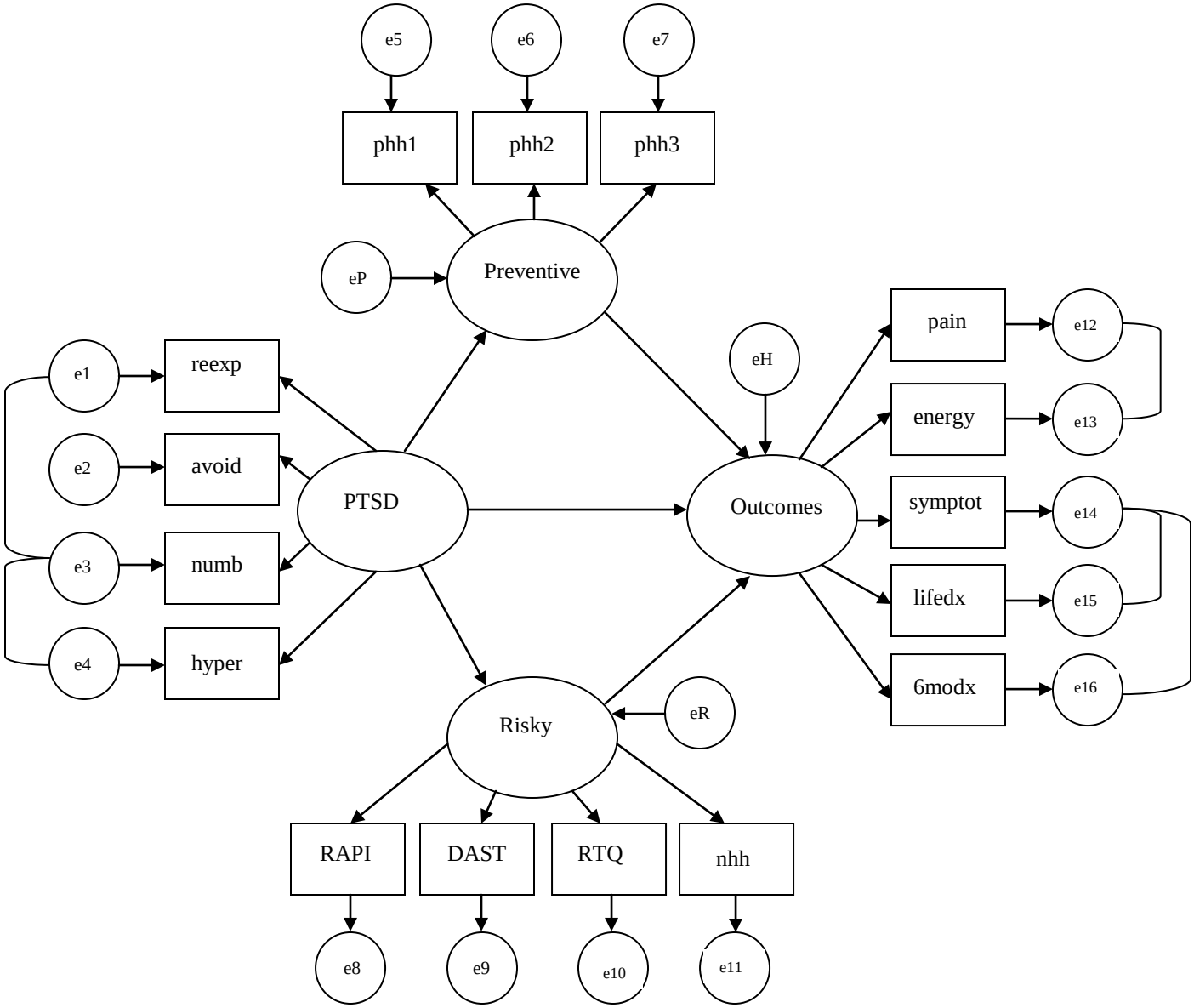
*Zero-Order Correlations for PTSD Symptoms, Risky Health Behaviors, Preventive Health Behaviors, and Health Outcomes*

| Scale | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. PCL Total | -- | | | | | | | | | | | | | | |
| 2. Re-experiencing | .86** | -- | | | | | | | | | | | | | |
| 3. Avoidance | .81** | .73** | -- | | | | | | | | | | | | |
| 4. Numbing | .84** | .51** | .63** | -- | | | | | | | | | | | |
| 5. Hyperarousal | .91** | .69** | .59** | .73** | -- | | | | | | | | | | |
| 6. PHH | .08 | .14 | .14 | -.02 | .05 | -- | | | | | | | | | |
| 7. RAPI Total | .12 | .09 | .03 | .11 | .14 | -.12 | -- | | | | | | | | |
| 8. RTQ Total | .08 | -.01 | .04 | .15 | .07 | -.16* | .44** | -- | | | | | | | |
| 9. DAST Total | .18* | .09 | .03 | .20* | .28** | -.11 | .43** | .31** | -- | | | | | | |
| 10. NHH | -.06 | -.05 | -.14 | -.04 | -.02 | -.22** | .47** | .31** | .30** | -- | | | | | |
| 11. Total Sx | .34** | .22** | .19* | .36** | .36** | .04 | .12 | .03 | .18* | -.03 | -- | | | | |
| 12. Lifetime Dx | .13 | .12 | .02 | .11 | .15 | .03 | .03 | -.05 | .03 | -.02 | .34** | -- | | | |
| 13. Six Month Dx | .04 | .00 | -.04 | .08 | .07 | -.30** | -.05 | -.04 | .01 | .29** | .16* | .27** | -- | | |
| 14. SF-36 Pain | -.16* | -.09 | -.09 | -.20** | -.16* | .11 | .04 | .08 | -.02 | -.05 | -.29** | -.17** | -.43** | -- | |
| 15. SF-36 Energy | -.41** | -.30** | -.32** | -.38** | -.39** | .07 | -.04 | -.02 | -.04 | -.03 | -.38** | -.24** | -.35** | .42** | -- |

*Note.* $N$ = 160. PCL = Posttraumatic Stress Disorder Checklist; PHH = Positive Health Habits; RAPI = Rutgers Alcohol Problems Inventory; RTQ = Revised Tolerance Questionnaire; DAST = Drug Abuse Screening Test; NHH = Negative Health Habits; Sx = symptoms; Dx = diagnoses; SF-36 = 36-Item Short Form Health Survey. SF-36 Pain and Energy scale scores are coded such that high scores signify better functioning. * $p < .05$. ** $p < .01$.

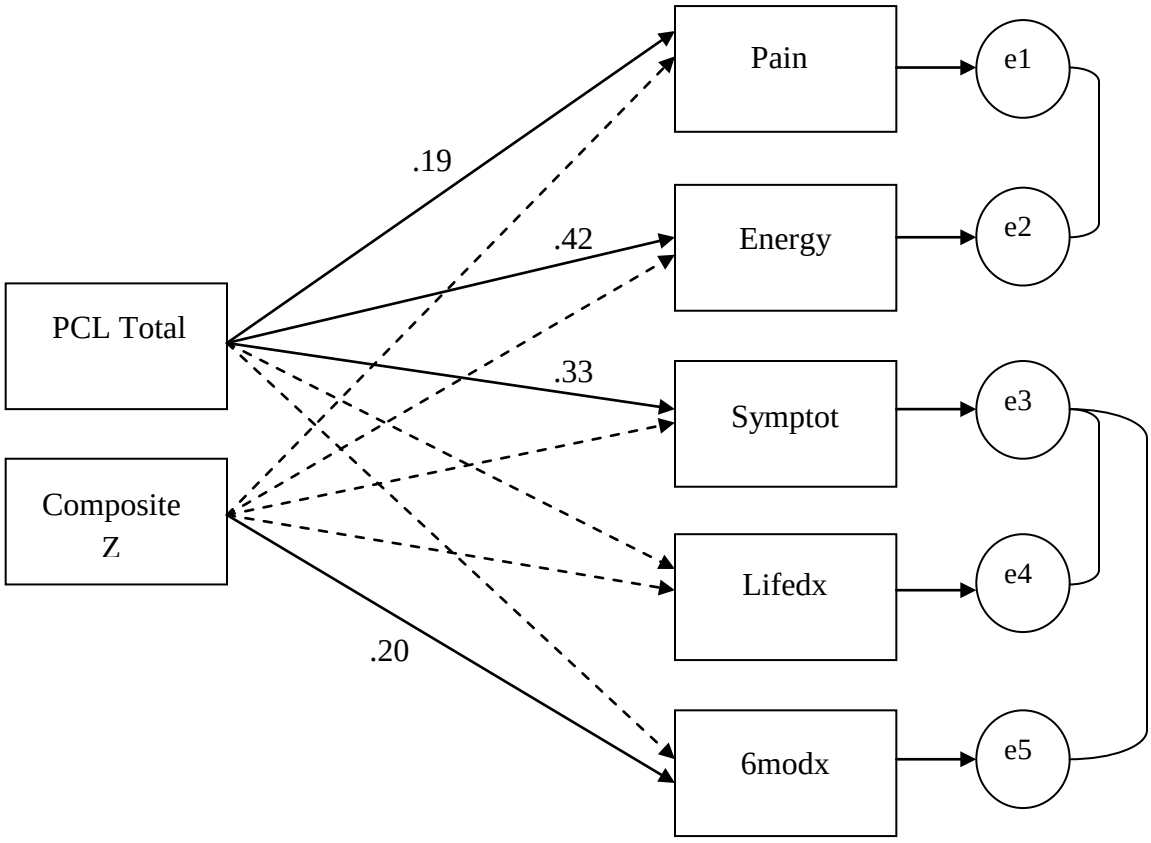
# APPENDIX 2: FIGURES

*Figure 1.* Conceptualized Structural Model



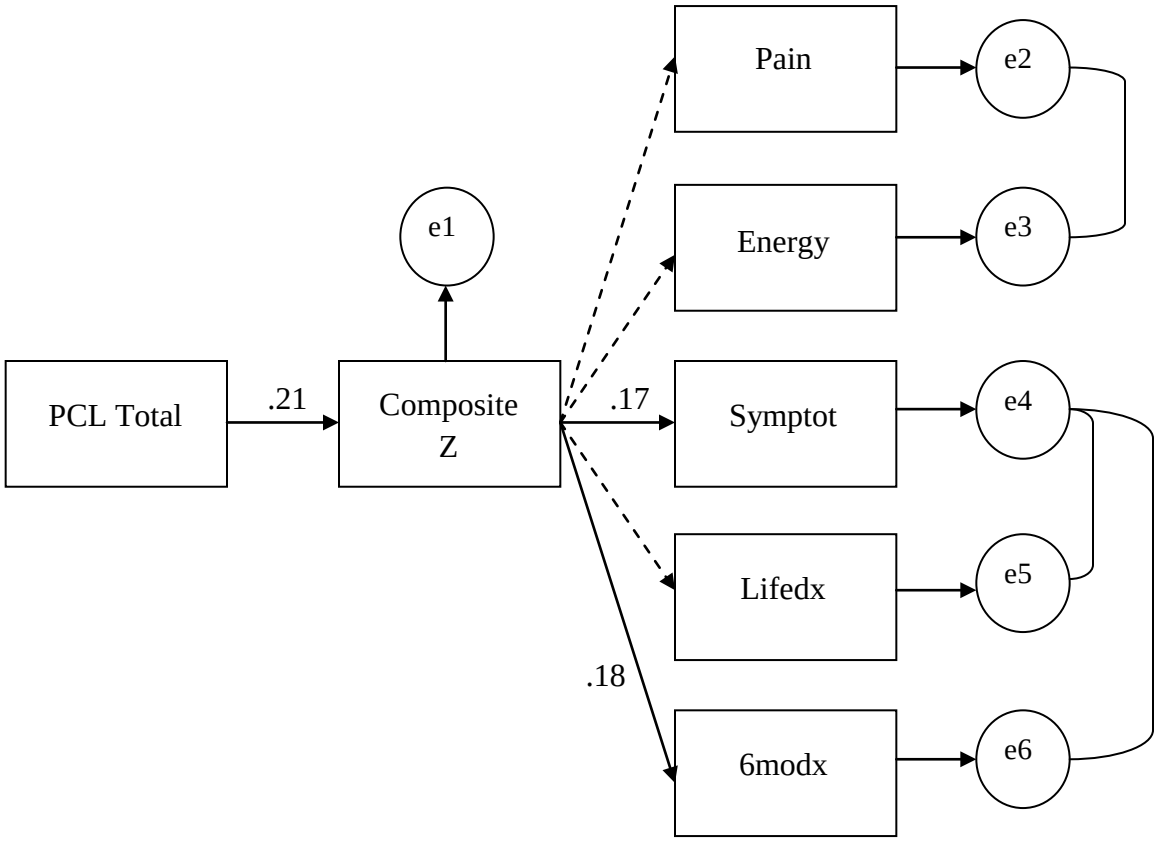

*Note.* reexp = Reexperiencing; avoid = Avoidance; numb = Numbing; hyper = hyperarousal; RAPI = Rutgers Alcohol Problems Inventory; DAST = Drug Abuse Screening Test; RTQ = Revised Tolerance Questionnaire; nhh = Negative Health Habits; symptot = total current symptoms; lifedx = lifetime problems and diagnoses; 6modx = problems and diagnoses in the past six months.

*Figure 2.* Direct Effects Path Analysis




*Note.* PCL Total = PTSD Checklist total score; Composite Z = composite z-score for risky health behaviors; symptot = total current symptoms; lifedx = lifetime problems and diagnoses; 6modx = problems and diagnoses in the past six months. Solid lines indicate significant effects ($p < .05$; standardized coefficients presented). Dashed lines indicate effects that were not significant.

*Figure 3.* Indirect Effects Path Analysis




*Note.* PCL Total = PTSD Checklist total score; Composite Z = composite z-score for risky health behaviors; symptot = total current symptoms; lifedx = lifetime problems and diagnoses; 6modx = problems and diagnoses in the past six months. Solid lines indicate significant effects ($p < .05$; standardized coefficients presented). Dashed lines indicate effects that were not significant.