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Development of a computer -administered analog assessment to evaluate PTSD symptoms in college students who have experienced a motor vehicle crash (MVC)

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Abstract

Development of a Computer-Administered Analog Assessment to Evaluate PTSD Symptoms in College Students Who Have Experienced a Motor Vehicle Crash (MVC)

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There has been a paucity of research investigating the characteristics of college students following a motor vehicle crash (MVC), a relatively common event in the lives of college students (e.g., an annual incidence rate of 1.37 per 10,000 resulting from dozing and driving between years 1984 to 1999). Moreover, typical PTSD assessment relies almost exclusively on indirect measures (e.g., interview, self-report, rating by others). The purpose of this study was threefold: (a) investigation of the characteristics of college students who had been involved in an MVC versus a control group, (b) development of a computer-administered analog assessment, the adult version of the MVC-Behavioral Avoidance Test (MVC-BAT-A), to assess MVC PTSD symptoms, and (c) examination of the psychometric properties of the MVC-BAT-A. The results of this study showed the group with High MVC PTSD symptoms had higher levels of general anxiety, fear of driving and riding in a car or other motor vehicle, and frequency and distress of non-MVC PTSD symptoms, as well as greater distress resulting from and experience of previous traumatic events. This group also rated higher levels of nervousness and lower levels of happiness after their exposure to the mild MVC-related stimuli. Low convergent validity was found between the MVC-BAT-A and other indirect measures. Total number of previous traumatic events, frequent experience of non-MVC PTSD symptoms, and lower levels of positive affect during the exposure to the mild trauma-related stimuli were risk factors for developing high MVC PTSD symptoms. Limitations, strengths, and further directions for this study are discussed.

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Dedication

This work is dedicated to my parents, Mr. Che Chen and Mrs. Lien-Tao Wu, who have supported me throughout my time in school, as well as in memory of one of my best friends, Chiang-Chun Chang, who was a clinical psychologist in the Department of Psychiatry at the Chang Guan Memorial Hospital, Lin-Ko, Taiwan. Chiang-Chun Chang gave me the confidence to succeed although he passed away on 09/12/2001 due to a physical illness.

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Development of a Computer-Administered Analog Assessment to Evaluate PTSD Symptoms in College Students Who Have Experienced a Motor Vehicle Crash (MVC)

Throughout his or her lifetime, an individual may be exposed to a variety of traumatic accidents [e.g., house fires, chemical explosions, motor vehicle crashes (MVCs)]. Traumatic accidents are defined by Scotti, Beach, Northrup, Rode, and Forsyth (1995) as "unintentional harm incurred to self, others, or property as the result of human error or technological failure" (p.182). Based on this definition, natural disasters such as earthquakes, floods, tornadoes, or natural fires are not considered traumatic accidents because these events result from natural forces rather than human error or technological failure. Crime, abuse, terrorism, and warfare also cannot be regarded as traumatic accidents because these events are characterized by an intention to harm rather than by human error.

In addition to natural disasters, other disasters including transportation accidents (e.g., train wrecks and plane crashes), technological accidents (e.g., toxic smoke from the furnaces of industry, emissions from power plants), community violence (e.g., school shootings, restaurant murder sprees), and bombings (e.g., Oklahoma City, U.S. embassies) often are discrete public events and involve victims from more than one family. Disasters of this nature (e.g., train wrecks or emissions from power plants) may share many characteristics (e.g., the result of human error and technological failure) with traumatic accidents; however, they often draw more media and public attention due to their marked human and financial tolls resulting from events characterized by images of carnage and massive destruction of property (Reyes & Elhai, 2004; Scotti et al., 1995).

Unlike traumatic accidents, individual's exposure to disaster and impairments (e.g., financial and social effects, threat of or actual loss of life, and physical injuries) arising from

disasters often are more severe and/or pervasive. Victims' postdisaster psychological reactions and resiliency after disasters appeared more complicated as a result of the interactions among these impairments (Norris, Friedman, Watson, Byrne, Diaz, et al., 2002). Scotti et al. (1995) argued a need to distinguish a disaster from a traumatic accident. Thus, traumatic accidents addressed in the remainder of this manuscript are based on the definition of Scotti et al. (1995) and involve victims from less than the size of one family.

Most studies have tended to classify traumatic events into certain types by their characteristics without regard to the chronicity of an individual's traumatic experiences (i.e., a relatively discrete or circumscribed traumatic event versus a continuous series of traumatic events). Terr (1991) argued trauma should be classified into two trauma typologies according to the chronicity of an individual's traumatic experiences: Type I (discrete) traumas and Type II (chronic) traumas. Exposure to a single traumatic event (one-time event trauma) which often results in reexperiencing, hyperarousal, and avoidance constitutes the Type I typology. The Type II typology results from a series of traumatic events (repeated traumas), or from prolonged exposure to a stressor (long-standing or chronic traumas). Symptoms characteristic of Type II include the characteristic PTSD symptoms of reexperiencing, hyperarousal, and avoidance as well as the coping responses of denial, rage, dissociation, sadness, and negative attributions. The clinical-based typology of traumatic events proposed by Terr (i.e., categorizing traumatic events as discrete or chronic) is useful due to different clinical pictures associated with each typology (Carlson, 1997).

Based on the characteristics of the trauma and the chronicity of an individual's traumatic experiences, MVCs apparently are discrete traumatic accidents. Therefore, they can be classified into the Type I typology of Terr (1991). Moreover, of the class of discrete traumatic accidents,

MVCs may be the most frequently experienced type. During the past decade, interest in understanding the clinical manifestations of MVCs in adult populations has increased. Numerous studies have demonstrated the high incidence rate of posttraumatic stress disorder (PTSD) in adult MVC survivors (e.g., Blanchard et al., 2004; Blanchard, Hickling, Taylor, & Loos, 1995; Blanchard, Hickling, Taylor, Loos, & Gerardi, 1994a; Holeva, 2001; Mayou & Bryant, 2002). This manuscript begins by providing the reader with an overview of the common psychological morbidity with a focus on adult MVC survivors. Next, the clinical features of PTSD following an MVC are addressed. The importance of using multiple methods and multiple response modes in the assessment of PTSD in adults following an MVC and a need of research investigating the characteristics of college students following an MVC also are advocated. Finally, the development of a computer-administered analog assessment to evaluate MVC PTSD symptoms in college students and its psychometric properties and application to this population are presented and discussed.

Common Psychological Morbidity in Adult MVC Survivors

Recent studies have demonstrated that MVCs appear to increase the risk of psychological morbidity in survivors (e.g., Blaszczynski et al., 1998; Ellis, Stores, & Mayou, 1998; Hobbs & Mayou, 2000). In the following sections, the most commonly reported psychological morbidity following MVCs in adults is discussed.

Psychological Morbidity Following MVCs

Acute responses. Little research has examined the acute reaction to MVCs. Dissociation (Hobbs & Mayou, 2000; Murray, 1997), avoidance distress associated with the accident, good recall of the accident, hyperamnesia (i.e., vivid memory without affective disturbance), intense intrusive thoughts with mild anxiety, and overt distress with many intrusions and avoidance

(Atchison & McFarlane, 1997) are important and conspicuous components of acute reaction to MVCs in adults.

Acute stress disorder (ASD). ASD, the potentially high levels of distress occurring during the acute trauma phase, is formally recognized in the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV;* American Psychiatric Association [APA], 1994). ASD appears to be common in many MVC survivors. The incidence of ASD following an MVC varies from 11% to 42% across studies (Bryant & Harvey, 1995a, 1996, 2003a; Harvey & Bryant, 1998, 1999; Holeva, Tarrier, & Wells, 2001; Holmes, Williams, & Haines, 2001; Mayou, Bryant, & Duthie, 1993; Vaiva et al., 2003; Veazey, 2003). Murray (1997) also reported the incidence of ASD to be 28.5% ($N = 117$) immediately after an MVC, 33.5% at some time during the first four weeks after the accident, and 10.3% four weeks after the accident.

Depression and anxiety. Depression is a common psychological consequence in MVC survivors. A number of studies showed that from 23% to 53% of adult MVC survivors experience depression (Blanchard et al., 1995; Blanchard et al., 1994a; Blanchard et al., 1996; Blanchard et al., 2004; Chan, Air, & McFarlane, 2003; Mayou et al., 1993). The incidence rates of depression in MVC survivors are much higher than the lifetime prevalence (varied from 10% to 25% for females and from 5% to 12% for males) and the point prevalence (ranged from 5% to 9% for females and from 2% to 3% for males) of Major Depressive Disorder and than the lifetime prevalence (approximately 6%) of and the point prevalence (approximately 3%) of Dysthymic Disorder (APA, 2000).

In addition to depression, MVC survivors often experience generalized or specific anxiety. The incidence of generalized anxiety in adult MVC victims varies from a low of 4% to a high of 87% (Blanchard et al., 2004; Chan et al., 2003; Culpan & Taylor, 1973; Jones & Riley,

1987; Malt, 1988; Mayou et al., 1993) with second lowest incidence rate of 11% (Culpan & Taylor, 1973). Thus, most incidence rates of generalized anxiety found in adult MVC studies are higher than the 1-year prevalence (approximately 3%) and the lifetime prevalence (approximately 5%) of Generalized Anxiety Disorder (APA, 2000).

The large range in the incidence of generalized anxiety may result from most studies using mixed groups of accidental injury victims (e.g., a sample of MVC and industrial accident survivors), and lacking clear separation of symptoms between depression and generalized anxiety. Although many individuals with generalized anxiety report having feelings of anxiety and nervousness all their lives, their symptoms of generalized anxiety may worsen during the times of stress (Wells, 2004). Thus, assessing MVC survivors at different time points after the accident (e.g., four to 12 months after the MVC, more than one year and less than two years after the MVC, over12 months following the MVC, over 10 years) may also be one of the confounding factors contributing to the large range in the incidence of generalized anxiety (Blanchard et al., 2004; Chan et al., 2003; Culpan & Taylor; Jones & Riley; Malt, 1988; Mayou et al., 1993).

The above studies investigating depression and generalized anxiety in MVC survivors did not track the onset and the course of these psychological problems; thus, MVC survivors' development of depression and generalized anxiety prior to or after the MVC is uncertain. In the current study, participants' previous psychological problems or disorders diagnosed by mental health professions and previous history of receiving counseling or psychological services for these problems or disorders were investigated to assess participants' co-morbidity of depression and anxiety with MVC PTSD symptoms.

Driving phobia. Research has demonstrated the effect of MVCs on subsequent levels of

driving-related fear (Taylor & Deane, 2000). Clinical significance of driving phobia has been recognized in MVC survivors with rates of 2% to 100% (e.g. Blanchard et al., 1995; Blanchard et al., 1994a; Culpan & Taylor, 1973; Hobbs, Mayou, Harrison, & Worlock, 1996; Mayou et al., 1993; Taylor, Deane, & Podd, 2002; Taylor & Koch, 1995). Taylor et al. (2002) and Taylor and Koch argued that differences in severity thresholds used to diagnose driving phobia might account for the reported wide range of rates. MVC investigators have defined driving phobia in different ways and terms. Kuch, Evans, Watson, Bubela, and Cox (1991) used the term, "accident phobia", to describe simple phobia of driving requiring the fear onset, content, symptoms, and behavior related to an MVC as well as meeting the criteria of simple phobia in the third revised version of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R*; APA, 1987).

Taylor et al. (2002) reported the key difference between the definitions of driving phobia and driving fear is whether an MVC survivor completely avoids driving or riding in a car. However, Blanchard and Hickling (1997) defined driving phobia as "either complete elimination of all driving or severe restriction of all driving" (p. 87) which is somewhat different from the definition of Taylor et al. To reduce the variation across studies, it has been suggested that avoidance rather than an experience of discomfort during driving be used to qualify the status of a driving phobia. MVC survivors who are able to drive or travel as a *passenger* in a vehicle, but no longer derive enjoyment from the activity, often now are considered as having "driving reluctance" (Taylor et al.; Taylor & Koch, 1995).

Post-traumatic stress disorder. PTSD is a common disorder following an MVC (e.g., Blanchard et al., 1995; Blanchard et al., 2004; Bryant & Harvey, 2003a; Ehlers, Majou, & Bryant, 1998; Miller, 2000; James, 1999; Veazey, 2003). The incidence of PTSD following MVCs in

adults has varied from a low of 0% (Malt, 1988) to a high of 78% (Veazey, Blanchard, & Hickling, 2004). It is again likely that the large fluctuations in the prevalence rates of PTSD following MVCs are due to methodological variations, particularly in sampling, recruitment, and timing of assessment (Blanchard & Hickling, 1997; Blanchard et al., 1996; Blanchard et al., 1995; Blanchard et al., 2004; Blanchard, Hickling, Veazey, et al., 2002; Blaszczynski et al., 1998; Bryant & Harvey, 2003a; Ehlers et al.; Holeva et al., 2001, Holmes et al., 2001; Kuhn, Blanchard, & Hickling, 2003; Miller; Veazey; Veazey et al., 2004).

Other psychological consequences. In addition to the above psychological morbidity, irritability, anger, insomnia, nightmares, and headaches are other psychological problems reported in adult MVC survivors (Blaszczynski et al., 1998). Although 20% of MVC survivors in the study of Mayou and Bryant (1995) were classified as "problem drinkers," there were no significant changes in the MVC survivors' alcohol consumption one year after the accident. Furthermore, MVC adult survivors may experience physical injury and disability, financial problems resulting from inability to work caused by physical injury and disability from the accident, cost of medical or psychological treatment, loss of a vehicle, and the slow progress of litigation (Blaszczynski et al., 1998; Chan et al, 2003; Hobbs & Mayou, 2000).

As noted earlier, PTSD is one of the most common psychological morbidities following MVCs and a number of studies have demonstrated the high incidence rate of PTSD in MVC survivors (e.g., Blanchard et al., 1995; Blanchard et al., 1994a; Blaszczynski et al., 1998; Keppel-Benson et al., 2002). The clinical features of PTSD following an MVC in adults are reviewed in the following sections.

PTSD in Adult MVC Survivors

Diagnostic Criteria of PTSD

Potentially traumatic events are defined by the American Psychiatric Association (APA, 2000) as "events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others" (p. 467). PTSD may result when one experiences, witnesses, or is confronted with one or more traumatic events to which one has reacted with fear, helplessness, or horror. After exposure to the traumatic event, the individual may develop trauma-related symptoms that include: (a) reexperiencing the event, (b) increased arousal following the event (i.e., hyperarousal), and (c) avoidance of the trauma or trauma-related stimuli.

Onset and Course of PTSD after MVCs

Individuals at any age, including children, can develop PTSD (APA, 2000). The *DSM-IV-TR* (APA, 2000) notes that individuals usually exhibit PTSD symptoms within the first three months following the traumatic event, though there are cases of delayed onset after months or even years. However, if an individual is experiencing traumatic reactions within the first month after the trauma, he or she may meet criteria for acute stress disorder (ASD), which has a strong association with the subsequent development of PTSD (Harvey & Bryant, 1998; Holeva et al., 2001). One month after the traumatic event, if the individual continues to exhibit posttraumatic stress symptoms, then a diagnosis of PTSD will be given. The predominant PTSD symptoms and their duration may vary over time; however, approximately half of all PTSD cases completely recover within three months whereas others may have persisting symptoms for longer than 12 months following the trauma. In some cases, the symptoms wax and wane over time and reminders of the original trauma, life stressors, or new traumatic events reactivate the symptoms (APA, 2000).

Studies of delayed onset of PTSD showed that adults after an MVC can develop

delayed/chronic onset of PTSD at three months, nine months, and 12 months after an MVC, respectively (Buckley et al., 2004; Epstein, 1993; Mayou et al., 1993; Mayou, Tyndel, & Bryant, 1997). In studies investigating the course of PTSD in adults after an MVC, the incidence rates of PTSD at a 3-month follow up, a 1-year follow-up, a 3-year follow up, and a 5-year follow up were from 10% to 39% (Blanchard et al., 2004: Ehlers, et al., 1998; Mayou et al., 1997), from 10% to 17% (Ehlers et al., 1998; Mayou et al., 1997), 11% (Mayou, Ehlers, & Bryant, 2002), and 10% (Mayou et al., 1997), respectively. Several studies (Blanchard & Hickling, 1997; Blanchard et al., 1996; Blanchard et al., 1995) found that there existed marked improvement in symptoms between three months and one year after the accident in MVC adult survivors. Those with PTSD at three months after the accident had a 50% chance of still suffering from the disorder at one year. However, Mayou et al. (1997) reported that the incidence of PTSD remained approximately 10% throughout the follow-ups: a 3-month follow-up, a 1-year follow-up, and a 5-year follow-up.

Predictors of PTSD after MVCs

Studies examining rates of PTSD after exposure to an MVC indicated that a number of individual characteristics and environmental factors had significant effects in predicting the presence of PTSD at different time points following the accident. Table 1 provides a list of factors that place one at risk of or protect one against the development of PTSD following an MVC in adults.

Differential Diagnoses with PTSD Following MVCs

Survivors following an MVC may develop symptoms similar to those of PTSD, but which could be better classified as other diagnoses or disorders, such as adjustment disorder, major depression, closed head injury resulting from car accidents, panic disorder, and

agoraphobia (Kuch, Cox, & Evans, 1996; Scotti, Morris, Ruggiero, & Wolfgang, 2002). For example, symptoms, such as avoidance, numbing, and increased arousal, may be due to the stressors independent of a traumatic event and may present before exposure to the traumatic event. If those symptoms do not fall within the orbit of PTSD, a mood disorder or anxiety disorder might be considered. To take another example, closed head injuries as a result of an MVC create another complication. The symptoms of a mild head injury, such as difficulty with attention and concentration, irritability, loss of interest, sleep disturbance, and anxiety, show considerable overlap with the symptoms of PTSD (Davidoff, Laibstain, Kessler, & Mark, 1988; Horton, 1993; Jacobson, 1999; Mittenberg, Wittner, & Miller, 1997; Scotti et al., 1992). However, the time course of symptoms is different between a mild head injury and PTSD. In a mild head injury, these symptoms occur within hours of the event and continue for several weeks to months. In PTSD, the symptoms have an onset one month following the motor vehicle crash. Scotti, Morris, et al. (2002) suggested using this difference in time course as a factor to make a differential diagnosis between a mild head injury and PTSD. Therefore, it is important for clinicians to distinguish the symptoms of psychological trauma from those of other disorders and medical conditions (i.e., head injury) to conduct appropriate treatments for clients' problems.

Additionally, MVCs often occur due to MVC survivors' and/or others' negligent actions causing unintentional harm to MVC survivors and their property. Particularly, as MVC survivors' harm resulting from others' negligent actions, precipitant(s) legally may become responsible for the compensation for the harm. To receive compensation for health care payments, lost wages, and/or pain and suffering, MVC survivors may overendorse or exaggerate their physical or psychological symptoms. Unlike pathogenic or criminological malingering, Rogers (1997) defined the MVC survivors' over-endorsement or exaggeration of mental health symptoms as

adaptational malingering. Of a number of variables (e.g., physical recovery, patients' pessimism about their recovery, stress of litigation, losses involved with traumatic injury) arising after MVCs and associated with MVC survivors' psychological distress and emotional recovery after the events, litigation stress and losses involved with traumatic injury are the potential factors intertwined with MVC survivors' motivation to exaggerate their mental health symptoms (Koch, Shercliffe, Fedoroff, Iverson, & Taylor, 1999; Rogers). According to Rogers, MVC litigants, particularly, are more likely to exaggerate their mental health symptoms when they sense a significant personal loss attached to their psychological problems and a method for obtaining compensation for this loss, when they are under conditions of limited personal options (e.g., poor job skills, limited financial resources, unavailable treatment of rehabilitation resources) and the adversarial litigation context, and when they have a desire to be heard.

Lees-Haley (1997) assessed malingering in 492 personal injury plaintiffs comprised of exclusively trauma victims with a variety of injuries and combinations of injuries (e.g., spinal cord injuries, brain injuries, toxic exposure) by use of the Minnesota Multiphasic Personality Inventory: Second Edition (MMPI-2; Arbisi & Ben-Porath, 1995, 1998). The validity scales of the MMPI-2 suggested possible malingering on approximately 20 to 30 percent of the profiles of these plaintiffs. Thus, ruling out the possibility of over-endorsement/exaggeration of mental health symptoms or adaptational malingering also is critical in the assessment of MVC PTSD.

Importance of Using Multiple Methods and Multiple Response Modes to Assess PTSD

Failure to resolve MVC PTSD symptoms may result in chronic consequences that interfere with an individual's physical or psychosocial functioning, that incur significant economic and health cost, or that facilitate the individual's development of MVC-related dysfunctional thinking (e.g., to interpret road traffic situations as more threatening than does the

individual who has not been exposed to an MVC); (e.g., Chan et al, 2003; Friedland & Dawson, 2001; Kuhn et al., 2003; Miller, 2000). It is important to detect PTSD or PTSD symptoms as early as we can and to prevent an increase or maintenance in symptoms over time. Traumatized individuals usually exhibit PTSD symptoms within multiple (three) response modes (i.e., cognitive, physiological, and motor responses). Cone (1978) argued for employing multiple methods and multiple response modes to assess a client's present problems and treatment progress.

Cone (1978), moreover, proposed that the methods (e.g., interviews, self-reports, self-observation) used to assess the three response modes usually fall along a continuum from direct to indirect. The continuum of directness/indirectness represents the extent to which a clinically relevant behavior is measured at the time and place of its occurrence. Of the methods used to assess the three content areas, the clinical interview typically employs an omnibus format to gather information on a variety of issues and behaviors, and aids in diagnostic evaluations and intervention planning (Beaver & Busse, 2000). Self-report measures are used in assessing an individual's perception of behavior across different dimensions of time, setting, and context (Witt, Cavell, Heffer, Carey, & Martens, 1988). Rating measures tend to provide a standardized format for an informant to summarize his or her judgments of an individual's behavioral characteristics that may have occurred in a variety of settings and over a long period of time (Merrell, 1999). All of these three methods— interviews, self-reports, and ratings by others— are considered indirect methods in that the clinically relevant behavior is reported or rated at some other time and place (Cone).

Self-observation, naturalistic free behavior, naturalistic role play, analog free behavior, and analog role play are considered direct methods in that the measure of clinically relevant

behavior takes place at the time and place of the behavior's occurrence (Cone, 1978). Self-monitoring, also termed self-observation, is a procedure that requires an individual to observe and record specific aspects of his or her own behavior (Cole & Bambara, 2000; Cole, Marder, & McCann, 2000). The naturalistic free behavior method for assessing an individual's PTSD requires that target behaviors be observed and assessed directly in one's natural environment as it typically occurs. In naturalistic role-play, the observee is provided with a set of instructions and is asked to act as if he or she was someone or something else in a natural environment (Cone). In analog free behavior, target behaviors are observed and recorded directly in simulated or hypothetical situations as they naturally occur. In free analog situations, the behavior of the individual is free to vary (Cone; Hintze, Stoner, & Bull, 2000). In analog role-play, the behavior of the observee is contrived or scripted in a simulated or hypothetical setting (Cone; Hintze et al.).

Most of the existing measures currently used to assess adult posttraumatic symptoms resulting from an MVC fall into the category of indirect methods (e.g., Blanchard et al., 2004; Blanchard et al., 1996; Bryant & Harvey, 2003b; Buckley et al., 2004; Buckley, Blanchard, & Hickling, 1996; Chan et al., 2003; Fullerton et al., 2000; Ursano et al., 1999). The author used the database of PsycARTICLES and PsycINFO spanning from the year 1987 to the present to search journal articles, book chapters, and dissertations related to the posttraumatic symptoms resulting from an MVC in adults. Based on the author's review of these articles, structured or semi-structured interviews including the Clinician-Administered PTSD Scale (CAPS; Blake, Weathers, Nagy, Kaloupek, Charney, et al., 1995), the Structured Clinical Interview (SCID; First, Gibbon, Spitzer, & Williams, 1996), and the Composite International Diagnostic Interview (CIDI; Peters, Andrews, Cottler, Chatterji, Janca, et al., 1996) and self-report measures involving

the Impact of Event (Horowitz, Wilner, & Alvarez, 1979) and the PTSD Checklist (PCL; Weathers, Litz, Huska, & Keane, 1994) have been found as the most common indirect measures used in current MVC studies in adults.

Few studies have used other methods assessing PTSD and PTSD symptoms resulting from MVCs. In these studies, MVC survivors were assessed for their physiological responsiveness (i.e., heart rate, blood pressure, startle responses, restlessness responses, perspiration, frontal electromyogram, electrodermal activity, and skin resistance level) via technological devices and/or were asked to rate their distress level using the Subjective Units of Distress Scale (SUDS) in laboratory situations or naturalistic hospital settings during their exposure to a mental arithmetic task, imaginal accident scenes, idiosyncratic audiotapes of their accidents, and/or standardized videotapes of generic MVC scenes (Blanchard, Hickling, Buckley, et al., 1996; Blanchard, Hickling, Galovski, & Veazey, 2002; Blanchard, Hickling, & Malta, 2003; Blanchard, Hickling, Taylor, Loos, & Gerardi, 1994b; Blanchard, Hickling, Veazey, et al., 2002; Buckely et al., 2004; Karl, Malta, Alexander, & Blanchard, 2004; Kuch, Swinson, & Kirby, 1985; Lyons, & Scotti, 1995; Veazey et al., 2004).

Additionally, the original Stroop task (Stroop, 1935) requires that individuals name the color of the ink in which a word is printed while ignoring the word itself. Gotlib and McCann (1984) applied a modified version of the Stroop task to study the effects of emotional disturbance. James (1999) and Scotti, Ruggiero, et al. (2002) addressed the mechanisms under which the Stroop interference for disorder-relevant words may result. These authors suggest that the Stroop interference is a conditioned emotional response where aversive stimuli disrupt over-learned behaviors.

The modified Stroop task has been used in adults with PTSD in a number of studies (e.g.,

Bryant & Harvey, 1995b; Cassiday, McNally, & Zeitlin, 1992; Thrasher, Dalgleish, & Yule, 1994). In these studies, participants were required to name the colors in which either trauma-related or nontrauma-related words were printed while trying to ignore the words themselves; however, little research has studied the Stroop interference in MVC survivors with PTSD. James (1999) and Moradi, Taghavi, Neshat-Doost, Yule, and Dalgleish (1999) demonstrated discriminant validity of the modified Stroop task, as youth with PTSD took a longer amount of time to name accident-related words than nontrauma-related words when compared to control participants. However, Devineni, Blanchard, Hickling, and Buckley (2004) investigated the effects of three treatment conditions (i.e., cognitive-behavioral, supportive psychotherapy, wait list control) on the Stroop color-naming interference for trauma cues in MVC survivors with PTSD. No significant Stroop color-naming interference was found among the three groups at either posttreatment or follow-up.

Using the definitions of Cone (1978), physiological measures can be characterized as direct methods of assessment. Some researchers may consider the SUDS ratings and the modified Stroop task to be direct methods because they examine participants' responses during and/or immediately after exposure to different modes of stimulus presentation (e.g., trauma-related or non-trauma-related audiotapes, videotapes, or words). Others may disagree with this classification because participants' responses on these measures are not considered observable behaviors. These responses typically are either self-report ratings (i.e., SUDS ratings) or inferences of private events [e.g., using reaction time (RT) as an inference to assess participants' MVC PTSD symptoms of intrusive cognition, hyperarousal, and hypervigilance].

As mentioned earlier, Cone (1978) proposed a "continuum" of assessment methods, ranging from direct to indirect. SUDS ratings and the modified Stroop task share varying degrees

of characteristics of indirect and direct methods. In the present study, the SUDS ratings, the modified Stroop task, and the adult version of the computer-administered MVC Behavioral Avoidance Test (MVC-BAT-A) developed for use in this study were considered direct methods of assessment, given the immediate measure of participants' responses during and/or immediately after their exposure to trauma-related stimuli. Detailed information regarding the MVC-BAT-A is provided in the "Method" section of this manuscript.

PTSD symptoms can be overlooked or misidentified when the selection of measures is restricted to a particular assessment method. There are several advantages and disadvantages in the utility of indirect (i.e., self-report, interview, rating by others) and direct measures (i.e., self-monitoring, natural free or role play observation, and analog free or role play observation) in assessing PTSD symptoms. Typically, indirect PTSD measures contain items that sample a large array of PTSD symptoms and other related symptoms. The score obtained from indirect PTSD measures usually is used to describe the relative standing of the target individual by comparing the score to a normative sample. Thus, the indirect PTSD measures may be useful for classification/diagnostic decisions (Kazdin, 1998; Stamm, 1996; Wilson & Keane, 2004). However, the indirect PTSD measures may not be designed to be repeated at frequent intervals. Indirect measures, thus, are not as sensitive as direct measures to changes in the frequency, intensity, or distress associated with target behaviors (Alessi, 1988; Kazdin, 1998). Thus, the use of these measures to examine the individual's change across time may be problematic.

In addition, the accuracy of data obtained from self-report and ratings by others measures may be biased or unreliable due to the reporters' own views of the target behaviors (Alessi, 1988; Patterson, 1982; Shapiro, Lentz, & Sofman, 1985). Moreover, an individual's memories for a traumatic event that they have experienced can be affected by leading or repeated

questioning about the event (Saywitz & Moan-Hardie, 1994) or can be reconstructed in the absence of complete encoding of the experience (Harvey & Bryant, 2001). An individual, further, can intentionally lie about the occurrence and report misperceptions, delusional beliefs, or fantasies of an event even though this event actually did not occur (Carlson, 1997).

Unlike indirect measures, direct measures are less inferential and can provide highly ecologically reliable and valid data if the process of conducting direct observations is systematic. Another advantage is that observers can identify target behaviors and antecedent conditions and consequent events related to target behaviors. Based on direct observation data, the contingent if-then relation (if this behavior occurs under these antecedent conditions, then this consequence will follow) is recognized and observers can judge the functions of target behaviors. Furthermore, direct measures (e.g., SUDS, modified Stroop) appear to be useful measures for evaluating outcome as they are highly sensitive to change (i.e., intrasubjective comparisons) and can be tailored to the symptoms of the individual patient as well as its application to examine an individual's mastery of a criterion. For example, an individual with MVC PTSD may receive exposure therapy to remediate his or her avoidance to MVC-related cues. The MVC-BAT-A developed in the present study can be used to examine an MVC survivor's improvement in avoidance to MVC-related cues during his or her exposure therapy. The treatment requires comparison of an individual's performance to a mastery criterion (e.g., absence of avoidance behavior to trauma-related cues).

One problem with the direct PTSD measures (e.g., BAT) is that it is not clear how the criterion representing mastery was derived. Although it seems that establishing this criterion may need a normative comparison, most direct measures established the acceptable criterion score on the basis of logical rather than empirical analysis (i.e., criterion = 80% of items/steps passed by

the individuals). Additionally, direct measures appear to address some of the problems (the limited range of PTSD symptoms) that indirect measures assess. Direct measures often do not have a normative base. As a result, direct measures usually are not helpful in determining an individual's standing relative to a normative sample as well as making decisions about diagnostic classifications. Moreover, direct measures (as opposed to indirect measures) require more time and resources to administer.

Both indirect and direct measures may only be useful for certain types of assessment decisions. Indirect measures may easily or accurately identify those individuals who have substantially severe PTSD symptoms. Direct measures may target these individuals for more in-depth evaluation. Particularly, the decision to which direct measures can contribute significantly is the identification of target areas for the development of interventions. An assessor should not make judgments based only on the data collected from indirect measures. It is important that an assessor collects other data that is measured by direct methods that can either support or fail to support the information collected from indirect methods. The commonalities among different assessment methods (indirect and direct measures) are imperative to assess the convergent validity for these measures.

Characteristics of College Students Following an MVC

As mentioned earlier, a large body of studies has consistently demonstrated a certain portion of MVC survivors with PTSD, PTSD symptoms, and comorbidities. A number of protective and risk factors were found in predicting MVC PTSD or MVC PTSD symptoms. These studies predominantly recruited clinical and/or community samples. The common sources and methods for recruitment included self-referral patients seeking medical or psychological services, hospitalized MVC survivors, police reports, newspaper, local media, practitioner

referrals (e.g., family medicine, orthopedics, chiropractors, psychiatrists), a regional trauma center, a local clinic, and/or the emergence department of a local hospital (e.g., Blanchard, Hickling, Galovski, et al., 2002; Buckley et al., 2004; Culpan & Taylor, 1973; Devineni et al., 2004; Feinstein & Dolan, 1991; Hickling, Gillen, Blanchard, Buckley, & Taylor, 1998; Kuch, Cox, Evans, & Shulman, 1994; Malt, 1988; Ursano et al., 1999). College students only comprise a minor portion of the clinical or community samples in these studies. Particularly, the mean age of the participants in these studies ranged from a lowest age of 27 (Harvey & Bryant, 2001) to a highest age of 49.5 (Ehlers, Hofmann, Herda, & Roth, 1994) which is at least 3 years older than the common age range of college students (i.e., 18-24; Hingson, Heeren, & Zakocs, 2002).

Of these studies on PTSD, PTSD symptoms, or other psychiatric morbidity in MVCs, only Hickling, Taylor, and Blanchard (1999) and Wallis and Bogduk (1996) recruited a number of college students in their MVC-related studies. College students in the two studies, however, were asked to simulate how they thought an MVC survivor would respond on psychological tests that often are used to assess MVC survivors for PTSD and to assess chronic pain 6 months after an MVC to ensure compensation. None of the two studies has examined the after-effects of an MVC in college students. Lindsay, Hanks, and Hurley (1999) conducted a telephone survey with 300 college students (median age = 22). The findings indicated an average of four student fatalities each year in a student population of approximately 29,000 and an annual incidence rate of 1.37 per 10,000 resulting from dozing and driving between year 1984 to 1999. Moreover, Everett, Lowry, and Cohen (1999) analyzed National College Health Risk Behavior Survey data (N = 2847) collected in 1995 by the Centers for Disease Control and Prevention and reported that substance-using college students are more likely to be at risk of involving MVCs or MVC injuries. As a result, MVCs commonly occur in college students, but often are not considered

potentially traumatic events that may lead to or exacerbate PTSD and a host of related psychological symptoms and disorders. Studies investigating the characteristics of college students following an MVC are needed.

Purposes and Hypotheses

This study had three specific aims: (a) investigation of the characteristics of college students who have been involved in an MVC versus a control group, (b) development of a computer-administered analog assessment to assist in evaluating MVC PTSD symptoms in adults, and (c) examination of the psychometric properties of the computer-administered analog assessment. In this study, a computer-administered analog assessment (i.e., the MVC-BAT-A) was developed to assess the participant's avoidance behavior, arousal level, and RT to trauma-related stimuli. During the assessment, the participants were administered the MVC-BAT-A during which six MVC- and non-MVC-related stories were presented via computer (with audio and still photos). The participants rated their arousal level and could terminate (avoid) any segments of each story at any point. Their RT to each Subjective Units of Distress Scale (SUDS) and their total RT to the entire task also were recorded. Detailed information regarding the MVC-BAT-A and the SUDS is provided in the "Method" section of this manuscript.

The two-factor theory of Mowrer (1947), a behavioral model, well explains the association between an individual's aroused state during a trauma and his or her reexperiencing and avoidance symptoms after it. In the application of Mowrer's two-factor model to an MVC case, the first factor in the two-factor model is conditioned fear learning, which involves both classical (Pavlovian) and conditioned processes. According to Mowrer, an organism responds to the environment in terms of unconditioned response (UR) and conditioned response (CR). An UR (e.g., fear elicited by an MVC) is innate and is elicited by an unconditioned stimulus (US,

e.g., car crashes). A CR (e.g., conditioned fear elicited by MVC-related stimuli) is elicited by a conditioned stimulus (CS, e.g., MVC-related stimuli including the images, sound, smell, or physical pressure occurring during the MVC) that was a neutral stimulus (NS) prior to its pairing with the US. The occurrence of a CR depends on frequency (e.g., multiple pairs or single pair) and strengths of pairs between the neutral stimulus (NS) and an US. Research has demonstrated fear responses can be strongly conditioned via only one traumatic event (Kleinknecht, 1994; LeDoux, Romanski, & Xagorans, 1989; Rudy, 1993).

The second factor in the two-factor theory is operant avoidance learning involving fear reduction. The conditioned fear that results from the presence of the CS presumably is an unpleasant or aversive state; therefore, motivational properties that encourage one to engage in behaviors to escape or avoid conditioned aversive stimuli (CS) to reduce the unpleasant or aversive state is assumed to be reinforcing. Thus, avoidance behaviors are learned because the response results in a reduction in conditioned aversive state. Following an MVC, a traumatized individual might report difficulty remembering details of the event, numbing of emotions, and avoidance of driving or riding in a car. This assumption is supported by the study of Steward and Peter (2004), investigating the driving and riding avoidance in a non-clinical sample of university undergraduates. Steward and Peter found MVC survivors who received medical treatment for their MVC-related injuries reported having greater driving and riding avoidance than those who were uninjured or injured and not medically treated.

Foa and Kozak (1986) proposed an emotional-information processing theory. In this model, the extended and repetitive presentation of the feared stimuli (either object or situation) tends to trigger the individual's fear memory structures consisting of three essential propositions: the stimulus element, the response element, and the meaning element. Thus, an individual with

MVC PTSD is highly likely to experience a certain amount of cognitive change and to exhibit symptoms of intrusive cognitions, hyperarousal, and hypervigilance toward trauma-related cues. Such cognitive change may lead to attention reduction in individuals with high MVC PTSD symptoms and may facilitate them to take a longer amount of time to respond to stimuli presented with trauma-related cues. Foa and Kozak's emotional-information processing theory is supported by the studies of James (1999) and Moradi et al. (1999) in which color-naming interference assessed by use of the modified Stroop task was found in MVC survivors more during their exposure to MVC-related words than during non-MVC-related ones.

Based on Mowrer's (1947) two-factor theory and Foa and Kozak's (1986) emotional-information processing theory and studies of James (1999), Moradi et al. (1999), and Steward and Peter (2004), the following hypotheses emerged. It was hypothesized that in comparison to the control group, the group with High MVC PTSD symptoms would engage in more avoidance behavior to MVC-related stories. It also was assumed that the group with High MVC PTSD symptoms would take a longer amount of time to complete their SUDS ratings and would experience higher levels of psychological distress after their exposure to the MVC-related stories, as compared to the control group.

Method

Participants

The current sample was drawn from participants who completed a screening questionnaire on the Internet and agreed to participate in the second (further assessment) phase of this study. Detailed information regarding the recruitment of participants is provided in the "Procedure" section of this manuscript. In the second phase, forty young adults (57.5% male), aged 18-24 years (M = 19.5, SD = 1.3), who had experienced an MVC with High MVC PTSD

symptoms were recruited from the students enrolled in psychology courses at West Virginia University. Forty non-MVC adults (male = 62.5%), aged 18-24 (M = 19.7, SD = 1.4) were recruited as a control group. Participants were excluded from the study if they had a loss of consciousness for more than 15 minutes during an MVC. Participants also were not eligible for this study if they were above 24 years of age and/or lacked interest in participating in the second phase of this study.

For the group with High MVC PTSD symptoms, nearly all (97.5%) participants were U.S. citizens, with 47.5% being from West Virginia (Pennsylvania = 22.5%, Virginia = 7.5%, New York = 7.5%, Maryland = 7.5%; Not Applicable = 2.5%). Caucasians (95%; African American = 2.5%) and freshmen (60%; juniors = 20%, sophomores = 12.5%, seniors = 7.5%) comprised the majority of the group. Additionally, most participants were single (90%; married = 5%, cohabiting = 5%) and were unemployed (60%; employed part-time = 35%, employed full-time = 5%). Eighty percent of the participants reported currently living with their family and friends (roommates = 7.5%, live alone = 5%, spouse = 5%, romantic partner = 5%). The sample of the non-MVC control group was similar to that of the group with High MVC PTSD symptoms and consisted of 92.5% participants who were U.S. citizens, with 50% being from West Virginia (Pennsylvania = 17.5%, Maryland = 12.5%, New Jersey = 7.5%, Not Applicable = 7.5%). Caucasians (85%; African American = 5%) and freshmen (45%; sophomores = 30%, juniors = 17.5%, seniors = 7.5%) again comprised the majority of the group. Nearly all participants were single (97.5%; married = 0%, cohabiting = 2.5%), with 65% being unemployed (employed part-time = 35%, employed full-time = 0%). Again, 60% of the participants reported currently living with their family and friends (roommates = 25%, live alone = 7.5%, spouse = 5%, romantic partner = 2.5%).

Measures

Demographic Questionnaire

A demographic questionnaire was designed by the investigator to assess sociodemographic information, such as age, gender, ethnic status, year of college, marital status, work status, significant medical and mental health history, and family income (see Appendix A). These data were included to describe the sample and to evaluate any relations with the other measures.

Accident Descriptor Checklist (ADC)

The ADC (Rode, 1997) is a 24-item parent-rating scale designed to obtain qualitative information regarding the nature and conditions of the MVC (e.g., type of accident, type of injury, medical services, road conditions) that their child has experienced. To apply this measure to undergraduate MVC survivors, the investigator deleted original items 5, 6, 16, 19, and 21 on the ADC and modified the original items 1, 2, 3, 7, 8, 11, 12, 18, 23, and 24 by changing the wording from the third person (e.g., item 1: Does the child remember the accident) to the first person (e.g., item 1: Do you remember the accident?). A set of 21 additional items (items 15 to 26, 29 to 37 on the modified ADC) were incorporated into the core set of original items 1 to 4, 7 to 15, 17, 18, 20, 22 to 24 on the ADC (see Appendix B) to form the modified ADC. The 21 additional items were constructed as a result of an extensive review of the literature describing predictors of MVC PTSD. The group with High MVC PTSD symptoms was asked to complete the modified ADC (ADC-M).

History of Psychosocial Stressors-College Student Version (HPS-C)

The HPS (Scotti, 1992; Ruggiero, 2001) is a 59-item self-report measure of potentially traumatic events (e.g., transportation accidents, sexual abuse, natural disaster) designed to be

used in adult populations. Scotti et al. (2000) selected and modifed15 items from the HPS to develop a college student version of the HPS (HPS-C), which is used to assess potentially traumatic events experienced by college students (see Appendix C). In terms of the psychometric properties of the HPS-C, Scotti et al. (2000) reported a mean of 4.7 events with 96% reporting at least one event in a sample of college students. A moderate Cronbach's alpha (r = .71) was reported for individual items, and test-retest analysis demonstrated stable reporting of total number of events over a one-week period (nonsignificant differences in test-retest means, r = .82, $p < .001$). Construct validity of the HPS-C was also demonstrated by a significant positive correlation between the Impact of Event Scale (IES; Horowitz et al., 1979) and numbers of HPS-C events. In this study, the HPS-C was used to assess the severity of psychological distress resulting from previous traumatic events (total distress score), the amount of previous experience with traumatic events (total number of traumatic events), and the total number of traumatic events witnessed.

Accident Characteristics Identification Scale (AcCIdentS)

The AcCIdentS, developed by Scotti et al. (1992), is a nine-item, Likert-type measure that has been used to assess the severity and impact of an MVC and to discriminate between non-accident, mild, and heavy MVC exposure groups with adults (see Appendix D). In this study, the AcCIdentS was used to assess the severity and impact of the MVC experienced by the participant.

Beck Depression Inventory-II (BDI-II)

The BDI-II (Beck, Steer, & Brown, 1996) is a 21-item self-report measure developed for the assessment of depressive symptoms in adults and adolescents aged 13 years and older. Because the BDI-II is based on the DSM-IV criteria for diagnosing depressive disorders, it has

good content validity. The total BDI-II scores vary from a low of 0 to a high of 63. The most severe levels of depression are reflected by scores ranging from 29 to 63. The BDI-II has demonstrated excellent internal consistency for 500 outpatients (α = .92) and for 120 college students (α = .93). A high test-retest correlation of .93 was found with a sample of 26 Philadelphia outpatients. With respect to convergent validity, the BDI-II is positively related to the Beck Hopelessness Scale (Beck & Stress, 1988) (*r* = .68), the Beck Scale for Suicide Ideation (Beck & Stress, 1991) (*r* = .37), and the Beck Anxiety Inventory (BAI; Beck & Steer, 1993) (*r* = .60). Further evidence of the convergent and discriminant validity of the BDI-II is the finding that the BDI-II is more positively related (*r* = .71) with the Hamilton Psychiatric Rating Scale for Depression (Hamilton, 1960) than it is with the Hamilton Rating Scale for Anxiety-Revised (Hamilton, 1959); (*r* = .47). The BDI-II total score was used to assess the severity of depression for the participants in the present study.

Beck Anxiety Inventory (BAI)

The BAI (Beck & Steer, 1993) consists of 21 descriptive items used to assess the severity of anxiety in adults and adolescents. The respondent is asked to rate his/her anxiety symptoms on a 4-point scale ranging from 0 to 3 (0 = *not at all*, 3 = *severely*). The scores of 23 to 63 reflect the most severe levels of anxiety. Good content validity has been demonstrated, because the BAI comprises content corresponding to the symptom criteria presented in the DSM-III-R. High internal consistency reliability (α = .92) has been established in 40 patients with anxiety disorders based on the DSM-III-R criteria (Beck, Epstein, Brown, & Steer, 1988). Beck, Rush, Shaw, and Emery (1979) reported moderate test-retest reliability (*r* = .75) in 83 outpatients, which is the subsample of Beck, Epstein et al.'s (1988) study. In terms of the convergent validity of the BAI, positive correlations ranged from .47 to .51 have been found between the BAI and

several measures assessing anxiety (e.g., the Hamilton Rating Scale for Anxiety-Revised); (Beck & Steer, 1993). Beck, Epstein et al. demonstrated the BAI's ability to discriminate a group of outpatients with a primary anxiety disorder (no secondary depression disorder) and another group of outpatients with a primary depression disorder (no anxiety disorder). In the present study, the participant's severity of general anxiety was measured by using the BAI total score.

Personality Assessment Screener (PAS)

The PAS (Morey, 1997) is a 22-item self-report measure developed with reference to its parent instrument, the Personality Assessment Inventory (PAI; Morey, 1991), to rapidly screen for a wide range of clinical issues for individuals aged 18 or older. The items on the PAS tap 10 domains of clinical problems: (a) Negative Affect, (b) Acting Out, (c) Health Problems, (d) Psychotic Features, (e) Social Withdrawal, (f) Hostile Control, (g) Suicidal Thinking, (h) Alienation, (i) Alcohol Problem, and (j) Anger Control. Each item score ranges from 0 to 3. A total score of 19 or above on the PAS suggests clinically significant emotional and/or behavioral problems.

Morey (1997) reported that the PAS has moderate internal consistency ($\alpha = .72$) for the entire scale and low ($\alpha = .29$) to moderate ($\alpha = .77$) internal consistency for the subscales. Good test-retest reliability ($r = .85$) for the entire scale and low ($r = .47$) to moderate ($r = .81$) test-retest reliability for the subscales in the college student sample ($N = 1051$) also were found. Moreover, Morey provided information on the convergent and discriminant validity of the PAS total score and its subscale scores with its parent PAI as well as numerous other measures with related constructs in various samples. For example, PAS total score was correlated with every clinical scale on the PAI (range = -.05 to .78). A moderate correlation ($r = .72$) was found between the Anger Control subscale of the PAS and the Aggression subscale of the PAI. Patients

diagnosed with adjustment disorders and schizophrenia obtained lower scores on the Anger Control subscale of the PAS than those diagnosed with prominent difficulties in the area of anger management.

Holmes et al. (2001) found that somatic complaints, anxiety and related disorders, depression, non-psychotic symptoms of schizophrenia, and negative relationships assessed by using the PAI are risk factors related to the development of PTSD in adult MVC survivors. Moreover, MVC survivors diagnosed with PTSD and a preexisting personality disorder (e.g., 52.4% of these MVC survivors presented with obsessive-compulsive personality disorder) were found to be at risk for developing chronic PTSD and being resistant to spontaneous remission of PTSD (Malta, Blanchard, & Taylor, 2002). In the present study, the PAS total score was utilized to provide the investigator a brief screening of information relevant to the participant's various clinical problems.

MVC Behavioral Avoidance Test (MVC-BAT)

Behavioral Avoidance Test (BAT). The BAT is a general strategy rather than a single standardized technique for assessing PTSD-related behavior. This strategy involves placing the individual in a setting that contains the feared stimuli (e.g., blood, darkness, heights, medical procedures) and then having the individual perform a series of graduated tasks that ask for approach to and interaction with the feared stimuli. The individual's performance in each step is used as an overall index of fear (Barrios & Hartmann, 1997). The BAT has been used in a group-design treatment study to assess avoidance of trauma-related cues in analog role-play settings for combat veterans with PTSD (Cooper & Clum, 1989). In this study, Copper and Clum designed a 10-minute slide-tape show of Vietnam with sound track starting with Billy Joel's "Goodbye, Saigon" and ending with battle sounds (e.g., mortars, rockets, sniper fire, choppers, jets). The

BAT was administered at pre- and post-treatment to assess the extent to which avoidance behavior was exhibited by the combat veteran. The slide-tape show was stopped as soon as the combat veteran indicated that the scenes became upsetting to him. The combat veteran's SUDS ratings and heart rate recordings at each minute of the slide-tape show were used to assess improved performance on the BAT.

Development of the adult version of the MVC-BAT (MVC-BAT-A). The computer-administered MVC-BAT, which was based on the work of Rode (1997), was developed by Chen, Scotti, and Fortson (2004) to assess the child's avoidance behavior, arousal level, and RT as he or she is exposed to MVC-related stimuli. In the study of Rode, self-monitoring (i.e., SUDS ratings) was used within an analog situation to assess MVC PTSD symptoms in 14 children who had been involved in an MVC versus 38 controls. Six hierarchical audiotaped vignettes, two that described positive social activities (a surprise party and last day of school), two that described potentially stressful events at school (school test and school oral report), and two that described non-injury MVCs (rainy night and snow day), were presented to all children in one of three counterbalanced orders of approximately one minute each. All children were asked to provide a SUDS rating at two points: during the middle of the story (preresolution) and at end of the story (resolution). SUDS ratings were made using a 4-point scale of either positive (how nervous/upset the story made them feel) or negative (how happy the story made them feel) reactions

In the present study, the child version of the computer-administered MVC-BAT was modified to create a version more suitable for college students (i.e., MVC-BAT-A). For the MVC-BAT-A, the participant was seated in front of a computer. The computer screen presented instructions that described the task procedures. The participant first was given a short 2-minute practice story to practice these procedures for ratings. Following a practice story, participants

were asked to perform a mental arithmetic task (i.e., count out loud backwards from 200 by 7s for 1 minute). Lee and Guck (1990) examined physiological arousal in relation to a serial 7s task (used as a mental arithmetic stressor) in 30 college students with high versus low levels of math anxiety and found the levels of the individuals' math anxiety did not affect their physiological arousal. The mental arithmetic task was used in this study as a non-vignette-related stressful stimulus.

Next, six stories were presented to the participants, two that described a car accident (mild MVC, severe MVC), two that described a school-related stressful event (forgetting to study for a test, giving an oral report), and two that described pleasant events (the last day of school before summer vacation, a surprise birthday party; See Appendix E). Each story lasted 4 minutes and was presented over the computer speakers. Each story was divided into 1-minute segments with the following four goals: (a) providing a context for the story, (b) providing the central events of the story, (c) continuing the central events, and (d) providing a resolution. During each 1-minute segment, a digital photo related to that segment was presented on the screen. Participants' responses on the mental arithmetic task and on the six stories were compared to examine differences in participants' levels of psychological distress following their exposure to non-vignette-related versus vignette-related stressful stimuli.

SUDS assessed during the MVC-BAT-A. Studies have used SUDS as a method that requires an individual to observe and record their subjective arousal level in response to traumatic scenes or audiotaped vignettes (e.g., Cooper & Clum, 1989; Kuch et al., 1985; Lyons & Scotti, 1995). In the present study, the participant rated his/her level of nervousness and happiness on a 0-9 scale (not at all nervous/happy to very nervous/happy) at three points for the practice story, at two points for the mental arithmetic task, and at five points for each story of the

MVC-BAT-A: (a) before the segment starts, and (b) after each 1-minute segment. The ratings were completed by clicking the mouse.

There were five SUDS nervous scores for each story. The first SUDS nervous score served as a baseline for the other SUDS nervous scores (the second to the fifth SUDS nervous scores). The second to the fifth nervous scores were adjusted by subtracting the first SUDS nervous score from the second through the fifth SUDS nervous scores, respectively. The adjusted mean SUDS nervous score for each story was formed by adding the four difference adjusted SUDS nervous scores and dividing by four. Because the mild and severe MVC stories were written in such a way as to create varying stress levels, the scores on these stories were analyzed separately. However, the adjusted mean SUDS nervous scores from the two stories in the category of the school-related stressful events (i.e., forgetting to study for a test, giving an oral report) and the adjusted mean SUDS nervous scores from the two stories in the category of the pleasant events (i.e., the last day of school before summer vacation, a surprise birthday party) were averaged to form two means: the average adjusted school-stress SUDS nervous score and the average adjusted pleasant-event SUDS nervous score. The adjusted SUDS nervous score for the mental arithmetic task was calculated by subtracting the SUDS nervous score prior to the mental arithmetic task from the SUDS nervous score after the mental arithmetic task.

Similarly, there were five SUDS happy scores for each story. The adjusted mean SUDS happy score for the mild MVC story, the adjusted mean SUDS happy score for the severe MVC story, the average adjusted school-stress SUDS happy score, and the average adjusted pleasant-event SUDS happy score were computed in the same way as the SUDS nervous scores above. The adjusted SUDS happy score for the mental arithmetic task was computed just as the SUDS nervous score above. Thus, 10 variables resulted from the above calculations: (a) the adjusted

mean SUDS nervous score for the mild MVC story, (b) the adjusted mean SUDS happy score for the mild MVC story, (c) the adjusted mean SUDS nervous score for the severe MVC story, (d) the adjusted mean SUDS happy score for the severe MVC story, (e) the average adjusted school-stress SUDS nervous score, (f) the average adjusted school-stress SUDS happy score, (g) the average adjusted pleasant-event SUDS nervous score, (h) the average adjusted pleasant-event SUDS happy score, (i) the adjusted SUDS nervous score for the mental arithmetic task, and (j) the adjusted SUDS happy score for the mental arithmetic task.

RT measured during the MVC-BAT-A. The participants' RTs to each set of SUDS ratings (SUDS nervous rating plus SUDS happy rating) prior to and after each segment of the stories were recorded. Each RT was calculated from the time that each set of SUDS ratings came onto the screen until the participant completed the set of ratings by clicking the buttons for both SUDS nervous rating and SUDS happy rating. There were five RTs for each story. The adjusted mean RT score for the mild MVC story, the adjusted mean RT score for the severe MVC story, the average adjusted school-stress RT, and the average adjusted pleasant-event RT were computed in the same way as the associated SUDS scores described above (i.e., obtaining difference scores using the baseline and averaging scores). Similarly, the adjusted RT for the mental arithmetic task was calculated by subtracting the RT prior to the mental arithmetic task from the RT after the mental arithmetic task. Thus, five variables resulted from the above calculations: a) the adjusted mean RT for the mild MVC story, (b) the adjusted mean RT for the severe MVC story, (c) the average adjusted school-stress RT, (d) the average adjusted pleasant-event RT, and (e) the adjusted RT for the mental arithmetic task.

Occurrence of avoidance assessed during the MVC-BAT-A (avoidance). The participant was told that during the presentation of each story, the participant could stop any segments of

each story anytime they wanted by using the mouse to click on the "stop" button on the computer screen. Once the "stop" button was clicked, one button with the text of "Start the next segment" was presented to the participant on the computer screen. The participant then was asked to click on the button to skip the current segment and to continue the remaining segments of the story.

The participant's avoidance to each story was rated on an occurrence-nonoccurrence basis. The occurrence of the participant's avoidance to each story was counted as the participant clicked the "stop" button at least once during his or her exposure to any segments of the story. Thus, there were six variables to assess the participant's avoidance to each story: (a) the avoidance for the mild MVC story, (b) the avoidance for the severe MVC story, (c) the avoidance for the story of forgetting to study for a test, (d) the avoidance for the story of giving an oral report, (e) the avoidance for the story of the last day of school before summer vacation, and (f) the avoidance for the story of a surprise birthday.

Reduction in carryover effects. To avoid carryover effects (Keppel, 1991) occurring after the presentation of the two MVC-related stories (i.e., the participant's high levels of anxiety remaining longer for all other stories following the presentation of MVC-related stories), there were 1-minute baselines/breaks interposed between stressors (i.e., the mental arithmetic task and stories) and at the beginning and the conclusion of the MVC-BAT-A. No studies have investigated the extent to which the specific amount of time (e.g., 1-minute interval) for the baselines/breaks between tasks lead to reduction in the traumatized individual' arousal level. The use of 1-minute baselines/breaks between tasks in this study was derived and modified from the study of Scotti, Ruggiero, et al. (2002). Additionally, the order of the stories was set as follows: instruction, baseline, practice story, baseline, mental arithmetic task, baseline, last day of school before summer, baseline, mild MVC story, baseline, forgetting to study for a test, baseline, a

surprise party, baseline, severe MVC story, baseline, giving an oral report, and baseline. The procedures for the administration of the MVC-BAT-A via a computer program are presented in Appendix J.

Anxiety Disorders Interview Schedule for DSM-IV, Adult Version-PTSD Section (ADIS-IV-A-PTSD)

The ADIS-IV-A is a structured interview designed to assess for current episodes of anxiety disorders based on the full-range of DSM-IV criteria (Brown, DiNardo, & Barlow, 1994). Although the ADIS-IV-A contains PTSD as one of the anxiety disorders, research examining the psychometric properties of the ADIS-IV-A for traumatized individuals is needed. Only one published study exists that utilized the original ADIS (DiNardo, O'Brien, Barlow, Waddell, & Blanchard, 1983) to make diagnoses of PTSD in 43 male Vietnam War veterans with combat experiences. Good inter-rater reliability (k = .86) was found in 93% of cases, suggesting that ascertaining PTSD diagnosis can be reliably identified by the utility of the ADIS (Blanchard, Gerardi, Kolb, & Barlow, 1986). In the present study, the ADIS-IV-A-PTSD total frequency and distress scores were utilized to assess the frequency and the severity of MVC PTSD and non-MVC PTSD symptoms obtained by having them complete the ADIS-IV-A-PTSD based on the most traumatizing MVC and non-MVC-related event, respectively.

Participants in both the High MVC PTSD symptoms group and the control group were administered the PTSD section of the ADIS-IV-A (ADIS-IV-A-PTSD) to systematically diagnose PTSD and assess the severity of the PTSD symptoms. Because inter-rater reliability is essential to the usefulness of this measure, several integrity procedures were included in the study. First, four doctoral clinical psychology students (interviewers) and two undergraduate students (reliability checks) were trained in administration of the ADIS-IV-A-PTSD. Training

continued until all trainees obtained a Kappa of .8 with a live, simulated interview. An average Kappa coefficient of .88 was achieved by all trainees. Next, 8 out of 40 interviews (20%) randomly were selected for reliability assessment from both the High MVC PTSD symptoms group and the control group, separately. For the reliability checks, a second trained coder sat in the interviews and simultaneously coded the participant's response with the interviewer. If coding had fallen below .7 Kappa on two occasions, data collection would have stopped until coders were retrained and again reached the .8 Kappa criterion with a live simulated interview. However, coding never fell below .7 Kappa on two occasions. Inter-rater agreement using the Kappa coefficient was calculated based on the 20% of the completed coding files for each group. High inter-rater agreements (k = .88 and k =. 94) were obtained across the eight completed coding files for the group with High MVC PTSD symptoms and for the control group, respectively.

Impact of Event Scale-Revised-Modified Version (IES-R-M)

The IES-R (Weiss & Marmar, 1997) is a revised version of the Impact of Event Scale (IES; Horowitz, Wilner, & Alvarez, 1979). The IES is a 15-item self-report measure used to capture the level of the intrusive and avoidance symptoms 7 days following exposure to a specific traumatic stressor. The IES is based on the *DSM-III-R PTSD criteria* but did not tap the D criteria (arousal symptoms) of the *DSM-III-R* (APA, 1987) and now *DSM-IV* criteria for PTSD. Weiss and Marmar revised the IES by incorporating a set of seven additional items (six hyperarousal items and one intrusion item) to the core set of original 15 items in the measure of PTSD for adults. Thus, the IES-R is a 22-item self-report measure representing the three PTSD symptom clusters: eight intrusion items, eight avoidance items, and six hyperarousal items. Participants were asked to rate the frequency of the 22 symptoms in the past seven days on a 4-

point scale (1 = *not at all*, 4 = *often*).

The internal consistency, measured by Cronbach's alpha, for intrusion, avoidance, and hyperarousal ranges from .87 to .92, from .84 to .86, and from .70 to .90, respectively. The test-retest reliability was .57 and .94 for intrusion, .51 and .89 for avoidance, and .59 and .92 for hyperarousal in that order. Factorial validity was established by conducting a principal factors factor analysis with varimax rotation for 206 adults who experienced the 1994 Northridge earthquake in the Los Angeles area. The factor analysis yielded a strong single factor that accounted for 49% of the variance for the entire scale. The subscale correlations are .74 for intrusion with avoidance, .87 for intrusion with hyperarousal, and .74 for avoidance and hyperarousal (Weiss & Marmar, 1997).

Weiss and Marmar (1997) recommended the IES-R be modified so that the respondent is asked to rate the degree of distress of the 22 symptoms in the past seven days on a 5-point scale (0= *not at all*, 4 = *extremely*; see Appendix G). The total score of the modified version of the IES-R (IES-R-M) was administered to the participant to evaluate his or her degree of distress on the intrusive, avoidance, and hyperarousal PTSD symptoms.

The PTSD measures used in this study are listed in Table 2. During the administration of the MVC-BAT-A, participants were asked to watch, listen carefully, and imagine six "standardized" rather than idiosyncratic MVC- and Non-MVC–related stories via computer (see instructions in Appendix E). They also rated their arousal level and could terminate (avoid) any segments of the stories at any time. Their RTs for the SUDS ratings prior to and after each segment of the stories were recorded.

Unlike other psychological problems (e.g., social anxiety), PTSD symptoms are often triggered by the presence of a stimulus situation that resembles one that occurred during the

original traumatic situation. The reconstruction of the original traumatic situation (e.g., rape, war, MVC) via role play in a laboratory setting often is highly difficult or aversive for participants. It may be unpractical to use highly contrived or scripted analog role play methods to assess traumatized individuals. Additionally, in the time since Cone (1978) proposed the six types of assessment methods, applications of computers for automated administration, scoring, reporting, and interpretation of conventional tests has become more commonplace, much easier, and more affordable. Thus, a new category of assessment methods, such as computer-administered analog assessment, might be more appropriate to describe the special features of the MVC-BAT-A.

Procedures

Recruitment and Consent

The recruitment of participants for this study consisted of two phases: screening phase and further assessment phase. In the first (screening) phase, undergraduates enrolled in Psychology classes at West Virginia University were informed by their instructors that they could fill out a self-report measure, the modified version of the Impact of Event Scale-Revised (IES-R-M; Weiss & Marmar, 1997), on the internet to receive extra credit. The process for obtaining participants' consent online included providing an Informed Consent Form and the Health Insurance Portability and Accountability Act (HIPAA) Authorization Form followed by a statement, "clicking below indicates that I have read and understood the description of the study and I agree to participate" online. Only participants who accepted the conditions of the consent forms were allowed to complete the IES-R-M screening instrument. Fourteen additional questions were added into the IES-R-M to classify the participant's group status (see Appendix F and G). These questions inquired about participants' MVC history, the most traumatizing event in his/her lifetime, age, gender, race/ethnicity, course name for extra credit, instructor's name for

extra credit, course number for extra credit, interest in participating in the second phase of this study, and contact information. The IES-R-M was used to assess the severity of the PTSD symptoms in undergraduates who have and have not experienced an MVC. MVC participants completed two IES-R-Ms based on the most traumatizing MVC and non-MVC-related event, respectively. Non-MVC participants only identified the event they perceived as the most traumatizing and completed the IES-R-M based on this event.

Participants who endorsed a loss of consciousness for more than 15 minutes, age above 24, or a lack of interest in participating in the second phase of this study were excluded. A total of 226 undergraduates who had been involved in at least one MVC in their lifetime made an attempt to complete the screening questionnaire on internet. Of the 226 undergraduates who had experienced at least one MVC, 179 undergraduates successfully completed the screening questionnaire and met the inclusion criteria. However, seven out of the 179 undergraduates (3.9%) did not indicate their interest in participating in the second phase of this study. A total of 88 undergraduates who had not been involved in any MVCs responded to the first phase of screening. Of the 88 undergraduates, 81 successfully completed the screening questionnaire. Eighteen out of the 81 (22.2%) undergraduates declined the opportunity for participating in the second phase of this study. Of the 179 participants who had experienced an MVC and who met the inclusion criteria, a sample of 40 MVC participants with highest MVC IES-R-M scores was recruited and classified as the group with High MVC PTSD symptoms in the second phase of this study. Forty participants, who had not experienced an MVC, who met the inclusion criteria, and whose demographics (i.e., age, gender, race/ethnicity) were similar to the group with High MVC PTSD symptoms, were selected and recruited as the control group. Because previous research has indicted that demographic variables may be confounding factors when assessing

PTSD symptoms following MVCs or other discrete or chronic traumas (e.g., Bryant & Harvey, 2003b; Green, Gleser, & Lindy. 1996; MacDonald, Chamberlain, & Long, 1997; Mayou et al, 2002), a blocking procedure was conducted to insure that the control group had similar age, gender, and race/ethnicity to the group with High MVC-PTSD. The flow chart for the first (screening) phase of this study is presented in Appendix H.

In the second phase (further assessment phase), the investigator contacted the group with High MVC-related PTSD symptoms and the control group via electronic mails, and/or phone. During the contact, the purpose of the study and the extent of participation (including risks and benefits) were briefly introduced to the participants. An appointment also was scheduled. At the beginning of the appointment, the purpose of the study and the extent of participation (including risks such as conditions of the assessment and limits of confidentiality and benefits such as payment for the participation) were explained to the participants once more. The participants again were provided with a paper-format Informed Consent Form and a paper-format HIPAA Authorization Form to indicate their willingness to participate.

During the second phase of recruitment, a total of 42 undergraduates with highest MVC IES-R-M scores were contacted and invited to participate in the second phase of this study. Two female undergraduates did not present at their appointment for the further assessment. A total of 44 undergraduates who had not experienced an MVC also were selected for the further assessment. Four female undergraduates in this group did not show up for their appointments. A visual inspection of the MVC IES-R-M total scores and the Non-MVC IES-R-M total scores did not reveal a pattern for the drop-out undergraduates in either group.

After completing the second phase of recruitment, all identifiable information (e.g., name, home, address, electronic mail address, telephone number) except for age, gender, and

race/ethnicity were de-identified by removing it from the data and assigning each participant an identification number. To minimize the impact of a high rate of missing data on the later statistical analyses, all participants' protocols were screened for skipped responses on each measure. If missed items were found on any of the measures, the participants were asked if they felt comfortable completing the unanswered items. If the participant indicated that he or she was uncertain about how to rate an item, the investigator suggested the respondent estimate or guess. If the participant did not wish to complete an item, he or she was asked to leave the rating blank. If less than 10% of the data were missing for a measure, the missing data were replaced with the group mean for that measure item. Only four participants (two from the group with High MVC PTSD symptoms and two from the control group) were found to have skipped items on the HPS-C. In these cases, less than 10% of the total items of the measure were missing, allowing the replacement procedure to be used.

Assessment

The group with High MVC PTSD symptoms randomly was administered the demographic questionnaire, the ADC-M, the AcCIdentsS, the HPS-C, the BAI, the BDI-II, the PAS, the ADIS-IV-IA-PTSD, and the MVC-BAT-A. Prior to the assessment, nine lottery balls numbered and representative of each of the different measures was drawn from a non-transparent bag, one at a time until the bag was empty, to decide the order of assessment procedures for each participant. A label with the randomly assigned order was attached to each testing package to guide the administration of the assessment. The assessment procedure for the control group was conducted in the same manner as the MVC group with two exceptions: (a) the control group was excluded from completing the ADC-M, and (b) the control group was asked to provide answers to only the first two questions of the AcCIdentS. The two questions of the AcCIdentS were used

to assess the possibility of experiencing an MVC between the screening phase and the second phase along with levels of fear of riding in an automobile.

Benefits and Referrals

Following the assessment, the participant received extra credit and $10 dollars for participation. A list of local mental health resources was provided to the participant in case he or she felt in need of services. The flow chart for the second (further assessment) phase of this study is presented in Appendix I.

Results

Demographics Analysis

Comparsion of the Demographics by Group. Chi-square and independent-samples t tests were conducted to examine any group differences in the participants' demographic characteristics, the total number of car accidents the participant had had in his/her lifetime as a driver or passenger, level of fear of riding in an automobile, level of fear of driving an automobile, level of PTSD symtpoms based on the most traumatizing event that is not MVC related, level of distress resulting from previous traumatic events that participants endorsed, the total number of traumatic events that participants reported having experienced, and the total number of traumatic events that participants reported having witnessed. These variables were assessed by using the demographic questionnaire, the first two questions from the AcCIdentS, the IES-R-M, and HPS-C.

As expected, in comparison to the control group, the group with High PTSD symptoms had a higher number of car accidents (an average of 2.6 MVCs versus none), $t(78) = 15.92$, $p < .01$, a higher level of fear of driving in a car or other motor vehicle, $t(78) = 5.62$, $p < .01$, a higher level of fear of riding in a car or other motor vehicle, $t(78) = 6.49$, $p < .01$, a higher level

of distress resulting from previous traumatic events that participants endorsed, $t(78) = 3.93$, $p < .01$, and a higher number of traumatic events that participants reported having experienced, $t(78) = 4.99$, $p < .01$. Except for the variables above, chi-square and independent-samples t tests revealed no signficant differences between the group with High MVC PTSD symptoms and the control group on other variables (see Table 3).

MVC Group (Group with High MVC PTSD Symptoms)

In addition to the demographic questionnaire, the group with High MVC PTSD also completed the modified ADC-M, the AcCIdentS, and IES-R-M to provide information regarding the nature, conditions, severity, and impact of their MVC. The group with High MVC PTSD symptoms consisted of 23 males (57.5%) and 17 females (42.5%) with gender difference on the MVC PTSD symptoms assessed by the IES-R-M, $t(38) = 3.49$, $p < .01$. Females ($M = 50.18$, $SD = 8.48$) tended to rate the severity of their MVC PTSD symptoms more highly than males ($M = 42.39$, $SD = 5.65$) on the IES-R-M. In contrast, there was no gender difference found on the frequency, $t(38) = .42$, $p > .05$, and severity, $t(38) = .56$, $p > .05$, of the MVC PTSD symptoms assessed by the ADIS-IV-A-PTSD.

Most participants indicated that they were drivers (65%) instead of passengers (35%) in the accident. A total of 16 (40%) individuals in this group reported that they had been injured in the accident. Twelve (75%) of the 16 injured participants classified the severity for each type of injury into the categories of "not at all severe" and "a little bit severe" (15 out of 16 participants with extremity injury, 8 out of 9 participants with neck injury, 7 out of 7 participants with face injury, 6 out of 7 participants with head injury, 4 out of 4 participants with abdomen injury, 3 out of 4 participants with thorax injury, 1 out of 1 participant with pelvis injury, 1 out of 1 participant with spine injury, 1 out of 1 participant with other injuries not previously asked).

Moreover, participants reported receiving several types of medical treatments. First aid at scene (17.5%), first aid at home (10%), visiting emergency room (17.5%), and visiting doctor's office (10%) comprised the majority of the sample. Only one participant was hospitalized for treating his/her injury.

In terms of the damage to participants' vehicles, 80% of participants indicated that their cars involved in the accident were mainly damaged but reparable (20%) or not repairable/totaled (60%). With regard to their perception of the MVC, over 60% of the participants perceived themselves as being at least someone in danger of being injured (82.5%) and being killed (62.5%) during the accident. A total of 29 participants (72.5%) reported having others present at the time of the accident and two (5%) indicated experiencing friends killed in the accident.

At the time of assessment, 17 participants (42.5%) were taking medications for a variety of medical concerns (e.g., birth control, asthma, allergy, ulcers, depression) with six reporting that their current medical problems did not result from the MVC. Only 11 (27.5%) of the participants had ever had psychological problems or disorders diagnosed by mental health professions and had ever received counseling or psychological services for these problems or disorders. Except for depression (17.5%), the 11 participants reported an approximately equal percentage of psychological problems or disorders diagnosed by mental health professions (anxiety = 7.5%, learning problems = 2.5%, anger control problems = 2.5%, relationship problems = 2.5%, posttraumatic disorder = 2.5%). The various time lengths that the 11 participants reported receiving counseling or psychological services for their psychological problems or disorders were: 1 to 3 years (12.5%), 1 month to 1 year (10%), less than 1 month (2.5%), and more than 3 years (2.5%). Interestingly, none of the 11 participants indicated that the MVCs required him or her to receive psychiatric or psychological services. Moreover, seven of

the 11 participants, reportedly, had received the services prior to the accident. Though 28 participants (70%) endorsed receiving no compensation as a result of the accident, 85% of the participants had not had a major financial crisis resulting from the accident and 80% had not been involved in a legal suit/litigation regarding the accident.

Additionally, two separate paired-sample t tests were conducted to evaluate whether there were differences in the fear of driving in a car or other motor vehicles and the fear of riding in a car or other motor vehicles in the group with High MVC PTSD symptoms prior to and after their MVC. The results indicated that the fear of driving in a car or other motor vehicles after the MVC (M = .83, SD = .84) was significantly higher than that prior to the MVC (M = .25, SD = .49),), $t(39) = 4.31$, $p < .01$. Similar results were found between the the mean fear of riding in a car or other vehicles after the MVC (M = .85, SD = .58) and that prior to the MVC (M = .50, SD = .64), $t(39) = 2.88$, $p < .01$. The descriptive statistics (e.g., calculation of means and frequencies) describing the information assessed by using the ADC-M and the AcCIdentS are presented in the Tables 4 and 5.

Characteristics of College Students— MVC Group versus Control Group (Purpose a, page 20)

A one-way multivariate analysis of variance (MANOVA) was conducted to determine the effect of the group on eight dependent variables: (a) the BDI-II total score, (b) the BAI total score, (c) the ADIS-IV-A-PTSD total frequency score for the most traumatizing non-MVC event, (d) the ADIS-IV-A-PTSD total distress score for the most traumatizing non-MVC event, (e) the PAS total score, (f) the HPS-C total distress score resulting from previous traumatic events that participants endorsed, (g) the HPS-C total number of traumatic events that participants reported having experienced, and (h) HPS-C total number of traumatic events that participants reported having witnessed. Significant differences were found between the two

groups on the eight dependent variables, Wilk's $\Lambda = .69$, $F(8, 71) = 3.91$, $p < .01$. The multivariate η^2 based on Wilk's Λ was .31. Analyses of variance (ANOVAs) on each dependent variable were conducted as follow-up tests to the MANOVA. The following ANOVAS were significant: the BAI total score, $F(1, 78) = 5.70$, $p < .05$, $\eta^2 = .07$, the ADIS-IV-A-PTSD total frequency score for the most traumatizing non-MVC event, $F(1, 78) = 8.43$, $p < .01$, $\eta^2 = .10$, the ADIS-IV-A-PTSD total distress score for the most traumatizing non-MVC event, $F(1, 78) = 8.56$, $p < .01$, $\eta^2 = .10$, the HPS-C total distress score resulting from previous traumatic events that participants endorsed, $F(1, 78) = 15.47$, $p < .01$, $\eta^2 = .17$, and the HPS-C total number of traumatic events that participants reported having experienced, $F(1, 78) = 24.93$, $p < .01$, $\eta^2 = .24$. The group with High MVC PTSD symptoms endorsed significantly greater severity of general anxiety, non-MVC PTSD symptoms, and distress resulting from previous traumatic events in comparison with the control group. This group again was more likely than the control group to report having higher frequency of non-MVC PTSD symptoms and greater number of experienced previous traumatic events. The means and the standard deviations on the eight dependent variables for the two groups are listed in Table 6.

To look closely at participants' previous traumatic events, the frequency and percentage of positive responses and the mean and standard deviation of the distress level for each traumatic event on the HPS-C by group are presented in Tables 7 and 8. There was a notable consistency in the most and the second most commonly occurring traumatic events experienced by both groups. Specifically, death of spouse or someone close to you was the most commonly occurring traumatic event as it was experienced by 65% of the group with High MVC PTSD symptoms and 57.5% of the control group. The second most commonly occurring traumatic event was severe injuries which were experienced by 25% of the group with High MVC PTSD symptoms and

30% of the control group. In terms of distress level for each traumatic event experienced and/or witnessed by participants, death of spouse or someone close to you again was the traumatic event that both groups (group with High MVC PTSD symptoms; control group) endorsed as causing the highest level of distress. MVCs and divorce/separation from spouse/significant others were the traumatic events eliciting the second highest level of distress for the group with High MVC PTSD symptoms and the control group, respectively.

Except for the MVCs, the frequency of exposure to each of the traumatic events on the HPS-C were similar, as was the frequency of witnessing each of the traumatic events. There were significant differences between the two groups on the distress levels of five traumatic events: MVCs, $t(78) = 5.63$, $p < .01$, pedestrian accident, $t(78) = 2.12$, $p < .05$, living in a high crime area, $t(78) = 2.03$, $p < .05$, treating critical patients in a hospital emergency room, $t(78) = 2.51$, $p < .05$, and death of spouse or someone close to you, $t(78) = 2.40$, $p < .05$ (group with High MVC PTSD was higher).

PTSD Symptoms and DSM-IV PTSD Diagnosis

To assess the frequency and the severity of MVC PTSD symptoms, descriptive statistics were performed on the IES-R-M total score and the ADIS-IV-A-PTSD total frequency and distress scores based on the most traumatizing MVC for the group with High MVC PTSD symptoms. To assess the frequency and the severity of non-MVC PTSD symptoms, independent-samples t tests were conducted to examine any group differences in participants' frequency and distress level of PTSD symptoms for their most traumatizing non-MVC event also assessed by using the IES-R-M and the ADIS-IV-A-PTSD. The group with High PTSD symptoms endorsed an average IES-R-M total score of 45.70 with a standard deviation of 7.92, an average ADIS-IV-A-PTSD total frequency score of 19.82 with a standard deviation of 16.59, and an average

ADIS-IV-A-PTSD total distress score of 21.58 with a standard deviation of 17.64 for their most traumatizing MVC. In comparison to the control group, this group also had a significantly higher level of IES-R-M total score, $t(78) = 5.78$, $p < .01$, ADIS-IV-A-PTSD total frequency score, $t(78) = 2.90$, $p < .01$, and ADIS-IV-A-PTSD total distress score, $t(78) = 2.93$, $p < .01$, based on the most traumatizing non-MVC event (see Table 9).

Additionally, the ADIS-IV-A-PTSD was used to determine if participants were classifed as meeting diagnositc criteria for MVC PTSD and non-MVC PTSD. Seven (17.5%) of the group with High MVC PTSD symptoms met criteria for MVC PTSD. For non-MVC PTSD diagnosis, four (10%) of the group with High MVC PTSD symptoms and one (2.5%) of the control group met criteria for non-MVC PTSD, χ^2 (1) = 1.92, $p > .05$ (see Table 10).

Evaluation of Psychometric Properties for the MVC-BAT-A (Purposes b & c, page 20)

Comparison of the SUDS nervous scores by group (discriminant validity). A one-way MANOVA was performed to examine the effect of the group on five dependent variables: (a) the adjusted mean SUDS nervous score for the mild MVC story, (b) the adjusted mean SUDS nervous score for the severe MVC story, (c) the average adjusted school-stress SUDS nervous score, (d) the average adjusted pleasant-event SUDS nervous score, and (e) the adjusted SUDS nervous score for the mental arithmetic task. The MANOVA revealed significant differences between two groups on the five dependent variables, Wilk's $\Lambda = .86$, $F(5, 74) = 2.44$, $p < .05$, $\eta^2 = .14$. Only the ANOVA on the adjusted mean SUDS nervous score for the mild MVC story was significant, $F(1, 78) = 6.42$, $p < .05$, $\eta^2 = .08$. Participants with High MVC PTSD symptoms rated a higher level of nervousness after their exposure to the mild MVC story than the control group. Table 11 contains the means and the standard deviations on the five dependent variables for the two groups.

Comparison of the SUDS happy scores by group (discriminant validity). A one-way MANOVA was conducted on five dependent variables: (a) the adjusted mean SUDS happy score for the mild MVC story, (b) the adjusted mean SUDS happy score for the severe MVC story, (c) the average adjusted school-stress SUDS happy score, (d) the average adjusted pleasant-event SUDS happy score, and (e) the adjusted SUDS happy score for the mental arithmetic task. Significant differences were found between the two groups on the five dependent variables, Wilk's $\Lambda = .86$, $F(5, 74) = 2.39$, $p < .05$, $\eta^2 = .14$. A comparison of the SUDS nervous scores by group revealed that only the ANOVA on the adjusted mean SUDS happy score for the mild MVC story was significant, $F(1, 78) = 10.29$, $p < .01$, $\eta^2 = .12$. Participants with High MVC PTSD symptoms rated lower level of happiness after their exposure to the mild MVC story than the control group. The means and the standard deviations on the five dependent variables for the two groups are presented in Table 12.

Comparison of the RT and avoidance by group (discriminant validity). Participants with High MVC-PTSD symptoms and the control group were compared on five dependent variables including the adjusted mean RT for the mild MVC story, the adjusted mean RT for the severe MVC story, the average adjusted school-stress RT, the average adjusted pleasant-event RT, and the adjusted RT for the mental arithmetic task by conducting a one-way MANOVA. An overall MANOVA on the five dependent variables revealed no significant differences by group, Wilk's $\Lambda = .92$, $F(5, 74) = 1.38$, $p = .24$, $\eta^2 = .09$.

Descriptive statistics were performed to describe the frequency and the percentage of participants' avoidance to each story presented at the MVC-BAT-A by group. When they clicked on the "stop" button, participants were asked about their intention of clicking (i.e., accidentally clicking the "stop" button or intentionally clicking the "stop" button to avoid exposure to the

segment of each story). The descriptive statistics revealed that only two (5%) of the group with High MVC-PTSD symptoms clicked the "stop" button and these occurred during the first segment of the first story—last day of school before summer. In both cases, the click of the stop button was reported to be an accident. None of the participants accidentally or intentionally clicked the "stop" button during his or her exposure to any segments of the other stories. A chi-square test revealed no significant difference between the two groups in the frequency of participants' clicking the "stop" icon, χ^2 (1) = 2.05, $p > .05$.

Intrascale correlations, internal consistency reliability, and convergent validity. Intrascale correlations within each of the three PTSD measures (i.e., ADIS-IV-A-PTSD, HPS-C, IES-R-M) and internal consistency (i.e., inter-item correlations) and convergent validity of the MVC-BAT-A were assessed by conducting a series of correlational analyses among 13 outcome variables of the four PTSD measures. These variables assessed MVC and non-MVC PTSD symptoms and previous traumas for the combined sample and included: (a) the adjusted mean SUDS nervous score for the mild MVC story, (b) the adjusted mean SUDS nervous score for the severe MVC story, (c) the adjusted mean RT for the mild MVC story, (d) the adjusted mean RT for the severe MVC story, (e) the ADIS-IV-A-PTSD total frequency score for the most traumatizing non-MVC event, (f) the ADIS-IV-A-PTSD total distress score for the most traumatizing non-MVC event, (g) the ADIS-IV-A-PTSD total frequency score for the most traumatizing MVC, (h) the ADIS-IV-A-PTSD total distress score for the most traumatizing MVC, (i) the HPS-C total distress score resulting from previous traumatic events that participants endorsed, (j) the HPS-C total number of traumatic events that participants reported having experienced, and (k) HPS-C total number of traumatic events that participants reported having witnessed, (l) the IES-R-M total score for the most traumatizing non-MVC event, and (m) the

IES-R-M total score for the most traumatizing MVC.

The results of the correlational analyses presented in Table 13 showed that 27 out of the 78 correlations were statistically significant and were greater than or equal to $r = .23$. In the paragraphs below, correlations among the outcome variables within each measure first were addressed (see Figures 1 to 4) followed by the report of correlations among the outcome variables across different measures (see Figure 5). For the ADIS-IV-A-PTSD (interview measure), positive correlations (range $r = .35$-$.96$, ps $<.05$) were found among the total frequency score and the total distress score for the most traumatizing non-MVC event and those for the most traumatizing MVC (see Figure 1). For the HPS-C (self-report measure), correlations (range $r = .33$-$.66$, ps $<.01$) among HPS-C total distress score resulting from previous traumatic events that participants endorsed, the HPS-C total number of traumatic events that participants reported having experienced, and the HPS-C total number of traumatic events that participants reported having witnessed were significant (see Figure 2). For the IES-R-M (self-report measure), scores were positively correlated ($r = .35$, $p < .05$) between the IES-R-M total score for the most traumatizing non-MVC event and that for the most traumatizing MVC (see Figure 3). Unlike the HPS-C, the IES-R-M, and ADIS-IV-A-PTSD above (i.e., self-report and interview measures), of the four MVC-BAT-A outcome variables, only the adjusted mean SUDS nervous score for the mild MVC story was positively correlated with the adjusted mean SUDS nervous score for the severe MVC story, $r = .61$, $p < .01$ (see Figure 4).

With regard to the correlations among the outcome variables across PTSD measures, the ADIS-IV-A-PTSD (interview measure) total frequency score ($r = .62$, $p < .01$) and the ADIS-IV-A-PTSD total distress score ($r = .63$, $p < .01$) for the most traumatizing non-MVC event were positively correlated with the IES-R-M total score for the most traumatizing MVC (self-report

measure); however, the ADIS-IV-A-PTSD total frequency score ($r = .35$, $p < .05$) and the ADIS-IV-A-PTSD total distress score ($r = .32$, $p < .05$) for the most traumatizing MVC were positively correlated with the IES-R-M total score for the most traumatizing non-MVC event. The ADIS-IV-A-PTSD total frequency score and the ADIS-IV-A-PTSD total distress score failed to correlate significantly with the IES-R-M total score, as participants reported those scores based on their most traumatizing MVC.

Moreover, positive correlations appeared between the ADIS-IV-A-PTSD total distress score for the most traumatizing non-MVC event and the HPS-C total distress score resulting from previous traumatic events that participants endorsed and the HPS-C total number of traumatic events that participants reported having experienced, $r = .29$, $p < .01$ and $r = .23$, $p < .05$, respectively. Participants' report on the IES-R-M total score for the most traumatizing non-MVC event showed positive correlations with the HPS-C total distress score resulting from previous traumatic events that participants endorsed and the HPS-C total number of traumatic events that participants reported having experienced, $r = .52$, $p < .01$ and $r = .48$, $p < .01$, respectively. The correlations between the IES-R-M total score for the most traumatizing MVC and the HPS-C total distress score resulting from previous traumatic events that participants endorsed ($r = .32$, $p < .05$) and the HPS-C total number of traumatic events that participants reported having experienced ($r = .35$, $p < .01$) also were significant (see Figure 5).

Only four significant correlations were found among the outcome variables of the MVC-BAT-A and those of other indirect/retrospective measures (i.e., the ADIS-IV-A-PTSD, the IES-R-M, and the HPS-C). There were positive correlations between the adjusted SUDS mean nervous score for the severe MVC story and the ADIS-IV-A-PTSD total distress score for the most traumatizing non-MVC event, $r = .23$, $p < .05$, and between that and the IES-R-M total score for

the most traumatizing MVC, $r = .25$, $p < .05$. Results also showed positive correlations between the adjusted SUDS mean nervous score for the mild MVC story and the HPS-C total distress score resulting from previous traumatic events that participants endorsed, $r = .23$, $p < .05$ and between the adjusted mean RT for the mild MVC story and the ADIS-IV-A-PTSD total frequency score for the most traumatizing MVC, $r = .34$, $p < .05$ (see Figure 5).

A large number of correlational analyses (i.e., 78) were conducted among the 13 outcome variables of the four PTSD measures; thus, Type I error may be responsible for some of the significant correlations. To examine the possibility of Type I error, Box's M tests were conducted to examine the homogeneity of covariance matrices for 10 of the 13 variables within each group (i.e., group with High MVC PTSD symptoms versus the controls; see Table 13). Three variables (i.e., the ADIS-IV-A-PTSD total frequency and total distress scores and the IES-R-M total score for the most traumatizing MVC) were excluded from Box's M tests because one group of data (i.e., the group with High MVC PTSD symptoms) was collected for each variable. Box's M tests revealed group differences in 24 pairs of variables, indicating limited linearity for these variables within each group (see Table 13). Of the 24 pairs of variables, seven pairs were statistically significant in Box's M tests as well as in intrascale (2 pairs of variables) and interscale (5 pairs of variables) correlations. For the intrascale correlations, positive correlations were found between the ADIS-IV-A-PTSD total frequency score for the most traumatizing non-MVC event and the ADIS-IV-A-PTSD total distress score for the most traumatizing non-MVC event, $r = .95$, $p < .01$ and between the HPS-C total distress score resulting from exposure to previous traumatic events and the HPS-C total number of traumatic events witnessed, $r = .39$, $p < .01$.

With regard to the five pairs of interscale correlations, the ADIS-IV-A-PTSD total distress score for the most traumatizing non-MVC event positively correlated with the adjusted

mean SUDS nervous score for the severe MVC story, $r = .23$, $p < .05$, the HPS-C total distress score resulting from exposure to previous traumatic events, $r = .29$, $p < .01$, and the HPS-C total number of traumatic events experienced, $r = .23$, $p < .05$. The HPS-C total distress score resulting from exposure to previous traumatic events also positively correlated with the ADIS-IV-A-PTSD total frequency score for the most traumatizing non-MVC event, $r = .23$, $p < .05$ and the IES-R-M total score for the most traumatizing non-MVC event, , $r = .52$, $p < .01$. Given the significant findings in Box's M tests, the seven significant intrascale and interscale correlations may be due to Type I error and should be interpreted with caution.

Excluding the seven significant intrascale and interscale correlations, 20 rather than 27 significant correlations were retained in the final report. In summary, low to high and low to moderate, positive intrascale correlations were found on the interview (i.e., the ADIS-IV-A-PTSD) and self-report measures (i.e., the HPS-C, the IES-R-M), respectively. For the computer administered measure (i.e., MVC-BAT-A) used in the analog assessment measure, only one moderate inter-item correlation was found between the adjusted mean SUDS nervous score for the mild MVC story and for the severe MVC story. Low to moderate convergent validity was found between the ADIS-IV-A-PTSD and the IES-R-M; however, this held true only when measuring PTSD symptoms of a different origin. For example, when the ADIS-IV-A PTSD measured non-MVC PTSD symptoms, convergent validity was found with the IES-R-M when MVC PTSD symptoms were assessed. Likewise, when the ADIS-IV-A-PTSD measured MVC PTSD symptoms, convergent validity was noted when the IES-R-M assessed non-MVC PTSD symptoms. Moreover, convergent validity was not found for the ADIS-IV-A-PTSD and the IES-R-M, both of which were used to assess MVC PTSD symptoms. Additionally, more positive and higher correlations were found between the outcome variables of the HPS-C and the IES-R-M as

compared to relations between the outcome variables of the HPS-C and the ADIS-IV-A-PTSD.

Concurrent validity. Four one-way MANOVAs were conducted on the 23 outcome variables that assessed characteristics of college students, history of traumatic events, and PTSD symptoms. Follow up analyses demonstrated significant group differences. The seven variables were: (a) the BAI total score, (b) the ADIS-IV-A-PTSD total frequency score for the most traumatizing non-MVC event, (c) the ADIS-IV-A-PTSD total distress score for the most traumatizing non-MVC event, (d) the HPS-C total distress score resulting from previous traumatic events that participants endorsed, (e) the HPS-C total number of traumatic events that participants reported having experienced, (f) the adjusted mean SUDS nervous score for the mild MVC story, and (g) the adjusted mean SUDS happy score for the mild MVC story.

To examine how the seven variables discriminate among group membership, a stepwise discriminant analysis was conducted as a post hoc test with group category as the criterion variable and the seven variables as predictor variables. The stepwise discriminant analysis revealed significant overall Wilks's lambda, $\Lambda = .63$, $\chi^2(3, n = 80) = 35.05$, $p < .01$, indicating that overall the predictors differentiated among the two groups. Only one discriminant function consisting of three variables resulted from the stepwise discriminant analysis. The three variables were the HPS-C total number of traumatic events that participants reported having experienced, the ADIS-IV-A total frequency score for the most traumatizing non-MVC event, and the adjusted mean SUDS happy score for the mild MVC story. Table 14 presented the within-group correlations between the three predictors and the discriminant functions as well as the standardized weights. Based on these coefficients, the HPS-C total number of traumatic events that participants reported having experienced demonstrated the stronger positive correlation with the discriminant function in comparison with the ADIS-IV-A total frequency score for the most

traumatizing non-MVC event. On the other hand, the adjusted mean SUDS happy score for the mild MVC story showed a moderate negative correlation with the discriminant function. In terms of accuracy of predicting the group membership, 81% of the individuals in the sample of this study were classified correctly using the three identified variables. A kappa coefficient was conducted to take into account chance agreement on the group membership. A kappa coefficient of .63 was obtained, suggesting that the variables significantly predicted membership, even when controlling for chance agreement. Finally, the leave-one-out technique was used to assess how well the classification procedure would predict in a new sample and 81% of the new sample was classified correctly.

Discussion

As noted earlier, college students have been found to have high incidence rates of MVCs and fatalities (Lindsay et al., 1999). Research also has demonstrated the possibility of development or exacerbation of PTSD symptoms, PTSD, and other psychological symptoms and disorders in MVC survivors; however, MVCs, compared to other traumas, often are less likely to be considered as potentially traumatic events. This is the first study to compare the characteristics of college students who had been involved in MVCs with High MVC PTSD symptoms to a control group. Additional purposes of this study were to develop a computer-administered analog assessment to assist in evaluating MVC PTSD symptoms for this population and to examine the psychometric properties of the assessment.

Summary of Major Findings and Interpretations of Results

Group Differences in Characteristics of College Students

The examination of group differences and characteristics of college students showed the group with High MVC PTSD symptoms reported a higher level of general anxiety, a higher level

of fear of driving and riding in a car or other motor vehicle, and a higher frequency and distress of non-MVC PSTD symptoms. The group with High MVC PTSD symptoms also endorsed greater distress arising from their experience of previous traumatic events as well as a greater number of traumatic events experienced.

On the HPS-C which measured participants' experience of previous traumatic events, the group with High MVC PTSD symptoms reported having experienced approximately one more traumatic event than the control group, on average. Except for the MVCs, the frequencies for each traumatic event on the HPS-C that the groups reported having experienced were not significantly different. Both groups rated the traumatic event, "the death of spouse or someone close to you," as the most distressful event. The second most distressful traumatic event for the group with High MVC PTSD symptoms was "MVCs" as compared to severe injuries for the control group. The distress rating for MVCs endorsed by the group with High MVC PTSD symptoms was higher than any distress ratings of the traumatic events on the HPS-C for the control group. Thus, previous exposure to MVCs is likely to be the one additional traumatic event eliciting considerable levels of distress for the group with High MVC PTSD symptoms and may contribute to their higher levels of general anxiety, fear of driving and riding in a car or motor vehicle, frequency and distress of non-MVC PTSD symptoms, and distress from their experience of previous traumatic events.

PTSD Symptoms and DSM-IV PTSD Diagnosis

Based on the DSM-IV criteria, this study found a 17.5% rate of MVC PTSD diagnosis assessed by the ADIS-IV-A-PTSD for the group with High MVC PTSD symptoms. This rate was higher than the incidence rates found in the majority of other MVC studies assessing PTSD at different time points by using clinical and/or community samples: 3-month follow up (10% to

39%; Blanchard et al., 2004; Ehlers, et al., 1998; Mayou et al., 1997), 1-year follow up (10% to 17%; Ehlers et al., 1998; Mayou et al., 1997), 3-year follow up (11%; Mayou et al., 2002), and 5-year follow up (10%; Mayou et al., 1997). Because the investigator intended to recruit MVC survivors with High PTSD symptoms as an experimental group in this study, the higher incidence rate of MVC PTSD diagnosis found in the experimental group was expected. This appears to support the belief that the severity of MVC PTSD for this group might be comparable to a clinical or community sample. The higher rate of MVC PTSD diagnosis found in the group with High MVC PTSD symptoms; however, should be considered within the context of the time of the assessment. The time between the MVC and the PTSD assessment varied in the sample (one month to 1 year ago = 40%, more than 1 year to 5 years ago = 47.5%, more than 5 years = 12.5%). It is difficult to compare the results of this study to previous literature as the incidence rates do not reflect the assessment conducted at a standard point of the time following the MVC (e.g., 3 months post accident).

With regard to assessing the severity of MVC PTSD symptoms rather than MVC PTSD diagnosis, previous studies predominantly recruited clinical and/or community samples rather than college students. Additionally, previous studies used different measures than the current study (e.g., Blanchard, Hickling, Devineni, et al., 2003; Blanchard, Hickling, Veazey, et al., 2002; Buckley et al., 2004; Devineni et al., 2004). For example, previous studies have used the original IES whereas the IES-R was used in this investigation. Additionally, this study used a different interview measure (i.e., ADIS-IV-A-PTSD) than previous investigations (e.g., CAPS) to assess MVC PTSD symptoms. Thus, it is difficult to compare participants' total distress and/or frequency scores of MVC PTSD symptoms to previous studies due to differences in sampling and in the selection of measures. The results of descriptive analyses of the total distress

and/or frequency scores of MVC PTSD symptoms assessed by the IES-R-M, and ADIS-IV-A-PTSD in this study can be used as references for future studies in assessing severity of MVC PTSD symptoms in college students.

Several risk factors associated with the development of MVC PTSD were assessed in this study. Prior research has shown that females are more likely to develop PTSD than males (Dougall, Ursano, Posluszny, & Fullerton, 2001; Ehlers et al., 1998; Mayou et al., 2002). In this study, females scored higher on MVC PTSD symptoms than males on the self-report measure (i.e., the IES-R-M); however, no gender difference was found on MVC PTSD symptoms assessed by interview (i.e., the ADIS-IV-A-PTSD). Reactivity of assessment (Kazdin, 1998) resulting from the use of different methods for assessing MVC PTSD might be the reason affecting the participants' ratings on their MVC PTSD symptoms. Interviews are more likely than self-report measures to increase the participants' awareness of the performance being assessed and to result in participants modifying their answers to what they believe to be a socially approved response.

Prior studies also have found that hospital admission for injury due to the accident (Ehlers et al., 1998; Mayou et al., 2002), presence of other passengers (Dougall et al., 2001), degree of loss (Holeva et al., 2001), and perceived threat (Ehlers et al., 1998; Dougall et al., 2001; Mayou et al., 2002; Vaiva et al., 2003) are risk factors positively correlated with the presence of PTSD. In terms of the MVC characteristics for the group with High MVC PTSD symptoms, 20% of participants reported that their cars involved in the accident were mainly damaged but reparable whereas 60% reported their cars as not repairable/totaled. The majority of the group with High MVC PTSD symptoms perceived themselves as at least somewhat in danger of being injured (82.5%) or killed (62.5%) during the accident. 72.5% of this group reported

having others present at the time of the accident. However, less than half of this group (40%) was injured in the accident and almost all of these injured participants indicated their injuries were "not at all severe" or "a little bit severe" with one individual having hospital admission for the injury. Moreover, only two participants (5%) indicated experiencing friends killed in the accident. According to the above results, having others (e.g., family, stranger) present at the time of the accident and perceived threat during the accident might be the main MVC characteristics placing the group with High MVC PTSD symptoms at the risk for the development of MVC PTSD.

The literature indicates that the following conditions also are risk factors for developing PTSD: (a) persistent health problems (Ehlers et al., 1998), (b) psychological morbidity including somatic complaints, anxiety and related disorders, depression, and non-psychotic symptoms of schizophrenia (Holmes et al., 2001; Malta et al., 2002), and (c) preaccident emotional problems (Ehlers et al., 1998). A total of 17 participants (42.5%) in the MVC group reported taking medications for a variety of medical issues (e.g., birth control, asthma, allergy, ulcers, antidepressants) with six of them having medical problems not resulting from the MVC. Only 11 (27.5%) participants in the MVC group had medical problems prior to, during, and after the MVC. Thus, the majority of the MVC group did not report having persistent health problems.

With regard to the psychological morbidity and preaccident emotional problems of the group with High MVC PTSD symptoms, 11 participants (27.5%) had psychological problems or disorders diagnosed by mental health professions and had received counseling or psychological services for these problems or disorders. All of the 11 participants indicated their psychological problems or disorders did not result from the MVC and seven of them reported receiving their psychiatric or psychological services prior to the MVC.

The group with High MVC PTSD obtained a BDI-II total score of 10.85 and a BAI total score of 9.85 which fall below the severe cutoff scores (29-63 for severe depression and 23-63 for severe anxiety). They also reported a PAS total score of 19.08 (the cutoff score for the PAS =19), suggesting borderline emotional and/or behavioral problems. The findings on these measures are contradictory making it difficult to conclude whether the participants with High MVC PTSD symptoms were experiencing significant levels of psychological problems.

The literature has showed that the development of PTSD is positively correlated with persistent financial problems and involvement in a legal litigation (Ehlers et al., 1998). Among the reasons that an individual may be motivated to feign PTSD, obtaining financial compensation either from governmental agencies or from civil litigation is a primary one (Guriel & Fremouw, 2003). Therefore, malingering is a critical issue in the assessment of MVC PTSD. In the present study, most of the group with High MVC PTSD symptoms did not have a major financial crisis (85%) resulting from the MVC and most had not been involved in a legal suit/litigation (80%) regarding the MVC. Thus, malingering may have been less relevant in this sample of college students as compared to clinical and community samples.

Overall, descriptive data from this study suggested that gender, the presence of others at the time of the accident, and perceived threat during the accident might be the factors for the group with High MVC PTSD at the risk of developing MVC PTSD. Additionally, the MVC group rated their fear of driving and riding in a car or other motor vehicle after the MVC significantly higher than that prior to the MVC. When compared to the control group, the MVC group also had higher levels of fear of driving and riding in a car or other motor vehicle. Steward and Peter (2004) reported that college students who received medical treatment for their MVC-related injuries reported having greater driving and riding avoidance than those who were

uninjured or injured and not medically treated. In the present study, 19 (47.5%) participants with High MVC PTSD symptoms received medical treatment for their MVC-related injuries and 21 (52.5%) participants were uninjured or injured and not medically treated. Thus, the findings of this study demonstrated that when compared to a control group, college students either with or without medical treatment for their MVC-related injuries developed fear of driving and riding in a car or other motor vehicle following an MVC.

Evaluation of Psychometric Properties for the MVC-BAT-A

One of the aims of the present study was to investigate the psychometric properties of the MVC-BAT-A with an adult MVC population with focus on college students. The primary hypotheses for the assessment results of the MVC-BAT-A were: (a) the group with High MVC PTSD symptoms would experience higher levels of psychological distress after their exposure to the MVC-related stories than the control group, (b) the group with High MVC PTSD symptoms would take a longer amount of time to complete their SUDS ratings, as compared to the control group, and (c) in comparison to the control group, the group with High MVC PTSD symptoms would engage in more avoidance behavior to MVC-related stories. Described below are the psychometric properties and assessment results for the MVC-BAT-A.

Comparison of the adjusted mean SUDS nervous/ happy scores by group (discriminant validity). The results of the comparison of the adjusted mean SUDS nervous and happy scores by group partially supported the first hypothesis (a). When compared to the control group, the group with High MVC PTSD symptoms experienced higher levels of nervousness after their exposure only to the mild MVC story but not to the severe MVC story. Similarly, the group with High MVC PTSD symptoms rated lower levels of happiness than the control group after their exposure only to the mild MVC story but not to the severe MVC story.

Though the six MVC-BAT-A stories were presented in a specific order to avoid carryover effects (see the reduction in carryover effects section on page 33 of this manuscript), this order might not completely exclude carryover effects. There existed a methodological weakness in this order. The mild MVC story always was presented earlier than the severe MVC story. It is possible that the presence of the two MVC stories may have had a fatigue or desensitization effect on participants. When participants first were exposed to the mild MVC story, this story might quickly trigger their levels of nervousness/happiness. By the time they were exposed to the second MVC (severe MVC) story, they perhaps become fatigued or desensitized by the previous stories. Visual inspection of the data presented in Tables 11 and 12 and additional correlation analyses between the adjusted mean SUDS nervous/happy score for the mild MVC story and for the severe one support the above explanation. In Tables 11 and 12, it appears that both groups rated their levels of nervousness higher and their levels of happiness lower after their exposure to the severe MVC story than to the mild MVC story. The correlation analyses revealed a significantly positive correlation between the adjusted mean SUDS nervous score for the mild MVC story and for the severe MVC story, $r = .61$, $p < .01$ and a nearly significantly positive correlation between the adjusted mean SUDS happy score for the mild MVC story and for the severe MVC story, $r = .21$, $p = .06$.

The context of the vignette designed for the severe MVC story also may have been problematic for the current sample. The main theme for the story was that a senior college student (Todd) found out 30 minutes before his afternoon class that he forgot to bring in a paper. A severe MVC occurred when he was driving home in the snow to get his paper. As all the participants in this study were college students, “worry of not being able to turn in the paper” might be a confounding factor that increased the levels of nervousness or decreased the levels of

happiness for the group with High MVC PTSD symptoms and/or the control group.

Another interpretation for the finding is related to the degree of similarity between the participants' MVC characteristics and the MVC vignettes of the MVC-BAT-A. The majority of the group with High MVC PTSD symptoms reported that weather conditions at the time of the accident were dry (70%) or wet (25%). A snow/ice problem was a concern for only 5% of this group. Thus, weather conditions at the time of the accident appear to be more relevant in the vignette for the mild MVC story (rain) than for that of the severe MVC story (snow). It is possible that there may be other MVC characteristics (e.g., time of day, presence of family members, types of crash) in college students which are more relevant than weather conditions to the MVC vignettes of the MVC-BAT-A (particularly the mild MVC story). Unfortunately, the method of this study did not permit specific analyses to assess the similarity between other MVC characteristics and the MVC vignettes of the MVC-BAT-A.

In attempting to understand possible reasons the mild MVC story was causing more distress than the severe MVC it is helpful to explore the general BAT literature. The BAT has been used as an analog test situation to assess observable avoidance behavior associated with self-reported anxiety levels for individuals with anxiety disorders, particularly for phobias and agoraphobia (Steketee, Chambless, Tran, Worden, & Gillis, 1996). However, the BAT has been used only rarely to assess avoidance behavior for individuals with PTSD, although a few investigators have made attempts with combat veterans (Cooper & Clum, 1989) and children and adolescents (Saigh, 1986, 1987a, 1987b, 1987c, 1992) with PTSD. The reasons for its infrequent use for PTSD most likely pertain to the difficulty of constructing such tests for a disorder like PTSD, which tends to have remarkable variability in the content of fears resulting from traumas. The fears associated to traumas tend to be more complicated than the simple phobia typically

assessed by the BAT. Frustration with measurement difficulties has led to a lack of research using BATs to assess individuals' avoidance behavior to trauma-related stimuli (particularly to assess MVC survivors' avoidance behavior to MVC-related stimuli). The present study is the first study developing a BAT and using it to assess MVC PTSD in college students; thus, some findings of the present study were compared to the previous studies assessing fears to other stimulus objects (e.g., rats, snakes).

Bernstein (1974) employed a snake BAT to assess fear of snakes by manipulating the demand conditions for approach to the target object (i.e., a snake) in five groups of 15 female undergraduates. The demand consists of five conditions: (a) four of the five groups tested under low and then the same condition or under one of three demand increase conditions (mediated by instructions, mode of administration, or both), and (b) one group tested under high and then low demand. Bernstein found that the four groups first tested under low demand demonstrated significantly higher levels of fear to the snake than the group first tested under high demand. Considering the results of Bernstein' study, the current finding that higher nervous scores and lower happy scores were found in the mild MVC story than the severe MVC story could be due to the fact the participants may experience higher levers of fear to the conditions presented first.

*Comparison of the RT and avoidance by group (discriminant validity).*Results for the comparison of the RT by group were contrary to the second hypothesis (b). The group with High MVC PTSD symptoms did not take a longer amount of time to complete each set of their SUDS ratings (SUDS nervous rating and SUDS happy rating) than the control group. This finding conflicts with the studies of Moradi et al. (1999) and James (1999), but is consistent with the study of Devineni et al. (2004). Dissimilarities in participants' development/maturity and the format of trauma and nontrauma-related stimuli might account for the inconsistent findings.

First, participants in this study were adults; however, participants in the previous studies were youth recruited from local hospitals, community-based cable television advertisements, and/or flyers as well as being referred by the clinicians of the Psychology Department of a Psychiatry Institution (James; Moradi et al.). Second, participants in the present study were presented with two MVC- and four non-MVC-related standardized stories via a computer with audio and still photos; however, the modified Stroop task for MVC was used in the previous studies (James; Moradi et al.).

In terms of participants' avoidance to the six stories (two MVC-related and four Non-MVC related stories) of the MVC-BAT-A, neither the group with High MVC PTSD nor the control group intentionally engaged in any avoidance behavior to any of these stories, suggesting failure to support the third hypothesis (c). As noted earlier, compared to the control group, the group with High MVC PTSD rated increased levels of nervousness and reduced levels of happiness after their exposure only to the mild MVC story. Thus, based on the results, non-occurrence of participants' avoidance behavior to other stories of the MVC-BAT-A was not surprising. However, the finding that both groups did not intentionally engage in any avoidance behavior to the mild MVC story was not expected.

With regard to the interpretation of the finding that no avoidance behavior occurred during the MVC-BAT-A, it is possible that the students in this study artificially inflated their SUDS ratings in attempt to meet the expectation of the experiment. In a study related to this issue, Gliksman (1980) assessed 16 undergraduates' fear of rats by giving them a BAT with the use of a rat as the stimulus object and by having them complete a self-report test of rat fear. Course credit was offered to the participants for their participation. In comparison to their self-report on the rat-fear avoidance scores, Gliksman found that the participants had significantly

lower rat-fear avoidance scores obtained from the rat-fear BAT than from the self-report test of a rat fear. Gliksman concluded that high course credit might inflate the participants' self-report of fear.

To apply Gliksman's (1980) conclusion to the present study, all participants in the present study received a total of 3 hours of extra credit and $10 dollars for their participation, and they knew that they were assigned to either the group who had experienced at least one MVC or the group that had not experienced any MVC. Thus, the 3-hour course extra credit, $10 payment for participation, and reactivity of experimental arrangements (i.e., trying to please the experimenters due to knowing that they were participating in an MVC-related study to examine a particular outcome) might be the reason for inflated SUDS nervousness scores and declined SUDS happiness score on the mild MVC story. However, this conclusion is not supported by the lack of group differences on participants' SUDS nervousness and happiness ratings after their exposure to the severe MVC story. According to Gliksman's conclusion, if participants in the present study intended to inflate their fear to MVC-related stimuli, it is highly likely to find group differences on participants' levels of SUDS nervousness and happiness after their exposure to the severe MVC story. However, as noted earlier, the fatigue or desensitization effect might play a role in participations' intention to inflate their fear. Additionally, the MVC vignettes of the MVC-BAT-A might not be distressful enough for the MVC survivors who participated in this study. Moreover, this study did not recruit a clinical sample of MVC PTSD who may engage in more avoidance behavior to MVC-related stories. Modification of the MVC vignettes of the MVC-BAT with more detailed or traumatized stimuli (e.g., more vivid sound and image) to a clinical sample of MVC PTSD may increase the occurrence of the participants' avoidant behavior to MVC-related stimuli.

Intrascale and inter-item correlations. All the interview and self-report measures (i.e., the ADIS-IV-A-PTSD, the HPS-C, and the IES-R-M) used in this study showed positive correlations among their outcome variables within each measure (see Figures 1, 2, and 3). The results suggested low to high intrascale correlations for each measure in their assessment of the construct for individuals' MVC and non-MVC PTSD symptoms or distress and frequency of previous traumatic events. Of the four MVC-BAT-A outcome variables with the focus on assessing PTSD symptoms (i.e., the adjusted mean SUDS nervous scores for the mild and the severe MVC stories and the adjusted mean RTs for the mild and the severe MVC stories), the only significant inter-item correlation was found between the adjusted mean SUDS nervous score for the mild MVC story and that for the severe MVC story (see Figure 4).

With regard to the interpretation of finding only one inter-item correlation within the outcome variables of the MVC-BAT-A, Skinner (1953) argued that not all behavior takes place at the level of observation. Skinner divided behavior into two categories: private events and public behavior. Private events, which include thoughts and feelings, can be experienced and accessed by only the person. Unlike private events, public behavior (e.g., kicking, biting, crying) is accessible to all observers. In this investigation, MVC survivors' psychological states (e.g., nervousness, happiness) can be classified as private events and, therefore, may not lead themselves to direct observation.

In this study, psychological distress (nervousness and happiness) was assessed by participants' subjective SUDS ratings (which can be considered as the product of participants' psychological distress) immediately after their exposure to MVC-related cues. MVC survivors' PTSD symptoms of intrusive cognition, hypearousal, and hypervigilance toward MVC-related cues also should be considered private events. In addition to the use of SUDS ratings to assess

participants' psychological distress, the present study also utilized participants' RTs to MVC-related cues as inferences for assessing their PTSD symptoms of intrusive cognition, hypearousal, and hypervigilance resulting from an MVC.

The results revealed that participants' adjusted mean RTs to complete their SUDS ratings for the mild and for the severe MVC story were not correlated. Each of the two RTs also was not correlated to each other. Compared to conducting SUDS ratings for his or her psychological distress, the participants' PTSD symptoms of intrusive cognitions, hyperarousal, and hypervigilance toward MVC-related cues involving certain levels of cognitive changes seem to be more difficult to be observed by others and to be aware of by the participant himself or herself. Thus, lack of pairwise correlations among participants' adjusted mean SUDS nervous scores for the MVC-related stories and their RTs to these stories might be expected because these two variables are examining different constructs (i.e., the products and inferences of private events).

Another interpretation for the lack of pairwise correlations may be due to the sample selection in this study. Again, the MVC survivors recruited in this study were not a clinical sample with MVC PTSD. They might not be traumatized enough to experience the PTSD symptoms of fear/nervousness, intrusive cognitions, hyperarousal, and hypervigilance toward MVC stories of the MVC-BAT-A. It also is possible that MVC PTSD is less traumatizing than other types of traumas because of exposure. It is more difficult for survivors with MVC PTSD to avoid their exposure to cars in their daily lives than those with PTSD resulting from other types of traumas (e.g., war, disaster, childhood abuse). Thus, to function in their daily lives, MVC survivors may develop adaptive/maladaptive coping styles to remediate their MVC PTSD symptoms to function in their daily lives. Thus, PTSD symptoms resulting from MVCs may be

less apparent than other types of traumas.

This study did not assess participants' active and passive responding to complete SUDS ratings for each MVC-related story which might be another factor influencing the RTs. Active responding can be defined as paying attention to the task, whereas passive responding can be defined as providing the ratings in a careless fashion. For future assessment, the MVC-BAT-A should be modified by designing observation codes for assessing the level of the participant's active responding to complete SUDS ratings for each MVC-BAT-A story.

Convergent validity. Interscale correlations among the outcome variables across the PTSD measures were presented in Figure 5. Low to moderate convergent validity was found between the two methods (interview versus self-report) of indirect measures (i.e., ADIS-IV-A-PTSD and the IES-R-M) as the ADIS-IV-A-PTSD assessed non-MVC PTSD symptoms and the IES-R-M measured MVC PTSD symptoms or reversely as the ADIS-IV-A-PTSD assessed MVC PTSD symptoms and the IES-R-M measured non-MVC PTSD symptoms. However, convergent validity with the focus of assessing only MVC PTSD symptoms between the two methods of indirect measures was not found. Additionally, more positive and higher correlations were found between the outcome variables of the HPS-C (self-report measure) and those of the IES-R-M (self-report measure) than those found between the outcome variables of the HPS-C (self-report measure) and the ADIS-IV-A-PTSD (interview measure).

Results examining the convergent validity of the four MVC-BAT-A outcome variables (i.e., the adjusted mean SUDS nervous scores for the mild and the severe MVC stories and the adjusted mean RTs for the mild and the severe MVC stories) with the indirect measures (i.e., the ADIS-IV-A-PTSD, the HPS-C, and the IES-R-M) were not very supportive and consistent. The results revealed only four significant correlations among the four outcome variables of the MVC-

BAT-A and those of these indirect measures. For participants' psychological distress toward the MVC-related cues, low convergent validity was found between the adjusted mean nervous score for the severe MVC story and the ADIS-IV-A-PTSD total distress score for the most traumatizing non-MVC event and the IES-R-M total score for the most traumatizing MVC, respectively. Moreover, there was low convergent validity between the adjusted SUDS mean nervous score for the mild MVC story and the HPS-C total distress score resulting from previous traumatic events that participants endorsed. For participants' RTs to complete their SUDS ratings for each MVC story, results showed low convergent validity between the adjusted mean RT for the mild MVC story and the ADIS-IV-A-PTSD total frequency score for the most traumatizing MVC (see Figure 5).

Participants' awareness of their performance being assessed (i.e., reactivity of assessment; Kazdin, 1998) may help to explain the relative low convergent validity among the four outcome variables of the MVC-BAT-A and those of indirect measures. Participants in this study may be motivated to "fake good" or "fake bad" due to their awareness of the face validity of the measures (particularly the face validity of the items on the indirect measures). Face validity is defined by Anastasi and Urbina (1997) as "whether the test 'looks valid' to the examinees who take it, the administrative personnel who decide on its use, and other technically untrained observers" (p.117). Thus, participants may have less unwillingness to face up to his/her limitations, more general need for self-protection, avoidance of criticism, social conformity, and social approval (Crowne & Marlowe, 1964; Frederiksen, 1965). They also may endorse unfavorable self-description responses due to a need for attention, sympathy, or help in solving personal problems (Anastasi & Urbina). Moreover, participants' susceptibility to faking good or bad or giving desirable responses may vary with assessment methods. For example, in

comparison to completing a self-report questionnaire, an individual interviewed by an investigator may have a tendency to provide answers that give a more favorable impression because of his or her direct face-to-face interaction with the investigator. In the case of an analog assessment condition (e.g., the MVC-BAT-A) which assesses behavior in a simulated or hypothetical situation that reflects how an individual might behave in a real-life situation, an individual might become less susceptible to the assessment condition and might behave or respond less differently from the real-life setting.

Cone (1978), Kazdin (1998), and Michelson and Ascher (1987) have advocated for a multimethod approach to assess multiple response modes of symptoms (i.e., cognitive, physiological, and motor responses) to mitigate the limitations of each method. As noted earlier, indirect measures (i.e., self-report, interview, rating by others) often consist of items that sample a large array of behaviors or symptoms and are useful for screening and quantifying problem behavior, particularly for comparing to a normative sample and making diagnostic decisions. Direct measures (i.e., self-monitoring, natural free or role play observation, and analog free or role play observation), in contrast, often are designed for pinpointing specific behaviors to target with treatment and for monitoring the individual's progress during treatment. Therefore, due to the different functions for indirect and direct measures, the coverage of PTSD symptoms assessed by the two types of measures might be limited.

The failure to show good convergent validity between the MVC-BAT-A and indirect measures used in this study may not reflect that the MVC-BAT-A unreliably assessed the construct of PTSD symptoms. Instead, the limited convergent validity between the MVC-BAT-A and the indirect measures may result from the restricted overlapping PTSD symptoms that the MVC-BAT-A and the indirect measures assessed. Replication and extension of the present study

by employing a multi-method approach to assess MVC PTSD symptoms is needed to examine this possible explanation. Again, better convergent validity may be found if this study recruited a clinical sample with MVC PTSD rather than a sample of college students following an MVC.

Concurrent validity. The results of the stepwise discriminant analysis revealed that the total number of traumatic events that the participants reported having experienced and the total frequency score of participants' PTSD symptoms for the most traumatizing non-MVC event were positively associated with their development of High MVC PTSD symptoms. In contrast, a negative correlation was found between participants' ratings of experiencing positive affect during the exposure to the mild trauma-related cues (i.e., mild MVC story) and their development of High MVC PTSD symptoms. Based on the findings, the levels of psychological distress from previous traumas including most traumatizing MVC and non-MVC events do not predict participants' High MVC PTSD symptoms though the group with High MVC PTSD symptoms endorsed significantly greater levels of distress resulting from previous traumatic events in comparison with the control group. Motivation of faking good or bad or experience of restricted range of affect (one of DSM-IV PTSD diagnostic criteria; APA, 2000) may serve as confounding factors to interfere with the predictability of psychological distress resulting from previous traumatic events in participants' High MVC PTSD symptoms.

Unlike the psychological distress resulting from previous traumatic events, the total number of traumatic events that the participants reported having experienced and the total frequency score of participants' PTSD symptoms for the most traumatizing non-MVC event predict participants' High MVC PTSD symptoms. Thus, predisposition of previous exposure to multiple traumas was a risk factor to predict high MVC PTSD symptoms. A review of the literature found a lack of studies examining the linkages between previous exposure to multiple

traumas and PTSD in MVC survivors. Banyard, Williams, and Siegel (2001) examined the relation between previous exposure to multiple traumas and mental health symptoms in survivors of childhood sexual abuse and found that in comparison to nonsurvivors, survivors of childhood sexual abuse reported more exposure to various traumas and higher levels of mental health symptoms. Banyard et al.'s finding is consistent with the results in this study. Therefore, the role of previous exposure to multiple traumas is clearly an important variable for future study to explore, confirm, and replicate the results of this study. Moreover, during the initial screening phase for PTSD in MVC survivors, clinicians should be particularly attentive to MVC survivors who have a history of many traumas and report frequently experiencing PTSD symptoms resulting from their most traumatizing non-MVC event, even though they may not endorse high levels of psychological distress from previous traumatic events.

A number of studies have demonstrated individuals' experiences of psychological distress, particularly negative affect (e.g., anxiety, fear, nervousness), following their exposure to trauma-related cues (e.g., Cooper & Clum, 1989; James, 1999; Kuch et al., 1985; Lyons & Scotti, 1995). The results of this study revealed that individuals' levels of experiencing positive affect during their exposure to the mild trauma-related cues (i.e., mild MVC story) also are a risk factor for developing high PTSD symptoms. The findings suggest the importance of assessing both positive and negative affect during their exposure to mild level of trauma-related cues in individuals who have experienced MVC(s).

Limitations of the Study

There are several limitations for the present study. First, the sample sizes for the group with High MVC PTSD symptoms and the control group were small (n = 40 for each group), but large enough to meet statistical assumptions. Second, because participants were tested at two

different points in time (screening phase and further assessment phase), an inevitable portion of participants drop out of the study over time (i.e., 3.9% drop-out rate at the screening phase and 22.2% drop-out rate at the further assessment phase). This attrition of participants might impact the conclusions drawn from the results of this study. For example, it is possible that the individuals who dropped out of this study had more avoidant behavior than those who remained in this study. Because a convenience sample was recruited for the experimental and control conditions of this study, another limitation is that the method for selecting participants was not based on random assignment. As a result, there may exist a high likelihood of selection biases. For example, all participants were self-referred to participate in this study. In comparison to the individuals who declined the opportunity to participated in this study, the self-referred participants might be a group of individuals who have less difficulty performing tasks or reporting their thoughts or affect under the condition of being assessed by others (i.e., investigators). The self-referred MVC survivors in this study also might have less avoidance symptoms to MVC-related stimuli than others refusing to be involved in this study.

Additionally, participants of this study were the only information source providing their MVC PTSD symptoms. Collateral sources such as records of prior treatment, testing results, medical records, police records, school records, etc. which may provide useful information about participant's current functioning were not gathered in this study. Particularly, such sources may have information that is not available from participants because of their cognitive avoidance or denial. Participants' parents, family, friends, teachers, employers, and former therapists also might be helpful collateral sources of information. The sample recruited in this study was composed primarily of Caucasian college students, which is not representative of the general population of individuals who have experienced MVC(s). Finally, although in attempt was made

to study individuals with high PTSD symptoms, this is not a clinical sample. Individuals with diagnosable PTSD following an MVC might respond quite differently to the assessment used in this study.

Strengths of the Study

Lack of generalizability is often one of weaknesses in studies of college students; however, the present study has some noteworthy features in that regard. First, as noted earlier, this is the first study to investigate the characteristics of college students who have been involved in an MVC with High MVC PTSD symptoms versus a control group. This study found that the majority of the group with High MVC PTSD symptoms had a minor injury resulting from an MVC. Half of them had received counseling or psychological services for their past psychological problems or disorders; however, none of these participants indicated that their past MVCs required him or her to receive psychiatric or psychological services though they endorsed high MVC PTSD symptoms. The findings of this study suggest that minor injury resulting from an MVC can lead to high MVC PTSD symptoms in college students; however, college students following an MVC may have ignored the effects that MVCs can have on them. There is a need for campus-wide attention to monitor the impact of MVCs on college students. Additionally, the information regarding the characteristics of college students with High MVC PTSD symptoms are not only important to college students themselves, but also to the researchers and clinicians, especially to those who interact with, teach, and ultimately are responsible for college students' health and well-being.

Second, unlike most previous studies using self-report and/or interview formats in the assessment of PTSD symptoms in MVC survivors (e.g., Blanchard et al., 2004; Blanchard et al., 1996; Bryant & Harvey, 2003b; Buckley et al., 2004; Buckley et al, 1996; Chan et al., 2003;

Fullerton et al., 2000; Ursano et al., 1999), a multi-method approach including the methods of interviews, self-reports, and an analog assessment was conducted to accurately capture the constructs of PTSD symptoms and to complement the limitations of each method.

Additionally, a computer-administered analog assessment with standardized testing procedures, the MVC-BAT-A, was developed to assess participants' MVC PTSD symptoms. Particularly, the outcome variables of the MVC-BAT-A (e.g., adjusted mean SUDS nervous score for the mild MVC story, adjusted mean RT for the severe MVC story) were properly operationally defined. The standardized testing procedures and operationally defined outcome variables were used to reduce the threat to internal validity of this study. Finally, according to the literature review, several extraneous factors, which may confound the research results of this study in the assessment of PTSD symptoms, were controlled by blocking the control group with participants of similar age, gender, and race/ethnicity to the group with High MVC-PTSD symptoms.

Future Directions

According to a review of the literature, MVC survivors' psychosocial functioning and coping strategies for their MVCs were related to the development of MVC PTSD (Dougall et al., 2001; Holeva et al., 2001; Holmes et al., 2001). The present study, however, did not assess these factors. Future research examining MVC survivors' psychosocial functioning, adaptive/ maladaptive coping styles, and ways to promote resilience in MVC survivors is warranted. This study found that predisposition of previous exposure to multiple traumas was a risk factor to predict High MVC PTSD symptoms. Future studies should explore, confirm, and replicate the linkage between previous exposure to multiple traumas and the development of PTSD in MVC survivors. Researchers and clinicians also should pay close attention to the variety of traumatic

events that occur over the lifecourse of MVC survivors. Additionally, this study recruited a small, nonrandomly assigned sample. The sample may not be representative of college students who have experienced an MVC in general. As a result, the power and the generalization of the research findings should be guarded. To compensate for the loss of power and to increase the generalization of the research findings, replication of this study with a larger sample size as well as random assignment for selecting participants are recommended. Moreover, this study did not recruit a clinical sample of MVC PTSD. Modification of the MVC-BAT-A with more detailed or traumatized vignettes (e.g., more vivid sound and image) to a clinical sample of MVC PTSD and a control group may result in better finding of discriminate validity for the MVC-BAT-A.

Blanchard, Hickling, Buckley, et al. (1996) and Blanchard et al. (1994b) found that MVC survivors exhibited greater heart rate responses (physiological responses) to the idiosyncratic audiotapes of their individualized accident than a standardized videotape containing generic scenes from MVCs in laboratory situations. In this study, two MVC- and four non-MVC-related standardized stories were presented via computer (audio and still photos). Participants rated their levels of psychological distress and terminated (avoided) any segments of each story at any point if they wanted. This study, however, did not assess participants' physiological responses and did not present the idiosyncratic MVC stories to them. Moreover, to date, there are no studies examining the MVC survivors' levels of psychological distress following their exposure to different modes of stimulus presentation (e.g., idiosyncratic versus standardized stimulus presentation). Future studies may extend the present study by investigating how the MVC-BAT-A differentiates the severity of PTSD symptoms in MVC survivors by assessing their levels of physiological responses and psychological distress during their exposure to different modes of stimulus presentation. The research comparing efficiency and effectiveness of different modes of

MVC-related stimuli across various techniques (e.g., audiotapes, videotapes, or computer programs) and imaginal exposure might be helpful for researchers and clinicians in selecting appropriate MVC-related stimuli for the assessment and the treatment of MVC PTSD.

Inconsistent findings exist in the present and previous studies (Devineni et al., 2004; James, 1999; Moradi et al., 1999) examining participants' RT to the trauma-related stimuli. No group difference in participants' RTs to the MVC-related stories was found in this study. Dissimilarities in participants' maturity (e.g., a sample of youth versus adults) and types of analog measures (e.g., use of the modified Stroop task versus the MVC-BAT-A) might be the factors contributing to the inconsistent findings. Thus, the impact of participants' developmental maturity and the use of different types of analog measures to assess participants' RT to the trauma-related stimuli remain to be systematically examined.

Additionally, this study did not examine malingered PTSD in the MVC survivors and the control group. Given the high malingering rate (approximately 20 to 30 percent) of the profiles of personal injury plaintiffs (Lees-Haley, 1997), malingered PTSD needs to be further examined. Guriel and Fremouw (2003) reviewed the measures used most commonly in the assessment of malingered PTSD. Multi-scale self-report inventories [e.g., MMPI-2; Butcher et al., 1989, Personality Assessment Inventory (PAI; Morey, 1991)] and uni-scale self-report inventories [e.g., Trauma Symptom Inventory (TSI; Briere, 1995), Mississippi Scale for Combat-related PTSD (MS-PTSD; Keane, Caddell, & Taylor, 1998)], symptom checklists [e.g., Post-traumatic Symptom Scale-Self-Report (PSS-SR; Foa, Riggs, Dancu, & Rothbaum, 1993)], projective tests (i.e., Rorschach; Frueh & Kinder, 1994), and psychophysiological assessment (e.g., heart rate, blood pressure, peripheral surface temperature, forehead electromyogram; Gerardi, Blanchard, & Kolb, 1989) were reported. According to Guriel and Fremouw, direct measures have not been

employed to detect malingering in PTSD claimants. Detection of malingering should be investigated using multiple methods of measures to obtain convergent validity. Thus, research, which develops direct measures (i.e., self-monitoring, natural free or role play observation, and analog free or role play observation) in the assessment of malingering PTSD and compares MVC survivors' responses to the direct measures to other measures including projective tests and indirect/retrospective measures (e.g., multi-or uni-scale self report inventories, symptom checklists, interview), or psychophysiological measures, is needed.

Conclusion

The present study found a 17.5% rate of MVC PTSD diagnosis for the group with High MVC PTSD symptoms which is comparable to a community sample (Blanchard et al., 2004; Ehlers, et al., 1998; Mayou et al., 2002; Mayou et al., 1997). The number may be inflated. As compared to the control group, the group with High MVC PTSD symptoms had higher levels of general anxiety, fear of driving and riding in a car or other motor vehicle, and frequency and distress of non-MVC PTSD symptoms as well as greater distress resulting from and experience of previous traumatic events.

In terms of participants' responses to the MVC-BAT-A, the group with High MVC PTSD symptoms experienced higher levels of nervousness and lower levels of happiness after their exposure only to the mild MVC story but not to the severe MVC story. No group differences in RTs and absence of intentional avoidance behavior to the MVC-related stories were found. Low convergent validity (only four significant correlations) was found between the MVC-BAT-A and other indirect measures. The results of the stepwise discriminant analysis revealed that total number of previous traumatic events, frequent experience of non-MVC PTSD symptoms, and lower levels of positive affect during the exposure to the mild trauma-related stimuli were risk

factors for developing high MVC PTSD symptoms.

The findings of this study suggest the need for campus-wide attention to the impact of MVCs on college students. A multimethod approach which includes self-report, interview, and an analog assessment (i.e., the MVC-BAT-A developed by the investigators) was conducted to assess PTSD symptoms in this study. Though low convergent validity was found among the MVC-BAT-A and indirect measures used in this study, it may not reflect that the MVC-BAT-A unreliably assessed the constructs of PTSD symptoms due to the functional difference between the indirect and direct measures. In other words, indirect measures often consist of items that sample a large array of behaviors or symptoms and are useful for screening and quantifying problem behavior. In contrast, direct measures often are designed for pinpointing specific behaviors to target with treatment and for repeatedly monitoring the individual's progress during treatment. Replication of this study with a larger randomized sample size and modification of the MVC-BAT-A with more traumatized or idiosyncratic MVC vignettes as well as a multiple-method approach is necessary to better understand the findings of this investigation.

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Table 1

Potential Risk and Protective Factors for the Development of PTSD in Adults Exposed to an MVC, with Supporting Citations

Risk or protective factors	Time assessed post-MVC	Outcome
Risk factors		
Gender		Females are more likely to develop PTSD than males
Dougall et al. (2001)	1 month	
Bryant & Harvey (2003b)	1 month and 6 months	
Ehlers et al. (1998)	3 and 12 months	
Mayou et al. (2002)	3 years	
Perceived threat or peritraumatic dissociation		Perceiving high threat and experiencing dissociation during the accident or litigation are associated with the development of PTSD
Vaiva et al. (2003)	Between day 2 and day 5 of their hospitalization	
Dougall et al. (2001)	1 month	
Bryant & Harvey (2003b)	1 month and 6 months	

(table continues)

Table 1 *(continued)*

Risk or protective factors	Time assessed post-MVC	Outcome
Ehlers et al. (1998)	3 and 12 months	
Mayou et al. (2002)	3 years	
Degree of loss		Higher degree of loss (e.g., damage to a vehicle, death of someone known) is associated with a greater probability of developing PTSD
Holeva et al. (2001)	4 to 6 months	
Negative relationships		Negative relationships are positively correlated with the presence of PTSD
Holmes et al.(2001)	Average time = 87.6 months	
Experiencing ASD		Rates of PTSD are higher when the MVC survivors experience Acute Stress Disorder within 4 weeks of the accident
Bryant & Harvey (2003b)	1 month and 6 months	
Holeva et al. (2001)	4 to 6 months	

(table continues)

Table 1 *(continued)*

Risk or protective factors	Time assessed post-MVC	Outcome
Psychological morbidity		Somatic complaints, anxiety and related disorders, depression, and non-psychotic symptoms of schizophrenia are risk factors for developing PTSD MVC survivors diagnosed with PTSD and a preexisting personality disorder are highly likely to develop chronic PTSD and impede remission
Holmes et al. (2001)	Average time = 87.6 months	
Malta et al. (2002)	12 months	
A change in perceived social support		More changes in perceived social support between 4 weeks and 6 months of the accident are positively associated with the development of PTSD
Holeva et al. (2001)	4 to 6 months	

(table continues)

Table 1 *(continued)*

Risk/protective factors	Time assessed post-MVC	Outcome
Experiencing worry and punishing self as intrusive thoughts occur		The use of worry and punishment as control strategies for intrusive thoughts is positively correlated with the development of PTSD
Holeva et al. (2001)	4 to 6 months	
Perceived social support and social control		MVC survivors who perceive poor social support and who frequently use social interactions as a distraction from experiencing intrusive thoughts have greater probability of developing PTSD
Holeva et al. (2001)	4 to 6 months	
Persistent health problems		Persistent health problems increase the risk of PTSD
Ehlers et al. (1998)	3 and 12 months	
Persistent financial problems		Persistent financial problems are positively correlated with subsequent PTSD
Ehlers et al. (1998)	3 and 12 months	

(table continues)

Table 1 *(continued)*

Risk or protective factors	Time assessed post-MVC	Outcome
Litigation		Positive association is found between litigation and the development of PTSD
Ehlers et al. (1998)	3 and 12 months	
Preaccident emotional problems		Preaccident emotional problems (e.g., anxiety, depression, irritability) increase the risk of PTSD
Ehlers et al. (1998)	3 and 12 months	
Interpretation of intrusive thoughts, rumination, suppression of intrusive thoughts, and anger induced by the accident		Negative interpretation of intrusive thoughts, higher degree of suppressing intrusive thoughts and experiencing rumination and anger are positively associated with the development of PTSD
Ehlers et al. (1998)	3 and 12 months	
Mayou et al. (2002)	3 years	

(table continues)

Table 1 *(continued)*

Risk or protective factors	Time assessed post-MVC	Outcome
Hospital admission for injury due to the accident		Hospital admission for injury is positively correlated with developing PTSD
Ehlers et al. (1998)	3 and 12 months	
Mayou et al. (2002)	3 years	
Presence of other passengers		Report of other passengers present at the time of the accident is associated with a greater possibility of developing PTSD
Dougall et al. (2001)	6 and 12 months	
Use of wishful thinking as a coping strategy		Use of wishful thinking coping at 3 months after the accident is positively correlated with the presence of PTSD
Dougall et al. (2001)	6 and 12 months	

(table continues)

Table 1 *(continued)*

Risk or protective factors	Time assessed post-MVC	Outcome
Anxiety sensitivity about harmful events		Anxiety sensitivity about harmful events is positively correlated with the exacerbation of PTSD symptoms and is negatively associated with the maintenance of PTSD symptoms
Fedoroff et al. (2000)	Average time = 28.8 months	
Protective factors		
The use of distraction and social control as control strategies for intrusive thoughts		The use of distraction and social control as control strategies for intrusive thoughts is negatively correlated with the development of PTSD
Holeva et al. (2001)	4 to 6 months	
Amnesia		No memory of the precipitating trauma is less likely to develop subsequent PTSD
Flesher (2001)	6 weeks	

Table 2

Measures Used to Assess PTSD Symptoms Arising from a Motor Vehicle Crash in Adults

	Response Modes		
Methods/Measures	Cognitive/Covert behavior	Motor/Overt behavior	Physiological responses
Indirect			
Interview	Anxiety Disorders Interview Schedule for DSM-IV, Adult Version-PTSD Section (ADIS-IV-A-PTSD; Brown et al, 1994)	ADIS-IV-A-PTSD	ADIS-IV-A-PTSD
Self-report	The modified version of the Impact of Event Scale-Revised (IES-R-M). (Weiss & Marmar, 1997)	IES-R-M	IES-R-M

(table continues)

Table 2 *(continued)*

	Response Modes		
	Cognitive/Covert behavior	Motor/Overt behavior	Physiological responses
Methods/Measures			
Direct			
Self-monitoring	Adult version of the MVC-Behavioral Avoidance Test (MVC-BAT-A; Chen, 2005)		
Analog Free Behavior			
Analog Role Play	Adult version of the MVC-Behavioral Avoidance Test (MVC-BAT-A; Chen, 2005)	Adult version of the MVC-Behavioral Avoidance Test (MVC-BAT-A; Chen, 2005)	

Table 3

Demographic Characteristics

Demographics	Group with High MVC PTSD Symptoms		Control Group		Pearson Chi Square or t test	p value
	Frequency or Mean	Percent or SD	Frequency or Mean	Percent or SD		
Gender						
Male	23	57.5%	25	62.5%	$\chi^2 = .21$	.65
Female	17	42.5%	15	37.5%		
Age	19.5	1.3	19.7	1.4	$t = .66$	.51
Country of origin						
USA	39	97.5%	37	92.5%	$\chi^2 = 4.05$	.40
South Korea	0	0%	1	2.5%		
Russia	0	0%	1	2.5%		

(table continues)

Table 3 *(continued)*

Demographics	Group with High MVC PTSD Symptoms		Control Group		Pearson Chi Square or t test	p value
	Frequency or Mean	Percent or SD	Frequency or Mean	Percent or SD		
Japan	0	0%	1	2.5%		
Bangladesh	1	2.5%	0	0%		
Home state					$\chi^2 = 8.78$	.36
WV	19	47.5%	20	50%		
VA	3	7.5%	1	2.5%		
PA	9	22.5%	7	17.5%		
NY	3	7.5%	1	2.5%		
NJ	0	0%	3	7.5%		
ND	1	2.5%	0	0%		
MD	3	7.5%	5	12.5%		

(table continues)

Table 3 *(continued)*

Demographics	Group with High MVC PTSD Symptoms		Control Group		Pearson Chi Square or t test	p value
	Frequency or Mean	Percent or SD	Frequency or Mean	Percent or SD		
MA	1	2.5%	0	0%		
Not applicable	1	2.5%	3	7.5%		
Race/ethnicity					$\chi^2 = 2.36$	.31
Caucasian	38	95%	34	85%		
African American	1	2.5%	2	5%		
Asian American	0	0%	0	0%		
Native American	0	0%	0	0%		
Hispanic American	0	0%	0	0%		
Other	1	2.5%	4	10%		

(table continues)

Table 3 *(Continued)*

Variables	Group with High PTSD Symptoms		Control Group		Pearson Chi Square or t test	p value
	Frequency or Mean	Percent or SD	Frequency or Mean	Percent or SD		
People whom you currently live with					$\chi^2 = 11.72$	.16
Family	13	32.5%	14	35%		
Extended family	0	0%	1	2.5%		
Spouse	1	2.5%	0	0%		
Romantic partner	2	5%	2	5%		
Romantic partner and friends	0	0%	1	2.5%		
Family and friends	3	7.5%	0	0%		
Friends	16	40%	10	25%		
Roommates	3	7.5%	10	25%		
Live alone	2	5%	3	7.5%		

(table continues)

Table 3 *(Continued)*

Variables	Group with High PTSD Symptoms		Control Group		Pearson Chi Square or t test	p value
	Frequency or Mean	Percent or SD	Frequency or Mean	Percent or SD		
Year of college					$\chi^2 = 3.81$	.28
Freshman	24	60%	18	45%		
Sophomore	5	12.5%	12	30%		
Junior	8	20%	7	17.5%		
Senior	3	7.5%	3	7.5%		
Marital status						
Single	36	90%	39	97.5%	$\chi^2 = 2.45$	.29
Married	2	5%	0	0%		
Cohabitating	2	5%	1	2.5%		

(table continues)

Table 3 *(Continued)*

Variables	Group with High PTSD Symptoms		Control Group		Pearson Chi Square or t test	p value
	Frequency or Mean	Percent or SD	Frequency or Mean	Percent or SD		
Work status					$\chi^2 = 2.08$	.35
Unemployed	24	60%	26	65%		
Employed full-Time	2	5%	0	0%		
Employed part-Time	14	35%	14	35%		
Occupation					$\chi^2 = 9.95$	.19
Unskilled worker	2	5%	6	15%		
Semiskilled worker	7	17.5%	2	5%		
Skilled worker	2	5%	2	5%		
Clerical worker	1	2.5%	0	0%		
Salesperson	1	2.5%	3	7.5%		

(table continues)

Table 3 *(Continued)*

Variables	Group with High PTSD Symptoms		Control Group		Pearson Chi Square or t test	p value
	Frequency or Mean	Percent or SD	Frequency or Mean	Percent or SD		
Small business owner	1	2.5%	0	0%		
Manger	2	5%	0	0%		
Not applicable	24	60%	27	67.5%		
Annual family income from all sources					$\chi^2 = 8.59$	.57
Less than 10,000	7	17.5%	6	15%		
10,000-19,999	0	0%	3	7.5%		
20,000-29,999	2	5%	1	2.5%		
30,000-39,999	4	10%	1	2.5%		
40,000-49,999	2	5%	2	5%		
50,000-59,999	2	5%	2	5%		

(table continues)

Table 3 *(Continued)*

Variables	Group with High PTSD Symptoms		Control Group		Pearson Chi Square or t test	p value
	Frequency or Mean	Percent or SD	Frequency or Mean	Percent or SD		
50,000-59,999	2	5%	2	5%		
60,000-69,999	6	15%	6	15%		
70,000-79,999	3	7.5%	3	7.5%		
80,000-89,999	2	5%	3	7.5%		
90,000-above	12	30%	10	25%		
Do not know	0	0%	3	7.5%		
Currently under medical care						
Yes	2	5%	2	5%	$\chi^2 = .00$	1
No	38	95%	38	95%		
Currently taking any medications					$\chi^2 = .85$	.36

(table continues)

Table 3 *(Continued)*

Variables	Group with High PTSD Symptoms		Control Group		Pearson Chi Square or t test	p value
	Frequency or Mean	Percent or SD	Frequency or Mean	Percent or SD		
Yes	17	42.5%	13	32.5%		
No	23	57.5%	27	67.5%		
Current medical problems that do not result from an MVC					$\chi^2 = .46$	.50
Yes	6	15%	4	10%		
Require any surgeries/hospitalizations						
Yes	2	5%	1	2.5%		
No	4	10%	3	7.5%		
No	34	85%	36	90%		

(table continues)

Table 3 *(Continued)*

Variables	Group with High PTSD Symptoms		Control Group		Pearson Chi Square or t test	p value
	Frequency or Mean	Percent or SD	Frequency or Mean	Percent or SD		
Past medical problems that do not result from an MVC					$\chi^2 = .39$	.53
Yes	5	12.5%	7	17.5%		
Require any surgeries/hospitalizations						
Yes	3	7.5%	6	15%		
No	2	5%	1	2.5%		
No	35	87.5%	33	82.5%		

(table continues)

Table 3 *(Continued)*

Variables	Group with High PTSD Symptoms		Control Group		Pearson Chi Square or t test	p value
	Frequency or Mean	Percent or SD	Frequency or Mean	Percent or SD		
Have ever had psychological problems or disorders diagnosed by mental health professionals					$\chi^2 = 1.15$	.28
Yes (check all that apply)	11	27.5%	7	17.5%		
Anxiety	3	7.5%	6	15%		
Learning problems	1	2.5%	1	2.5%		
Legal problems	0	0%	0	0%		
Depression	7	17.5%	6	15%		
Hyperactivity	0	0%	0	0%		
Substance abuse	0	0%	0	0%		

(table continues)

Table 3 *(Continued)*

Variables	Group with High MVC PTSD Symptoms		Control Group		Pearson Chi Square or t test	p value
	Frequency or Mean	Percent or SD	Frequency or Mean	Percent or SD		
Stress management problems	0	0%	2	5%		
Anger control problems	1	2.5%	0	0%		
Relationship problems	1	2.5%	2	5%		
Problems with parents	0	0%	0	0%		
Physical abuse	0	0%	0	0%		
Sexual abuse	0	0%	0	0%		
Posttraumatic stress disorder	1	2.5%	0	0%		
Others	3	7.5%	0	0%		

(table continues)

Table 3 *(Continued)*

Variables	Group with High PTSD Symptoms		Control Group		Pearson Chi Square or t test	p value
	Frequency or Mean	Percent or SD	Frequency or Mean	Percent or SD		
Have ever received counseling or psychological services for this problem or disorders	11	27.5%	3	7.5%		
Service last						
Less than 1 month	1	2.5%	0	0%		
1 month to 1 year	4	10%	2	5%		
More than 1 year to 3 years	5	12.5%	0	0%		
More than 3 years	1	2.5%	1	2.5%		
No	29	72.5%	33	82.5%		

(table continues)

Table 3 *(Continued)*

Variables	Group with High PTSD Symptoms		Control Group		Pearson Chi Square or t test	p value
	Frequency or Mean	Percent or SD	Frequency or Mean	Percent or SD		
How many car accidents have you had in your lifetime as a driver/passenger?	2.6	1.03	0	0	$t = 5.92$	.00**
Currently fear driving a car or other motor vehicles	0.83	.84	0.05	0.22	$t = 5.62$	.00**
Currently fear riding in a car or other motor vehicles	.85	.58	.13	.40	$t = 6.49$	.00**
IES-R-M total score based on the most traumatizing event that is not MVC related	47.5	15.58	27.3	15.67	$t = 5.78$	.00**

(table continues)

Table 3 *(Continued)*

Variables	Group with High PTSD Symptoms		Control Group		Pearson Chi Square or t test	p value
	Frequency or Mean	Percent or SD	Frequency or Mean	Percent or SD		
HPS-C total distress score resulting from previous traumatic events that participants endorsed	8.33	6.34	3.49	4.52	$t = 3.93$	.00**
HPS-C total number of traumatic events that participants reported having experienced	3.08	1.51	1.59	1.13	$t = 4.99$	.00**
HPS-C total number of traumatic events that participants reported having witnessed	1.93	2.03	1.27	1.77	$t = 1.3$	.13

Table 4

Summary of MVC Characteristics from the Modified Accident Descriptor Checklist

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
Remember the accident(s)		
Yes	40	100%
No	0	0%
Were asleep before/during the accident		
Yes	6	15%
No	34	85%
Have you been involved in a legal suit/litigation regarding the accident?		
Have not been involved in a legal suit/litigation regarding the accident	32	80%
Has settled	6	15%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
Still ongoing (within 6 months)	1	2.5%
Still ongoing (more than 6 months)	1	2.5%
The accident happened to me		
One month to 1 year ago	16	40%
More than 1 year to 5 years ago	19	47.5%
More than 5 years	5	12.5%
Were others present at the time of the accident?		
Yes	29	72.5%
No	11	27.5%
Specify others present at the time of the accident		
Alone	11	27.5%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
Friends	14	35%
Romantic partner	1	2.5%
Family	13	32.5%
Acquaintance	1	2.5%
Were you the driver?		
Driver	26	65%
Passenger	14	35%
Type of accident		
Single vehicle accident		
Yes	9	22.5%
No	31	77.5%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
Multiple car collision		
Yes	10	25%
No	30	75%
Hit fixed object		
Yes	14	35%
No	26	65%
Head on collision		
Yes	3	7.5%
No	37	92.5%
Hit pedestrian/animal		
Yes	0	0%
No	40	100%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
Hit other moving vehicle		
Yes	12	30%
No	28	70%
Ran off road		
Yes	9	22.5%
No	31	77.5%
Were drugs or alcohol involved in the accident?		
Yes	6	15%
No	34	85%
Were you wearing a seatbelt at the time of the accident?		
Yes	35	87%
No	4	10%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
Don't know	1	2.5%
What type of vehicle were you in at the time of the accident?		
Car	33	82.5%
Three-or four-wheeler (ATV)	1	2.5%
Pick-up truck	1	2.5%
Motorcycle	0	0%
Sport utility vehicle	4	10%
Van	1	2.5%
Weather conditions at the time of the accident		
Dry	28	70%
Snow/ice	2	5%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
Wet	10	25%
Muddy	0	0%
Hazardous material on the road	0	0%
During the accident, did you have, at least momentarily, a complete absence of affect, or lack of thought, or loss of words, or being spaced out, or all these symptoms?		
Yes	36	90%
No	4	10%
Was anyone injured in the accident?		
Yes	20	50%
No	20	50%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
Who was injured in the accident?		
Child	0	0%
Parent	4	10%
Sibling	1	2.5%
Other family member	1	2.5%
Friend	8	20%
Stranger/acquaintance	2	5%
Not Applicable	24	60%
Did you lose your consciousness during/after the accident?		
Yes	5	12.5%
30 seconds	1	2.5%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
More than 30 seconds but less than 1 minute	1	2.5%
1 minute	1	2.5%
Few minutes	1	2.5%
10 minutes	1	2.5%
No	35	87.5%
Were you in coma during/after the accident?		
Yes	0	0%
No	40	100%
Were you injured during the accident?		
Yes	16	40%
No	24	60%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
Was your head injured during the accident?		
Yes	7	17.5%
How severe was it following the accident?		
Not at all severe	3	7.5%
A little bit severe	3	7.5%
A lot severe	1	2.5%
Very severe	0	0%
What type of injury to you?		
Bruises, scrapes, swelling	5	12.5%
Cuts or open wounds	4	10%
Burns	0	0%
Broken bone(s)	1	2.5%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
Other (Whiplash)	1	2.5%
No	33	82.5%
Was your face injured during the accident?		
Yes	7	17.5%
How severe was it following the accident?		
Not at all severe	3	7.5%
A little bit severe	4	10%
A lot severe	0	0%
Very severe	0	0%
What type of injury to you?		
Bruises, scrapes, swelling	6	15%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
Cuts or open wounds	5	12.5%
Burns	0	0%
Broken bone(s)	0	0%
Other	0	0%
No	33	82.5%
Was your neck injured during the accident?		
Yes	9	22.5%
How severe was it following the accident?		
Not at all severe	2	5%
A little bit severe	6	15%
A lot severe	1	2.5%
Very severe	0	0%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
What type of injury to you?		
Bruises, scrapes, swelling	6	15%
Cuts or open wounds	1	2.5%
Burns	1	2.5%
Broken bone(s)	0	0%
Other (soreness)	1	2.5%
Other (Whiplash)	3	7.5%
No	31	77.5%
Was your thorax injured during the accident?		
Yes	4	10%
How severe was it following the accident?		
Not at all severe	2	5%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
A little bit severe	1	2.5%
A lot severe	0	0%
Very severe	1	2.5%
What type of injury to you?		
Bruises, scrapes, swelling	4	10%
Cuts or open wounds	0	0%
Burns	0	0%
Broken bone(s)	1	2.5%
Other	0	0%
No	36	90%
Was your abdomen injured during the accident?		
Yes	4	10%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
How severe was it following the accident?		
Not at all severe	0	0%
A little bit severe	4	10%
A lot severe	0	0%
Very severe	0	0%
What type of injury to you?		
Bruises, scrapes, swelling	3	7.5%
Cuts or open wounds	1	2.5%
Burns	0	0%
Broken bone(s)	0	0%
Other	0	0%
No	36	90%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
Was your pelvis injured during the accident?		
Yes	1	2.5%
How severe was it following the accident?		
Not at all severe	0	0%
A little bit severe	1	2.5%
A lot severe	0	0%
Very severe	0	0%
What type of injury to you?		
Bruises, scrapes, swelling	1	2.5%
Cuts or open wounds	1	2.5%
Burns	0	0%
Broken bone(s)	0	0%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
Other	0	0%
No	39	97.5%
Was your spine injured during the accident?		
Yes	1	2.5%
How severe was it following the accident?		
Not at all severe	0	0%
A little bit severe	1	2.5%
A lot severe	0	0%
Very severe	0	0%
What type of injury to you?		
Bruises, scrapes, swelling	0	0%
Cuts or open wounds	0	0%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
Burns	0	0%
Broken bone(s)	0	0%
Other (spinal compression)	1	2.5%
No	39	97.5%
Was your extremities injured during the accident?		
Yes	16	40%
How severe was it following the accident?		
Not at all severe	4	10%
A little bit severe	11	27.5%
A lot severe	1	2.5%
Very severe	0	0%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
What type of injury to you?		
Bruises, scrapes, swelling	12	30%
Cuts or open wounds	6	15%
Burns	2	5%
Broken bone(s)	1	2.5%
Other (dislocates)	1	2.5%
Other (sprained wrists)	1	2.5%
No	24	60%
Did you sustain any injuries not previously asked?		
Yes (shock)	1	2.5%
How severe was it following the accident?		
Not at all severe	0	0%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
A little bit severe	1	2.5%
A lot severe	0	0%
Very severe	0	0%
What type of injury to you?		
Bruises, scrapes, swelling	0	0%
Cuts or open wounds	0	0%
Burns	0	0%
Broken bone(s)	0	0%
Other (mild shock)	1	2.5%
No	39	97.5%
Type of medical treatment received (check all that apply)		
First aid at scene	7	17.5%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
First aid at home	4	10%
Emergency room	7	17.5%
Doctor's office	4	10%
Hospitalized	1	2.5%
Injured but not treated	6	15%
Not injured	15	37.5%
Number of days you spent in the hospital		
None	33	82.5%
4 hours	2	5%
A half day/daytime	2	5%
1 day	3	7.5%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
Length of time you spent receiving outpatient treatment		
None	33	82.5%
1 day	1	2.5%
1 month	1	2.5%
2 months	2	5%
4 months	1	2.5%
6 months	1	2.5%
12 months	1	2.5%
Are you satisfied with the medical treatment?		
Yes	2	5%
No	22	55%
Not Applicable	16	40%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
Has the accident ever required you to receive psychiatric/psychological services?		
Yes	0	0%
No	40	100%
Had you received psychiatric/psychological services prior to the accident?		
Yes	7	17.5%
If yes, how long the service last?		
2 months	1	2.5%
1 year	1	2.5%
1.5 years	1	2.5%
2 years	2	5%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
3 years	1	2.5%
No	33	82.5%
Was anyone killed in the accident?		
Yes	2	5%
If yes, what was the relation of the deceased to you (if applicable)?	38	95%
Friend	2	5%
No	38	95%
Have you had a major financial crisis resulting from the accident?		
Yes	6	15%
No	34	85%

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
Have you received compensation as a result of the accident?		
Yes	11	27.5%
No	28	70%
Not sure	1	2.5%
Prior to the accident, how fearful were you driving a car or other motor vehicles? (0 = Not at all fearful, 3 = very fearful)	.25	.49
Prior to the accident, how fearful were you riding in a car or other motor vehicle? (0 = Not at all fearful, 3 = very fearful)	.50	.64

(table continues)

Table 4 *(Continued)*

Descriptor of MVC	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
How many days of school/work have you missed because of the accident?	1.33	2.78
How many days of school/work have you missed since the accident?		
0 days	27	67.5%
2 to 3 days	3	7.5%
5 to 10 days	7	17.5%
More than 10 days	2	5%
Don't know	1	2.5%

Table 5

Summary of MVC Characteristics from the AcCIdentS

Variables	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
How many car accidents have you had in your lifetime as a driver/passenger? (0 = 0, 1 = 1, 2 = 2, 3 = 3, 4 = 4, 5 = More than 4)	2.60	1.03
How much do you currently fear riding in a car or other motor vehicles? 0 = Not at all fearful, 1 = A little bit fearful, 2 = A lot fearful, 3 = Very fearful	.85	.58
How much was the car damaged during the accident?		
0 = None	0	0%
1 = Minor repairable damage	8	20%
2 = Major repairable damage	8	20%

(table continues)

Table 5 *(Continued)*

Variables	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
3 = Not repairable/totaled	24	60%
How much did you feel that you were in danger of being injured during the accident? 0 = Not at all in danger, 2 = Somewhat in danger, 4 = Very much in danger		
0 = Not at all in danger	0	0%
1	7	17.5%
2 = Somewhat in danger)	9	22.5%
3	10	25%
4 = Very much in danger	14	35%

(table continues)

Table 5 *(Continued)*

Variables	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
How much did you feel that you were in danger of being killed during the accident? 0 = Not at all in danger, 2 = Somewhat in danger, 4 = Very much in danger		
0 = Not at all in danger	7	17.5%
1	8	20%
2 = Somewhat in danger)	11	27.5%
3	6	15%
4 = Very much in danger	8	20%
How many people (including family, friends, strangers) were injured or killed in the accident?		

(table continues)

Table 5 *(Continued)*

Variables	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
0	20	50%
1-2	16	40%
3-12	4	10%
More than 12	0	0%
Were you injured in the accident, and if so, how long did it take for your injuries to heal?		
0 = Not injured	24	60%
1 = Less than one month	7	17.5%
2 = Less than three months	6	15%
3 = Less than one year	1	2.5%
4 = Still not healed	2	5%

(table continues)

Table 5 *(Continued)*

Variables	Group with High MVC PTSD Symptoms	
	Frequency or Mean	Percent or SD
Which of the following best describe the accident you experienced?		
0 = No accident	0	0%
1 = Hit by or ran into another vehicle/car	23	57.5%
2 = Hit a fixed object/ran off road	17	42.5%
Thinking about your accident, how serious/severe do you think that accident was?	6.10	2.02
0 = Not at all severe, 5 = Somewhat severe, 10 = very severe		

Table 6

Comparison of the Characteristics of College Students by Group

Outcome Measures	Group with High MVC PTSD Symptoms (*M*, *SD*)	Control Group (*M*, *SD*)	F Value	P	Eta Squared
BDI-II total score	10.85 (6.71)	7.93 (6.48)	3.93	.051	.05
BAI total score	9.85 (7.30)	6.32 (5.83)	5.70	.019*	.07
ADIS-IV-A-PTSD total frequency score for the most traumatizing event that is not MVC related	22.25 (19.91)	11.38 (12.83)	8.43	.005**	.10
ADIS-IV-A-PTSD total distress score for the most traumatizing event that is not MVC related	24.48 (22.07)	12.18 (14.84)	8.56	.005**	.10
PAS total score	19.08 (6.74)	16.93 (7.04)	1.95	.167	.02

(table continues)

Table 6 *(Continued)*

Outcome Measures	Group with High MVC PTSD Symptoms (*M*, *SD*)	Control Group (*M*, *SD*)	F Value	P	Eta Squared
HPS total distress score resulting from previous traumatic events that participants endorsed	8.33 (6.34)	3.49 (4.52)	15.47	.000**	.17
HPS total number of traumatic events that participants reported having experienced	3.08 (1.51)	1.59 (1.13)	24.93	.000**	.24
HPS total number of traumatic events that participants reported having witnessed	1.92 (2.03)	1.27 (1.77)	2.33	.131	.03

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

Table 7

Summary of the Numbers of Traumatic Events that Participants Reported Having Experienced and Witnessed on the HPS-C

Traumatic Events	Group with High MVC PTSD Symptoms		Control Group	
	Experienced Personally (Frequency/Percent)	Witnessed (Frequency/Percent)	Experienced Personally (Frequency/Percent)	Witnessed (Frequency/Percent)
Motor vehicle crash	40 (100%)	9 (22.5%)	0 (0%)	10 (25%)
Pedestrian accident	3 (7.5%)	7 (17.5%)	1 (2.5%)	3 (7.5%)
Natural disaster	6 (15%)	7 (17.5%)	3 (7.5%)	5 (12.5%)
Technological accident	0 (0%)	7 (17.5%)	0 (0%)	3 (7.5%)
Military combat	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Living in a high crime area	6 (15%)	4 (10%)	2 (5%)	0 (0%)
Performing an emergency rescue	4 (10%)	5 (12.5%)	2 (5%)	6 (15%)

(table continues)

Table 7 *(Continued)*

Traumatic Events	Group with High MVC PTSD Symptoms		Control Group	
	Experienced Personally (Frequency/Percent)	Witnessed (Frequency/Percent)	Experienced Personally (Frequency/Percent)	Witnessed (Frequency/Percent)
Treating critical patients in a hospital emergency room	5 (12.5%)	5 (12.5%)	2 (5%)	0 (0%)
Fire-fighting	0 (0%)	3 (7.5%)	0 (0%)	1 (2.5%)
Finding or seeing a dead body	3 (7.5%)	4 (10%)	4 (10%)	2 (5%)
Abortion or miscarriage	1 (2.5%)	3 (7.5%)	0 (0%)	4 (10%)
Severe injuries	10 (25%)	10 (25%)	12 (30%)	4 (10%)
Death of spouse or someone close to you	26 (65%)	5 (12.5%)	23 (57.5%)	0 (0%)

(table continues)

Table 7 *(Continued)*

Traumatic Events	Group with High MVC PTSD Symptoms		Control Group	
	Experienced Personally (Frequency/Percent)	Witnessed (Frequency/Percent)	Experienced Personally (Frequency/Percent)	Witnessed (Frequency/Percent)
Divorce/separation from spouse/significant other	4 (10%)	3 (7.5%)	4 (10%)	8 (20%)
Abuse (sexual, physical, emotional)	6 (15%)	3 (7.5%)	4 (10%)	3 (7.5%)
Assault with a weapon	4 (10%)	2 (5%)	1 (2.5%)	2 (5%)
Other traumatic event	6 (15%)	0 (0%)	5 (12.5%)	0 (0%)

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

Table 8

Summary of Participants' Distress Levels Resulting from Previous Traumatic Events on the HPS-C

Traumatic Events	Group with High MVC PTSD Symptoms	Control Group		
	Distress Level *(M, SD)*	Distress Level *(M, SD)*	t test	p value
Motor vehicle crash	1.33 (1.19)	.15 (.58)	5.63	.000**
Pedestrian accident	.50 (1.09)	.10 (.50)	2.12	.037*
Natural disaster	.38 (.77)	.13 (.46)	1.75	.084
Technological accident	.23 (.77)	.20 (.79)	.14	.886
Military combat	.00 (.00)	.00 (.00)		
Living in a high crime area	.43 (1.03)	.08 (.35)	2.03	.046*
Performing an emergency rescue	.40 (1.08)	.15 (.70)	1.23	.223

(table continues)

Table 8 *(Continued)*

Traumatic Events	Group with High MVC PTSD Symptoms	Control Group		
	Distress Level *(M, SD)*	Distress Level *(M, SD)*	t test	p value
Treating critical patients in a hospital emergency room	.38 (.87)	.03 (.16)	2.51	.014*
Fire-fighting	.10 (.44)	.00 (.00)	1.43	.156
Finding or seeing a dead body	.50 (1.32)	.15 (.48)	1.57	.119
Abortion or miscarriage	.18 (.78)	.05 (.22)	.97	.333
Severe injuries	.75 (1.32)	.42 (.84)	1.32	.192
Death of spouse or someone close to you	1.52 (1.54)	.77 (1.27)	2.40	.019*

(table continues)

Table 8 *(Continued)*

Traumatic Events	Group with High MVC PTSD Symptoms	Control Group		
	Distress Level *(M, SD)*	Distress Level *(M, SD)*	t test	p value
Divorce/separation from spouse/significant other	.27 (.78)	.53 (1.11)	-1.16	.248
Abuse (sexual, physical, emotional)	.55 (1.28)	.35 (1.03)	.77	.443
Assault with a weapon	.33 (1.00)	.13 (.65)	1.06	.291
Other traumatic event	.32 (.92)	.20 (.72)	.68	.500

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

Table 9

Frequency and Severity of MVC and non-MVC PTSD Symptoms

Variables	Group with High MVC PTSD Symptoms		Control Group		t test	p value
	Mean	SD	Mean	SD		
IES-R-M total score for the most traumatizing MVC	45.70	7.92	--	--	--	--
IES-R-M total score for the most traumatizing non-MVC event	47.50	15.58	27.30	15.67	5.78	.00**
ADIS-IV-A-PTSD total frequency score for the most traumatizing MVC	19.82	16.59	--	--	--	--
ADIS-IV-A-PTSD total distress score for the most traumatizing MVC	21.58	17.64	--	--	--	--

(table continues)

Table 9 *(Continued)*

Variables	Group with High MVC PTSD Symptoms		Control Group		t test	p value
	Mean	SD	Mean	SD		
ADIS-IV-A-PTSD total frequency score for the most traumatizing non-MVC event	22.25	19.91	11.38	12.83	2.90	.005**
ADIS-IV-A-PTSD total distress score for the most traumatizing non-MVC event	24.48	22.07	12.18	14.84	2.93	.005**

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

Table 10

Frequency for DSM-IV MVC and non-MVC PTSD Diagnoses (Full Criteria with Functional Impairment)

Meet DSM-IV PTSD Diagnosis Criteria Based on the ADIS-IV-A-PTSD	Group with High MVC PTSD Symptoms		Control Group		Pearson Chi Square	p value
	Frequency	Percent	Frequency	Percent		
The most traumatizing MVC						
Yes	7	17.5%	--	--	--	--
No	33	82.5%	--	--		
The most traumatizing non-MVC event					1.92	.17
Yes	4	10%	1	2.5%		
No	36	90%	39	97.5%		

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

Table 11

Comparison of the Adjusted Mean SUDS Nervous Scores by Group

Outcome Measures	Group with High MVC PTSD Symptoms (*M*, *SD*)	Control Group (*M*, *SD*)	F Value	P	Eta Squared
Adjusted mean SUDS nervous score for the mild MVC story	.94 (1.32)	.26 (1.08)	6.42	.013*	.08
Adjusted mean SUDS nervous score for the severe MVC story	1.91 (1.88)	1.19 (1.73)	3.16	.079	.04
Average adjusted school-stress SUDS nervous score	.67 (1.33)	.58 (1.24)	.09	.761	.00
Average adjusted pleasant-event SUDS nervous score	-.35 (.77)	-.33 (.69)	.01	.909	.00
Adjusted SUDS nervous score for the mental arithmetic task	2.13 (2.14)	1.73 (1.06)	.90	.347	.01

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

Table 12

Comparison of the Adjusted Mean SUDS Happy Scores by Group

Outcome Measures	Group with High MVC PTSD Symptoms (*M*, *SD*)	Control Group (*M*, *SD*)	F Value	P	Eta Squared
Adjusted mean SUDS happy score for the mild MVC story	-.600 (.79)	2.452 (.88)	10.29	.002*	.117
Adjusted mean SUDS happy score for the severe MVC story	-.981 (.94)	-.738 (1.02)	1.24	.269	.016
Average adjusted school-stress SUDS happy score	-0.006 (.60)	0.072 (.52)	.39	.534	.005
Average adjusted pleasant-event SUDS happy score	.294 (.82)	.350 (.85)	.09	.764	.001
Adjusted SUDS happy score for the mental arithmetic task	-.750 (1.26)	-.380 (.98)	2.22	.140	.028

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

Table 13

Correlations Among Four Measures Consisting of 13 Outcome Variables Assessing PTSD Symptoms and Previous Traumas

	1	2	3	4	5	6	7 [a]	8 [a]	9	10	11	12	13 [a]
1. Adjusted mean SUDS nervous score for the mild MVC story	--	.61**	-.08	.02 [c]	.09 [b]	.06 [b]	.19	.19	.23*	.18	.08	.09	.20
2. Adjusted mean SUDS nervous score for the severe MVC story		--	-.16	.01 [c]	.22 [c]	.23* [c]	.21	.16	.13	.08	-.02	.12	.25*
3. Adjusted mean RT for the mild MVC story			--	.12 [c]	.21	.21	.34*	.31	.04	.15	.09	.12	.14
4. Adjusted mean RT for the severe MVC story				--	.01 [c]	-.03 [c]	-.07	-.01	.11 [c]	-.01 [c]	.20 [c]	.11 [c]	-.01
5. ADIS-IV-A-PTSD total frequency score for the most traumatizing non-MVC event					--	.95** [c]	.35*	.39*	.23* [c]	.20 [b]	.05 [b]	.27 [b]	.62**

(table continues)

Table 13 *(Continued)*

	1	2	3	4	5	6	7 [a]	8 [a]	9	10	11	12	13 [a]
6. ADIS-IV-A-PTSD total distress score for the most traumatizing non-MVC event						--	.40*	.46**	.29** [b]	.23* [b]	.05 [b]	.27 [b]	.63**
7. ADIS-IV-A-PTSD total frequency score for the most traumatizing MVC [a]							--	.96**	.10	-.05	-.24	.35*	.00
8. ADIS-IV-A-PTSD total distress score for the most traumatizing MVC[a]								--	.18	-.06	-.21	.32*	.06
9. HPS-C total distress score resulting from previous traumatic events that participants endorsed									--	.66**	.39** [b]	.52** [b]	.48**
10. HPS-C total number of traumatic events that participants reported having experienced										--	.33**	.32*	.35**

(table continues)

Table 13 *(Continued)*

	1	2	3	4	5	6	7[a]	8[a]	9	10	11	12	13[a]
11. HPS-C total number of traumatic events that participants reported having witnessed											--	.04	.25*
12. IES-R-M total score for the most traumatizing non-MVC event												--	.35*
13. IES-R-M total score for the most traumatizing MVC[a]													--

Note. Measures assessing PTSD symptoms were administered to all participants (n = 80) except [a]the ADIS-IV-A-PTSD total frequency score for the most traumatizing MVC, the ADIS-IV-A-PTSD total distress score for the most traumatizing MVC, and the IES-R-M total score for the most traumatizing MVC event, which were given to the participants who have been involved in at least one MVC (n = 40).There were significant differences in the covariance matrices between the group with High MVC PTSD symptoms and the control, [b]p value less than .05 and [c]p value less than .01 for the Box's M tests.

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

Table 14

Standardized Coefficients and Correlations of Predictor Variables with the Discriminant Function

	Correlation coefficients with discriminant function	Standardized coefficients for discriminant function
Predictors	Function 1	Function 1
Adjusted mean SUDS happy score for the mild MVC story	-.48**	-.56**
ADIS-IV-A-PTSD total frequency score for the most traumatizing event that is not MVC related	.43**	.50**
HPS-C total number of traumatic events that participants reported having experienced	.74**	.70**

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

Figure Captions

Figure 1. Significant Intrascale Correlations Among the Outcome Variables Within the ADIS-IV-A-PTSD

Figure 2. Significant Intrascale Correlations Among the Outcome Variables Within the HPS-C

Figure 3. Significant Intrascale Correlations Among the Outcome Variables Within the IES-R-M

Figure 4. Significant Inter-item Correlations Among the Outcome Variables Within the MVC-BAT-A.

Figure5. Significant Interscale Correlations Among the Outcome Variables Across the PTSD Measures

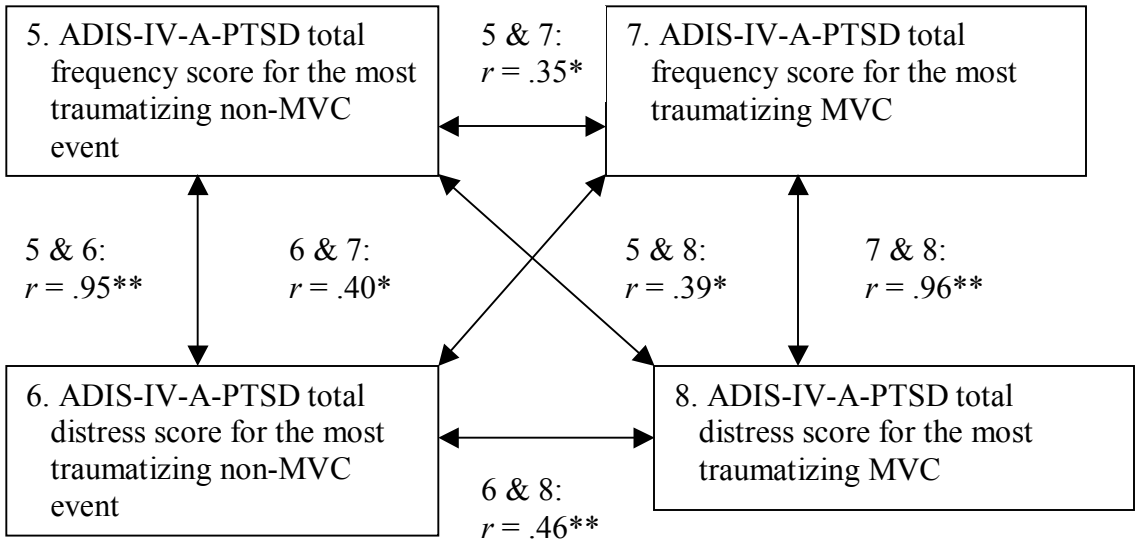


Figure 1. Significant Intrascale correlations Among the Outcome Variables Within the ADIS-IV-A-PTSD

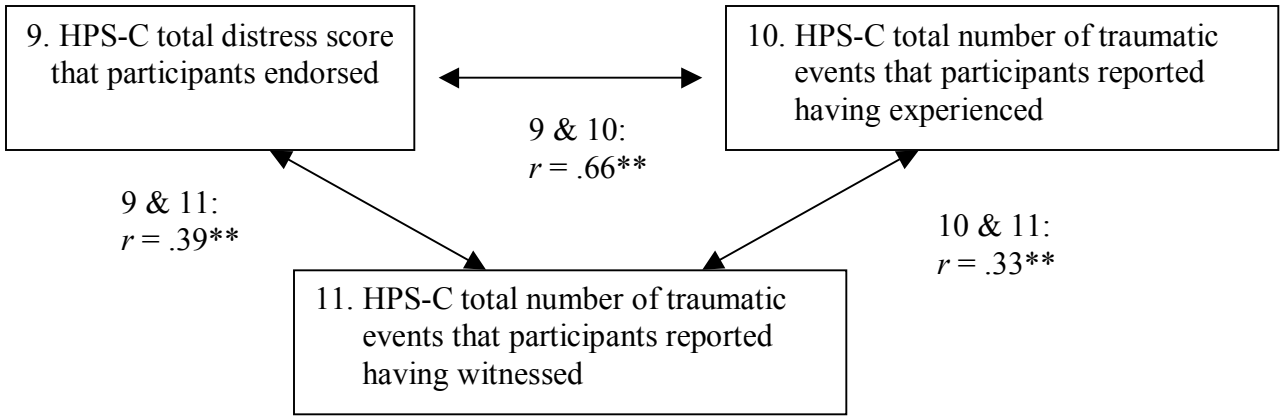


Figure 2. Significant Intrascale Correlations Among the Outcome Variables Within the HPS-C

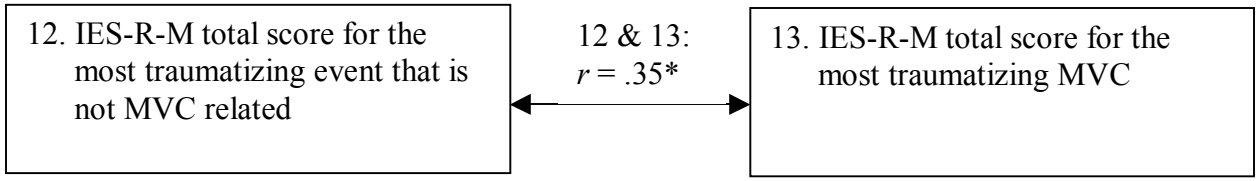


Figure 3. Significant Intrascale Correlations Among the Outcome Variables Within the IES-R-M

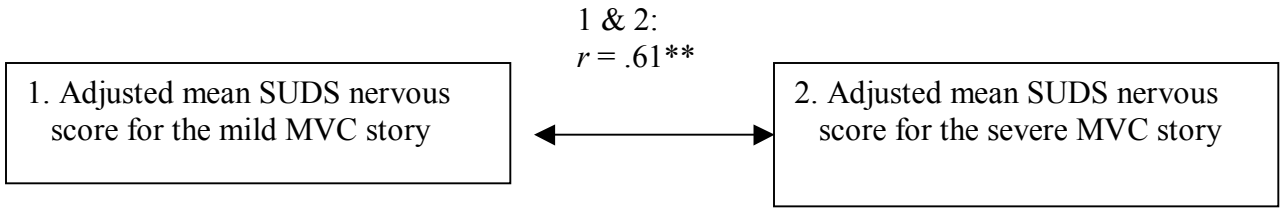


Figure 4. Significant Inter-item Correlations Among the Outcome Variables Within the MVC-BAT-A

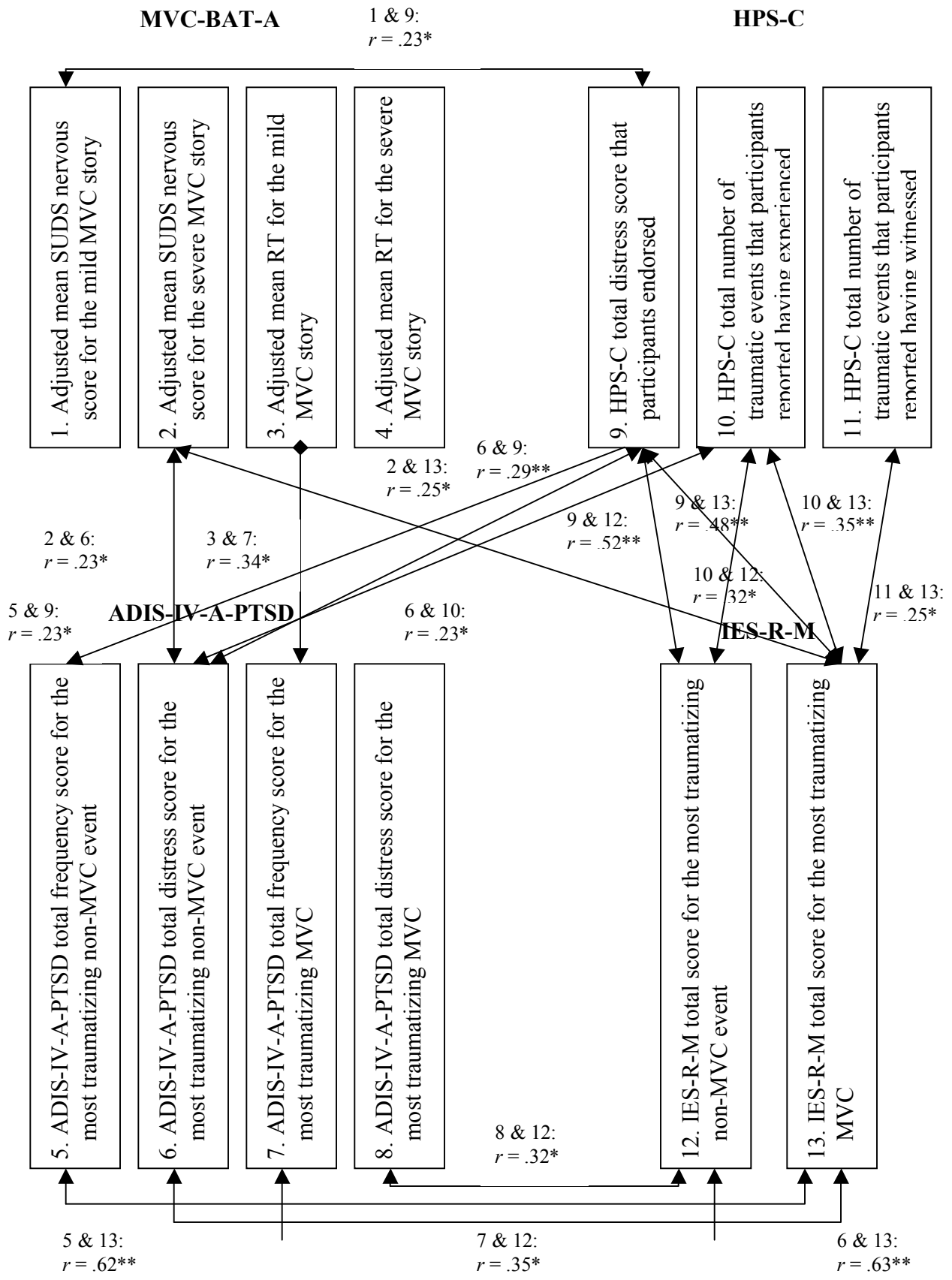


Figure 5. Significant Interscale Correlations Among the Outcome Variables Across the PTSD Measures

Appendix A
Demographic Questionnaire

Participant ID# (fill out by the investigator only): _____

Please answer the following questions about **you**.

1. Today's Date: _____

2. Gender: _____ Male _____Female

3. Date of Birth: _____ / _____ / _____

4. Age: _____

5. Country of origin: _____

6. Home state: _____

7. Race or Ethnicity:
   _____ Caucasian _____African American
   _____ Asian American _____ Native American
   _____ Hispanic American
   _____ Other, please describe: _____

8. List people (e.g., parents, children, siblings, spouse, boyfriends, friends) whom you current live with

Name	Relationship	Age	Name	Relationship	Age
_____	_____	___	_____	_____	___
_____	_____	___	_____	_____	___
_____	_____	___	_____	_____	___
_____	_____	___	_____	_____	___
_____	_____	___	_____	_____	___

9. _____ What year of College are you in
   1. Freshman
   2. Sophomore
   3. Junior
   4. Senior

10. _____ Marital status
    1. Single
    2. Married
    3. Divorced
    4. Separated
    5. Widowed
    6. Cohabitating

11. _____ Work status

1. Does not work
2. Employed full-time
3. Employed part-time
4. Retired
5. Homemaker
6. Disabled
7. Student
8. Unemployed
9. Other _____

12. _____ Occupation

1. Does not apply
2. Unskilled worker
3. Semiskilled worker
4. Skilled worker
5. Clerical worker
6. Salesperson
7. Small business owner
8. Technical specialist
9. Manager
10. Professional
11. Other _____

13. _____ Annual family income from all sources

1. Less than 10,000
2. 10,000 - 19,999
3. 20,000 – 29,999
4. 30,000 – 39,999
5. 40,000 – 49,999
6. 50,000 – 59,999
7. 60,000 – 69,999
8. 70,000 –79,999
9. 80,000 – 89,999
10. 90,000 - above

14. _____ Are you currently under medical care?

1. Yes (please specify _____)
2. No

15. _____ Are you currently taking any medication?

1. Yes (please specify _____)
2. No

16. _____ Do you have any current medical problems that do not result from a motor vehicle accident and that are a source of concern to you?

1. Yes (please specify _____)

_____ If yes, does the current medical problems requiring any surgeries or hospitalizations?

a. Yes b. No

2. No

17. _____ Do you have any *past* medical problems that do not result from a motor vehicle accident and that are a source of concern to you?

1. Yes (Please give details or please specify _____)

_____ If yes, did the past medical problems requiring any surgeries or hospitalizations?

a. Yes b. No

2. No

18. _____ Have you ever had psychological problems or disorder diagnosed by mental health professionals (e.g., psychiatrists, psychologists)?

1. Yes

A. If yes, check all that apply

_____ Anxiety _____ Learning problems _____ Legal problems
_____ Depression _____ Hyperactivity _____ Substance abuse
_____ Stress management problems _____ Anger control problems
_____ Relationship problems _____ Problems with parents
_____ Physical abuse _____ Sexual abuse
_____ Posttraumatic Stress Disorder
_____ Others:_____

B. Have you ever received counseling or psychological services for this problem or disorder?

_____ Yes _____ No, how long the services last?: _____

2. No

19. How much do you ***currently*** fear driving a car or other motor vehicles?

0	1	2	3
Not at all fearful	A little bit fearful	A lot fearful	Very fearful

Appendix B
Accident Descriptor Checklist-College Student Version

1. Do you remember the accident(s)? _____Yes _____No

2. Were you asleep before/during the accident? _____ Yes _____No

3. Have you been involved in a legal suit/litigation regarding the accident?
   _____ Have not been involved in a legal suit/litigation regarding the accident
   _____ Had settled
   _____ Still ongoing (within 6 months)
   _____ Still ongoing (more than 6 months)

4. The accident happened to me
   _____ Last month
   _____ One month to 1 year ago
   _____ More than 1 year to 5 years ago
   _____ More than 5 years

5. Were others (e.g., parents, friends, spouse, children) presented at the time of the accident?
   _____ Yes (Please specify: _____)
   _____ No

6. _____ Were you the (1) driver, (2) passenger, or (3) pedestrian during the accident?

7. Type of accident: _____Single vehicle accident _____multiple car collision
   _____Hit fixed object _____head on collision
   _____Hit pedestrian/animal _____hit other moving vehicle
   _____Ran off road

8. Were drugs or alcohol involved in the accident? _____ Yes _____ No

9. Were you wearing a seatbelt at the time of the accident?
   _____ Yes _____ No _____ Don't know

10. What type of vehicle were you in at the time of the accident?
    _____ Car _____ Moped/scooter _____ Three- or four-wheeler (ATV)
    _____ Pick-up truck _____ Motorcycle _____ Other (_____)

11. What were the weather conditions at the time of the accident?
    _____ Dry _____ Snow/ice _____ Wet
    _____ Muddy _____ Hazardous material on the road

12. During the accident, did you have, at least momentarily, a complete absence of affect, or lack of thought, or loss of words, or being spaced out, or all these symptoms?
    _____ Yes _____ No

13. Was anyone injured in the accident?
_____ Yes _____ No

14. Who was injured?
_____ Child _____ Other family member (describe:_____)
_____ Parent _____ Friend
_____ Sibling _____ Stranger/acquaintance

15. Did you lose your consciousness during/after the accident?
_____ Yes _____ No
If yes, how long it was? _____ hours and _____ minutes

16. Were you in coma during/after the accident?
_____ Yes _____ No

17. Were you injured during the accident?
_____ Yes _____ No

18. Was your head injured during the accident? _____ Yes _____ No
If yes, how severe it was following the accident?

0	1	2	3
Not at all severe	A little bit severe	A lot severe	Very severe

What type of injury to you?
_____bruises, scrapes, swelling
_____cuts or open wounds _____burns _____broken bone(s)
_____other (describe:_____)

19. Was your face injured during the accident? _____ Yes _____ No
If yes, how severe it was following the accident?

0	1	2	3
Not at all severe	A little bit severe	A lot severe	Very severe

What type of injury to you?
_____bruises, scrapes, swelling
_____cuts or open wounds _____burns _____broken bone(s)
_____other (describe:_____)

20. Was your neck injured during the accident? _____ Yes _____ No
If yes, how severe it was following the accident?

0	1	2	3
Not at all severe	A little bit severe	A lot severe	Very severe

What type of injury to you?
_____bruises, scrapes, swelling

_____cuts or open wounds _____burns _____broken bone(s)
_____other (describe:_____)

21. Was your thorax injured during the accident? _____ Yes _____ No
If yes, how severe it was following the accident?

0	1	2	3
Not at all severe	A little bit severe	A lot severe	Very severe

What type of injury to you?
_____bruises, scrapes, swelling
_____cuts or open wounds _____burns _____broken bone(s)
_____other (describe:_____)

22. Was your abdomen injured during the accident? _____ Yes _____ No
If yes, how severe it was following the accident?

0	1	2	3
Not at all severe	A little bit severe	A lot severe	Very severe

What type of injury to you?
_____bruises, scrapes, swelling
_____cuts or open wounds _____burns _____broken bone(s)
_____other (describe:_____)

23. Were your pelvic contents injured during the accident? _____ Yes _____ No
If yes, how severe it was following the accident?

0	1	2	3
Not at all severe	A little bit severe	A lot severe	Very severe

What type of injury to you?
_____bruises, scrapes, swelling
_____cuts or open wounds _____burns _____broken bone(s)
_____other (describe:_____)

24. Was your spine injured during the accident? _____ Yes _____ No
If yes, how severe it was following the accident?

0	1	2	3
Not at all severe	A little bit severe	A lot severe	Very severe

What type of injury to you?
_____bruises, scrapes, swelling
_____cuts or open wounds _____burns _____broken bone(s)
_____other (describe:_____)

25. Were your extremities injured during the accident? _____ Yes _____ No
If yes, how severe it was following the accident?

0	1	2	3
Not at all severe	A little bit severe	A lot severe	Very severe

What type of injury to you?
_____bruises, scrapes, swelling
_____cuts or open wounds _____burns _____broken bone(s)
_____other (describe:_____)

26. Was your external injured during the accident? _____ Yes _____ No
If yes, how severe it was following the accident?

0	1	2	3
Not at all severe	A little bit severe	A lot severe	Very severe

What type of injury to you?
_____bruises, scrapes, swelling
_____cuts or open wounds _____burns _____broken bone(s)
_____other (describe:_____)

27. Type of medical treatment received:
_____ First aid at scene _____ First aid at home
_____ Emergency room _____ Doctor's office
_____ Hospitalized _____ Injured but not treated
_____ Not injured

28. Number of days you spent in the hospital:_____

29. Length of time you spent receiving outpatient treatment: _____ months

30. Are you satisfied with the medical treatment?
_____ Yes _____ No

31. Has the accident ever required you to receive psychiatric/psychological services (counseling, psychotherapy)?
_____ Yes _____ No
If yes, how long the service last? _____

32. Had you received psychiatric/psychological services prior to the accident?
_____ Yes _____ No
If yes, how long the service last? _____

33. Was anyone killed in the accident?
_____ Yes _____ No
If yes, what was the relation of the deceased to you (if applicable)?
_____ Parent _____ Other family member (describe:_____)

_____ Sibling _____ Friend
_____ Stranger/acquaintance

34. Have you had a major financial crisis resulting from the accident?
_____ Yes _____ No

35. Have you had received compensation as a result of the accident?
_____ Yes _____ No

36. ***Prior to the accident***, how fearful were you driving a car or other motor vehicles?

0	1	2	3
Not at all fearful	A little bit fearful	A lot fearful	Very fearful

37. ***Prior to the accident***, how fearful were you riding in a car or other motor vehicles?

0	1	2	3
Not at all fearful	A little bit fearful	A lot fearful	Very fearful

38. How many days of school have you missed school/work ***since*** the accident?_____

39. How many days of school have you missed school/work ***because of*** the accident?_____

Appendix C

History of Psychosocial Stressors-College Student Version (HPS-C)

Instructions: Listed below are a number of difficult or stressful things that sometimes happen to people. For each event circle one or more of the numbers to the right to indicate whether (1) it *did not happen to you*, (2) it *happened to you* personally or, (3) you *witnessed it* happen to someone else.

Then indicate when the event happened, (1) *last month*, (2) *between last month and last year*, or (3) *more than one year ago*. Finally, rate how much that event *currently distresses* you (where 1 = "not at all" and 5 = extremely").

	Circle *one or more* of the numbers below.			Circle *one or more* of the numbers below.			Circle *only one* of the numbers below.
Event	*Did not happen*	*Happened to me*	*Witnessed It*	*Event happened last month*	*Happened 1 month to one 1year ago*	*Happened more than 1 year ago*	*How Distressing is the event to you currently (This Week)* None Extreme
1. MOTOR VEHICLE CRASH: Car, Motorcycle, ATV, etc.	1	2	3	1	2	3	1 2 3 4 5
2. PEDESTRIAN ACCIDENT: Hit, run over by a vehicle, etc.	1	2	3	1	2	3	1 2 3 4 5
3. NATURAL DISASTER (Flood, Tornado, Hurricane etc.)	1	2	3	1	2	3	1 2 3 4 5
4. TECHNOLOGICAL ACCIDENT: House or building fire, building or bridge collapse, explosion, exposed to toxic waste	1	2	3	1	2	3	1 2 3 4 5
5. MILITARY COMBAT: Being in a war zone and engaging in combat as a member of the military	1	2	3	1	2	3	1 2 3 4 5
6. LIVING IN A HIGH CRIME AREA (where there are frequent assaults, robberies, gang violence)	1	2	3	1	2	3	1 2 3 4 5
7. PERFORMING AN EMERGENCY RESCUE: At the scene of an accident, fire, shooting, etc., as a civilian or part of a volunteer or professional emergency response team	1	2	3	1	2	3	1 2 3 4 5
8. EMERGENCY ROOM: Treating critical patients in a hospital emergency room	1	2	3	1	2	3	1 2 3 4 5
9. FIRE-FIGHTING: Responding to a fire as part of a volunteer or professional fire department	1	2	3	1	2	3	1 2 3 4 5
10. FINDING OR SEEING A DEAD BODY: Other than at a funeral, such as finding a dead body in some state of decomposition in the woods, in a home, or at a crime scene	1	2	3	1	2	3	1 2 3 4 5
11. ABORTION OR MISCARRIAGE	1	2	3	1	2	3	1 2 3 4 5
12. SEVERE INJURIES (e.g., severe sports injuries; rock climbing, hang-gliding, parachuting accidents; accidents in the home fall, cut, burned, loss of a finger/limb/foot, being poisoned, etc.)	1	2	3	1	2	3	1 2 3 4 5
13. DEATH OF SPOUSE OR SOMEONE CLOSE TO YOU	1	2	3	1	2	3	1 2 3 4 5
14. DIVORCE/SEPARATION FROM SPOUSE/SIGNIFICANT OTHER	1	2	3	1	2	3	1 2 3 4 5
15. ABUSE: Sexual, physical, emotional (includes by a stranger, as well as by a family member, parent, friend, spouse, significant other etc.)	1	2	3	1	2	3	1 2 3 4 5

Instructions: Listed below are a number of difficult or stressful things that sometimes happen to people. For each event circle one or more of the numbers to the right to indicate whether (1) it *did not happen to you*, (2) it *happened to you* personally or, (3) you *witnessed it* happen to someone else.

Then indicate when the event happened, (1) *last month*, (2) *between last month and last year*, or (3) *more than one year ago*. Finally, rate how much that event *currently distresses* you (where 1 = "not at all" and 5 = extremely").

Event	Circle *one or more* of the numbers below.			Circle *one or more* of the numbers below.			Circle *only one* of the numbers below.
	Did not happen	*Happened to me*	*Witnessed it*	*Event happened last month*	*Happened 1 month to one 1year ago*	*Happened more than 1 year ago*	*How Distressing is the event to you currently (This Week)* None Extreme
16. ASSAULT WITH A WEAPON: Being attacked with a belt, bottle, gun, knife, club, etc. (includes threats of such assaults).	1	2	3	1	2	3	1 2 3 4 5
OTHER: Any other very bad, scary, fearful, extreme experience or time in which you thought your life was in danger, you might be hurt, or you were distressed. Please descrbe:_____ _____	1	2	3	1	2	3	1 2 3 4 5

Appendix D

Accident Characteristics Identification Scale (AcCIdentS)

These questions ask about aspects of your accident. Please select the best answer to each question.

1. How many car accidents have you had in your lifetime as a driver/passenger? Please circle the correct answer.

0	1	2	3	4	more than 4

2. How much do you currently fear riding in a car or other motor vehicles?

0	1	2	3
Not at all fearful	A little bit fearful	A lot fearful	Very Fearful

3. How much was the car damaged during the accident?

0	1	2	3
None	Minor Repairable Damage	Major Repairable Damage	Not Repairable (Totaled)

4. How much did you feel that you were in danger of being ***injured*** during the accident?

0	1	2	3	4
Not at all in danger		Somewhat in danger		Very much in danger

5. How much did you feel that you were in danger of being ***killed*** during the accident?

0	1	2	3	4
Not at all in danger		Somewhat in danger		Very much in danger

6. How many people (including family, friends, strangers) were injured or killed in the accident?

0	1-2	3-12	more than 12

7. Were you injured in the accident, and if so, how long did it take for his/her injuries to heal?

0	1	2	3	4
Not injured	Less than one month	Less than three months	Less than one year	Still not healed

8. Which of the following best describes the accident you experienced?

0	1	2
No accident	Hit by or ran into another vehicle/car	Hit a fixed object/ ran off road

9. Thinking about your accident, how serious/severe do you think the accident was?

0	1	2	3	4	5	6	7	8	9	10
Not at all severe					Somewhat severe					Very severe

Appendix E

Vignettes of the MVC-BAT-A

Instructions: I am going to present several short stories. You will first be given a short 2-minute practice story to practice the procedures for ratings. The practice story consists of two 1-minute segments. You will practice rating your level of nervousness and happiness on a 0-9 scale before the segment starts and after each 1-minute segment. (0 is equal to "*not at all nervous*" or "*not at all happy*" and 9 is equal to "*very nervous*" or "*very happy*.") (The ratings are completed by clicking with the mouse.) Following a practice story, the computer screen will present an instruction requesting you to do a mental arithmetic task. A total of six stories will then be presented. Each story lasts 4 minutes consisting of four one-minute segments. During each 1-minute segment, I want you to watch and listen carefully and imagine all the things described in these stories. You will again be asked to rate your level of nervousness and happiness on a 0-9 scale before the segment starts and after each 1-minute segment. There will be a 1-minute break between each story. Now we will start with a practice story.

Practice story: Watching a Movie:

1. Setting the context and the central events of the story

It is Saturday afternoon. After finishing his school readings, Kevin sees his dirty clothes piled up in the hamper and finds his apartment kind of messy. He then decides to do laundry and clean his apartment. It takes Kevin about 1 and a half hours to have all the work done. After completing the work, he feels like that he needs to take a break. He then decides to invite several of his friends to come over of his apartment to do something fun. He makes several phone calls. On the phone, Kevin and his friends decide to watch movies. His friends offer to rent a videotape named "Spider Man II" on their way to Kevin's apartment. Kevin is asked to buy and serve drinks and snacks. (Pause the tape and cover the stimulus card)

2. Continuation of the central events and resolution of the story

After making several phone calls, Kevin opens his refrigerator and food cabinet and finds out that he has run out of drinks and snacks. He decides to buy some drinks and snacks. While Kevin's friends are on their way to his apartment, Kevin walks to a Mini Mart nearby his apartment to buy some drinks and snacks. After quickly picking up some potato chips, pop corn, cokes, and beers, Kevin walks back to his apartment and waits for his friends to come. His friends arrive at his apartment five minutes after Kevin returned home. They help Kevin to set the drinks and snacks on the coffee table and turn on the movie. They begin to watch the movie. After watching the movie, Kevin and his friends discuss the content of the movie. They all agree that it is a good movie and they made a good choice. (Pause the tape and cover the stimulus card)

School vignette #1: School oral report

1. Setting the context

Susan is an 18 year-old female. She graduated from high school last year. She currently is enrolled at a college as a freshman. This is her first semester at college. Because the college

she attends is located in another state, she had to leave her family to attend school. Susan decided to live in a dormitory to increase her chances of meeting new friends. After helping Susan to settle into her dorm room, her parents returned to their home. Susan has two roommates, and they get along with each other very well. As a freshman at college, she is taking several courses. One of her courses is Introductory Psychology. Susan has not taken any psychology courses before; therefore, this is a fairly new subject for her.

2. The central event of the story

Susan attends the first class of the Introductory Psychology. After introducing himself, the instructor, Dr. McNeil, passes out the syllabus and explains the course requirement. After listening to Dr. McNeil, Susan finds out that she is one of several students who have to give an oral book report in their next class, which is in two days. She has two days to prepare for this report about a book that she has never read. She does not think that she has enough time to get ready for the assignment. She has to talk for 5 minutes in front of the entire class and the instructor about this book. Two days later, Susan attends her second class of Introductory Psychology where she was asked to give an oral book report. Susan is waiting in her seat for the instructor to call the first person to give their report.

3. Continuation of the central event

Dr. McNeil, looks around the room at all the students. Susan sees Dr. McNeil walking toward her. He stands right in front of her. She then looks at Dr. McNeil and finds that Dr. McNeil is looking down at her. "Susan," he says, "you can be the first to give your report." Susan can hear the other students sigh with relief at Dr. McNeil's announcement. After sitting in her seat for one minute, Susan gradually stands up and walks to the front of the room. Susan stands against the chalkboard, with her book and handouts in hand. All the other students and the instructor are staring at Susan, waiting for her to start the report. Susan can hear that two students in the back are whispering.

4. Resolution

Susan decides to ignore the whispering from the two students in the back and begins to distribute the handouts to the instructor and other students. After distributing the handouts, Susan opens her book and beings giving her report. She tells about the main content of the book she read and what she liked and disliked about this book. During her report, she sees that all of the students in the class are watching and listening. There are several times when she turns her head toward the instructor and looks at the instructor. Susan finds that the instructor is nodding his head. In the last five minutes of her report, there are a couple of students who ask her questions about the book and her report. Susan is able to answer the questions appropriately. When she finishes the report, all the students and the instructor smile and offer applause. The instructor says that she did a great job.

School vignette #2: School test

1. Setting the context

Mike is a 19 year-old sophomore. It is Monday morning. Mike is sleeping. Suddenly, his alarm goes off. Mike looks the alarm. It is 7:30 AM. He turns off the alarm and gets out of his bed quickly. As usual, Mike washes and brushes his teeth, eats his breakfast, and dresses himself. He leaves his apartment for school around 8:00 AM. It is a sunny day. On his way to school, he sees blue sky and hears birds singing. He says to himself, "What a beautiful day." After arriving at school, Mike enters the classroom and walks toward the seat that he always sits in. He suddenly finds that all the other students are already sitting at their desks and are reading their books and class notes quietly.

2. The central event of the story

Mike sits in his seat and then looks at all of the students in the classroom. While he is wondering about why all of the students are studying quietly, the instructor walks into the classroom. Mike sees the instructor standing in front of the classroom with a yellow paper bag. The instructor then takes a pack of paper out of the yellow paper bag and begins passing paper out. "It's time for the test. I hope that you all reviewed the lectures from the past weeks. There are 25 questions on the test. 20 questions are multiple choices and five are essay questions. You will have 60 minutes to answer all of the questions." says the instructor.

3. Continuation of the central event

At this moment, Mike recalls that he was supposed to study for this test over the weekend; however, because his cousin came to visit him during the weekend, he forgot that he had a test today. "Put all your books and class notes away and take out a pen. Remember that you only have 60 minutes to answer all the questions. Do not cheat on the test. If you cheat, you will fail the class" says the instructor. Mike is not very good at memorizing, and he usually has to review books and class notes several times before taking each test. He has not gotten a chance to review his books and class notes since last class. One of the students passed the exam paper to him and he begins reading the questions.

4. Resolution

Prior to reading the first question, Mike looks around the room at the other students who are working on the test. Everybody else seems to know the answers. Mike tells himself to take a deep breath and he begins working on the test. When Mike reads the first question, he is surprised that he knows the answer. After writing down the answer for the first question, he continues to work on other questions. Mike then realizes that he knows the answers for most of them. For those few questions that he does not know the answers, Mike makes his best guess. He finally completes the test and turns in his paper. The instructor grades the test and posts the grade right after the test. Mike finds out that he gets a good grade on the test.

Motor vehicle accident #1: Rainy night

1. Setting the context

Christina is a 20 year-old female college student. Since Christina attended a college located in another state, she has been busy with schoolwork and rarely had time to go home and

spend time with her family. Next Monday is Martin Luther King, Jr. Birthday recess. Christina will have a long weekend from this Friday to next Monday. Thus, Christina decides to call her parents and let them know her plans of going home and spending time with them. After discussing possible plans with her parents, Christina and her parents decide to visit Christina's grandparents who live in another town in Christina's home state. Christina has not seen her grandparents for a year and she is very close to them. Thus, Christina is looking forward to visiting her grandparents.

2. The central event of the story

Christina arrives home on Friday night. She sleeps well that night. On Saturday, she stays at home and helps her parents do some housework during the day. Christina and her parents are going to have dinner with Christina's grandparents. It is late in the evening and just starting to get dark. Christina and her parents are supposed to arrive at her grandparents' home around 6:30 PM; however, now it is 6:05 PM. Because Christina's grandparents live in another town, it will take about at least 30 minutes to arrive at her grandparents' house. They are highly likely to be late for dinner. Christina father quickly drives his car out of the garage and rushes Christina and her mother into the car. Christina is sitting in the back seat of the car with her seatbelt on while her father starts the engine.

3. Continuation of the central event

Christina's father said, "Your grandparents care a lot about being on time. We need to arrive at your grandparents' house on time." After five-minutes of driving, it gets dark. Christina is sitting in the back seat and cannot clearly see the road in front of them from where she is sitting, but she knows they are driving on a busy road. From the side and back windows, Chris can see the trees speeding by, and the headlights of other cars. Christina notices that it is beginning to rain, slowly at first, but now it is raining very hard. Christina's parents are talking about how hard it is to see the road now. Another car zooms past them and honks. She hears the loud, squealing sound of car brakes. Suddenly, their car starts to spin around in a circle, and slides off the road.

4. Resolution

The car comes to a stop in the grass on the side of the road. Christina's father first makes sure that no one in the car is hurt. Christina father then gets out of the car to check whether the car is damaged. "Thank God! We are lucky. Everybody is okay and the car is not damaged…" Christina's father says. They wait for it to stop raining and then get back on the road. They arrive safely at their grandparents' house a short while later. After explaining to their grandparents about the reason for being late, Christina's grandparents are glad that nobody is hurt and the car is not damaged. Christina and her parents then have dinner with her grandparents. They have a wonderful time together.

Motor vehicle accident #2: Snowy day

1. Setting the context

Todd is a senior college student. As usual, he attends school on a Monday afternoon. It is a cold, snowy winter afternoon. Todd has one afternoon class at 2:30. He decides to arrive at school one hour early and stays at the library to review last week's lecture. Todd is sitting at a desk and is reading his book. It is about 30 minutes prior to his afternoon class. Todd suddenly recalls that he is supposed to turn in his paper in this class. Todd begins looking in his backpack and finds out that he left his paper on his desk at home. Because the instructor does not allow any students to turn in papers late, Todd realizes that he needs to go home to get his paper to turn it in.

2. The central event of the story

After cleaning up his book and class notes on the library desk and putting them back into his backpack, Todd quickly walks into the school parking lot to get his car. Todd gets into his car and starts the engine. Given that it takes 5 minutes to walk to the parking lot, Todd only has 25 minutes to go back to his apartment to get his paper and drive back to school to attend his class. Todd tells himself, " I need to be quick. The instructor only accepts papers at the beginning of the class. If I do not turn it in on time, I will receive a grade of zero on my paper…" There are lots of cars and school buses on the roads inside and outside of the school.

3. Continuation of the central event

Todd forgets to put on his seatbelt as he starts the car. He drives away from the curb and starts down a long, windy hill. Todd notices that it is beginning to snow very hard. Todd is driving very slowly because the road is icy and slippery. There is another car on the road heading up the hill in front of Todd's car. That car is going too fast and it begins to skid and spin on the icy road. Todd tries to move out of the way, but the road is too slippery. The car starts to spin around in a circle and slides off the road, just as the other car crashes into him. It makes a terrible, loud sound of crunching metal and breaking glass, and Todd is knocked back in his seat.

4. Resolution

The airbag of Todd's car inflated due to the crash. After his car comes to a stop on the side of road, Todd begins checking his physical condition and finds slight bruises on his knees and arms. He then gets out of his car to look at the damage. Todd's car has a small dent in the back, but the other car has a much bigger dent in the front. Fortunately, the person who hit Todd is not severely injured either. Both of them then decide to call the police and their car insurance companies to take care of this crash. After talking to the police and the insurance companies, they both go to the hospital to check their physical conditions. Fortunately, physical examinations indicate that neither of them has significant physical injuries.

Positive vignette #1: Surprise party

1. Setting the context

Today is Jamie's 20th birthday; however, her birthday this year is during the college spring break. Because she will have a big paper to turn in right after the spring break and she has not started working on it, Jamie decides not to go home. She stays at the dorm to work on her paper. It is a 25-page paper. Jamie is sitting in her seat and typing on the computer. After spending about three hours writing, Jamie begins losing her patience. Jamie says to herself, "I am tired of writing. Most of my friends went home for spring break. My parents went on a vacation. I probably will be one of a few students who stays at school during the spring break working on the paper."

2. The central event of the story

Jamie continues telling herself "Today is my birthday. I need to do something for myself. Maybe a few of my friends are still around. I should be able to ask them to celebrate my birthday." Jamie then begins to call her friends. Two of her friends do not answer their phones and an answering machine comes on. She does not want to leave a message. Three of her friends already have their time scheduled or do not want to go out because it is cold and rainy outside. After making several phone calls, Jamie gives up calling. She decides to do something for herself on her birthday. She turns off her computer and put her books away.

3. Continuation of the central event

After putting on a beautiful dress and makeup, Jamie leaves the dorm by herself. Jamie then decides to go to the mall to buy a dress as her birthday gift. It takes about 30 minutes to arrive the mall. There are lots of different stores in the mall, full of clothes, furniture, sporting equipment, cosmetics, videogames, and other things. Jamie walked into a store selling a variety of clothes. While Jamie is wondering about which dress she should pick as her birthday gift, Jamie sees one of her friends, Tina. After having a five-minute conversation with Tina, Jamie realizes that Tina has come to the store to pick up a birthday gift for Tina's sister. Jamie says to herself "I hope that my family remembers my birthday."

4. Resolution

After talking to Tina, Jamie picks a pink dress as her birthday gift. She then puts her new dress on. When she looks at herself in the mirror, Jamie feels that she looks very nice with the pink dress. She is happy with the birthday gift she picked for herself. While Jamie is at the mall, all of her friends, roommates, and family arrived at her dorm for a surprise birthday party. Jamie's room is decorated with balloons and streamers and there is a huge birthday cake and a variety of drinks and snacks on the table surrounded by presents. As Jamie opens the door to her room, she is greeted by a loud yell of "Surprise!!!". This is the best birthday she has ever had.

Positive vignette #2: Last day of school

1. Setting the context

Casey is a junior college student. He has worked hard since the beginning of this semester and is looking forward to finishing it. Time flies. Today is the last day of school before

summer vacation and Casey only has one class he needs to attend. As usual, he walks to school. It is a sunny, warm morning in June. After arriving at the classroom, he sees the instructor standing in front of the classroom making an announcement. Because it is the last class of this semester, the instructor announces that they do not have to sit at their desks to listen to the instructor's lecture. The instructor then has all the students in the classroom discuss where they would like to have their last class of this semester.

2. The central event of the story

Because it is a sunny, warm morning, one of the students suggests they have an outdoor class. They can go outside and sit on the grass in front of the building. Another student recommends that they order some pizza and drinks and have them delivered. All the students and the instructor are pleased by both suggestions. The instructor then asks a couple of volunteers to order the pizza and drinks and to prepare some paper napkins and paper plates and cups. John (one of Casey's classmates) and Casey both raise their hands and volunteer themselves to do the work. Casey finds a phone book from the department secretary and begins placing his order. John goes to the student center to buy some napkins and paper plates and cups.

3. Continuation of the central event

While Casey finishes his order and comes back to the class, Casey hears that everyone is talking about their plans for the summer. One of the students is talking about going to Disney World in Orlando, Florida. This reminds Casey about his summer plan. Casey is going on a family vacation to New York City. Casey has not been to New York City. He has been looking forward to this trip for a long time. He has designed his tour so that he can stop frequently at shops, museums, and restaurants. He also plans to visit all the city's major attractions, such as, Time Square, Rockefeller Center, the Empire State Building, the Broadway Shows, and the Statute of Liberty. Casey then talks to his classmates about his summer plan.

4. Resolution

While talking about his summer plan to several of his classmates, John returns to the class with some napkins, paper plates, and cups. Five minutes after John's arrival, the pizza and drinks are delivered to the class. "Because it is the last day of the class and I am very pleased by all of your performances during this semester, all the expenses are on me..." the instructor says. All the students are happy to hear the instructor's announcement. The students then take turns to serve themselves pizza and drinks. After all the students have their food and sit on the grass, the instructor begins his lecture. This is the best day of school Casey has ever had. He wishes every day of school could be this much fun!

Appendix F

Questions for Internet Screening Procedure

Dear participant,

My name is Vivian Chen. I am a doctoral student (being supervised by Dr. Cheryl B. McNeil) in the Department of Psychology at West Virginia University. I currently am in the process of conducting my dissertation research, which is the reason for my setting up the internet questionnaire. Thank you so much for participating in the initial phase of this study. The purpose of this study is to understand how motor vehicle crashes affect individuals, it is important to compare the responses of individuals who have experienced a motor vehicle crash with the responses of individuals who have not had such an experience.

Participation in this study is voluntary. You are free to withdraw your consent to participate in this study at any time. The recruitment of this study consists of two phases: initial phase and data collection phase. You will receive extra credit for completing the initial phase of this study. I will randomly select a certain portion of students who completed the initial phase of this study to participate in the second phase of this study. If you are selected, you will be given an appointment for a further assessment (approximately one hour) and you will receive extra credit along with $10 for your time. If you are interested in participating in the second phase of this study, please type your contact information in the below blanks. Please remember to submit your questionnaire after you complete it.

Thank you so much for your assistance. I look forward to your further assistance in the second phase of this study.

Sincerely,
Yi-Chuen Vivian Chen, M.A.

Name: _____ Age: _____

Gender: ___ Male ___ Female

Race/Ethnicity: ___ Caucasian ___ African American ___Asian American

___ Native American ___ Hispanic American ___ Other

Telephone number: _____ E-mail address: _____

Home address: _____

Course name for extra credit: _____

Instructor's name for extra credit: _____

Course number for extra credit: _____

Best time to contact you at : from _____ AM/PM to _____ AM/PM by _____

(phone/email/regular mail)

Please list your available times (including weekdays and weekend) for appointments:

_____

Appendix G

Modified Version of the Impact of Event Scale—Revised (IES-R-M)

Section I

Please answer the following questions before you begin filling out the questionnaire.

_____ 1. Have you been involved in at least one motor vehicle crash in your lifetime as a driver or passenger (being a pedestrian or bicyclist does not count)? 1. Yes 2. No

If yes, please go to Section II and answer question 2. If no, please go to Section III.

Section II

_____ 2. During and after the accident, did you have a severe head injury, or a loss of consciousness for more than 15 minutes? 1. Yes 2. No

Please fill out the below questionnaires (two questionnaires) based on *the most traumatizing motor vehicle accident* you have had and *the most traumatizing event that is not motor vehicle accident related*.

Questionnaire 1

Instructions: The following is a list of difficulties people sometimes have after stressful life events. Please read each items, and then indicate how distressing each difficulty has been for you during the past 7 days with respect to the *motor vehicle crash*. How much were you distressed or bothered by these difficulties?

	Not at all	A little bit	Moderatel	Quite a bit	Extremely
1. Any reminder brought back feeling about the crash.	0	1	2	3	4
2. I had trouble staying asleep.	0	1	2	3	4

	Not at all	A little bit	Moderatel	Quite a bit	Extremely
3. Other things kept making me think.	0	1	2	3	4
4. I felt irritable and angry.	0	1	2	3	4
5. I avoided letting myself get upset when I thought about the crash or was reminded of the crash.	0	1	2	3	4
6. I thought about the crash when I didn't mean to.	0	1	2	3	4
7. I felt as if the crash hadn't happened or wasn't real.	0	1	2	3	4
8. I stayed away from reminders about the crash.	0	1	2	3	4
9. Pictures about the crash popped into my mind.	0	1	2	3	4
10. I was jumpy and easily startled.	0	1	2	3	4
11. I tried not to think about the crash.	0	1	2	3	4
12. I was aware that I still had a lot of feeling about it, but I didn't deal with them.	0	1	2	3	4
13. My feelings about it were kind of numb.	0	1	2	3	4
14. I found myself acting or feeling like I was back at that time.	0	1	2	3	4
15. I had trouble falling asleep.	0	1	2	3	4
16. I had waves of strong feelings about the crash.	0	1	2	3	4
17. I tried to remove the crash from my memory.	0	1	2	3	4
18. I had trouble concentrating.	0	1	2	3	4

	Not at all	A little bit	Moderatel	Quite a bit	Extremely
19. Reminders of the crash caused me to have physical reactions, such as sweating, trouble breathing, nausea, or pounding heart.	0	1	2	3	4
20. I had dreams about the crash.	0	1	2	3	4
21. I felt watchful and on guard.	0	1	2	3	4
22. I tried not to talk about the crash.	0	1	2	3	4

Questionnaire 2

Instructions: The following is a list of difficulties people sometimes have after stressful life events. Please read each items, and then indicate how distressing each difficulty has been for you during the past 7 days with respect to _____ (please list the most traumatizing event that is not motor vehicle accident related here).

How much were you distressed or bothered by these difficulties?

	Not at all	A little bit	Moderatel	Quite a bit	Extremely
1. Any reminder brought back feeling about it.	0	1	2	3	4
2. I had trouble staying asleep.	0	1	2	3	4
3. Other things kept making me think.	0	1	2	3	4
4. I felt irritable and angry.	0	1	2	3	4

	Not at all	A little bit	Moderatel	Quite a bit	Extremely
5. I avoided letting myself get upset when I thought about it or was reminded of it.	0	1	2	3	4
6. I thought about it when I didn't mean to.	0	1	2	3	4
7. I felt as if it hadn't happened or wasn't real.	0	1	2	3	4
8. I stayed away from reminders about it.	0	1	2	3	4
9. Pictures about it popped into my mind.	0	1	2	3	4
10. I was jumpy and easily startled.	0	1	2	3	4
11. I tried not to think about it.	0	1	2	3	4
12. I was aware that I still had a lot of feeling about it, but I didn't deal with them.	0	1	2	3	4
13. My feelings about it were kind of numb.	0	1	2	3	4
14. I found myself acting or feeling like I was back at that time.	0	1	2	3	4
15. I had trouble falling asleep.	0	1	2	3	4
16. I had waves of strong feelings about it.	0	1	2	3	4
17. I tried to remove it from my memory.	0	1	2	3	4
18. I had trouble concentrating.	0	1	2	3	4
19. Reminders of it caused me to have physical reactions, such as sweating, trouble breathing, nausea, or pounding heart.	0	1	2	3	4
20. I had dreams about it.	0	1	2	3	4
21. I felt watchful and on guard.	0	1	2	3	4

	Not at all	A little bit	Moderatel	Quite a bit	Extremely
22. I tried not to talk about it.	0	1	2	3	4

Section III

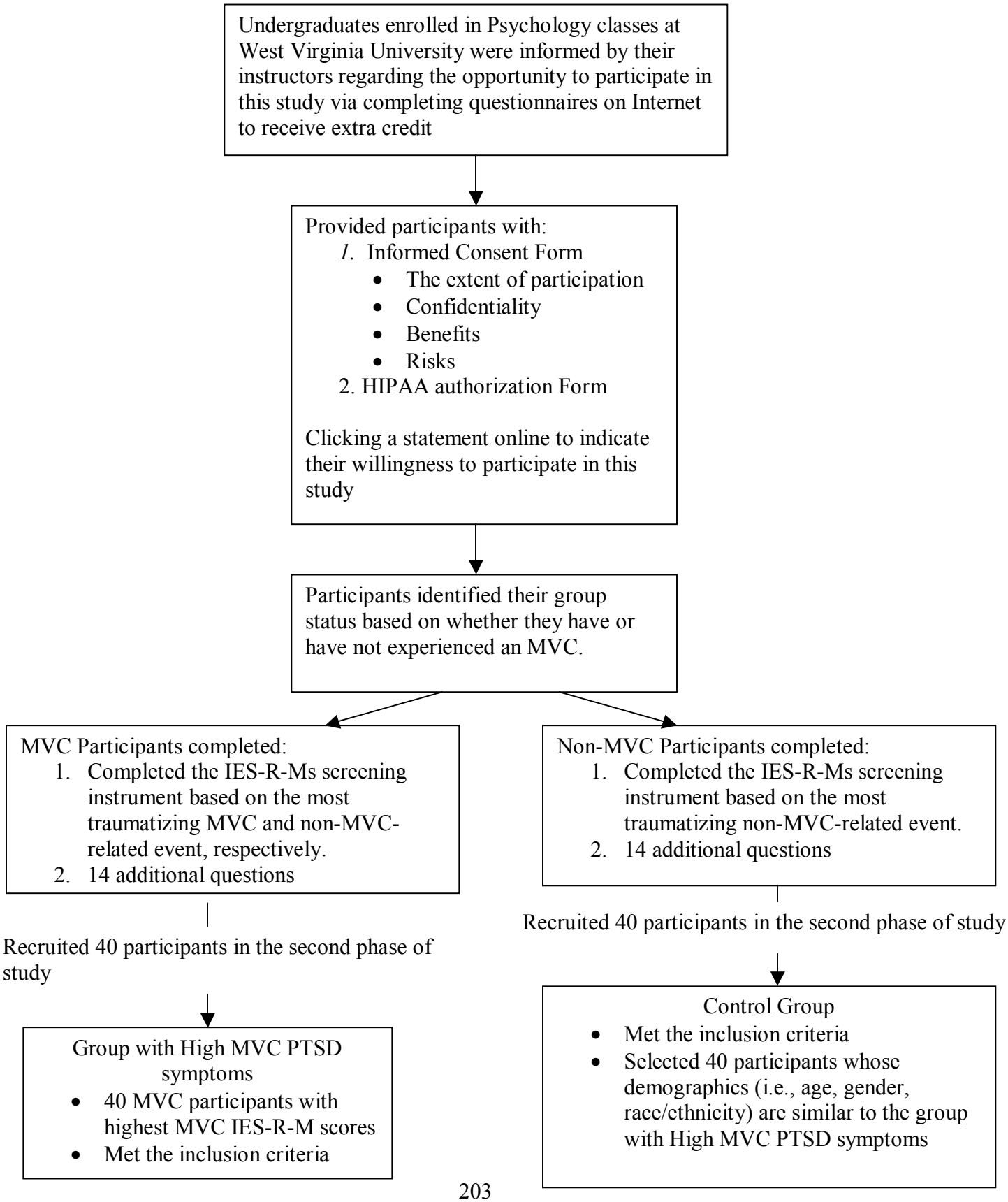
Please fill out the below questionnaire based on *the most traumatizing event that is not motor vehicle accident related*.

Instructions: The following is a list of difficulties people sometimes have after stressful life events. Please read each items, and then indicate how distressing each difficulty has been for you during the past 7 days with respect to _____ (please list the most traumatizing event that is not motor vehicle accident related here). How much were you distressed or bothered by these difficulties?

	Not at all	A little bit	Moderatel	Quite a bit	Extremely
1. Any reminder brought back feeling about it.	0	1	2	3	4
2. I had trouble staying asleep.	0	1	2	3	4
3. Other things kept making me think.	0	1	2	3	4
4. I felt irritable and angry.	0	1	2	3	4
5. I avoided letting myself get upset when I thought about it or was reminded of it.	0	1	2	3	4
6. I thought about it when I didn't mean to.	0	1	2	3	4

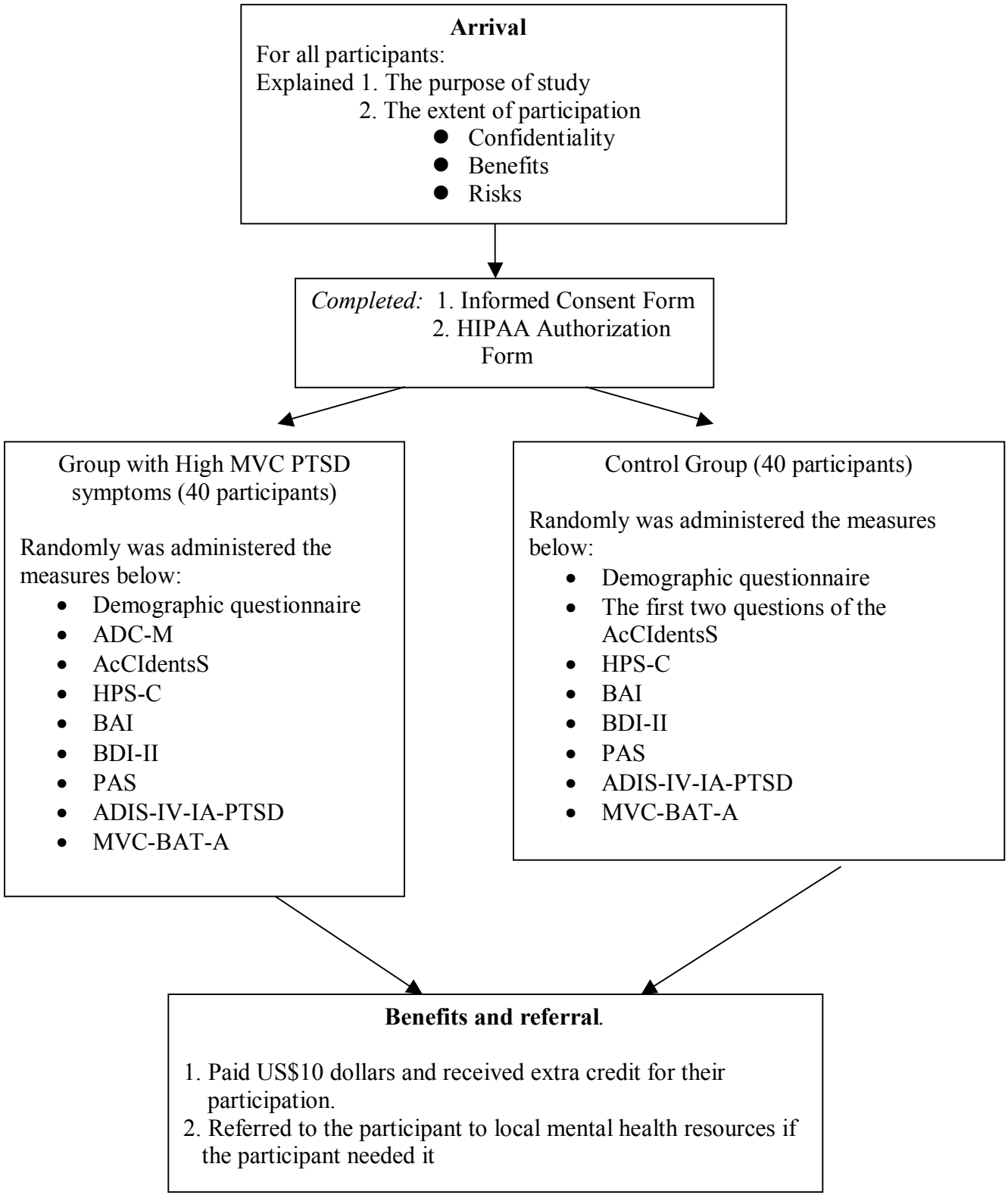
	Not at all	A little bit	Moderatel	Quite a bit	Extremely
7. I felt as if it hadn't happened or wasn't real.	0	1	2	3	4
8. I stayed away from reminders about it.	0	1	2	3	4
9. Pictures about it popped into my mind.	0	1	2	3	4
10. I was jumpy and easily startled.	0	1	2	3	4
11. I tried not to think about it.	0	1	2	3	4
12. I was aware that I still had a lot of feeling about it, but I didn't deal with them.	0	1	2	3	4
13. My feelings about it were kind of numb.	0	1	2	3	4
14. I found myself acting or feeling like I was back at that time.	0	1	2	3	4
15. I had trouble falling asleep.	0	1	2	3	4
16. I had waves of strong feelings about it.	0	1	2	3	4
17. I tried to remove it from my memory.	0	1	2	3	4
18. I had trouble concentrating.	0	1	2	3	4
19. Reminders of it caused me to have physical reactions, such as sweating, trouble breathing, nausea, or pounding heart.	0	1	2	3	4
20. I had dreams about it.	0	1	2	3	4
21. I felt watchful and on guard.	0	1	2	3	4
22. I tried not to talk about it.	0	1	2	3	4

Appendix H
Flow Chart for the Phase I (Screening Phase) of the Study



Appendix I

Flow Chart for the Phase II (Further Assessment Phase) of the Study



Appendix J
Procedures for the Administration of the MVC-BAT-A via a Computer Program

Procedure 1: Presented the instructions
Procedure 2: Presented one practice story (two segments)
Procedure 3: Presented one mental arithmetic task

I	B	S	PS1	S	PS2	S	B	S	MAT	S	B

*Abbreviations: I = Instruction, B = Baseline, S = SUDS, PS = Practice story, and MAT = Mental arithmetic task

Procedure 4: Presented two MVC- related stories (i.e., mild and severe MVC stories) and four non-MVC-related stories (i.e., surprise party, last day of school before summer, oral report, forgetting to study for a test)

- Order of presenting the six stories:
- Story 1: Last day of school before summer
- Story 2: Mild MVC story
- Story 3: Forgetting to study for a test
- Story 4: A surprise party
- Story 5: Severe MVC story
- Story 6: Giving an oral report

B	S-N	S-H	ST1-1	S-N	S-H	ST1-2	S-N	S-H	ST1-3	S-N	S-H	ST1-4	S-N	S-H
B	S-N	S-H	ST2-1	S-N	S-H	ST2-2	S-N	S-H	ST2-3	S-N	S-H	ST2-4	S-N	S-H
B	S-N	S-H	ST3-1	S-N	S-H	ST3-2	S-N	S-H	ST3-3	S-N	S-H	ST3-4	S-N	S-H
B	S-N	S-H	ST4-1	S-N	S-H	ST4-2	S-N	S-H	ST4-3	S-N	S-H	ST4-4	S-N	S-H
B	S-N	S-H	ST5-1	S-N	S-H	ST5-2	S-N	S-H	ST5-3	S-N	S-H	ST5-4	S-N	S-H
B	S-N	S-H	ST6-1	S-N	S-H	ST6-2	S-N	S-H	ST6-3	S-N	S-H	ST6-4	S-N	S-H

*Abbreviations: B = Baseline, S = SUDS ratings consisting of SUDS ratings for nervousness and happiness, ST(i)-(j): ST = Story, i = number of stories, j = number of segments for each story, for example, ST1-1 = the first segment of the Story 1 (Surprise party)