Applied Psychophysiology and Biofeedback, Vol. 30, No. 2, June 2005 (© 2005)
DOI: 10.1007/s10484-005-4307-8

Psychophysiological Assessment of Youthful Motor Vehicle Accident Survivors

Jacqueline Jones-Alexander,[1,2] **Edward B. Blanchard,**[1] **and Edward J. Hickling**[1]

Twenty-one children and adolescents (age range 8–17, mean 12.7 years) who had been in motor vehicle accidents (MVAs), and 14 non-MVA controls matched for age and gender, underwent a psychophysiological assessment in which heart rate, systolic and diastolic blood pressure, and skin conductance were measured during baseline and two stressor phases: mental arithmetic and listening to and imagining a MVA like their own. The eight youth who currently met criteria for PTSD or sub-syndromal PTSD significantly reported more subjective distress to the MVA audiotape than the 13 MVA non-PTSD youth or the 14 non-MVA controls. All groups responded physiologically to the mental arithmetic. However, in contrast to expectations, there were no differential physiological responses among the groups to the stimuli reminiscent of the trauma. Possible explanations are explored.

KEY WORDS: PTSD; psychophysiological testing; youthful PTSD; motor vehicle accidents.

Personal injury motor vehicle accidents (MVAs) are probably the leading cause of acute Posttraumatic Stress Disorder (PTSD) in the USA. There are over 3 million Americans of all ages injured in MVAs in the USA each year (USDOT, 2002); the best estimate is that about one quarter of these MVA survivors will meet criteria acutely for PTSD (Ehlers, Mayou, et al., 1998) and that one-third of those acute cases will persist for at least a year (Blanchard & Hickling, 2004).

There is a well-developed literature on the assessment and psychological treatment of PTSD in adult MVA survivors (for a summary of this adult literature see Blanchard & Hickling, 2004). The literature on assessment of possible PTSD in youthful MVA survivors is more limited but several moderate-sized cross-sectional studies (Aaron, Zaglul, & Emery, 1999; DeVries, Kassam-Adams, Canaan, et al., 1999; Ellis, Stores, & Mayou, 1998; Keppel-Benson, Ollendick, & Benson, 2002) and prospective longitudinal studies (Daviss, Mooney, Racusin, et al., 2000; DiGallo, Barton, Parry-Jones, 1997; Ehlers, Mayou, & Bryant, 2003; Mirza, Bhadrinath, Goodyer, & Gilmour, 1998; Stallard, Velleman, & Baldwin, 1998) have appeared over the past few years.

For the most part, the literature on children and adolescents mirrors the adult MVA survivor literature. For example, the rate of PTSD in adult and youthful MVA survivors

[1]Center for Stress and Anxiety Disorders, University at Albany, Albany.
[2]Address all correspondence to Jacqueline Jones-Alexander, 6004 Cranberry Drive, Raleigh, NC 27609.

appears to be similar. Blanchard and Hickling (2004) estimate that 8 to 40% of injured adult MVA survivors develop PTSD. In youthful MVA survivors the value ranges from 8 to 25% based on several large-scale studies (Aaron et al., 1999; DeVries et al., 1999; Ehlers et al., 2003; Keppel-Benson et al., 2002). Further, as in the adult population (Blanchard & Hickling, 2004) there is evidence of spontaneous remission of PTSD and PTSD symptoms in over half of youthful MVA survivors over the year following the MVA (DiGallo et al., 1997; Ehlers et al., 2003; Mirza et al., 1998; Stallard et al., 1998).

A robust assessment finding, among adult MVA survivors, is that trauma survivors with PTSD show noticeable physiological responding to cues reminiscent of the trauma (Blanchard, Hickling, Buckley, et al., 1996). In fact, this has been shown among adult survivors of other traumas such as combat in time of war (Blanchard, Kolb, Gerardi, Ryan, & Pallmeyer, 1986; Blanchard, Kolb, Taylor, & Wittrock, 1989; Keane et al., 1998; Pitman, Orr, Forgue, deJong, & Claiborn, 1987) and sexual assault (Griffith, Resick, & Mechanic, 1994). For a summary of research on MVA survivors see Blanchard and Hickling, (2004); for a summary across trauma types see Blanchard and Buckley (1999). In fact, a psychophysiological assessment is a recommended adjunct for establishing PTSD among Vietnam veterans (Gronwall, 1986).

To the best of our knowledge, there is no literature on the psychophysiological assessment of trauma sequelae among youthful trauma survivors. This absence of literature led to the following study designed to see if the robust adult psychophysiological findings would replicate in a population of child and adolescent MVA survivors, since the clinical findings do seem to be similar.

Several authors (Beidel, 1989; King, 1993; King, Ollendick, & Murphy, 1997) note that psychophysiological assessments with youth can be challenging. Beidel (1989) and King (1993) provide detailed summaries of the issues found by researchers using physiological assessments. For example, Beidel (1989) discussed the difficulty of designing psychologically provocative stimuli that take into account the range of developmental levels of children in the studies. Further, Beidel (1989) found that physiological assessments with youth must be relatively short. King (1993) notes that children may be apprehensive about the equipment used in the assessment and that children may have difficulty accepting the need for this type of assessment.

We tried to take these warnings into account in the study described below.

METHODS

Participants

Twenty-one children and adolescents (hereafter referred to as "youth") who had been in a motor vehicle accident after their sixth birthday, and whose accident occurred at least 1 month prior to the assessment, were the primary population. They ranged in age from 8 to 17 with a mean of 12.7 years. There were 11 boys and 10 girls. They were recruited through school nurses, area pediatricians, and advertising and stories in local media.

One custodial parent accompanied the youth to the assessment and gave written informed consent. The youth gave written assent after the study was described, he or she had a chance to fully explore the psychophysiology laboratory, and the parent and youth had an opportunity to discuss the procedures privately. One youth who had been in a MVA was dismissed by the experimenter when she gave obvious non-verbal indications of not wanting to participate after hearing a detailed description of the study. Another MVA youth declined to give assent for monitoring of her blood pressure and heart rate because she feared the monitoring equipment would cause discomfort. However, she agreed to permit monitoring of her electrodermal responses.

As a non-accident control we recruited 14 children and adolescents (7 boys, 7 girls, of average age 12.6 years) who had not been in a personal injury MVA and were friends or relatives of the MVA participants or of Center staff. They gave written assent and their parents gave written informed consent.

The MVA youth were given a gift certificate worth $15 for participation. Their parent received $15 to cover transportation expenses. A summary of the assessment findings were made available to the parents and any professional of their choosing (with a written release). Free non-drug treatment was offered for any MVA youth found to be suffering with PTSD symptoms. One parent of an MVA survivor asked for treatment for their child. The control youth received a gift certificate worth $20; their parents received $20.

Procedures

MVA Youth

The youth who had been in MVAs were interviewed separately from their parents about details of their MVAs (child and adolescent Motor Vehicle Accident Interview), using an adaptation of Blanchard and Hickling's (2004) structured MVA Interview. In addition, the Children's PTSD Inventory (CPTSDI) (Saigh, 1987) was administered as a structured interview as our measure of possible PTSD. The CPTSDI has good reliability (Saigh et al., 2000) and validity (Yasik et al., 2001). The interviewer (JJA) had consulted with the inventory developer, Dr Saigh, about its use. The participant also completed the PCL-C (PTSD Checklist-Child) (Weathers, Litz, Herman, Huska, & Keane, 1993) as a second measure of possible PTSD. The coefficient alpha for the PCL for this sample was 0.94. Finally, they were assessed for other possible traumas they had experienced and assessed for possible PTSD related to that trauma.

The parents of the MVA youth were interviewed separately for their version of the MVA (12 had been in the vehicle at the time of the MVA, whereas eight had not). We assessed for their perception of PTSD symptoms in their child using a structured interview, the Diagnostic Interview for Children and Adolescents-Revised (Parent Version) (Welner & Reich, 1997). All parents were assessed for possible PTSD using the Clinician-Administered PTSD Scale (CAPS, Blake et al., 1998), regardless of whether or not they had been in the accident with the youth. A number of other measures were obtained from the youth and his/her parent. They are not the participant of this report.

Control Youth

The control youth were asked about a brief psychosocial history and trauma history. If they had suffered a trauma, we followed up to see if they had developed PTSD.

Table I. Description of Experimental Conditions in the Psychophysiological Assessment of Child and Adolescent Motor Vehicle Accident Survivors

Condition	Duration	Instructions
Adaptation and initial baseline	10 min	Sit quietly with your eyes closed
Mental arithmetic	2-1/2–3 min	Count from 10 backwards by ones, Count from 30 backwards by threes Add sequential sevens
Return to baseline #1	5 min	Sit quietly with your eyes closed
Motor vehicle accident stimulus	2.5 – 3 min	Listen to the tape and try to imagine the scene as clearly as you can
Return to baseline #2	5 min	Sit quietly with your eyes closed

Note. SUDS (Subject Units of Discomfort, 0 – not at all anxious to 100 – as anxious and uncomfortable as I can imagine) ratings were taken at the end of each condition.

Psychophysiological Assessment

The psychophysiological assessment was modeled after procedures described by Blanchard and Hickling (2004) for conducting this assessment with adults. In Table I is a description of the experimental conditions, their duration, and the specific instructions given to the youth.

Unlike the work of Blanchard and Hickling (2004), we used a single audiotaped description of the MVA (rather than 2) to help keep the length of the assessment to a minimum.

The audiotape script was made by the experimenter who interviewed the youth. An example is given in Figure 1. It was designed to set the context for the accident and then to capture sensory, motor, and cognitive cues provided by the MVA survivor, in a fashion pioneered by Pitman et al. (1987) and used with several cohorts of adult MVA survivors (see Blanchard & Hickling, 2004).

We measured heart rate, in beats per minute, and blood pressure (BP), both systolic BP and diastolic BP, in millimeters of mercury, using a Critikon Dinamapp, model 1990, on a once-per-minute basis. The blood pressure cuff was placed on the upper left arm. Care was taken to use an appropriately sized cuff when the child's upper arm was small. The

> Try to picture this story in your mind. It is about 1:00 p.m. on the Wednesday of spring break. It is a bright sunny day and it is breezy. You are riding in the front seat with your mom to take your friends home (8 sec pause). Your van is stopped at ABC Road and XYZ Road and your mom is waiting to take a left-hand turn. You hear music playing (8 sec pause). Just as your mom starts to turn, you hear a loud bang and squealing sounds. You feel your van moving faster but don't understand what is happening. You feel confused and afraid (8 sec pause). As your van is pushed across the road you see cars coming at you. You are afraid someone will be hurt or killed. You feel helpless to stop what is happening (8 sec pause). There are two cars headed at your van and you feel even more afraid and you feel sick to your stomach (8 sec pause). Finally, your mom gets the van back into the right lane without getting hit again. She stops the van but you still feel worried that someone is hurt (30-sec pause). Now put that scene out of your mind. You don't have to think about it anymore.

Fig. 1. Verbatim script for descriptionn of MVA.

Dinamapp provides a once-per-minute printout. Children were seated upright in a padded chair with their feet on the floor.

We measured electrodermal activity using a Grass Model 7 polygraph with a 7-P1 pre-amplifier. Once-per-minute the pen was centered so that the value of skin resistance could be read directly from the potentiometer. It was converted arithmetically to skin conductance for analysis. We used silver–silver chloride electrodes filled with Beckman electrode gel, attached to the ventral surface of the index and middle fingers by double stick collars. The skin surface had been cleaned with alcohol wipes.

The participant was in a separate room from the monitoring equipment and experimenter. The two were in constant voice contact by an intercom and the experimenter could see the child through a one-way mirror. The participant's parent observed the procedures, without commenting, in the majority of cases.

For the control youth, a tape was selected at random with the restriction that it not be from a MVA survivor known by the control participant.

RESULTS

Because of the relatively modest sample sizes, we sub-divided the youth who had been in a MVA into two groups, those who met DSM-IV (American Psychiatric Association, 1994) criteria for either full PTSD or sub-syndromal PTSD versus those we have termed non-PTSD. The sub-syndromal category has been defined as meeting criterion A (experience of trauma and subjective reaction to it, and Criterion B (reexperiencing symptoms) and either Criterion C (avoidance and numbing symptoms) or Criterion D (hyperarousal symptoms), but not both. Blanchard and Hickling (2004) have shown it to be a useful sub-categorization in the study of MVA survivors. This yielded three groups: MVA-PTSD (and sub-syndromal PTSD) ($n = 8$), MVA non-PTSD ($n = 13$) and non-MVA controls ($n = 14$).

Manipulation Checks

To determine if the audiotaped description of the MVA was subjectively arousing, we compared the SUDS ratings of the three groups of participants at five conditions. The mean values are given in Table II.

A repeated measures MANOVA yielded a significant main effect of Phase ($F[4, 30] = 11.6$, $p < .001$), of Group ($F[2, 33] = 4.39$, $p = .020$, and interaction of Group X Phase ($F[6.1, 100.0] = 2.61$, $p = .021$ Greenhouse–Geiser correction). The interaction is primarily accounted for by the differential responding of the MVA-PTSD group to the MVA audiotape with a 47 point increase as contrasted to 16 and 14 points, respectively for the MVA-non-PTSD and non-MVA groups. These differences were significant at $p = .015$

Table II. Mean SUDS Rating as a Function of PTSD Status and Phase of Psychophysiological Assessment

	Phases				
PTSD status	Baseline	Mental arithmetic	Baseline	MVA audiotape	Baseline
MVA-PTSD	18.1	26.1	11.0	58.4	21.9
MVA-Non-PTSD	8.9	12.7	7.9	24.1	5.1
Non-MVA	4.3	18.9	8.4	22.4	5.8

Table III. Mean Values of Four Physiological Responses as a Function of PTSD Status and Phase of Assessment

	Phases				
PTSD status	Baseline	Mental arithmetic	Baseline	MVA audiotape	Baseline
Heart rate					
MVA-PTSD	78.9 (10.5)	83.9 (6.9)	78.1 (8.0)	75.8 (8.3)	76.5 (9.9)
MVA-Non-PTSD	69.8 (10.8)	78.3 (12.3)	72.4 (12.1)	71.0 (12.1)	72.6 (9.8)
Non-MVA	68.5 (13.1)	77.8 (15.0)	68.8 (10.6)	68.9 (12.9)	70.9 (10.6)
Systolic BP					
MVA-PTSD	106.8 (10.6)	110.5 (12.0)	105.3 (10.1)	105.4 (10.2)	104.3 (11.7)
MVA-Non-PTSD	108.2 (8.8)	112.5 (8.9)	107.0 (6.8)	108.3 (7.4)	109.0 (9.9)
Non-MVA	106.1 (19.0)	114.7 (12.1)	106.7 (9.8)	109.0 (9.9)	105.5 (9.3)
Diastolic BP					
MVA-PTSD	62.4 (11.2)	63.2 (8.9)	57.0 (8.9)	59.4 (8.2)	55.6 (8.5)
MVA-Non-PTSD	59.3 (5.2)	63.7 (8.1)	59.1 (4.9)	61.8 (5.0)	58.2 (4.3)
Non-MVA	58.7 (6.8)	64.2 (8.1)	55.6 (5.1)	59.0 (5.6)	56.1 (5.9)
Skin conductance					
MVA-PTSD	5.7 (4.3)	6.0 (4.1)	5.4 (1.1)	4.4 (2.9)	4.6 (3.2)
MVA-Non-PTSD	14.6 (14.9)	10.7 (9.5)	11.7 (10.7)	10.4 (11.1)	10.6 (11.5)
Non-MVA	13.1 (7.9)	8.7 (3.4)	10.3 (5.9)	7.8 (3.5)	7.6 (3.5)

and $p = .009$, respectively. Thus, the MVA-PTSD group found the cues reminiscent of the trauma very differentially distressing at the subjective level.

Mean vividness ratings were arithmetically higher for the MVA-PTSD group (76.9) than the MVA-non-PTSD group (52.7) or non-MVA group (45.9), but did not differ statistically.

Physiological Data

For data analytic purposes, we averaged three minute-by-minute readings from each condition: the last three readings from each baseline and the three available values for the two stimulus conditions. The mean values for each of the four physiological responses at each of the five experimental conditions for each of the three sets of participants are presented in Table III.

The overall MANOVA revealed a significant ($p < .001$) main effect of Phase but no main effect of Group or interaction. Follow-up analyses on each physiological response also yielded a significant main effect of Phase ($p < .001$) but no main effect of Group or interaction.

Further follow-up analyses revealed significant ($p < .001$ or better) across group increases in HR, SBP and DBP from baseline to mental arithmetic and a concomitant significant decrease ($p < .001$) from mental arithmetic to baseline 2. There was no statistically reliable reaction to the MVA audiotape in HR or SBP. However, for diastolic BP there was an across groups increase to the audiotape ($p < .001$) followed by a significant decrease ($p < .001$) when returning to baseline 3. The increase in DBP was about 2.5–3 mm Hg or about a 5% increase. Again, there was no differential responding in DBP based on group membership.

Given the arithmetic differences in mean values for HR across groups, we calculated one way ANOVAs across groups at each phase. None of these were significant, including the initial baseline value ($F[2, 32] = 2, 17$, $p = .13$).

DISCUSSION

These results were both surprising and disappointing, especially for heart rate. The literature on the psychophysiological assessment of adults with PTSD has consistently shown that trauma victims with diagnosable PTSD and subsyndromal PTSD show reliable and large differences in HR, BP and to a lesser degree electrodermal activity when they are exposed to cues reminiscent of the trauma. Such was not the case with our sample of youthful MVA survivors. The failure to find an expected result needs to be examined for possible causes.

It could be that the youth with PTSD were not physiologically responding to any stimulation. This does not seem to be the case as the youth with PTSD did respond to mental arithmetic, as did the non-MVA group and the non-PTSD group.

Perhaps the audiotapes did not capture the MVA experience. This does not seem to be the case since the SUDS ratings show that the youth with MVA-PTSD were significantly more distressed (twice the rating) with the MVA audiotape than either of the other two groups. Thus, the subjective response is what one would expect.

This discrepancy among youthful participants between self-reported distress or behavioral observations and physiological responses has been noted earlier by King (1993). He noted that these measures often do not correlate well.

Perhaps the sample sizes were too small to yield a statistically reliable effect. Sample size certainly is a limitation to the study. When one examines the mean values in Table III, one can see almost no response in HR, SBP or skin conductance. The means for the MVA-PTSD group for HR even show a *decrease* in average HR to the MVA-audiotape. Thus, there are not even trends that might become significant with a larger sample. The only exception is the trend ($p = .13$, $\eta^2 = .12$) for initial baseline HR to be the higher for the MVA-PTSD group than the other two groups. Such initial baseline differences have been noted in Vietnam combat veterans undergoing a psychophysiological assessment (Blanchard, 1990).

It is possible that psychophysiological responses other than the ones used would have shown results, or that more continuous recording of the responses would have shown results. The former seems unlikely because we used HR, BP and electrodermal activity, the same responses that have yielded results with adults. The latter is a possibility that could be explored. However, the once per minute readings have been sensitive enough with adults.

We are left without a ready explanation for these results other than to say children and adolescents seem to be different than adults in this aspect of their PTSD. King's (1993) warning about the lack of correlation among youth between self-report and physiological responses seems well taken. Because there is no other extant research on the topic of PTSD in youthful survivors, to the best of our knowledge, further research with a larger sample would certainly be to confirm or disconfirm these results.

ACKNOWLEDGMENT

This research was supported in part by a grant from NIMH, MH-48476.

REFERENCES

Aaron, J., Zaglul, H., & Emery, R. E. (1999). Posttraumatic stress in children following acute physical injury. *Journal of Pediatric Psychology*, *24,* 335–343.

American Psychiatric Association. (1994) *Diagnostic and statistical manual of mental disorders,* (4th ed.). Washington, DC: American Psychiatric Association.

Beidel, D. C. (1989). Assessing anxious emotion: A review of psychophysiological assessment in children. *Clinical Psychology Review*, *9,* 717–736.

Blake, D., Weathers, F., Nagy, L., Kaloupek, D., Klauminzer, G., Charney, D., & Keane, T. (1998). *Clinician-Administered PTSD Scale (CAPS)*. National Center for Posttraumatic Stress Disorder, Behavioral Science Division – Boston VA, Boston, MA.

Blanchard, E. B. (1990). Elevated basal levels of cardiovascular responses in Vietnam veterans with PTSD: A health problem in the making? *Journal of Anxiety Disorders*, *4,* 233–237.

Blanchard, E. B., & Buckley, T. C. (1999). Psychophysiological assessment and PTSD. In P. Saigh & D. Bremner (Eds.), *Posttraumatic stress disorder: A comprehensive approach to research* (pp. 248–266). Needham, MA: Allyn & Bacon.

Blanchard, E. B., & Hickling, E. J. (2004). *After the crash (2nd ed.)*. Washington, DC: American Psychological Association.

Blanchard, E. B., Hickling, E. J., Buckley, T. C., Taylor, A. E., Vollmer, A., & Loos, W. R. (1996). The psychophysiology of motor vehicle accident-related posttraumatic stress disorder: Replication and extension. *Journal of Consulting and Clinical Psychology*, *64,* 742–751.

Blanchard, E. B., Kolb, L. C., Gerardi, R. J., Ryan, P., & Pallmeyer, T. P. (1986). Cardiac response to relevant stimuli as an adjunctive tool for diagnosing posttraumatic stress disorder in Vietnam veterans. *Behavior Therapy*, *17,* 592–606.

Blanchard, E. B., Kolb, L. C., Taylor, A., & Wittrock, D. A. (1989). Cardiac response to relevant stimuli as an adjunct in diagnosing posttraumatic stress disorder: Replication and extension. *Behavior Therapy*, *20,* 535–543.

Daviss, W. B., Mooney, D., Racusin, R., Ford, J. D., Fleischer, A., & McHugo, G. (2000). Predicting posttraumatic stress after hospitalization for pediatric injury. *Journal of the American Academy of Child and Adolescent Psychiatry*, *39,* 576–583.

DeVries, A. P. J., Kassam-Adams, N., Canaan, A., Sherman-Slate, E., Gallagher, P. R., & Winston, F. K. (1999). Looking beyond the physical injury: Posttraumatic stress disorder in children and parents after pediatric traffic injury. *Pediatrics*, *104,* 1293–1299.

DiGallo, A., Barton, J., & Parry-Jones, W. L. (1997). Road traffic accidents: Early psychological consequences in children and adolescents. *British Journal of Psychiatry*, *170,* 358–362.

Ehlers, A., Mayou, R. A., & Bryant B. (1998) Psychological predictors of chronic posttraumatic stress disorder after motor vehicle accidents. *Journal of Abnormal Psychology*, *107,* 508–519.

Ehlers, A., Mayou, R. A., & Bryant, B. (2003). Cognitive predictors of posttraumatic stress disorder in children: Results of a prospective longitudinal study. *Behaviour Research and Therapy*, *41,* 1–10.

Ellis, A., Stores, G., & Mayou, R. (1998). Psychological consequences of road traffic accidents in children. *European Child and Adolescent Psychiatry*, *7,* 61–68.

Griffin, M. G., Resick, P. A., & Mechanic, M. B. (1994). *Psychophysiological and nonverbal assessment of peritraumatic dissociation in rape victims.* Paper presented at the 10th Annual Meeting of the International Society for Traumatic Stress Studies, Chicago, IL.

Gronwall, J. A. (1986). The *Physicians Guide*, Veterans Administration, Department of Medicine and Surgery, Clinical Affairs, Chap. 20. Psychiatric Sequelae of Military Duty in a War Zone, 20.3 (d).

Keane, T. M., Kaloupek, D. C., Blanchard, E. B., Hsieh, F. Y., Kolb, L. C., Orr, S. P., Thomas, R. G., & Lavori, P. W. (1998). Utility of psychophysiological measurement in the diagnosis of posttraumatic stress disorder: Results from a Department of Veterans Affairs Cooperative Study. *Journal of Consulting and Clinical Psychology*, *66,* 914–923.

Keppel-Benson, J. M., Ollendick, T. H., & Benson, M. J. (2002). Post-traumatic stress in children following motor vehicle accidents. *Journal of Child Psychology and Psychiatry*, *43,* 203–212.

King, N. J. (1993). Physiological assessment. In M. Hersen & T. H. Ollendick (Eds.), *Handbook of child and adolescent assessment: Vol. 167 General psychology series* (pp. 180–191). Needham Heights, MA: Allyn & Bacon.

King, N. J., Ollendick, T. H., & Murphy, G. C. (1997) Assessment of childhood phobias. *Clinical Psychology Review*, *7,* 667–687.

Mirza, K. A. H., Bhadrinath, B. R., Goodyer, I. M., & Gilmour, C. (1998). Post-traumatic stress disorder in children and adolescents following road traffic accidents. *British Journal of Psychiatry*, *172,* 443–447.

Pitman, R. K., Orr, S. P., Forgue, D. F., deJong, J. B., & Claiborn, J. M. (1987). Psychophysiologic assessment of posttraumatic stress disorder imagery in Vietnam combat veterans. *Archives of General Psychiatry*, *44,* 970–975.

Saigh, P. (1987). *The development and validation of the Children's Posttraumatic Stress Disorder Inventory*. Paper presented at the meeting of the Association for the Advancement of Behavior Therapy, Boston, MA.

Saigh, P. A., Yasik, A. E., Oberfield, R. A., Green, B., Halamadaris, P. V., Rubenstein, H., Nester, J., Reski, J., Hetz, B., & McHugh, M. (2000). The children's PTSD Inventory: Development and reliability. *Journal of Traumatic Stress*, *13,* 369–380.

Stallard, P., Velleman, R., & Baldwin, S. (1998). Prospective study of post-traumatic stress disorder in children involved in road traffic accidents. *British Medical Journal*, *317,* 619–623.

United States Department of Transportation. (nd). *Traffic safety facts 2002: final version*. Retrieved July 29, 2004, from the National Highway Traffic Safety Administration. Web site: http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCA/TSFAnn/TSF2002Final.pdf

Weathers, F. W., Litz, B. T., Herman, D. S., Huska, J. A., & Keane, T. M. (1993, October). *The PTSD Checklist: Reliability, validity, & diagnostic utility*. Paper presented at the annual meeting of the International Society for Traumatic Stress Studies, San Antonio, TX.

Welner, Z., & Reich, W. (1997). Diagnostic Interview for Children and Adolescents-Revised (Parent version). Washington University, St Louis, MO.

Yasik, A. E., Saigh, P. A., Oberfield, R. A., Green, B., Halamandaris, P., & McHugh, M. (2001). The validity of the children's PTSD Inventory. *Journal of Traumatic Stress*, *14,* 81–94.