

Posttraumatic Stress and Depressive Symptoms, Alcohol Use, and Recurrent Traumatic Life Events in a Representative Sample of Hospitalized Injured Adolescents and Their Parents

Douglas Zatzick,^{1,2,3} MD, Joan Russo,¹ PhD, David C. Grossman,² MD, MPH, Gregory Jurkovich,^{2,4} MD, Janice Sabin,² MSW, Lucy Berliner,³ MSW, and Frederick Rivara,^{2,5} MD, MPH

¹Department of Psychiatry and Behavioral Sciences, Harborview Medical Center, ²Harborview Injury Prevention and Research Center, ³National Child Traumatic Stress Network, Washington State Site at Harborview Medical Center, ⁴Department of Surgery, University of Washington School of Medicine, and ⁵Department of Pediatrics, University of Washington School of Medicine

Objective Few investigations have comprehensively assessed the scope of impairment of injured adolescents presenting to acute care inpatient settings. **Methods** Randomly sampled injured adolescent inpatients and their parents were screened for posttraumatic stress (PTS) and depressive symptoms, preinjury alcohol use, and preinjury trauma. Linear regression was used to assess which clinical, demographic, and injury characteristics were independently associated with increased levels of adolescent PTS and depressive symptoms. **Results** Seventy percent of adolescent–parent dyads endorsed high levels of PTS or depressive symptoms and/or high preinjury alcohol use. Adolescent female gender, greater levels of preinjury trauma, greater subjective distress at the time of the injury, and greater parental depressive symptoms were independently associated with increased levels of adolescent PTS and depressive symptoms.

Conclusions The adoption of early screening and intervention procedures that broadly consider the scope of impairment of injured adolescents and their family members could enhance the quality of acute care mental health service delivery.

Key words adolescents; alcohol; depression; injury; posttraumatic stress; trauma history.

The Centers for Disease Control estimate that each year in the United States approximately 600,000 adolescents incur injuries so severe that they require inpatient hospital admission (Center for Disease Control and Prevention, 1993). Adolescents treated in the acute care inpatient setting may constitute a particularly vulnerable patient population requiring more intensive investigative focus; preliminary reports from combined adult-pediatric level I trauma centers suggest that adolescents are routinely hospitalized, with adults on trauma surgical services and may not receive specialized/age appropriate services (Segui-Gomez et al., 2003; Zatzick, Jurkovich et al., 2004).

A series of seminal investigations in the acute care setting have demonstrated that high levels of early posttraumatic stress (PTS) symptoms occur frequently among youth and their parents in the days and weeks immediately following traumatic injury (Daviss, Racusin, Fleischer, Mooney, Ford, & McHugo, 2000; Di Gallo, Barton, & Parry-Jones, 1997; Fein, Kassam-Adams, Vu, & Datner, 2001; Winston et al., 2002). Greater symptomatic distress appears to be an important risk factor in the development of enduring PTS in injured youth (Aaron, Zaglul, & Emery, 1999; Daviss, Mooney, Racusin, Ford, Fleischer, & McHugo, 2000; Di Gallo et al., 1997; Ehlers,

All correspondence concerning this article should be addressed to Doug Zatzick, MD, Associate Professor, Department of Psychiatry and Behavioral Sciences, Harborview Medical Center, University of Washington, PO Box 359896, 325 Ninth Avenue, Seattle, Washington 98104-02499. E-mail: dzatzick@u.washington.edu.

Journal of Pediatric Psychology 31(4) pp. 377–387, 2006

doi:10.1093/jpepsy/jsj056

Advance Access publication August 10, 2005

Journal of Pediatric Psychology vol. 31 no. 4 © The Author 2005. Published by Oxford University Press on behalf of the Society of Pediatric Psychology. All rights reserved. For permissions, please e-mail: journals.permissions@oupjournals.org

Mayou, & Bryant, 2003; Kassam-Adams & Winston, 2004; Stallard, Velleman, & Baldwin, 1998). Acute care screening procedures (Winston, Kassam-Adams, Garcia-Espana, Ittenbach, & Cnaan, 2003) may serve to identify youth and family members at risk for enduring symptoms who may ultimately require empirically supported intervention (National Institute of Mental Health, 2002; U.S. Department of Health and Human Services, 2003).

Recent commentary has encouraged investigations that bridge public health and pediatric psychological perspectives (Fuemmeler, 2004). Population-based epidemiologic investigation can serve to characterize the scope of symptomatic impairment (Kazdin, 1996) that injured youth and their family members experience (Stoddard & Saxe, 2001). This information can in turn inform which mental health symptom clusters/disorders may be important to screen for in acute care settings. Initial epidemiological investigations can also facilitate intervention development in general medical settings by informing the selection of intervention components and combinations when multifaceted treatments are required for patients with comorbid medical and psychiatric conditions (Kazdin, 1996; Shrout, 1998; Zatzick, Simon, & Wagner, submitted for publication; Zatzick & Roy-Byrne, 2003). Commentary by child psychologists suggests that by more fully addressing issues of primary concern to youth and family members, screening and intervention procedures that broadly address the scope of impairment of patients presenting to real world treatment settings may have an increased likelihood of initially engaging youth and families in the delivery of empirically supported treatments (Weisz, Chu, & Polo, 2004; Weisz, Southam-Gerow, Gordis, & Connor-Smith, 2003).

The National Co-morbidity Survey (NCS), an epidemiological survey of mental disorders in Americans ages 15–54, established that traumatic life events and post-traumatic stress disorder (PTSD) were endemic among US civilians (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995). Eleven percent of individuals in the NCS reported that over the course of their lifetime they had experienced four or more severe traumas (e.g., natural disaster, assault). The NCS also demonstrated that over 80% of individuals with PTSD had a lifetime history of one or more co-morbid Axis I diagnoses. Major depression and alcohol use disorders were among the most common co-morbidities, occurring in 30–50% of individuals with PTSD. Other investigations of trauma exposed youth (Kilpatrick et al., 2003) and adults (Resnick, Acierno, Holmes, Dammeyer, & Kilpatrick,

2000) have also identified the constellation of PTSD, depressive symptoms, and substance abuse.

Prior investigation suggests that along with postinjury PTS, traumatically injured youth may be at risk for the development of postinjury depressive symptoms (Reijneveld, Crone, Verhulst, & Verloove-Vanhorick, 2003), are more likely to report preinjury histories of recurrent traumatic life events (Shemesh et al., 2003) and are more likely to report high levels of preinjury alcohol consumption (Spirito et al., 2001). Investigations in representative samples of injured adults across level I trauma center sites suggest that this scope of impairment/constellation of PTS and depressive symptoms, high preinjury alcohol use, and substantial preinjury cumulative trauma burden is highly prevalent (Zatzick, Jurkovich et al., 2004). A literature review revealed no previous studies that have broadly screened for this scope of impairment in adolescents admitted to acute care settings after incurring traumatic injuries.

The goal of this investigation was to assess the constellation of PTS and depressive symptoms, preinjury alcohol use, and preinjury trauma in hospitalized injured adolescents and their parents. The investigation employed clinical epidemiological methods in an effort to attain a representative sample of intentionally (e.g., injuries associated with human malice such as physical assaults) and unintentionally (e.g., motor vehicle crashes) injured adolescents admitted to a level I trauma center. The investigation also aimed to contribute to the understanding of the development of posttraumatic symptomatic distress (i.e., PTS and depressive symptoms) in the days and weeks following traumatic injury. Because pragmatically oriented acute care providers may have limited time available for mental health screening (Winston et al., 2003; Zatzick, Russo, Pitman et al., 2005), the investigation aimed to ascertain clinical, demographic, and injury characteristics readily identifiable at the time of acute care inpatient admission that were independently associated with PTS and depressive symptoms (Kraemer, Stice, Kazdin, Offord, & Kupfer, 2001).

A literature review revealed no previously published, comprehensive model for understanding the development of early symptomatic distress for injured youth initially presenting to acute care settings. Therefore, we used previous investigations of child and adolescent injury survivors to inform the selection of candidate variables. We hypothesized that adolescent female gender (Mirza, Bhadrinath, Goodyer, & Gilmour, 1998; Stallard et al., 1998; Winston et al., 2003), older age (Winston et al., 2003), and a preinjury history of emotional and behavioral disturbances (Daviss, Mooney

et al., 2000; Daviss, Racusin et al., 2000; Winston et al., 2003) would be associated in bivariate analyses with increased levels of adolescent PTS and depressive symptoms. We also hypothesized that greater levels of preinjury trauma (Daviss, Mooney et al., 2000; Daviss, Racusin et al., 2000; Shemesh et al., 2003), event severity (Fein et al., 2001; Winston et al., 2003), adolescent physiological response (Winston et al., 2003), adolescent subjective distress at the time of the trauma (Aaron et al., 1999; Di Gallo et al., 1997; Ehlers et al., 2003; Mirza et al., 1998), and parental distress (Daviss, Mooney et al., 2000; Daviss, Racusin et al., 2000; de Vries et al., 1999; Mirza et al., 1998) would be associated in bivariate analyses with increased levels of adolescent PTS and depressive symptoms. The adult injury literature (Zatzick, Roy-Byrne et al., 2004) and child and adult reviews (Brewin, Andrews, & Valentine, 2000; Foy, Madvig, Pynoos, & Camilleri, 1994) informed predictions surrounding an association between greater adolescent preinjury alcohol use, non-white ethnicity, intentional injury, and low SES, and increased levels of adolescent PTS and depressive symptoms. Finally, because some (O'Donnell, Creamer, & Pattison, 2004), but not all (Shalev et al., 1998; Zatzick, Russo, Pitman et al., 2005) previous investigations in adult injury survivors have demonstrated similar predictors of PTS and depressive symptoms, we performed exploratory analyses aimed at determining whether similar demographic, injury, and clinical characteristics were independent predictors of early PTS and depressive symptoms in injured adolescents.

Method

Participants

The patient population targeted for inclusion in the study were adolescents ages 12–18 who presented to the University of Washington's Harborview level I trauma center between July 2002 and August 2003 with injuries so severe that they required inpatient surgical admissions. Patients included in the investigations were hospitalized English-speaking survivors of intentional or unintentional injuries. Patients who were determined to have self-inflicted injuries were excluded from the study. One parent of each patient was also invited to participate in the investigation. All informed consent procedures were approved by the University of Washington's institutional review board, and full informed consent was obtained before data collection. For patients under the age of 18, adolescent assent and parental consent were obtained.

Each weekday morning a research associate downloaded a list of all newly admitted injury survivors between the ages of 12 and 18 from the Harborview automated admissions/trauma registry database. Microsoft Excel (Microsoft Inc) was used to generate random number assignments for each newly admitted adolescent. The research associate then approached each potential participant in the surgical ward in the order dictated by the random number assignments. Upon approach, inpatients with severe injuries that prevented participation were excluded from the study. With regard to cognitive status, patients approached in the ward were required to have a Glasgow Coma Scale Score (Teasdale & Jennet, 1974) of 15 and a score of at least 7 on the two Mini-mental State Examination items that assess orientation to location and date (Folstein, Folstein, & McHugh, 1975).

Of 365 adolescent inpatients assigned random numbers for approach, 16 were ineligible (14 injury too severe, 2 deceased) and 159 were discharged before approach. One hundred and eighty-eight patients were approached in the surgical ward; 18 of these patients were aged 17 or younger, had no available parent, and therefore could not undergo informed consent, 15 patients and/or parents were monolingual non-English speaking, and 1 patient was discovered to have recently attempted suicide, leaving 154 available for approach for consent. Forty potential participants refused study participation. Of the 114 consented adolescent inpatients, 5 were discharged before completion of the surgical ward interview, 1 withdrew from the study, and 11 did not complete the interview within 30 days after the trauma, leaving 97 adolescents in the investigation. Nine 18-year-old adolescents were not living with parents and 5 parent interviews could not be completed before 30 days after the injury leaving 83 parents in the investigation.

Data Collection

Adolescents and parents were separately interviewed for approximately 1 h each. The hour-long interview contained measures assessing current symptoms, and preinjury health service use and functioning. Adolescent self-report was used to assess all adolescent symptoms and parent self-report was used to assess all parent symptoms. The investigation aimed to complete both the adolescent and parent assessment as early on after the traumatic injury as possible. Interviews were performed either in-person during the inpatient hospital admission or over the telephone after hospital discharge. Telephone follow-up is a commonly employed assessment strategy in acute care studies of trauma exposed youth

and families (Daviss, Mooney et al., 2000; de Vries et al., 1999; Fein et al., 2001). A series of investigations support the equivalence of in-person and telephone assessments across a spectrum of anxiety and depressive disorders including PTSD (Dansky, Saladin, Brady, Kilpatrick, & Resnick, 1995; Paulsen, Crowe, Noyes, & Pfohl, 1988; Wells, Burnam, Leake, & Robbins, 1988). In this investigation, combining parent and adolescent interviews, 48% ($n = 86$) were performed in-person and 52% ($n = 94$) over the telephone. Interviews were conducted by research associates trained by the principal investigator (PI).

Measures

Adolescent PTS Symptoms

Adolescent posttraumatic stress symptoms were assessed with the adolescent version of the UCLA Reaction Index (RI) for DSM-IV (Steinberg, Brymer, Decker, & Pynoos, 2004). The RI includes seven items that evaluate the PTSD A1 criteria (i.e., exposure to traumatic elements of the event) and five items that assess the PTSD A2 criteria (i.e., subjective experience of the event). Each PTSD A1 and A2 item is scored as present or absent. The RI also included 20 items that assess the DSM-IV B (intrusion), C (avoidance), and D (arousal) PTSD symptom clusters. These items are rated on a five-point Likert scale ranging from 0 (none of the time) to 4 (most of the time). Adolescents were asked to anchor all symptom reports to the injury event (e.g., "How much of the time since your injury did you have dreams about the event in which you were injured or other bad dreams"). Steinberg et al. report a Chronbach's alpha for the RI in the range of 0.90 (Steinberg et al., 2004). In this investigation Chronbach's alpha for the measure was .87. An RI cutoff score of 38 or greater has a sensitivity of 0.93 and specificity of 0.87 when compared to the Child and Adolescent version of the Clinician-Administered PTSD scale (Steinberg et al., 2004); this cutoff was used in this investigation to assess for high PTS symptom levels. The RI has been previously used to assess PTS symptoms in injured youth presenting to acute care settings (Aaron et al., 1999; Shemesh et al., 2003).

Parent PTS Symptoms

We used the civilian version of the Post-Traumatic Stress Disorder Checklist (PCL) (Weathers, Huska, & Keane, 1991), a 17-item self-report Likert response (1–5) questionnaire, to assess the intrusive, avoidant, and arousal PTSD symptom clusters. The measure has established reliability and validity (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996) and has been used extensively to assess PTS in the acute care setting (Marshall &

Schell, 2002; Zatzick et al., 2002). All parent symptom responses were anchored to the injury event. In this investigation, the Chronbach's alpha for the measure was .93. In a study of motor vehicle crash survivors, Blanchard et al. report that a cutoff score of 45 or greater had a sensitivity of 0.95 and specificity of 0.86 when compared to the gold standard Clinician-Administered PTSD Scale (CAPS) (Blanchard et al., 1996); this cutoff was used in this investigation to assess for high levels of PTS symptoms.

Adolescent and Parent Depressive Symptoms

The Center for Epidemiological Studies Depression Scale (CES-D) (Radloff, 1977), a 20-item self-report Likert response (0–3) instrument, was used to assess adolescent and parent depressive symptoms. The scale has been used extensively to assess depressive symptoms in adolescents (Wight, Sepulveda, & Aneshensel, 2004) and has excellent internal consistency and convergent validity (Radloff, 1977). In this investigation, Chronbach's alpha for adolescents was .88 and .92 for parents. A score of 27 or greater has been suggested as a conservative indicator of high levels of depressive symptoms (McDowell & Newell, 1996); this cutoff was used in this investigation to assess for high levels of depressive symptoms.

Adolescent and Parent Preinjury Alcohol Use

Alcohol consumption in the year before the index injury was assessed with the Alcohol Use Disorders Identification Test (AUDIT), a 10 item self-report screening measure used for early identification of problem drinking in the acute care setting (Babor & Grant, 1989; Gentilello, Donovan, Dunn, & Rivara, 1995). The measure has established reliability, validity, and responsiveness to change (Bradley et al., 1998). In this investigation the Chronbach's alpha for the AUDIT was .86 for adolescents and .88 for parents. A cutoff of ≥ 8 was used as an indicator of high levels of preinjury alcohol consumption (Gentilello et al., 1995).

Adolescent and Parent Preinjury Trauma

Traumatic life events that predated the adolescent's index injury admission were screened for using a modified version of the RI trauma history screen (Steinberg et al., 2004). The version of the RI trauma screen that was used assessed lifetime exposure to natural disasters, motor vehicle crashes, war zones, physical assault, witnessing violence or death, sudden unexpected loss of a loved one, and life threatening medical conditions.

To assess prior traumatic life events in parents, we used a modified version of the traumatic event inventory

that accompanies the Composite International Diagnostic Interview (CIDI) (World Health Organization, 1997). The CIDI was developed by the World Health Organization to be used by lay interviewers to assess mental disorders including PTSD (Kessler et al., 1995). The measure screens for the occurrence of 12 traumatic life events such as physical and sexual assault, natural disasters, and combat.

Injury Severity

Injury severity was abstracted from surgical records using a conversion software program (The Johns Hopkins Health Services Research and Development Center, 1989) that transforms recognized *International Classification of Disease Ninth Version Clinical Modification (ICD-9CM)* codes into Abbreviated Injury Scale (AIS) and subsequently injury severity scores (ISS) (The Committee on Injury Scaling, 1985).

Other Demographic and Injury Characteristics

We used self-report and/or trauma registry data to ascertain injury type and admit insurance status. Based on adolescent and parent retrospective reports, we created a variable documenting any adolescent history of psychiatric diagnosis, psychotropic medication use, or mental health visits in the year before injury. We examined insurance status as a readily identifiable acute care proxy for socioeconomic status (Brewin et al., 2000).

Statistical Analyses

To assess the representativeness of the sample we compared the demographic, injury, and clinical characteristics of patients included in the investigation with the characteristics of all eligible adolescent patients admitted to Harborview trauma surgery services during the time period of the study. Next, we ascertained the frequencies of high levels of PTS and depressive symptoms, preinjury alcohol consumption, and preinjury trauma for adolescents, parents, and adolescent–parent dyads.

We examined the bivariate associations between adolescent and parent demographic, injury, and clinical characteristics, and adolescent RI and CES-D scale scores. To assess which clinical, injury, and demographic characteristics were independently and significantly associated with the development of increased levels of adolescent PTS and depressive symptoms, we developed four linear regression models. Two regressions that included only adolescent clinical characteristics ($n = 97$) identified variables independently associated with greater RI and CES-D scale scores; these regressions were included to maintain the representative sampling frame. Two regressions used both adolescent and

parent clinical characteristics ($n = 83$) to identify variables independently associated with greater RI and CES-D scale scores. Adolescent and/or parent characteristics that demonstrated significant bivariate ($p < .05$) associations with either RI or CES-D scores were tested in the regression models. The final linear regression models retained only those adolescent and parent clinical variables that demonstrated significant independent associations with increased levels of adolescent PTS and depressive symptoms.

Results

Adolescent patients included in the study did not significantly differ from all adolescent patients admitted to Harborview surgical services with regard to gender (percent female in study sample 32% vs. percent female all other admissions 30%; $\chi^2(1) = 0.23$, $p = .63$), age (mean = 15.9, standard deviation (SD) = 1.9 vs. 15.8 (1.9); $t(677) = 1.3$, $p = .20$), injury type (study sample intentional injury 12% vs. all others 9%; $\chi^2(1) = 0.66$, $p = .42$), injury severity (ISS mean = 9.7 (6.2) vs. 11.0 (10.2), $t(669) = 1.1$, $p = .27$), alcohol toxicology status (percent positive 8 vs. 7%; $\chi^2(2) = 0.38$, $p = .83$), or inpatient length of stay (mean = 5 days (6.1) = 5.0 days (7.3); logarithm transformed $t(677) = 0.68$, $p = .27$).

Study adolescents were admitted after heterogeneous traumatic events. These included motor vehicle related injuries 47% ($n = 46$, i.e., automobile, motorcycle, bicycle, or pedestrian vs. motor vehicle), falls 18% ($n = 17$), physical assaults 8% ($n = 8$), sports injuries 7% ($n = 7$), intentional or unintentional stabbings 5% ($n = 5$) and gunshots 4% ($n = 4$), burn injuries 5% ($n = 5$), and other miscellaneous injury events 5% ($n = 5$, e.g., near-drowning).

Adolescents were interviewed a median of 7 days after the injury (range 0–28 days) and parents were interviewed a median of 6 days after the injury (range 0–28 days). Of the parents interviewed 75% ($n = 62$) were the adolescent's biological mother, 24% ($n = 19$) were biological fathers, and 2% were adopted ($n = 1$) or foster ($n = 1$) mothers.

The mean RI score for adolescents was 37.8 (SD = 12.9). The mean CES-D score for adolescents was 17.4 (SD = 11.0). Adolescent RI and CES-D scores were significantly correlated ($r = .68$, $p < .001$). Forty-one percent ($n = 40$) of adolescents had RI scores ≥ 38 , 17% ($n = 16$) had CES-D scores ≥ 27 , and 13% ($n = 13$) had AUDIT scores ≥ 8 . In total, 47% ($n = 46$) of adolescents had either high levels of PTS and depressive symptoms and/or high preinjury alcohol consumption.

The mean parent PCL score was 35.8 ($SD = 16.2$) and the mean parent CES-D score was 18.2 ($SD = 12.1$) (Table I). Parent PCL and CES-D scores were significantly correlated ($r = .76, p < .001$). Twenty-eight percent ($n = 23$) of parents had PCL scores ≥ 45 , 23% ($n = 20$) had CES-D scores ≥ 27 , and 16% ($n = 13$) had AUDIT scores ≥ 8 . All together 58% ($n = 48$) of parents had either high levels of PTS and depressive symptoms and/or high preinjury alcohol consumption. In total 70% ($n = 58$) of adolescent-parent dyads had high symptom levels and/or high preinjury alcohol consumption.

Thirty percent ($n = 29$) of adolescents endorsed experiencing four or more serious prior traumatic life events that predated the index injury. Forty percent of parents ($n = 33$) endorsed experiencing four or more prior traumas. Adolescent and parent prior trauma were significantly correlated ($r = .28, p = .01$).

In bivariate analyses, adolescent gender (female) and ethnicity (non-white), greater levels of exposure (PTSD A1 criteria) and subjective distress (PTSD A2 criteria), greater prior trauma, and preinjury alcohol use were significantly associated with increased RI and CES-D scale scores (Table I). Parent PTS and depressive symp-

toms were also associated with significantly increased adolescent RI and CES-D scores.

Adolescent female gender, greater subjective distress, and greater preinjury trauma were significant independent predictors of both adolescent PTS and depressive symptoms in linear regression models that included adolescent characteristics (Table II). Female gender, greater subjective distress, greater preinjury trauma, and parental depressive symptoms were significant independent predictors of both adolescent PTS and depressive symptoms in linear regression models that included adolescent and parent characteristics.

Conclusions

To our knowledge this is the first investigation to document a scope of impairment that includes PTS, but also extends to high levels of postinjury depressive symptoms, high preinjury alcohol use, and preinjury histories of recurrent traumatic life events in a representative sample of hospitalized injured adolescents and their parents. This investigation found that 70% of adolescent-parent dyads endorsed high levels of PTS and depressive symptoms and/or high preinjury alcohol consumption.

Table I. Demographic, Injury, and Clinical Characteristics of Study Patients and Associations with Adolescent Posttraumatic Stress (PTS) and Depressive Symptoms

	Mean (SD)	n (%)	Association with RI ^a	Association with CESD ^a
Adolescent demographics				
Age	15.9 (1.9)		0.04	0.21*
Female		32 (33)	4.32***	3.49**
Non-White		27 (28)	2.61**	2.12*
Public Insurance		24 (25)	0.67	0.51
Injury characteristics				
Injury severity (ISS)	9.8 (6.3)		0.08	0.03
Exposure to traumatic elements of the injury event (PTSD A1 criteria)	2.6 (1.5)		0.31**	0.29**
Unintentional injury		86 (89)	0.59	0.86
Adolescent clinical characteristics				
Emergency Department Heart Rate	94.0 (22.8)		0.10	0.12
Adolescent's subjective response to injury event (PTSD A2 criteria)	2.3 (1.4)		0.50***	0.40***
Pre-injury trauma	2.5 (1.8)		0.22*	0.25*
Pre-injury alcohol use (AUDIT)	2.5 (4.7)		0.29*	0.29*
Prior psych meds, DX, or service use		13 (13)	0.34	1.27
Parental clinical characteristics				
PTS symptoms	35.4 (16.1)		0.40***	0.26*
Depressive symptoms	18.2 (12.0)		0.40***	0.41***
Pre-injury trauma	3.2 (2.1)		0.17	0.25*

AUDIT, Alcohol Use Disorders Identification Test (Babor & Grant, 1989); CES-D, Center for Epidemiologic Studies Depression Scale (Radloff, 1977); PTSD, posttraumatic stress disorder; RI, PTSD Reaction Index (Steinberg et al., 2004).

^aPearson's correlations or *t*-test ($df = 95$ for adolescent variables, $df = 81$ for parent variables).

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table II. Demographic, Injury, and Clinical Characteristics Associated with Adolescent Posttraumatic Stress (PTS) and Depressive Symptoms: Linear Regression Results

Characteristic	PTS: adolescent variables (N = 97) ^a		PTS: adolescent and parent variables (N = 83) ^b		Depressive symptoms: adolescent variables (N = 97) ^c		Depressive symptoms: adolescent and parent variables (N = 83) ^d	
	Standardized β	SE	Standardized β	SE	Standardized β	SE	Standardized β	SE
Adolescent demographics								
Female gender	0.32***	2.23	0.31***	2.27	0.26**	2.06	0.27**	2.10
Adolescent clinical characteristics								
Adolescent's subjective response to injury event (PTSD A2 criteria)	0.44***	0.77	0.40***	0.81	0.36***	0.71	0.32**	0.75
Pre-injury trauma	0.21*	0.58	0.17*	0.60	0.24**	0.53	0.19*	0.56
Parent clinical characteristics								
Depressive symptoms			0.25**	0.09			0.29**	0.09

Adolescent PTS symptoms, posttraumatic stress disorder (PTSD) A2 criteria, and pre-injury trauma were assessed with the PTSD Reaction Index (Steinberg et al., 2004).

Depressive symptoms in adolescents and parents were assessed with the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977).

^aAdjusted R² = 0.37, F = 20.15, df = 3, 93, p < .001.

^bAdjusted R² = 0.44, F = 17.12, df = 4, 78, p < .001.

^cAdjusted R² = 0.27, F = 12.88, df = 3, 93, p < .001.

^dAdjusted R² = 0.37, F = 12.82, df = 4, 78, p < .001.

*p < .05. **p < .01. ***p < .001

Whereas, only 11% of American civilians ages 15–54 report experiencing four or more lifetime traumas (Kessler et al., 1995), 40% of parents and 30% of injured adolescents endorsed four lifetime traumas before the index injury admission. On average, adolescents experienced 2.5 serious traumatic life events before the event in which they were injured. These findings contextualize the current injury care episode within a developmental trajectory that may potentially include a history of recurrent traumatic life events.

Our results corroborate and extend observations from previous investigations as prior studies have identified female gender, greater adolescent subjective distress, greater preinjury trauma, and greater parental distress as predictors of early and prolonged PTS in youth after injury (Daviss, Mooney et al., 2000; Daviss, Racusin et al., 2000; Mirza et al., 1998; Stallard et al., 1998; Winston et al., 2003). To our knowledge, this is the first investigation in injured youth to identify similar independent predictors of PTS and depressive symptoms (O'Donnell et al., 2004). In terms of negative findings, because we limited our sample to the population of adolescents admitted to the hospital, this may have restricted the range and severity of injuries and may in part explain why injury severity was not identified as a significant predictor of early symptomatic distress. Also, we found no association between acute physiological response and early symptomatic distress; recent investigation suggests that longitudinal assessment of PTS in the weeks and months postinjury may be required to

identify this association (Zatzick, Russo, Pitman, et al., 2005). Also, the prior psychiatric diagnoses variable was derived exclusively from self-reports and may not have fully captured psychiatric histories.

This study has some limitations. The RI and CES-D cutoffs used to identify high levels of PTS and depressive symptoms were developed in outpatient samples and may not generalize to acute care inpatient evaluations. We did not assess PTS and depressive symptom levels beyond the 30-day postinjury time point; symptom levels are known to decline in the weeks and months postinjury. Thus, the frequencies of high symptom levels reported may be accurate estimates of individuals who will screen positive in acute care inpatient settings, but may overestimate the number of individuals who will ultimately develop chronic PTSD and depression. The results of the investigation may not generalize to less severely injured youth who present to the emergency department but are not admitted. Finally, approximately half of the subjects were interviewed after hospital discharge.

Beyond these limitations, the investigation's findings have important implications for the development of acute care screening and intervention procedures for populations of injured adolescents and their families. Between 13 and 30% of injured adolescents suffered from high levels of preinjury alcohol consumption and/or high levels of preinjury recurrent traumatic life events. Other investigations have demonstrated that trauma exposed youth are at risk for increased posttraumatic

alcohol consumption (Reijneveld et al., 2003) and recurrent posttraumatic life events including reinjury (Johnston, Grossman, Connell, & Koepsell, 2000; Litaker, 1996; Taylor, MacIntyre, & Forgeron, 1999). Future prospective investigations of injured youth should assess whether high preinjury alcohol consumption is a risk factor for reinjury after an index injury hospital admission (Rivara, Koepsell, Jurkovich, Gurney, & Soderberg, 1993). Findings of an association between preinjury alcohol consumption and recurrent traumatic injury would suggest the development of combined intervention procedures that target both postinjury PTSD and postinjury alcohol consumption. In this case, combined interventions could productively address primary and secondary PTSD prevention (Gentilello et al., 1999; Kazdin, 1996; Zatzick et al., submitted for publication; Zatzick, Roy-Byrne et al., 2004).

The finding that depressive symptoms are highly prevalent in populations of injured adolescents informs the selection of intervention components for clinical trials that target the secondary prevention of PTSD (Kazdin, 1996; Zatzick & Roy-Byrne, 2003; Zatzick, Roy-Byrne et al., 2004). Although secondary prevention trials of antidepressant trials have been initiated for injured youth with PTSD (Robert, Blakeney, Villareal, Rosenberg, & Meyer, 1999), the question of safety of anti-depressant medications for youth with depressive spectrum disorders is currently being debated (Glass, 2004; Riba, 2004; Varley, 2003). The findings of the current investigation could favor initial trials of cognitive behavioral psychotherapy interventions with established safety and efficacy in other populations of trauma exposed youth (Taylor & Chemtob, 2004).

Finally, pragmatically oriented, time pressured acute care providers have demonstrated a reluctance to systematically implement mental health screening and intervention procedures (Zatzick, Russo, Rivara et al., 2005). Future research efforts may need to be linked to changes in acute care policy surrounding the delivery of high quality mental health care for injured youth and their families.

Acknowledgments

This investigation was supported by grants from the University of Washington's Royalty Research Foundation, NIMH grant MH01610, and CDC grant R49/CCR002570. The authors thank Melissa Hanbey and Barbara MacCalla for their help with the preparation of the manuscript. Also, the authors express appreciation to the special issues editor and anonymous reviewers

for their helpful comments on earlier drafts of this manuscript.

Received June 30, 2004; revisions received November 5, 2004 and February 25, 2005; accepted February 27, 2005

References

- Aaron, J., Zaglul, H., & Emery, R. E. (1999). Posttraumatic stress in children following acute physical injury. *Journal of Pediatric Psychology, 24*, 335–343.
- Babor, T. F., & Grant, M. (1989). From clinical research to secondary prevention: International collaboration in the development of the alcohol use disorders identification test. *Alcohol Health and Research World, 13*, 371–374.
- Blanchard, E. B., Jones-Alexander, J., Buckley, T. C., & Forneris, C. A. (1996). Psychometric properties of the PTSD Checklist. *Behaviour Research and Therapy, 34*, 669–673.
- Bradley, K. A., McDonell, M. B., Bush, K., Kivlahan, D. R., Diehr, P., & Fihn, S. D. (1998). The AUDIT alcohol consumption questions: Reliability, validity, and responsiveness to change in older male primary care patients. *Alcoholism: Clinical and Experimental Research, 22*, 1842–1849.
- Brewin, C. R., Andrews, B., & Valentine, J. D. (2000). Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *Journal of Consulting and Clinical Psychology, 68*, 748–766.
- Center for Disease Control and Prevention. (1993). *Injury and mortality: National summary of injury mortality data 1984–1990*. Atlanta, GA: Centers for Disease Control and Prevention.
- Dansky, B. S., Saladin, M. E., Brady, K. T., Kilpatrick, D. G., & Resnick, H. S. (1995). Prevalence of victimization and posttraumatic stress disorder among women with substance abuse disorders: Comparison of telephone and in-person assessment samples. *International Journal of Addictions, 30*, 1079–1099.
- Daviss, W. B., Mooney, D., Racusin, R., Ford, J. D., Fleischer, A., & McHugo, G. J. (2000). Predicting posttraumatic stress after hospitalization for pediatric injury. *Journal of the American Academy of Child and Adolescent Psychiatry, 39*, 576–583.
- Daviss, W. B., Racusin, R., Fleischer, A., Mooney, D., Ford, J. D., & McHugo, G. J. (2000). Acute stress disorder symptomatology during hospitalization for pediatric injury. *Journal of the American Academy of Child and Adolescent Psychiatry, 39*, 569–575.

- Di Gallo, 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. (2003). Cognitive predictors of posttraumatic stress disorder in children: Results of a prospective longitudinal study. *Behaviour Genetics and Therapy, 41*, 1–10.
- Fein, J. A., Kassam-Adams, N., Vu, T., & Datner, E. M. (2001). Emergency department evaluation of acute stress disorder symptoms in violently injured youths. *Annals of Emergency Medicine, 38*, 391–396.
- Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state." A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research, 12*, 189–198.
- Foy, D., Madvig, B., Pynoos, R., & Camilleri, A. (1994). Etiologic factors in the development of posttraumatic stress disorder in children and adolescents. *Journal of School Psychology, 34*, 133–145.
- Fuemmeler, B. F. (2004). Bridging disciplines: An introduction to the special issue on public health and pediatric psychology. *Journal of Pediatric Psychology, 29*, 405–414.
- Gentilello, L. M., Donovan, D. M., Dunn, C. W., & Rivara, F. P. (1995). Alcohol interventions in trauma centers: Current practice and future directions. *Journal of the American Medical Association, 274*, 1043–1048.
- Gentilello, L. M., Rivara, F. P., Donovan, D. M., Jurkovich, G. J., Daranciang, E., Dunn, C. W., et al. (1999). Alcohol interventions in a trauma center as a means of reducing the risk of injury recurrence. *Annals of Surgery, 230*, 473–480.
- Glass, R. M. (2004). Treatment of adolescents with major depression: Contributions of a major trial. *Journal of the American Medical Association, 292*, 861–863.
- Johnston, B. D., Grossman, D. C., Connell, F. A., & Koepsell, T. D. (2000). High-risk periods for childhood injury among siblings. *Pediatrics, 105*, 562–568.
- Kassam-Adams, N., & Winston, F. K. (2004). Predicting child PTSD: The relationship between acute stress disorder and PTSD in injured children. *Journal of the American Academy of Child and Adolescent Psychiatry, 43*, 403–411.
- Kazdin, A. (1996). Combined and multimodal treatments in child and adolescent psychotherapy: Issues, challenges, and research directions. *Clinical Psychology: Science and Practice, 3*, 69–100.
- Kessler, R. C., Sonnega, A., Bromet, E., Hughes, M., & Nelson, C. B. (1995). Posttraumatic stress disorder in the National Comorbidity Survey. *Archives of General Psychiatry, 52*, 1048–1060.
- Kilpatrick, D. G., Ruggiero, K. J., Acierno, R., Saunders, B. E., Resnick, H. S., & Best, C. L. (2003). Violence and risk of PTSD, major depression, substance abuse/dependence, and comorbidity: Results from the National Survey of Adolescents. *Journal of Consulting and Clinical Psychology, 71*, 692–700.
- Kraemer, H. C., Stice, E., Kazdin, A., Offord, D., & Kupfer, D. (2001). How do risk factors work together? Mediators, moderators, and independent, overlapping, and proxy risk factors. *American Journal of Psychiatry, 158*, 848–856.
- Litaker, D. (1996). Preventing recurring injuries from violence: The risk of assault among Cleveland youth after hospitalization. *American Journal of Public Health, 86*, 1633–1636.
- Marshall, G. N., & Schell, T. L. (2002). Reappraising the link between peritraumatic dissociation and PTSD symptom severity: Evidence from a longitudinal study of community violence survivors. *Journal of Abnormal Psychology, 111*, 626–636.
- McDowell, I., & Newell, C. (1996). The Center for Epidemiologic Studies Depression Scale (CES-D). In I. McDowell & C. Newell (Eds.), *Measuring health: A guide to rating scales and questionnaires* (2nd ed., pp. 254–258). New York: Oxford University Press.
- 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.
- National Institute of Mental Health. (2002). *Mental health and mass violence: Evidence-based early psychological intervention for victims/survivors of mass violence. A workshop to reach consensus on best practices* (NIH Publication No. 02-5138). Washington, DC: National Institute of Mental Health.
- O'Donnell, M. L., Creamer, M., & Pattison, P. (2004). Posttraumatic stress disorder and depression following trauma: Understanding comorbidity. *American Journal of Psychiatry, 161*, 1390–1396.
- Paulsen, A. S., Crowe, R. R., Noyes, R., & Pfohl, B. (1988). Reliability of the telephone interview in diagnosing anxiety disorders. *Archives of General Psychiatry, 45*, 62–63.
- Radloff, L. S. (1977). The CES-D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*, 385–401.
- Reijneveld, S. A., Crone, M. R., Verhulst, F. C., & Verloove-Vanhorick, S. P. (2003). The effect of

- a severe disaster on the mental health of adolescents: A controlled study. *Lancet*, 362, 691–696.
- Resnick, H., Acierno, R., Holmes, M., Dammeyer, M., & Kilpatrick, D. (2000). Emergency evaluation and intervention with female victims of rape and other violence. *Journal of Clinical Psychology*, 56, 1317–1333.
- Riba, M. (2004). SSRIs: Beware of rush to judgment. *Psychiatric News*, 39, 3.
- Rivara, F. P., Koepsell, T. D., Jurkovich, G. J., Gurney, J. G., & Soderberg, R. (1993). The effects of alcohol abuse on readmission for trauma. *Journal of the American Medical Association*, 270, 1962–1964.
- Robert, R., Blakeney, P. E., Villareal, C., Rosenberg, L., & Meyer, W. J. (1999). Imipramine treatment in pediatric burn patients with symptoms of acute stress disorder. *Journal of the American Academy of Child and Adolescent Psychiatry*, 38, 873–882.
- Segui-Gomez, M., Chang, D. C., Paidas, C. N., Jurkovich, G. J., Mackenzie, E. J., & Rivara, F. P. (2003). Pediatric trauma care: An overview of pediatric trauma systems and their practices in 18 US states. *Journal of Pediatric Surgery*, 38, 1162–1169.
- Shalev, A. Y., Freedman, S., Peri, T., Brandes, D., Sahar, T., Orr, S. P., et al. (1998). Prospective study of posttraumatic stress disorder and depression following trauma. *American Journal of Psychiatry*, 155, 630–637.
- Shemesh, E., Keshavarz, R., Leichtling, N. K., Weinberg, E., Mousavi, A., Sadow, K., et al. (2003). Pediatric emergency department assessment of psychological trauma and posttraumatic stress. *Psychiatric Services*, 54, 1277–1281.
- Shrout, P. E. (1998). Causal modeling of epidemiological data on psychiatric disorders. *Social Psychiatry and Psychiatric Epidemiology*, 33, 400–404.
- Spirito, A., Barnett, N. P., Lewander, W., Colby, S. M., Rohsenow, D. J., Eaton, C. A., et al. (2001). Risks associated with alcohol-positive status among adolescents in the emergency department: A matched case-control study. *Journal of Pediatrics*, 139, 694–699.
- 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, 1619–1623.
- Steinberg, A. M., Brymer, M. J., Decker, K. B., & Pynoos, R. S. (2004). The University of California at Los Angeles post-traumatic stress disorder reaction index. *Current Psychiatry Reports*, 6, 96–100.
- Stoddard, F. J., & Saxe, G. (2001). Ten-year research review of physical injuries. *Journal of the American Academy of Child and Adolescent Psychiatry*, 40, 1128–1145.
- Taylor, T. L., & Chemtob, C. M. (2004). Efficacy of treatment for child and adolescent traumatic stress. *Archives of Pediatrics and Adolescent Medicine*, 158, 786–791.
- Taylor, B. W., MacIntyre, J., & Forgeron, P. (1999). Trauma recurrence in the pediatric emergency population. *Journal of Trauma: Injury, Infection, and Critical Care*, 46, 479–482.
- Teasdale, G., & Jennet, B. (1974). Assessment of coma and impaired consciousness: A practical scale. *Lancet*, 2, 81–84.
- The Committee on Injury Scaling. (1985). *The abbreviated injury scale, 1985 revision*. Morton Grove, IL: American Association for the Advancement of Automotive Medicine.
- The Johns Hopkins Health Services Research and Development Center. (1989). *Determining injury severity from hospital discharges: A program to map ICD-9CM diagnoses into AIS and ISS severity scores*. Baltimore, MD: The Johns Hopkins University Press.
- U.S. Department of Health and Human Services. (2003). *Mental health all-hazards disaster planning guidance* (DHHS Publication No. SMA 3829). Rockville, MD: Center for Mental Health Services, Substance Abuse and Mental Health Services Administration.
- Varley, C. K. (2003). Psychopharmacological treatment of major depressive disorder in children and adolescents. *Journal of the American Medical Association*, 290, 1091–1093.
- de Vries, A. P. J., Kassam-Adams, N., Cnaan, 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.
- Weathers, F. W., Huska, J. A., & Keane, T. M. (1991). *The PTSD checklist-civilian version*. Boston, MA: The National Center For PTSD and Boston, VA: Medical Center.
- Weisz, J. R., Chu, B. C., & Polo, A. J. (2004). Treatment dissemination and evidence-based practice: Strengthening intervention through clinician-researcher collaboration. *Clinical Psychology: Science and Practice*, 11, 300–307.

- Weisz, J. R., Southam-Gerow, M. A., Gordis, E. B., & Connor-Smith, J. (2003). Primary and secondary control enhancement training for youth depression. In A. E. Kazdin & J. R. Weisz (Eds.), *Evidence-based psychotherapies for children and adolescents* (pp. 165–183). New York: Guilford Press.
- Wells, K. B., Burnam, M. A., Leake, B., & Robbins, L. N. (1988). Agreement between face-to-face and telephone-administered version of the depression section of the NIMH Diagnostic Interview Schedule. *Journal of Psychiatric Research*, *22*, 207–220.
- Wight, R. G., Sepulveda, J. E., & Aneshensel, C. S. (2004). Depressive symptoms: How do adolescents compare with adults? *Journal of Adolescent Health*, *34*, 314–323.
- Winston, F. K., Kassam-Adams, N., Garcia-Espana, F., Ittenbach, R., & Cnaan, A. (2003). Screening for risk of persistent posttraumatic stress in injured children and their parents. *Journal of the American Medical Association*, *290*, 643–649.
- Winston, F. K., Kassam-Adams, N., Vivarelli-O'Neill, C., Ford, J., Newman, E., Baxt, C., et al. (2002). Acute stress disorder symptoms in children and their parents after pediatric traffic injury. *Pediatrics*, *109*, e90.
- World Health Organization. (1997). Composite International Diagnostic Interview (CIDI) (Version 2.1). Geneva: World Health Organization.
- Zatzick, D. F., Jurkovich, G., Russo, J., Roy-Byrne, P., Katon, W., Wagner, A., et al. (2004). Posttraumatic distress, alcohol disorders, and recurrent trauma across level 1 trauma centers. *Journal of Trauma: Injury, Infection, and Critical Care*, *57*, 360–366.
- Zatzick, D. F., Kang, S. M., Muller, H. G., Russo, J. E., Rivara, F. P., Katon, W., et al. (2002). Predicting posttraumatic distress in hospitalized trauma survivors with acute injuries. *American Journal of Psychiatry*, *159*, 941–946.
- Zatzick, D. F., & Roy-Byrne, P. (2003). Developing high quality interventions for PTSD in the acute care medical setting. *Seminars in Clinical Neuropsychiatry*, *8*, 158–167.
- Zatzick, D., Roy-Byrne, P., Russo, J., Rivara, F., Droesch, R., Wagner, A., et al. (2004). A randomized effectiveness trial of stepped collaborative care for acutely injured trauma survivors. *Archives of General Psychiatry*, *61*, 498–506.
- Zatzick, D. F., Russo, J., Pitman, R. K., Rivara, F., Jurkovich, G., & Roy-Byrne, P. (2005). Reevaluating the association between emergency department heart rate and the development of posttraumatic stress disorder: A public health approach. *Biological Psychiatry*, *57*, 91–95.
- Zatzick, D., Russo, J., Rivara, F., Roy-Byrne, P., Jurkovich, G., & Katon, W. (2005). The detection and treatment of posttraumatic distress and substance intoxication in the acute care inpatient setting. *General Hospital Psychiatry*, *27*, 57–62.
- Zatzick, D., Simon, G., & Wagner, A. Developing and implementing randomized effectiveness trials in general medical settings. *Clinical Psychology: Science and Practice*. Manuscript submitted for publication.