Parental Injury and Psychological Health of Children

WHAT'S KNOWN ON THIS SUBJECT: Injuries sustained by parents in combat can also have a variety of psychological effects on children in the family. However, there has been little research on the effect of parental injury on children in the civilian setting.

WHAT THIS STUDY ADDS: The effects of injury of parents impacted children's functioning by negatively affecting the health-related quality of life of the injured children, over and above the effect of any injury itself to the child. Injury to the parent also increased the likelihood of his or her uninjured children having PTSD symptoms 5 months after the parent's injury.

abstract

OBJECTIVE: To determine how parental injury affects the psychological health and functioning of injured as well as uninjured children.

METHODS: We recruited 175 parent-child dyads treated at a regional trauma center in 4 groups: parent and child both injured in the same event, child-only injured, parent-only injured, and neither parent nor child met criteria for significant injury. The preinjury health and functioning of parents and children were assessed with follow-up at 5 and 12 months.

RESULTS: Parents who were injured themselves showed higher levels of impairment in activities of daily living, quality of life, and depression at both follow-up assessments than parents who were not injured. Children in dyads with both parent and child injured had the highest proportion of posttraumatic stress disorder (PTSD) symptoms at both 5 and 12 months. In addition, children with an injured parent but who were not injured themselves were more likely to report PTSD symptoms at 5 months.

CONCLUSIONS: There were bidirectional effects of parental and child injury on the outcomes of each other. Injuries to the parent negatively affected the health-related quality of life of the injured children, over and above the effect of the injury itself on the child. Of great concern is the effect of parental injury on risk of stress and PTSD among uninjured children in the home. *Pediatrics* 2014;134:e88–e97

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KEY WORDS

injury, trauma, quality of life, PTSD

ABBREVIATIONS

ADL—activity of daily living

AIS—Abbreviated Injury Scale

ED—emergency department

IADL—instrumental activity of daily living

PedsQL—Pediatric Quality of Life Scale

PTSD—posttraumatic stress disorder

SF-36—Medical Outcomes Study 36-item Short Form

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In recent years, increasing attention has been given to the psychological consequences of injury. High levels of posttraumatic stress disorder (PTSD) symptoms have been documented in 15% to 42% of injured adolescents after acute injury.^{1–3} In 1 study, 27% of parents of injured adolescents reported symptoms consistent with a diagnosis of PTSD.⁴ Whereas only 11% of the general population has experienced ≥ 4 traumatic life events (eg, motor vehicle crash injury, sudden death of immediate family member, violent assault with a gun or other injury), 30% of randomly sampled adolescents presenting with injuries and 40% of their parents reported experiencing ≥ 4 such traumatic life events before the index injury.⁵ Greater numbers of previous traumatic life events are associated with substance use and the development of PTSD after admission for injury.^{6,7} There is also evidence that injury increases the likelihood for the subsequent development of other comorbid issues such as mood, anxiety, conduct, and school problems.^{8–11} The risk of posttraumatic stress symptoms among adolescents after injury is increased by the previous parental traumatic life-event burden.⁶

The effect of injury to a parent on recovery from injury in children and adolescents warrants further attention. Research on parental medical illness such as HIV and cancer documents the increased risk of their children for substance abuse, risky sexual behavior, emotional distress,¹² and increased prevalence of somatic symptoms.¹³ Injuries sustained by parents in combat can have a variety of psychological effects on their children.¹⁴ Injuries to 1 child in the family increase the risk of injuries to siblings, especially in the first 3 months after the index child's trauma.¹⁵ However, there has been little research on the effect of parental injury on children in the civilian setting.

We undertook this prospective study to determine how parental injury affects the psychological health and functioning of children, both those injured in the same event as well as uninjured children in the family. We hypothesized that injured children would have poorer recovery of physical and psychosocial function after their injury if their parents were also injured in the same event compared with injured children with an uninjured parent.

METHODS

The study was conducted at Harborview Medical Center, a level I adult and pediatric trauma center, and approved by the University of Washington Institutional Review Board. Patients were recruited from March 2010 through October 2011. The annual volume of the trauma center is 6000 trauma admissions and 62 000 emergency department (ED) visits annually. ED records were electronically screened to identify potentially eligible individuals who were then contacted in person or by phone to determine eligibility and to obtain consent. Eligible patients were from English- or Spanish-speaking families in which at least 1 family member received emergency medical services care after trauma, including being transported to the hospital, and treatment in the ED. "Injured" patients were defined as those diagnosed with an injury with Abbreviated Injury Scale (AIS)¹⁶ scores of ≥ 2 to exclude very minor injuries. One family member had to be a child between 6 and 17 years of age. We excluded events in which a death occurred because the problems sustained in fatal events were likely to be qualitatively different than nonfatal events.

Four groups of parent-child dyads were recruited on the basis of whether the parent and/or the child suffered a significant injury (AIS score ≥ 2) in the

same event. The Both-Injured group consisted of a parent and a child who both sustained injuries in the same event, such as a motor vehicle crash. The Child-Injured group was composed of families with a child who was injured but no parent was injured. The Parent-Injured group was the converse, in which there was an injured parent and no injured child. The Neither-Injured group, which served as a control group, was composed of participants in which at least 1 family member was transported to the ED for evaluation of an injury but no one had a significant injury (AIS ≥ 2). We set a goal of 50 dyads in each group on the basis of the ability to detect a clinically meaningful difference in the child Pediatric Quality of Life (PedsQL) scores at follow-up.

For this study, the definition of parent we used included the following: (1) biological parent living with the child, (2) stepparent living with the child, (3) other adult guardian living with the child, and (4) biological parent of the child who does not live with the child but has regular contact, defined as contact at least twice per month. For simplicity, we refer to all of the above as "parents." Families were defined broadly to include a child 6 to 17 years of age and a parent as previously defined.

Assessments

An interview was conducted as soon as possible after the injury, usually within 2 weeks, to reflect baseline functioning before the injury by modifying the stem of each item to read "During the 4 weeks before the injury event...", as we have done in previous studies in both adults^{17,18} and children.^{6,19,20}

Parent Assessments

The Medical Outcomes Study 36-item Short Form (SF-36)²¹ was used to assess the injured parent's health and quality of life; differences of 3 to 5 points are believed to be clinically

meaningful. This form was supplemented with questions of activities of daily living (ADLs) and instrumental activities of daily living (IADLs) to assess disabilities. Noninjured parents were administered the 12-Item Short-Form Health Survey (SF-12)²² to determine functioning; this survey is a shorter version to reduce respondent burden but measures similar constructs as the SF-36. Depressive symptoms were assessed with the Patient Health Questionnaire-9,²³ which has 88% sensitivity and 88% specificity for the diagnosis of depression.²³ The traumatic life-events history screen developed for the National Comorbidity Survey was used to assess parents' history of previous traumatic life events were assessed by using the Composite International Diagnostic Interview,^{24–26} which measures the occurrence of 12 traumatic life events such as motor vehicle crash injury, sudden death of immediate family member, or violent assault with a gun or other injury. Alcohol use was measured by using the Alcohol Use Disorders Identification Test-C.²⁷

Child Assessments

The parent was asked to complete the PedsQL scale, which measures health-related quality of life²⁸ assessing physical, emotional, social, and school functioning of children older than age 2. The PedsQL has been shown to be reliable and valid.²⁹ Scores range from 0 to 100, with higher scores indicating higher quality of life. A 4.5-point change in the PedsQL total score has been judged to represent a clinically meaningful difference. We used the child self-report UCLA PTSD Reaction Index to assess posttraumatic stress symptoms among children.³⁰

Family Assessments

The overall health/pathology of the family was determined by using the

12-item General Functioning Scale of the McMaster Family Assessment Device.³¹ Scores range from 11 to 41, with higher scores indicating worse functioning.

Follow-up interviews were conducted by mail or phone 5 and 12 months after the initial ED visit. Medical records were abstracted to capture details about the injury and treatment. International Classification of Diseases, Ninth Revision, Clinical Modification, codes for all injuries were used to calculate the AIS; the Injury Severity Score was used as a global measure of injury severity.

Data Analysis

Generalized linear mixed-models were used to assess the change in outcomes from baseline to the 5- and 12-month follow-up times in the 3 injury groups compared with the group in which neither parents nor children were injured. For the models examining dichotomized outcomes, mixed Poisson regression with robust SEs to estimate relative risks and 95% confidence intervals was used. For the models examining the continuous outcomes, linear mixed models were used. Regression models were adjusted for age, gender, and injury severity.^{6,7}

RESULTS

A total of 6664 patients were screened; 5754 were ineligible because they did not have an injury, did not arrive by emergency medical services, were injured due to self-injury or assault, had no child in the target age range, did not speak English or Spanish, or there was a fatality in the event. Of those who met screening criteria, an additional 340 were found not to be eligible when interviewed and 395 refused, giving a response rate of 34%. A total of 175 dyads were recruited as shown in Fig 1. Fewer participants were recruited in

the Both-Injured group because of the unexpected relative rarity of events in which both a child and parent were injured. We were able to obtain follow-up data on 95% of the sample at 5 months and on 91% at 12 months.

Baseline Characteristics of the Sample

The majority of parents were female, except for the Parent-Injured group in which 63% were male (Table 1). More of the parents in the Neither-Injured group were white and fewer were Hispanic. The Both-Injured group parents tended to be unmarried, not living with a spouse, and had lower incomes and educational achievement than parents in the other groups. Parents in the Neither-Injured group tended to have the highest incomes and educational backgrounds, and all lived with the index child, whereas those in the Parent-Injured group were more likely to be step- or adoptive parents. Parents in the Neither-Injured Group were less likely to be working outside of the home. The mean Physical Component Score and Mental Component Score were similar across groups, although a higher proportion of parents in the Both-Injured and Child-Injured groups described their health as only fair or poor compared with those in the Parent-Injured and Neither-Injured groups. Among the injured parents, ~6% had some limitation in ADLs or IADLs before the injury, and a small percentage were limited in the amount or type of work they could do. The proportion meeting criteria for previous depression was highest in the Parent-Injured group as was problem alcohol use; drug use was uncommon. There were no significant differences between groups in the number of traumatic life events or in family functioning at baseline.

Children were youngest in the Both-Injured group and were predominantly

FIGURE 1
Flow of study participants.

male in the Child-Injured and Neither-Injured groups, whereas they were mostly female in the other 2 groups (Table 2). A sizeable proportion of patients in the Both-Injured and Parent-Injured groups were Spanish speaking, whereas only 2% in the Neither-Injured group were Spanish speaking. Baseline school and cognitive functioning on the PedsQL was not significantly different between groups nor were the number of previous traumatic life events.

Characteristics of Injuries

Among the injured parents (Table 3), most in the Both-Injured Group were injured in motor vehicle crashes and came to Harborview Medical Center directly from the scene of injury, whereas only 22.6% of those in the

Parent-Injured group were in a crash and the majority were transferred from another hospital. The injuries tended to be somewhat more severe among the parents in the Parent-Injured group, with a greater percentage requiring ICU admission or direct transfer to the operating room from the ED.

Among the injured children, a larger proportion were transferred from another hospital in the Child-Injured compared with the Both-Injured group but fewer were in motor vehicle collisions. Injuries among children in the Child-Injured group were somewhat more severe, with a smaller proportion discharged from the hospital from the ED and a higher mean Injury Severity Score.

Outcomes of Parents

The injuries to either parents or children did not appear to have any effect on marital status at either the 5- or 12-month follow-up times (Table 4). At 5 months, parents with an injured child as well as those in the Parent-Injured group were more likely to not be working than the Neither-Injured controls; this difference in employment disappeared by 12 months after injury except for the group in which both parent and child were injured. Injured parents also had much higher risks of limitations in ADLs and IADLs after injury compared with baseline both at 5 and 12 months postinjury. The impact of injury on parents was also seen in the changes in the physical and mental health components of the SF-36, which showed 8- to 12-point decreases in these scores at both 5 and 12 months, with no significant changes in the SF-12 scores in the uninjured parents over time. Parents who were injured showed higher levels of depression on the Patient Health Questionnaire-9 at both follow-up assessments. Parental alcohol use problems significantly decreased after injury at both time points for parents who were injured alone. It is noteworthy that this group had the highest level of alcohol use and problems at baseline as reported on the Alcohol Use Disorders Identification Test-C, and that even after the decrease, scores were higher than for parents who had not sustained injuries. The addition of also having an injured child did not appear to affect the physical or mental health of the parents, family functioning, or alcohol use.

Outcomes of Children

Five months after injury, the adjusted functioning of the children as measured by the PedsQL was most impaired in children in the Both-Injured group (Table 5). These differences disappeared

TABLE 1 Baseline Characteristics of Parents

	Both Injured	Child Injured	Parent Injured	Neither Injured	<i>P</i>
<i>n</i>	17	53	54	51	
Age, mean (SD), y	40.8 (8.8)	42.8 (12.6)	40.2 (7.2)	43.4 (6.3)	.28
Gender, %					<.0001
Male	35.3	15.1	63.0	15.7	
Female	64.7	84.9	37.0	84.3	
Race, %					.03
White	52.9	52.8	55.6	82.4	
Hispanic	29.4	22.6	33.3	7.8	
Black	0.0	7.6	3.7	3.9	
Asian/Pacific Islander	5.9	5.7	1.8	2.0	
Native American	5.9	0.0	0.0	0.0	
Other/mixed	5.9	11.3	3.7	3.9	
Unknown	0.0	0.0	1.8	0.0	
Marital status, %					.76
Married	41.2	62.3	55.6	52.9	
Divorced	11.8	11.3	16.7	23.5	
Separated	5.9	1.9	5.6	2.0	
Remarried	11.8	9.4	5.6	5.9	
Never married	29.4	13.2	16.7	15.7	
Widowed	0.0	1.9	0.0	0.0	
Living with spouse, %	52.9	71.7	60.4	58.8	.32
Household income, %					.15
≤\$20 000	35.3	24.5	22.2	13.7	
\$20 001–\$30 000	11.8	9.4	18.5	11.8	
\$30 001–\$40 000	11.8	15.1	5.6	7.8	
\$40 001–\$50 000	0.0	7.5	20.4	5.9	
\$50 001–\$100 000	5.9	20.7	16.7	27.4	
>\$100 000	35.3	20.7	14.8	31.4	
Unknown	0.0	1.9	1.8	2.0	
Education, %					.004
Less than high school	35.3	28.3	25.9	3.9	
High school/GED	5.9	11.3	25.9	11.8	
Some college	11.8	22.6	18.5	21.6	
College (including associate's degree)	29.4	30.2	22.2	35.3	
Graduate degree	17.6	7.5	7.4	27.4	
Relationship to child, %					.01
Biological parent	88.2	98.1	77.8	86.3	
Step- or adoptive parent	11.8	0.0	18.5	13.7	
Other	0.0	1.9	3.7	0.0	
Live with child, %	94.1	98.1	96.3	100.0	.45
Work status, %					.06
Working outside of home	64.7	71.7	68.5	56.8	
Looking for work	0.0	1.9	11.1	5.9	
Student	5.9	3.8	3.7	2.0	
Homemaker	23.5	17.0	1.8	25.5	
Other	5.9	5.7	14.8	9.8	
SF-36/SF-12 physical component score, mean (SD)	55.5 (9.4)	52.0 (8.2)	54.8 (9.1)	53.2 (8.5)	.31
SF-36/SF-12 mental component score, mean (SD)	55.3 (8.3)	51.6 (7.9)	54.0 (9.0)	49.9 (11.2)	.07
Overall health, %					.44
Excellent	47.1	22.6	38.9	39.2	
Very good	29.4	32.1	25.9	27.4	
Good	11.8	26.4	27.8	21.6	
Fair	11.8	13.2	3.7	3.9	
Poor	0.0	5.7	3.7	7.8	
Number of ADLs with limitations, %		NA		NA	.96
0	94.1		94.4		
1–2	5.9		5.6		
Number of IADLs with limitations, %		NA		NA	.67
0	94.1		94.4		
1	5.9		1.9		
≥2	0.0		3.7		
Limited in amount or type of work, %	5.9	NA	5.6	NA	.96

TABLE 1 Continued

	Both Injured	Child Injured	Parent Injured	Neither Injured	P
Patient Health Questionnaire-9 total score, mean (SD)	2.4 (4.2)	2.7 (3.2)	3.1 (4.8)	3.7 (5.3)	.64
AUDIT-C score, mean (SD)	2.2 (2.3)	2.9 (12.6)	3.0 (3.0)	2.0 (1.9)	.002
Drug use, %	5.9	0.0	5.7	5.9	.26
CIDI trauma score, mean (SD)	2.1 (2.2)	NA	2.7 (2.5)	NA	.32
Family Assessment Device score, mean (SD)	21.9 (5.5)	19.5 (4.6)	20.2 (5.6)	20.1 (5.9)	.43

AUDIT-C, Alcohol Use Disorders Identification Test; CIDI, Composite International Diagnostic Interview; GED, General Educational Development; NA, not applicable; SF-12, 12-Item Short-Form Health Survey.

by 12 months. Among the injured children in the Child-Injured group, their reported functioning was back to baseline by 5 months after the injury. Surprisingly, children in the Parent-Injured group who were not injured but who had an injured parent were reported to have higher functioning on the PedsQL at both 5 and 12 months after injury compared with their preinjury baseline, although these differences were not significant when compared with the Neither-Injured group. Children in the Both-Injured group had the highest proportion of PTSD symptoms at both 5 and 12 months (Fig 2). In addition, children with an injured parent but who were not injured themselves were more likely to report PTSD symptoms at 5 months than those in the Neither-Injured group.

The results were similar when the 7 parents and 18 children with traumatic

brain injury were excluded from analyses.

DISCUSSION

This study found that the effects of injury of parents impacted children's functioning by negatively affecting the health-related quality of life of the injured children, over and above the effect of any injury itself to the child. Injury to the parent also increased the likelihood of his or her uninjured children having PTSD symptoms 5 months after the parent's injury. Conversely, the effect of child injuries influenced parents' employment status but largely did not impact other indices of functioning. Injuries to children greatly increased the proportion of parents who were not working 5 and 12 months after the injury event, both among the

group in which the parent was also injured as well as those events in which the parent was not involved or was uninjured in the event. There was also some surprising lack of effects of injury on the family. There were no effects of the child's injury on marital status, family functioning, parental depression, or parent drinking.

Many of the families were low income, and the impact of child injury on parental employment may have been financially large. Major medical illness or injury or medical bills not covered by insurance were the cause of nearly half of bankruptcies in 1 study.³² For low-income families, Medicaid does not protect them from the financial burden of injury due to potential job loss or out-of-pocket expenses.³³ Although the Affordable Care Act will decrease the number of people who are uninsured

TABLE 2 Baseline Characteristics of Children

	Both Injured	Child Injured	Parent Injured	Neither Injured	P
n	17	53	54	51	
Age, mean (SD), y	9.8 (3.5)	12.6 (3.2)	12.5 (3.3)	13.6 (3.1)	.001
Gender, %					<.0001
Male	35.3	82.7	46.3	68.6	
Female	64.7	17.3	53.7	31.4	
Spanish speaking	23.5	17.3	25.9	2.0	.01
PedsQLscore, mean (SD)					
Physical	89.5 (11.9)	88.0 (12.8)	87.2 (12.2)	90.7 (11.5)	.48
Emotional	77.5 (16.6)	79.1 (15.6)	72.1 (19.9)	79.4 (16.1)	.11
Social	88.2 (15.0)	87.2 (15.7)	85.0 (17.5)	89.8 (12.7)	.46
School	80.9 (13.1)	72.6 (16.0)	73.3 (17.4)	77.1 (16.8)	.20
Cognitive	81.9 (15.1)	75.8 (18.0)	73.6 (16.3)	79.2 (17.6)	.22
Total	84.2 (11.1)	81.1 (11.9)	79.0 (12.7)	83.8 (11.6)	.16
Number of previous traumatic life events, %					.61
0	76.5	59.6	46.3	58.8	
1	17.6	21.2	33.3	19.6	
2	5.9	9.6	11.1	11.8	
≥3	0.0	9.6	9.3	9.8	

TABLE 3 Injury Characteristics of the Parents and Children

	Both Injured	Child Injured	Parent Injured	Neither Injured
Injured parents, <i>n</i>	17		53	
Injury mechanism, %		NA		NA
Motor vehicle occupant	64.7		22.6	
Pedestrian	23.5		1.9	
Burn	5.9		20.8	
Fall	0.0		35.8	
Struck by an object	0.0		3.8	
Other	5.9		15.1	
Transferred from another hospital, %	17.7	NA	73.6	NA
HMC ED disposition, %		NA		NA
Ward	26.7		50.9	
ICU	13.3		28.3	
Operating room	6.7		20.8	
Home	53.3		0.0	
ED motor GCS score, %		NA		NA
6	93.8		90.6	
1, Pharmacologically paralyzed	6.2		9.4	
ISS, mean (SD)	6.4 (10.7)	NA	8.5 (8.2)	NA
Injured children, <i>n</i>	16	52	NA	NA
Injury mechanism, %			NA	NA
Motor vehicle occupant	68.7	13.5		
Pedestrian	25.0	5.8		
Burn	6.3	15.4		
Fall	0.0	30.7		
Struck by an object	0.0	25.0		
Other	0.0	9.6		
Transferred from another hospital, %	18.8	67.3	NA	NA
HMC ED disposition, %			NA	NA
Ward	42.9	40.4		
ICU	21.4	42.3		
Operating room	7.1	13.5		
Home	28.6	3.8		
ED motor GCS score, %			NA	NA
6	100.0	88.5		
5	0.0	3.9		
1, not pharmacologically paralyzed	0.0	1.9		
1, pharmacologically paralyzed	0.0	1.9		
Unknown	0.0	3.9		
ISS, mean (SD)	4.6 (7.2)	7.0 (5.6)	NA	NA

Medical records data were missing for 1 parent and 1 child. GCS, Glasgow Coma Scale; HMC, Harborview Medical Center; ISS, Injury Severity Score; NA, not applicable.

and potentially prevent loss of insurance with loss of employment, it will nevertheless not remove the financial burden altogether for families with injured children.

The negative impact of injury to the parent on the recovery of the child is concerning but not surprising. The injured children in the group without parental injury appeared to have recovered and returned to baseline by 5 months after their injury, demonstrating the resilience of most injured children. However, the lower quality of life in

those injured children with injured parents is likely due to a combination of financial disruption and relative decreased availability of at least the injured parent to attend to the needs of the child's recovery. Other studies indicate the importance of family availability and functioning in recovery of children and adolescents from trauma,^{34,35} availability that may be compromised by having another injured person at home. Parental coping strategies are an important element of the child's own coping and recovery,³⁶

and concurrent parental injury may reduce the parent's ability to provide this coping assistance. Utilization of coping strategies from other adults or even peers may be useful in the injured child's recovery.³⁶

Of great concern is the effect of parental injury on risk of stress and PTSD among uninjured children in the home. This effect has been shown among children of military personnel³⁷ but, to our knowledge, has not been examined in children of family members injured in noncombat events. Few injured children receive PTSD or other emotional health screening from their primary care providers in the weeks and months after exposure to injury events. Briefer screening tools for PTSD in children have been developed,³ and their routine use should be examined. Automated screening for PTSD using known risk factors and characteristics of the index injury is also feasible.^{20,38} In adolescents, PTSD is associated with a broad spectrum of functional impairments across multiple domains.²⁰ Although stepped care interventions for the prevention and treatment of PTSD in injured adults have been effective,^{39,40} initial interventions for the prevention of acute stress symptoms and PTSD in children and adolescents have not been shown to be effective⁴¹ and additional clinical trials are clearly needed.

There are important limitations to this study that should be considered. We were not able to recruit our target goal of 50 dyads in each group because there proved to be fewer parents and children injured in the same event than we anticipated. This smaller sample size decreased the power of the study and resulted in wide confidence intervals for some of the comparisons. Like all injury studies, the assessment of baseline function was conducted after the injury and may have been affected by a biased recall of preinjury health

TABLE 4 Outcomes of the Parents

	Baseline	5 Months	12 Months	Baseline – 5-Month Assessment		Baseline – 12-Month Assessment	
				RR (95% CI)	RR ^d (95% CI)	RR (95% CI)	RR (95% CI)
Not married, <i>n</i>	175	167	160				
Both injured, %	42.5	37.1	35.0	0.88 (0.67 to 1.14)	0.86 (0.66 to 1.13)	0.83 (0.60 to 1.13)	0.90 (0.63 to 1.27)
Child injured, %	22.6	22.2	21.7	0.98 (0.82 to 1.18)	0.97 (0.80 to 1.17)	0.96 (0.78 to 1.18)	1.04 (0.81 to 1.34)
Parent injured, %	32.8	32.4	30.0	0.99 (0.84 to 1.16)	0.97 (0.82 to 1.15)	0.91 (0.73 to 1.14)	1.00 (0.76 to 1.30)
Neither injured, %	34.0	34.5	31.2	1.01 (0.97 to 1.06)	Reference	0.92 (0.79, 1.06)	Reference
Not working/student/homemaker, <i>n</i>	175	167	160				
Both injured, %	5.8	23.2	18.7	4.00 (0.73 to 21.98)	5.21 (0.73 to 37.08)	3.22 (0.64 to 16.19)	3.14 (0.54 to 18.15)
Child injured, %	7.5	11.7	8.1	1.56 (0.44 to 5.55)	2.03 (0.41 to 10.06)	1.08 (0.27 to 4.35)	1.05 (0.22 to 4.97)
Parent injured, %	25.5	44.6	26.5	1.75 (1.11 to 2.77)	2.28 (0.78 to 6.70)	1.04 (0.57 to 1.90)	1.02 (0.41 to 2.53)
Neither injured, %	15.5	11.9	15.8	0.77 (0.29 to 2.04)	Reference	1.02 (0.52 to 2.03)	Reference
≥ 1 ADLs impaired, ^a <i>n</i>	71	66	61				
Both injured, %	5.7	23.0	30.3	4.00 (0.72 to 22.39)		5.26 (0.89 to 31.22)	
Parent injured, %	5.5	42.0	24.1	7.69 (2.66 to 22.26)		4.42 (1.38 to 14.14)	
≥ 1 IADLs impaired, ^a <i>n</i>	71	66	61				
Both injured, %	5.7	41.2	37.5	7.01 (1.11 to 44.13)		6.35 (1.03 to 39.04)	
Parent injured, %	5.6	49.0	40.0	8.82 (3.02 to 25.77)		7.22 (2.43 to 21.39)	
				Change (95% CI)	Change Diff (95% CI) ^b	Change (95% CI)	Change Diff (95% CI) ^b
SF-36 Physical Component Score, ^c <i>n</i>	71	66	61				
Mean score							
Both injured	55.5	44.9	45.9	−12.0 (−17.2 to −6.9)		−10.6 (−15.9 to −5.4)	
Parent injured	54.8	43.0	44.8	−12.0 (−15.0 to −9.0)		−10.2 (−13.2 to −7.1)	
SF-36 Mental Component Score, ^c <i>n</i>	71	66	61				
Mean score							
Both injured	55.3	45.7	45.9	−10.5 (−15.9 to −5.2)		−10.5 (−16.0 to −5.1)	
Parent injured	54.0	45.9	46.2	−8.3 (−11.4 to −5.3)		−7.9 (−11.1 to −4.8)	
SF-12 Physical Component Score, <i>n</i> ^a	103	100	99				
Mean score							
Child injured	52.1	50.5	50.5	−1.6 (−3.5 to 0.4)		−1.7 (−3.7 to 0.3)	
Neither injured	53.1	53.5	52.2	0.5 (−1.5 to 2.5)		−1.0 (−2.9 to 1.0)	
SF-12 Mental Component Score, <i>n</i> ^a	103	100	99				
Mean score							
Child injured	51.7	50.7	51.0	−1.0 (−3.5 to 1.5)		−0.8 (−3.2 to 1.7)	
Neither injured	49.8	51.0	49.7	1.1 (−1.4 to 3.6)		0.1 (−2.4 to 2.6)	
Patient Health Questionnaire-9, <i>n</i>	174	166	160				
Mean score							
Both injured	2.4	6.2	6.0	3.8 (1.5 to 6.2)	3.7 (1.0 to 6.4)	3.6 (1.2 to 5.9)	3.3 (0.6 to 6.1)
Child injured	2.7	3.2	3.8	0.5 (−0.8 to 1.9)	0.5 (−1.5 to 2.4)	1.1 (−0.2 to 2.5)	0.9 (−1.0 to 2.8)
Parent injured	3.1	7.6	6.6	4.5 (3.1 to 5.9)	4.4 (2.5 to 6.4)	3.5 (2.1 to 4.9)	3.3 (1.3 to 5.2)
Neither injured	3.8	3.9	4.0	0.1 (−1.3 to 1.4)	Reference	0.2 (−1.1 to 1.6)	Reference
AUDIT-C, <i>n</i>	175	166	160				
Mean score							
Both injured	2.2	2.4	2.6	0.2 (−0.5 to 0.9)	0.1 (−0.7 to 0.9)	0.4 (−0.3 to 1.1)	0.5 (−0.3 to 1.3)
Child injured	1.3	1.3	1.5	−0.01 (−0.4 to 0.4)	−0.1 (−0.7 to 0.5)	0.2 (−0.2 to 0.6)	0.3 (−0.3 to 0.8)
Parent injured	3.0	2.2	2.4	−0.8 (−1.2 to −0.4)	−0.9 (−1.5 to −0.3)	−0.6 (−1.1 to −0.2)	−0.5 (−1.1 to 0.04)
Neither injured	2.0	2.1	1.9	0.1 (−0.3 to 0.5)	Reference	−0.1 (−0.5 to 0.3)	Reference
Family Assessment Device, <i>n</i>	175	166	160				
Mean score							
Both injured	21.9	21.3	23.7	−0.6 (−3.4 to 2.1)	−1.7 (−4.9 to 1.4)	1.7 (−1.1 to 4.5)	0.1 (−3.1 to 3.3)
Child injured	19.5	21.0	21.0	1.5 (−0.03 to 3.1)	0.4 (−1.8 to 2.6)	1.6 (−0.01 to 3.2)	0.02 (−2.2 to 2.3)
Parent injured	20.2	21.9	22.7	1.8 (0.2 to 3.4)	0.7 (−1.6 to 2.9)	2.5 (0.9 to 4.2)	1.0 (−1.3 to 3.2)
Neither injured	20.0	21.1	21.6	1.1 (−0.5 to 2.7)	Reference	1.6 (−0.02 to 3.2)	Reference

AUDIT-C, Alcohol Use Disorders Identification Test; CI, confidence interval; Diff, difference; RR, relative risk; SF-12, 12-Item Short-Form Health Survey.

^a Adjusted for age and gender.^b Adjusted for Neither-Injured group.^c Adjusted for age, gender, and Injury Severity Score.^d Compared to the Neither injured group.

TABLE 5 Outcomes of the Children

PedsQL Inventory	Baseline	5 Months	12 Months	Baseline – 5 Months ^a		Baseline – 12 Months ^a	
				Change (95% CI)	Change Difference (95% CI)	Change (95% CI)	Change Difference (95% CI)
<i>n</i>	174	165	161				
Mean score							
Both injured	84.2	78.8	84.5	−5.2 (−11.2 to 0.8)	−6.1 (−12.9 to 0.7)	1.4 (−4.7 to 7.4)	0.6 (−6.2 to 7.4)
Child injured	81.1	81.0	82.2	−0.8 (−4.0 to 2.5)	−1.7 (−6.2 to 2.9)	0.4 (−2.9 to 3.6)	−0.4 (−4.9 to 4.2)
Parent injured	79.0	84.1	84.2	5.4 (2.2 to 8.6)	4.5 (−0.04 to 9.0)	5.1 (1.8 to 8.3)	4.3 (−0.2 to 8.9)
Neither injured	83.8	84.5	84.4	0.9 (−2.3 to 4.1)	Reference	0.7 (−2.5 to 3.9)	Reference

CI, confidence interval.

^a Adjusted for Injury Severity Score. **FIGURE 2**

PTSD prevalence among the children in the 4 study groups at 5 and 12 months after injury.

and functioning. However, all injury studies have been faced with the same issue and are generally consistent in obtaining functioning levels that ap-

proximate those of the general population.

There are a number of important implications of this study for both

practitioners and researchers. Acute care providers should screen both injured parents and injured children for acute stress symptoms and PTSD. Hospital-based providers should communicate to the injured person's primary care provider, who can closely follow the functional recovery of the injured patient. This communication is especially necessary for children who also have an injured parent, as well as for children, regardless of injury, who have an injured adult in the family.

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REFERENCES

- Winston FK, Baxt C, Kassam-Adams NL, Elliott MR, Kallan MJ. Acute traumatic stress symptoms in child occupants and their parent drivers after crash involvement. *Arch Pediatr Adolesc Med*. 2005;159(11):1074–1079
- Kassam-Adams N, Winston FK. Predicting child PTSD: the relationship between acute stress disorder and PTSD in injured children. *J Am Acad Child Adolesc Psychiatry*. 2004;43(4):403–411
- Winston FK, Kassam-Adams N, Garcia-España F, Ittenbach R, Cnaan A. Screening for risk of persistent posttraumatic stress in injured children and their parents. *JAMA*. 2003;290(5):643–649
- Ghesquiere A, Fan MY, Berliner L, et al. Adolescents' and parents' agreement on posttraumatic stress disorder symptoms and functioning after adolescent injury. *J Trauma Stress*. 2008;21(5):487–491
- Zatzick D, Russo J, Grossman DC, et al. Posttraumatic stress and depressive symptoms, alcohol use, and recurrent traumatic life events in a representative sample of hospitalized injured adolescents and their parents. *J Pediatr Psychol*. 2006;31(4):377–387
- Zatzick DF, Grossman DC, Russo J, et al. Predicting posttraumatic stress symptoms longitudinally in a representative sample of hospitalized injured adolescents. *J Am Acad Child Adolesc Psychiatry*. 2006;45(10):1188–1195
- Zatzick DF, Kang SM, Müller HG, et al. Predicting posttraumatic distress in hospitalized trauma survivors with acute injuries. *Am J Psychiatry*. 2002;159(6):941–946
- Bryant B, Mayou R, Wiggs L, Ehlers A, Stores G. Psychological consequences of road traffic accidents for children and their mothers. *Psychol Med*. 2004;34(2):335–346
- Caffo E, Belaise C. Psychological aspects of traumatic injury in children and adolescents. *Child Adolesc Psychiatr Clin N Am*. 2003;12(3):493–535
- Stallard P, Smith E. Appraisals and cognitive coping styles associated with chronic post-traumatic symptoms in child road traffic accident survivors. *J Child Psychol Psychiatry*. 2007;48(2):194–201
- Thomas CR, Blakeney P, Holzer CE III, Meyer WJ III. Psychiatric disorders in long-term adjustment of at-risk adolescent burn survivors. *J Burn Care Res*. 2009;30(3):458–463
- Lee SJ, Detels R, Rotheram-Borus MJ, Duan N. The effect of social support on mental and behavioral outcomes among adolescents with parents with HIV/AIDS. *Am J Public Health*. 2007;97(10):1820–1826
- Visser A, Huizinga GA, Hoekstra HJ, et al. Emotional and behavioural functioning of children of a parent diagnosed with cancer:

- a cross-informant perspective. *Psychooncology*. 2005;14(9):746–758
14. Gorman LA, Fitzgerald HE, Blow AJ. Parental combat injury and early child development: a conceptual model for differentiating effects of visible and invisible injuries. *Psychiatr Q*. 2010;81(1):1–21
 15. Johnston BD, Grossman DC, Connell FA, Koepsell TD. High-risk periods for childhood injury among siblings. *Pediatrics*. 2000;105(3 pt 1):562–568
 16. Gennarelli TA, Wodzin E. *Abbreviated Injury Scale 2005. Update 2008*. Des Plaines, IL: Association for the Advancement of Automotive Medicine; 2008
 17. Mackenzie EJ, Rivara FP, Jurkovich GJ, et al. The National Study on Costs and Outcomes of Trauma. *J Trauma*. 2007;63(6 suppl):S54–S67; discussion S81–S86
 18. Zatzick DF, Rivara FP, Jurkovich GJ, et al. Multisite investigation of traumatic brain injuries, posttraumatic stress disorder, and self-reported health and cognitive impairments. *Arch Gen Psychiatry*. 2010;67(12):1291–1300
 19. Rivara FP, Koepsell TD, Wang J, et al. Incidence of disability among children 12 months after traumatic brain injury. *Am J Public Health*. 2012;102(11):2074–2079
 20. Zatzick DF, Jurkovich GJ, Fan MY, et al. Association between posttraumatic stress and depressive symptoms and functional outcomes in adolescents followed up longitudinally after injury hospitalization. *Arch Pediatr Adolesc Med*. 2008;162(7):642–648
 21. Ware JE, Snow KK, Kosinski M, Gandek B. *SF-35 Health Survey Manual and Interpretation Guide*. Boston, MA: The Health Institute; 1993
 22. Ware J Jr, Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. *Med Care*. 1996;34(3):220–233
 23. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med*. 2001;16(9):606–613
 24. World Health Organization. Composite International Diagnostic Interview. Geneva, Switzerland: World Health Organization; 1997
 25. Kessler RC, Berglund P, Chiu WT, et al. The US National Comorbidity Survey Replication (NCS-R): design and field procedures. *Int J Methods Psychiatr Res*. 2004;13(2):69–92
 26. Ramstad SM, Russo J, Zatzick DF. Is it an accident? Recurrent traumatic life events in level I trauma center patients compared to the general population. *J Trauma Stress*. 2004;17(6):529–534
 27. Bush K, Kivlahan DR, McDonnell MB, Fihn SD, Bradley KA. The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. Ambulatory Care Quality Improvement Project (ACQUIP). Alcohol Use Disorders Identification Test. *Arch Intern Med*. 1998;158(16):1789–1795
 28. Varni JW, Limbers CA. The pediatric quality of life inventory: measuring pediatric health-related quality of life from the perspective of children and their parents. *Pediatr Clin North Am*. 2009;56(4):843–863
 29. Varni JW, Seid M, Kurtin PS. PedsQL 4.0: reliability and validity of the Pediatric Quality of Life Inventory version 4.0 generic core scales in healthy and patient populations. *Med Care*. 2001;39(8):800–812
 30. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 4th ed (text revised). Washington, DC: American Psychiatric Press; 2009
 31. Miller IW, Epstein NB, Bishop DS. The McMaster family assessment device: reliability and validity. *J Marital Fam Ther*. 1985;11(4):345–356
 32. Himmelstein DU, Warren E, Thorne D, Woolhandler S. Illness and injury as contributors to bankruptcy. *Health Aff (Millwood)*. 2005;(suppl Web exclusives):W5-63–73
 33. Hollingworth W, Relyea-Chew A, Comstock BA, Overstreet JK, Jarvik JG. The risk of bankruptcy before and after brain or spinal cord injury: a glimpse of the iceberg's tip. *Med Care*. 2007;45(8):702–711
 34. Fay GC, Jaffe KM, Polissar NL, Liao S, Rivara JB, Martin KM. Outcome of pediatric traumatic brain injury at three years: a cohort study. *Arch Phys Med Rehabil*. 1994;75(7):733–741
 35. Rivara JB, Jaffe KM, Fay GC, et al. Family functioning and injury severity as predictors of child functioning one year following traumatic brain injury. *Arch Phys Med Rehabil*. 1993;74(10):1047–1055
 36. Marsac ML, Donlon KA, Hildenbrand AK, Winston FK, Kassam-Adams N. Understanding recovery in children following traffic-related injuries: exploring acute traumatic stress reactions, child coping, and coping assistance. *Clin Child Psychol Psychiatry*. 2014;19(2):233–243
 37. Siegel BS, Davis BE; Committee on Psychosocial Aspects of Child and Family Health, Section on Uniformed Services. Health and mental health needs of children in US military families. *Pediatrics*. 2013;131(6). Available at: www.pediatrics.org/cgi/content/full/131/6/e2002
 38. Russo J, Katon W, Zatzick D. The development of a population-based automated screening procedure for PTSD in acutely injured hospitalized trauma survivors. *Gen Hosp Psychiatry*. 2013;35(5):485–491
 39. Zatzick D, Roy-Byrne P, Russo J, et al. A randomized effectiveness trial of stepped collaborative care for acutely injured trauma survivors. *Arch Gen Psychiatry*. 2004;61(5):498–506
 40. Zatzick D, Jurkovich G, Rivara FP, et al. A randomized stepped care intervention trial targeting posttraumatic stress disorder for surgically hospitalized injury survivors. *Ann Surg*. 2013;257(3):390–399
 41. Kassam-Adams N, García-España JF, Marsac ML, et al. A pilot randomized controlled trial assessing secondary prevention of traumatic stress integrated into pediatric trauma care. *J Trauma Stress*. 2011;24(3):252–259