Factors Identifying Risk for Psychological Distress in the Civilian Trauma Population

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Abstract

Objectives—The emergency department (ED) is a valuable setting to initiate intervention in order to prevent future complications following traumatic injury. Posttraumatic stress disorder (PTSD) occurs in 10% to 40% of patients after single-incident civilian trauma. Prior research suggests young age is associated with increased risk. We hypothesized that other factors correlated with age may be responsible. The aim of this study was to determine if factors identifiable in the ED can better explain the relationship between younger age and PTSD, therefore more specifically identifying those at risk for long-term distress.

Methods—The influence of age on PTSD severity scores was isolated using data from an established screening program for all admitted trauma patients at a Level I trauma center. The PTSD Checklist, Civilian (PCLC) was administered prospectively to 527 adult trauma patients in order to measure PTSD symptom severity immediately post-trauma. Patient and trauma characteristics were then reviewed using medical records. Hierarchical linear regression modeled and evaluated the independent association of age with PTSD symptom severity, and explored additional variables as better predictors of risk.

Results—PTSD symptom severity was associated individually with younger age, ethnic minority status, assaultive trauma, unemployment, low household income, and being unmarried, but not with sex, Injury Severity Score, or Glasgow Coma Scale score at the scene. Multivariate analysis demonstrated assaultive trauma and lower socioeconomic status (SES) were best associated with greater PCLC scores, accounting for 9.3% of the variance. Age did not account for additional variance.

Conclusions—Although young age is associated with increased PTSD symptom severity scores, characteristics associated with young age, specifically assaultive trauma and low SES, account for this risk. Young age is not an independent risk factor for PTSD. Psychological assessment in the ED can be targeted towards assaultive trauma patients, especially those of low SES, to establish early intervention and hopefully prevent the development of PTSD.

INTRODUCTION

Up to 70% of individuals experience at least one traumatic event in their lifetime.[1] Posttraumatic stress disorder (PTSD), an anxiety disorder that results from witnessing or experiencing a traumatic event, is characterized by avoidance, hyperarousal, and reexperiencing the event. PTSD affects between 10% and 40% of patients who survive single incident traumatic injuries,[2] and is highly correlated with poor quality of life after trauma.[3] If the characteristics that put one most at risk to develop PTSD after a traumatic

event could be understood, the health service community could provide early targeted screening and appropriate intervention to the high-risk population. The emergency department (ED) provides a valuable opportunity for early PTSD screening in order to connect patients to resources for future intervention. It is well documented that early PTSD symptom severity is related to later PTSD diagnosis.[4] Therefore, it is important for emergency physicians (EPs) to be able to identify at-risk patients.

Providing intervention to all of those who undergo trauma is neither practical nor necessary. A large proportion of individuals will recover on their own, and treating them could interfere with their natural coping mechanisms,[5] and potentially be deleterious.[6] Trauma survivors who are at risk for PTSD can benefit from trauma-focused cognitive behavioral therapy (CBT), a treatment for preventing or reducing PTSD symptoms.[6] Past research states that a course of CBT given between one and four months post-trauma, including up to 16 sessions, is effective.[5] Such an extensive intervention is time-intensive for health care providers, and consuming of health care dollars, making appropriate targeting and administration imperative.

Age has been investigated as a potentially important risk factor in the development of PTSD. A meta-analysis of 29 studies that looked at adult trauma patients found that younger age at the time of the trauma is a significant risk factor for PTSD.[7] However, the effect size of age in this meta-analysis was small.[7] Also, age has not consistently been reported as a risk factor for PTSD, with some studies reporting young age as a risk factor, and others finding that age does not have an effect on risk.[7] We hypothesized that age is not independently associated with PTSD. We did not believe that an individual's chronological age would inherently modify one's risk of developing PTSD. Instead, we believed that there must be characteristics and situations associated with age that actually modify the risk, perhaps explaining the inconsistent results. That is, predisposing factors that correlate with young age may better explain the increased risk of PTSD. Thus, the aim of this study was to investigate if factors identifiable during hospital admission for traumatic injury at a community Level I trauma center could better explain the relationship between younger age and PTSD, more specifically identifying those at risk for long-term distress. In this study, we attempted to isolate the independent influence of age on PTSD symptom severity, while including covariates of age that predict PTSD symptoms. The information from this study will aid EPs in targeting early intervention efforts.

METHODS

Study Design

This was a prospective study of trauma patients admitted to a large Level I trauma center in the Midwest as part of a program initiative. All study activities are in accordance with approval from the institutional review board affiliated with the study institution. Verbal informed consent was granted by all participants.

Study Setting and Population

Patient accrual began in October 2007 and continued until June 2009. Inclusion criteria included age 18 years or older, and admitted to the hospital due to injury from a traumatic event. Exclusion criteria included inability to speak English, self-inflicted injury, and unable to communicate due to traumatic injury. Of the 1,214 admitted patients, 617 were not approached due to our inability to administer the PTSD instrument directly following trauma. Reasons for this included: unable to communicate, too ill, somnolence, cognitive impairment, language barrier, or the participant was unable to be contacted prior to discharge. Of the 597 approached, 41 declined (6.9%), and 556 consented (93.1%). Five

hundred twenty-seven (88.3%) completed the questionnaire assessing PTSD symptom severity. Power analysis indicated a sample size of 108 would be adequate to detect moderate effect sizes; therefore, our actual sample size of 527 is adequate to detect much smaller effects.

Study Protocol

Participants were asked questions in person related to PTSD symptom severity. Additional information on variables of interest was collected through the patient medical records and trauma census, a required documentation system for Level I trauma centers.

PTSD Assessment—Because diagnostic criteria for PTSD require persistence of symptoms for greater than one month, or symptoms beginning greater than one month after trauma, participants in our study were not diagnosed with PTSD, but instead received a PTSD symptom severity score. PTSD criteria in the acute phase provide strong predictive power of later PTSD.[4] PTSD symptom severity was measured face-to-face using the PTSD Checklist-Civilian (PCLC)[8] for patients immediately post-trauma by a single survey administrator (KBC). The PCLC is a 17-item self-report measure of the 17 DSM-IV symptoms of PTSD. Respondents are asked how much they have been bothered by each symptom since their recent traumatic injury on a five-point Likert severity scale (1 = "not at all" to 5 = "extremely") in response to stressful life experiences. A total symptom severity score, which ranges from 17 to 85, can be obtained by summing the scores from each of the 17 items. The PCLC is used to assess current PTSD symptom severity and takes approximately 20 minutes to complete. The PCLC has demonstrated strong psychometric properties. A cutoff score of 50, or 44 in motor vehicle accident victims, for a PTSD diagnosis has demonstrated good sensitivity (0.78 to 0.82) and specificity (0.83 to 0.86).[8] The PCLC correlates strongly with the Mississippi PTSD Scale, the Minnesota Multiphasic Personality Inventory -2 Keane PTSD Scale, the Impact of Events Scale, and the Clinician-Administered PTSD Scale.[8,9] High internal consistency and test-retest reliability have been demonstrated.[8,10]

Demographic and injury variables—Information regarding demographic and injury variables of interest were collected from the trauma census and the electronic medical record. A single author (KBC) abstracted information on marital status (married versus single, divorced, separated, or widowed), zip code (to be used for mean household income by zip code from the 1999 U.S. Census Bureau data), and employment status (unemployed versus employed, student, or retired) from the electronic medical record. This same individual obtained sex, age, ethnicity (white versus non-white), trauma type (assaultive versus non-assaultive), Injury Severity Score (ISS), and Glasgow Coma Scale (GCS) score at the scene, from the trauma registry. Due to the objective nature of these data, and the fact that a single data abstracter was used, we believed errors would be minimal.

Data Analysis

Data were analyzed using SPSS software (SPSS Inc., Chicago, IL). Variables were tested for normality, and because neither PCLC scores nor age were normally distributed, analysis was conducted by rank sum tests and Spearman's correlation tests, with statistical significance set at $p < 0.05$. Correlations were estimated for PCLC scores and age with the injury and socioeconomic variables of interest.

Variables significantly associated with both higher PCLC scores and younger age were entered into block 1 of a hierarchical linear regression in order to model their relationship to PTSD symptom severity. Age was then entered with the best block 1 model into block 2 in order to isolate its influence on PCLC scores. Normality, linearity, homoscedasticity, and

major outliers, important assumptions in evaluating a hierarchical linear regression, were assessed. Variables that were not normally distributed were transformed to fit normal distributions. Linearity was assessed by correlations, tolerance values, and variance inflation values. Homoscedasticity was assessed by examining a scatterplot of standardized residuals against standardized predicted values. Major outliers were assessed by Mahalanobis distance.

RESULTS

Participants ranged in age from 18 to 87 years. Median values for quantitative variables and the percent of subjects in each category for categorical variables are shown in Table 1.

Results of univariate analyses, conducted to explore the relationship of PCLC scores and age with each variable, are shown in Table 2 for quantitative traits and Table 3 for categorical traits. As can be seen in these tables, higher PCLC scores, reflecting increased PTSD symptom severity immediately post-trauma, were associated individually with younger age, ethnic minority status, assaultive trauma, unemployment, low household income, and being unmarried; but not with sex, ISS, or GCS score at the scene. In this sample of those undergoing trauma, young age was associated with ethnic minority status, assaultive trauma, unemployment, low household income, being unmarried, and being male, but not with ISS, or GCS score at the scene.

Variables significantly associated with both higher PCLC scores and young age included ethnic minority status, assaultive trauma, unemployment, low household income, and being unmarried. Unemployment and low household income are both measures of socioeconomic status (SES). In order to prevent multicollinearity, and because information on household income is both more complete in our study and is a continuous variable, household income was used to measure SES. Employment status was excluded from the regression analysis. Ethnicity was not included in the hierarchical regression due to multicollinearity between ethnicity and SES. No further issues of multicollinearity existed. Transformations on non-normal variables included the inverse of PCLC scores, the log of age, and the square root of household income. No deviations from homoscedasticity were observed. Mahalanobis distance[11] was below the critical value, indicating that no major outliers existed. Consequently, trauma type (assaultive vs. non-assaultive), relationship status (married vs. single, divorced, separated, or widowed), and square root of household income were included in block 1 of the analysis, and the log of age in block 2. The inverse of PCLC scores was included as the dependent variable.

Results of the hierarchical regression are shown in Table 4. The model accounts for 9.3% of the variance in PCLC scores. Assaultive trauma type makes the largest contribution to the model, with lower income also being statistically significant. Relationship status did not account for a statistically significant contribution to PCLC score variance. When age was included in block 2 of this model, it did not account for additional variance in PCLC scores and was not a significant predictor, indicating that those who sustain assaultive trauma and are from a low income background have an increased risk of developing symptoms of PTSD. These two factors provide a risk that subsumes that of younger age. This new risk profile thus includes a significant number of older individuals who also exhibit these features.

DISCUSSION

The purpose of our study was to identify factors associated with young age that put individuals at risk for psychological distress following traumatic injury. Our analyses

indicate that although young age is associated with acute PTSD severity, age itself does not independently account for the increased risk. Instead, it can be explained by assaultive trauma and low household income, both associated with young age. The hierarchical regression reported here exhibits that after accounting for the influence of assaultive trauma and low household income on PTSD severity scores, age is not responsible for any additional risk. Thus, age should not be a deciding factor in the implementation of screening and intervention for PTSD, as an important segment of the trauma population may be missed. Instead, assaultive trauma victims, especially those of low SES, should be prioritized for psychological assessment and counseling.

At our institution we make a focused effort to administer the PCLC, a simple survey that takes only a few minutes, to all trauma survivors who are admitted to the hospital. All patients with a score greater than or equal to 44 are referred to our trauma health psychologist, who sees them prior to discharge and arranges any needed inpatient and outpatient follow-up. Establishing contact with a mental health professional prior to discharge is a much more effective way of providing service than waiting for an elective outpatient visit that may not happen, or a visit to the ED for masked PTSD symptoms, such as chronic pain, cardiovascular disease, hypertension, hyperlipidemia, or obesity.[12]

Given our findings, although our screening takes place after patients are admitted to the hospital, risk factors are detectable when patients are first seen in the ED. Identification of patients in the ED who have suffered assaultive trauma, especially patients of low SES, will lead to identification of a larger proportion of the patient population most likely to develop PTSD, and will potentially allow earlier treatment. A subset of trauma patients come through the ED, and are ultimately discharged home without being admitted. Our data showing that higher ISS is not predictive of increased PTSD symptom severity scores agree with prior research.[13] This leads to the conclusion that we are missing patients with less severe injuries who are not admitted to the hospital who may ultimately develop PTSD, making the ED a more influential location for screening. This is particularly true for hospitals treating urban populations, where assaultive trauma and patients of low SES are common. Those at risk who are then discharged to home from the ED could be provided information on outpatient follow-up with a mental health professional at that time. In the civilian trauma survivor population, where a significant proportion of patients are lost to follow-up, the ED becomes a valuable setting in which to both educate patients, and initiate intervention to prevent future complications following traumatic injury.

LIMITATIONS

This study suffers from three possible limitations. First, only trauma patients admitted to the hospital were included in this study, and a significant portion of those admitted were also missed. The majority of those unable to be contacted prior to discharge were discharged within 48 hours of admission with minor injuries. It is not clear whether these patients have the same risk profile for PTSD symptoms as patients admitted with more severe injuries. A second limitation is the use of a PTSD symptom score rather than establishing a true diagnosis of PTSD. This was done because follow-up in the trauma population, particularly those with assaultive trauma and those of low SES, is poor. Therefore, PTSD assessment was most complete and best represented the trauma population when conducted immediately post-trauma. Finally, our regression analysis only accounted for 11% of the variance in PCLC scores. Although there are many other factors that contribute to variability in PCLC scores, our analysis is important in that age was determined not to be an independent risk factor in PTSD symptom severity score. Instead, other factors that can easily be identified in the ED were found to be significant. A large portion of the remainder of the variability is likely due to individual cognitive factors that are not easily recognized in the ED.[14]

CONCLUSIONS

The emergency department provides a valuable opportunity to screen trauma patients for post traumatic stress disorder risk and connect them with mental health resources. Young age is not an independent risk factor for increased PTSD symptom severity score. Instead, both assaultive trauma and low SES are more common in the younger population, and these risk factors better account for the vulnerability of this specific population. Emergency departments should consider screening programs for this vulnerable population.

Acknowledgments

References

1. Freedy, JR.; Donkervoet, JC. Traumatic stress: an overview of the field. In: Freedy, JR.; Hobfoll, SE., editors. Traumatic Stress: From Theory to Practice. New York, NY: Plenum; 1995. p. 1-28.

2. Ursano RJ, Bell C, Eth S, et al. Practice guideline for the treatment of patients with acute stress disorder and posttraumatic stress disorder. Am J Psychiatry. 2004; 161:3–31. [PubMed: 15617511]

3. Kiely JM, Brasel KJ, Weidner KL, Guse CE, Weigelt JA. Predicting quality of life six months after traumatic injury. J Trauma. 2006; 61:791–8. [PubMed: 17033542]

4. Bryant RA, Creamer M, O'Donnell M, Silove D, McFarlane A. A multisite study of the capacity of acute stress disorder diagnosis to predict posttraumatic stress disorder. J Clin Psychiatry. 2008; 69:923–9. [PubMed: 18422396]

5. Ehlers A, Clark D. Early psychological interventions for adult survivors of trauma: a review. Biol Psychiatry. 2003; 53:817–26. [PubMed: 12725974]

6. Roberts NP, Kitchiner NJ, Kenardy J, Bisson JI. Systematic review and meta-analysis of multiple session early interventions following traumatic events. Am J Psychiatry. 2009; 166:293–301. [PubMed: 19188285]

7. Brewin CR, Andrews B, Valentine JD. Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. J Consult Clin Psychol. 2000; 68:748–66. [PubMed: 11068961]

8. Blanchard EB, Jones-Alexander J, Buckley TC, et al. Psychometric properties of the PTSD Checklist (PCL). Behav Res Ther. 1996; 24:669–73. [PubMed: 8870294]

9. Weathers, FW.; Litz, BT.; Herman, DS.; Huska, JA.; Keane, TM. The PTSD Checklist (PCL): reliability, validity, and diagnostic utility. Paper presented at the 9th Annual Meeting of the International Society for Traumatic Stress Studies; San Antonio, TX. 1993.

10. Ruggiero KJ, Del Ben K, Scotti JR, Rabalais AE. Psychometric properties of the PTSD Checlist--Civilian Version. J Trauma Stress. 2003; 16:495–502. [PubMed: 14584634]

11. Tabachnik, BG.; Fidell, LS. Using Mulitvariate Statistics. 4. Boston, MA: Allyn and Bacon; 2000.

12. McFarlane AC. The long term costs of traumatic stress: intertwined physical and psychological consequences. World Psychiatry. 2010; 9:3–10. [PubMed: 20148146]

13. Brasel KJ, deRoon-Cassini T, Bradley CT. Injury severity and quality of life: whose perspective is important? J Trauma. 2010; 68:263–8. [PubMed: 20154536]

14. Anderson J, Brasel K, deRoon-Cassini T. Predicting six month posttraumatic stress disorder symptoms and quality of life in an injured trauma population [Abstract]. J Surg Res. 2011; 165(2): 244.

Table 1

Descriptive Information in a Sample of Injured Trauma Survivors

Variable	Median	Interquartile Range
PCLC	29.0	(22.0–39.0)
Age, years	39.0	(25.0–52.0)
Household income, U.S. $	40,598	(32,340–52,251)
Injury Severity Score	12.0	(9.0–17.0)
GCS score at scene	15.0	(15.0-15.0)
	N	**%**
Ethnicity		
White	340	64.5
Non-white	187	35.5
Asian	1	0.2
Black or African American	156	29.6
Hispanic	24	4.6
Other	6	1.1
Trauma type		
Assaultive	139	26.4
Non-assaultive	364	69.1
Employment: unemployed	96	18.2
Employed/retired/student	317	60.2
Employed	271	51.4
Retired	37	7.0
Student	9	1.7
Marital status		
Married/engaged	155	29.4
Unmarried	361	68.5
Single	304	57.7
Divorced/separated	41	7.8
Widowed	16	3.0
Sex		
Male	378	71.7
Female	149	28.3

PCLC = Posttraumatic stress disorder Checklist-Civilian; GCS = Glasgow Coma Scale

Table 2

PTSD Symptom Severity Scores and Age Correlations with Income, Injury Severity Score, and Glascow Coma Scale

	1.	2.	3.	4.	5.
1. PCLC	--				
2. Age, years	−0.14*	--			
3. Household income	−0.23*	0.17*	--		
4. Injury Severity Score	−0.51	0.02	0.12*	--	
5. GCS score at scene	0.01	0.04	−0.13*	−0.20*	--

Spearman's rank correlation was used to obtain correlation values; PCLC = Posttraumatic stress disorder Checklist-Civilian; GCS = Glascow Coma Scale

*
p < 0.01

Table 3

Differences in PTSD Symptom Severity Scores and Age Across Ethnicity, Trauma Type, Employment Status, Marital Status, and Sex

Traits	PCLC scores			Age		
	Median	IQR	Z	Median	IQR	Z
Ethnicity			−5.92 [*]			−6.93 [*]
White	26.0	21.0–35.0		44.0	29.0–56.75	
Non-white	34.0	25.0–54.0		30.5	23.0–43.25	
Trauma type			−6.42 [*]			−8.58 [*]
Assaultive	36.0	26.0–55.0		26.0	23.0–36.0	
Non-assaultive	27.0	21.0–36.0		44.0	30.0–56.0	
Employment			−4.28 [*]			−1.96 [^]
Employed/retired/student	26.0	21.0–34.5		42.0	27.5–55.0	
Unemployed	33.0	25.0–50.25		38.0	26.0–50.0	
Marital status			−3.45 [*]			−8.94 [*]
Married	25.0	21.0–33.0		50.0	40.0–60.0	
Single	30.0	23.0–41.0		32.0	23.25–47.75	
Sex			0.90			3.31 [*]
Male	28.0	22.0–39.0		37.0	24.0–51.0	
Female	29.0	22.0–41.0		42.5	30.25–55.0	

[*]
$p < 0.01$;

[^]
$p < 0.05$

PCLC = PTSD Checklist, Civilian

Z scores were utilized for nonparametric statistics with a Mann-Whitney correction; Single = single/divorced/separated/widowed

Table 4

Hierarchical Regression Analysis Summary for Patient Variables Predicting PTSD Symptom Severity Scores

Variable	b	SEB	B	R^2	ΔR^2
Step 1				0.93	0.93
Trauma type	0.006	0.001	0.204		
Income	0.001	0.001	0.117		
Marital status	0.002	0.001	0.060		
Step 2				0.93	0.00
Age	0.001	0.004	0.018		

n = 527

b = unstandardized regression coefficients; SEB = standard error of b; B = standardized regression coefficients; R^2 = coefficient of determination, the proportion of variability in a data set that is accounted for by the statistical model.

PTSD = Posttraumatic stress disorder