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Violent injury predicts poor psychological outcomes after traumatic injury in a hard to reach population: an observational cohort study

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Abstract

Background: People who experience physical trauma face a range of psychosocial outcomes. These may be overlooked by busy clinicians. While some risk factors are understood, the understanding of the psychological effects of violent injury remains limited, particularly in UK settings. This study compared psychological outcomes following interpersonal violence and accidental injury, including the persistence of psychological distress.

Methods: A questionnaire survey was carried out at two time points of patients admitted to a large teaching hospital in London. Participants were **c**onsecutive adult patients admitted to the Royal London Hospital with traumatic injuries, with 219 participants at baseline. Follow up survey was eight months later (*N* = 109). Standardised measures assessed symptoms of post-traumatic stress (PTSS) (Acute Stress Disorder Scale, PTSD Checklist) and depression (Hospital Anxiety and Depression Scale).

Results: PTSS and depressive symptoms affected 27% and 33% respectively at baseline. At eight months, 27% and 31% respectively reported these symptoms. The repeated measures were assessed with multilevel models: after adjusting for demographic factors, patients with violent injury showed more PTSS (*OR* 6.27, *CI* 1.90 to 20.66), and depressive symptoms (*OR* 3.12, *CI* 1.08 to 8.99).

Conclusions: There were high levels of psychological distress among traumatic injury patients. Violent injuries were associated with an increased risk of both post-traumatic and depressive symptoms. People vulnerable to distress would benefit from psychological support and hospital admission provides a unique opportunity to engage hard to reach groups in interventions.

Strengths and limitations of this study

This prospective study accessed a unique and hard to reach urban sample of injured patients, many of whom would typically resist engagement with research[1,2] and health services.[3]

It reports high levels of unmet psychological needs among East London trauma patients, providing local-level information in a field where prevalences and risk factors vary considerably.

The study finds that violent injury is associated with high levels of distress, including high levels of depressive symptoms, eight months after injury.

Follow-up data collection with hard to reach groups is particularly challenging[1] and the significant differences in follow-up participant characteristics pose problems, however, the statistical approach minimised the detrimental effects of this bias.

The findings reinforce the need for routine assessment, intervention and signposting to support services in this population.

Introduction

Violence and injury pose significant public health problems and violence is a leading cause of death and injury worldwide.[4] There are over 700,000 hospital admissions for accidental and violent injuries each year in England,[5] and 9.2% of injuries occur through violence,[6] with higher rates in metropolitan hospitals,[7] in men and those aged 16 to 25.[8]

There is currently no routine assessment of psychological symptoms in trauma settings,[8] and symptoms of psychological distress are rarely identified by clinical staff.[9,10] However, traumatic injuries have psychological as well as physical consequences.[11] US studies have reported high rates of psychological distress following trauma such as post-traumatic stress disorder (PTSD) and depression.[12–15] PTSD can occur following exposure to, or witnessing, traumatic events such as death, serious injury or sexual violence. Post traumatic symptoms (PTSS) include disturbing flashbacks, avoiding reminders, feelings of alienation and blame, and hyperarousal and reactivity, which persist for at least a month. Acute symptoms within the first month following trauma are recognised as acute stress disorder (ASD). Depression is a mood disorder characterised by depressed mood or loss of interest or pleasure with neurovegetative and cognitive symptoms and significant impairment.

The prevalence of psychological distress following traumatic injury varies widely in different patient populations and countries, however there are few data available on UK rates.[16] An international review, which included one study of motor vehicle collision patients in the UK, reported PTSS rates

between 17.5% and 42% up to six months post-injury; the range was greater still at 12 months, ranging from 2% to 36%.[17] Longitudinal studies show that PTSS prevalence falls over time.[17,18] American and Australian studies report rates of depressive symptoms ranging from 60% at baseline,[14] to 31% at six months,[12,14] with rates at one year between 9% and 16%.[11,15] The variation in prevalence is likely due to differences in location, nature of injury and demographic profile. Although one UK study of non-violent injuries is in progress,[16] more studies are needed to plan NHS care.

Vulnerability to violent injury

Conflict in the world is increasing, not just in wars but also in civilian settings, through violent protests, football match violence, armed robbery and street gangs. Civilians injured through violence are at greater risk of PTSS and more persistent symptoms than those who experience non-violent injuries.[11,12,19,20] However, there is conflicting evidence on whether violent injury is associated with depressive symptoms.[12,21] Better recognition and treatment of those at risk of psychological sequelae would improve their quality of life and functioning.

Certain groups are more vulnerable to violent injury, including socio-economically deprived people, ethnic minorities, and young men,[7,22] and deprivation is often a determinant of violent injuries with violence being used to secure more resources or to protest about deprivation.[23] Rates of both violence and poor mental health are high in deprived urban areas.[24] For example, people in South East London have much higher rates of exposure to trauma than those in other European inner cities, as well as higher rates of PTSS, mental disorder and substance abuse. [25,26] In Hackney, East London, 9% of men report belonging to a gang compared with 1% across Britain[27] and East London boroughs are among those with the highest deprivation in England.[28] Hard to reach groups – including ethnic minorities, survivors of violence, people living in disadvantaged areas, those with mental health problems and youths at risk of criminal and gang involvement – are under-researched,[1] and tend to resist engaging with researchers[2] as well as health services.[3]

The variation in rates of psychological distress and the particular challenges in inner cities demonstrate the need for more 'local thinking' on mental health.[26] In this study, we tested the hypothesis that violent injury is associated with both depressive symptoms and PTSS, and assessed risk factors for persistence of PTSS and depressive symptoms in patients attending a teaching hospital and major trauma centre in East London.

Methods

This was an observational cohort study of inpatients admitted following accidental or violent injury.

Setting

Recruitment took place at the Royal London Hospital between July 2012 and April 2014. Participants were identified from consecutive patients discussed at bi-weekly multidisciplinary meetings of the major trauma and oral and maxillofacial surgery teams.

Participants

The inclusion criteria were: admitted as hospital inpatients under major trauma or oral and maxillofacial trauma; aged 18 or more; English-speaking. The exclusion criteria were: active psychosis; admission following deliberate self-harm; under the influence of alcohol or illegal substances; cognitive impairment.

All participants provided informed consent in writing. Baseline measures were collected in hospital with a follow-up postal questionnaire at eight months. All measures were self-report questionnaires, and we used published thresholds to identify clinically significant symptoms.

Measures

Baseline PTSS were measured using the Acute Stress Disorder Scale (ASDS),[29] with a threshold of scores ≥56. Follow up PTSS were measured using the PTSD Checklist – Specific version (PCL-S),[30] with a threshold of scores ≥45. Depressive symptoms at baseline and follow up were measured using the Hospital Anxiety and Depression Scale (HADS),[31] with a threshold of scores ≥8. Mechanism of injury was established from clinical information and provided a binary exposure variable of violent or accidental injury. Demographic information was also collected.

Statistical analysis

It was calculated that a sample size of 67 in each group was required to test the hypothesis that mean scores on the PCL-S would be at least five points higher among participants injured through violence than among those injured accidentally. Smaller numbers were required for the HADS. Higher numbers were sought at baseline because of anticipated difficulties in following up participants.

Sensitivity analyses used univariate logistic regressions to explore differences in follow up. To understand simple associations in the data, we used Chi squared tests and univariate logistic regressions. To test the longitudinal hypotheses, we used logistic multilevel models for repeated measures, with bootstrapping to produce more robust confidence intervals. Multilevel models allowed all participants' questionnaires to be included in the final statistical models whether participants had contributed to one or both waves, thus increasing statistical power. Missing data were not imputed. Outcomes for PTSS and depressive symptoms were assessed separately. When

adjusting multilevel models, they were subjected to a likelihood ratio test after estimation to ensure optimal modelling of the variation.

We considered P values of less than 0.05 to be statistically significant. Statistical analyses were carried out using Stata statistical software (version 14). Power calculations were carried out using G*Power (version 3.1.7).

Results

Description of the data

Of 829 patients admitted to the ward during the study period, 467 met the study criteria. Of these, 225 (48.2%) consented to take part, 219 (46.9%) of whom provided useable baseline data. Baseline measures were collected within 21 days after injury (mean days 4.27, *CI* 3.72 to 4.82). The main reason patients were excluded was a lack of an opportunity to approach patients due to surgical or rehabilitation procedures, or excessive pain or nausea (22.9%, *N* = 190). Recruitment to the study did not differ by age or gender.

Of the 219 baseline participants, 109 (49.8%) responded to follow up at eight months (mean days 228.23, *CI* 218.18 to 238.28), providing a total of 328 questionnaires for use in multilevel models. Reasons for loss to follow up were not known.

There were significant group differences in those who did follow up. Participants injured through interpersonal violence were significantly less likely to respond to follow up (*OR* 0.29, *CI* 0.16 to 0.52), as were those with clinically significant PTSS (*OR* 0.36, *CI* 0.19 to 0.67) or depressive symptoms (*OR* 0.40, *CI* 0.22 to 0.72) at baseline.

Sample characteristics

Participants were predominantly male and young; over a third of participants had been injured through interpersonal violence (Table 1). Violent injury was more common among young, male and ethnic minority groups. Among the violently injured group, 34 (44.7%) had been injured through suspected gang violence. Violence was more common among young, male and ethnic minority groups.

		N	(Column %)	% injured violently
Total		219	(100.00)	34.70
Gender	Male	166	(75.80)	39.76
	Female	53	(24.20)	18.87
Age	18-25	57	(26.03)	50.88
	26-35	59	(26.94)	42.37
	36-45	43	(19.63)	37.21
	46-65	42	(19.18)	11.90
	66+	18	(8.22)	5.56
Ethnicity	White, White British	163	(74.43)	24.54
	Black, Black British	23	(10.50)	78.26
	Asian, Asian British	17	(7.76)	52.94
	Mixed, Multiple, Other	16	(7.31)	56.25

Table 1: Demographics for all participants at baseline

Outcome data

More than one quarter of participants reported PTSS, both among all baseline participants, and among those responding at eight months (Figure 1). PTSS were more common after violent injury. Exact values are provided in the appendix (Table 2).

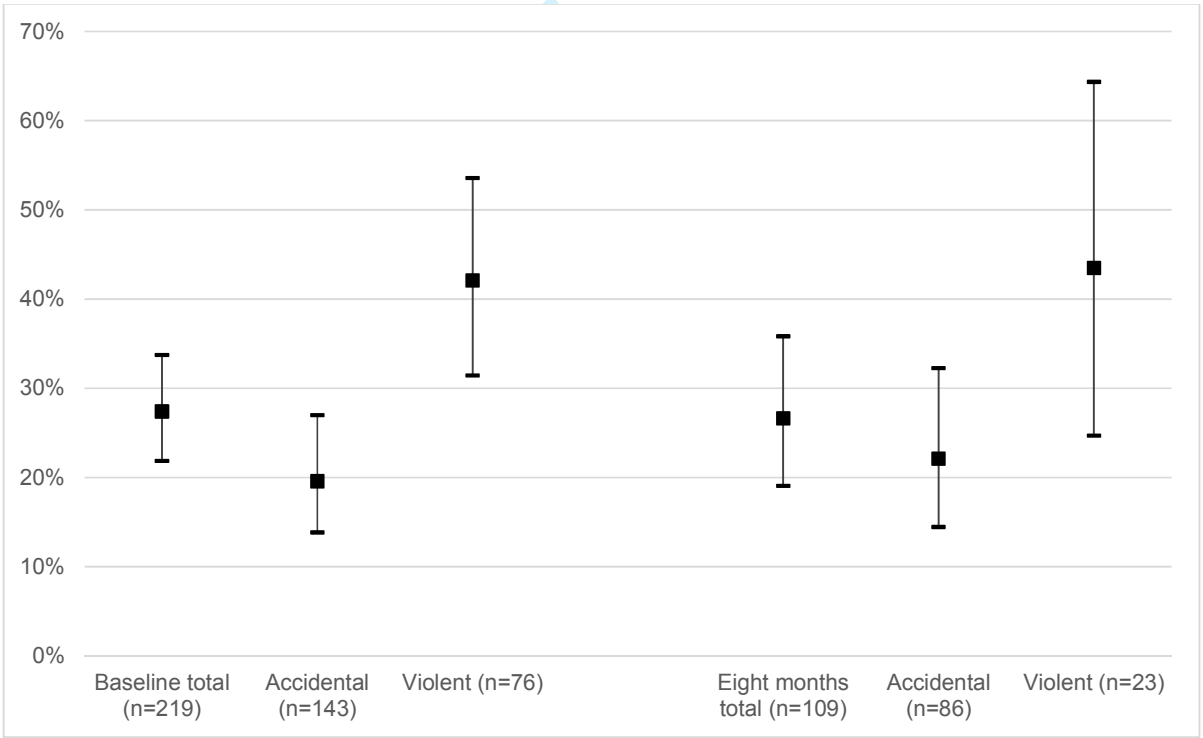

Figure 1: Prevalence of clinically significant PTSS at baseline and eight months. Threshold: ASDS ≥56 at baseline, PCL-S ≥44 at eight months.

Almost one third of participants reported depressive symptoms at baseline and at eight months (Figure 2). Those injured violently were more likely to have depressive symptoms. Exact values are provided in the appendix (Table 3).

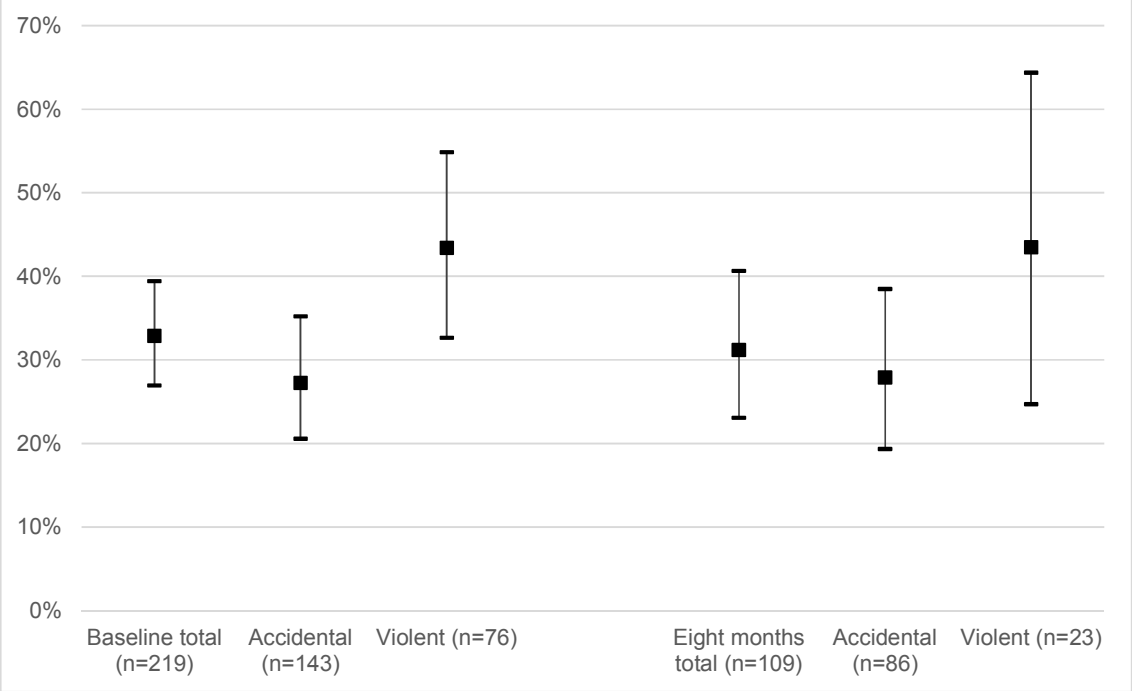

Figure 2: Prevalence of clinically significant depressive symptoms at baseline and eight months. Threshold HADS-D ≥8.

Main results

In longitudinal models, violent injury significantly increased the odds of PTSS (unadjusted *OR* 6.41, *CI* 2.05 to 20.04; adjusted for age and gender *OR* 6.27, *CI* 1.90 to 20.66) and depressive symptoms (unadjusted *OR* 3.47, *CI* 1.26 to 9.57; adjusted for age and gender *OR* 3.12, *CI* 1.08 to 8.99).

Discussion

Principal findings

This is the first UK prospective study of the persistence of psychological distress in people admitted with injuries to an inner city major trauma centre. The prevalence of both PTSS and depressive symptoms was high at baseline and follow up, with over a quarter of participants experiencing clinically significant symptoms of PTSS and up to a third reporting clinically significant symptoms of depression. These figures are likely to be underestimates as follow-up rates among those with psychological distress were lower. These rates are substantially higher than the 5.5% prevalence of PTSD in a London community sample[25] and 11.4% prevalence of depressive symptoms in the UK general population.[32] A large proportion of participants in this study represent a group that is hard to engage in follow up and into research studies. The sample comprised predominantly young men

and over a third of participants had been injured through interpersonal violence. Violent injury was more common among young, male and ethnic minority groups and 44.7% of these individuals had been injured through suspected gang violence.

Previous studies in other countries have reported that rates of psychological distress following injury decrease over time.[17,18] However, in this population, symptoms persisted and this may be partly due to the high proportion of participants injured through violence, as PTSS have been shown to remain high among victims of violence.[11,20] We found that the prevalence of depressive symptoms in the overall sample also remained high, which has not been described previously.

Violent injury was a significant risk factor for both PTSS and depressive symptoms, increasing the odds of PTSS by a factor of six (*OR* 6.27, *CI* 1.90 to 20.66), and the odds of depressive symptoms by a factor of three (*OR* 3.12, *CI* 1.08 to 8.99). This increased risk of depressive symptoms following violent injury accords with one previous study.[21]

Strengths and limitations

This study accessed a unique and hard to reach urban sample of injured patients, many of whom would typically resist engagement with research[1,2] and health services.[3] It provides local-level information in a field where prevalences and risk factors vary considerably.

Follow-up data collection with hard to reach groups is particularly challenging[1] and the significant differences in follow-up participant characteristics pose problems. However, the statistical approach minimised the detrimental effects of this bias. The prevalences reported at follow up are likely to be an underestimate: this reinforces the need for routine assessment, intervention and signposting to support services in this population. The modest sample size prevented further adjustments to the model, such as ethnicity or suspected gang violence. It was not possible to use a clinical interview to confirm suspected psychiatric diagnoses.

Implications

Given the high prevalence and persistence of distress in injury victims, there are clearly unidentified and unmet needs. In the high pressure environment of trauma care, and in longer term recovery from trauma, remarkably little attention is paid to mental health. NHS guidelines favour ‘watchful waiting’ for PTSS, with a follow up at one month. However, the present findings suggest that early identification and intervention may be essential in some cases. This concurs with the suggestions of others studying trauma.[33,34]

Traumatic injury patients, including those with significant psychological symptoms, often lack insight into their conditions[35] and can struggle to access counselling services.[36] This puts a greater onus

on healthcare workers to identify individuals at risk.[9] Trauma settings need appropriate staff to assess patients' psychological needs and to initiate the delivery of care.

Stereotyped attitudes to trauma patients may create a further barrier to psychological care, with some staff in primary and secondary care believing that patients are themselves responsible for their injuries and that they do not merit psychological support.[36,37] Furthermore, trauma healthcare workers in the UK report that the environment is not conducive to forming therapeutic relationships, and that there is a gap between the ideal, compassionate care they would like to provide, and the time-pressured reality.[38] Gaps can occur in the transfer from secondary and primary care, where there is a need for continuity.[36,39]

Young people involved in gangs are likely to have poor experiences of healthcare, as well as educational and social care systems.[1] Trauma care is one of the key contact points within these systems where intervention may be possible, and it has been suggested that, in areas where gang activity is common, all individuals being treated by health services should be asked about gang membership.[27] Hospital admission may thus provide a unique opportunity for intervention. An American intervention targeted hospitalised teenagers with evidence of violent behaviour and alcohol use: a brief hospital intervention improved violent behaviour and reduced alcohol use at follow up.[40] Such initiatives can be highly effective, and could help seize unique 'teachable moments'.

Contributors: ER participated in the design, data collection, data analysis, and manuscript preparation. KB participated in the design, data analysis and manuscript preparation. MS participated in data analysis. IH participated in the receipt of funding, design and data collection. AK participated in the receipt of funding, design, data collection and manuscript preparation. All authors contributed to manuscript development and approved the final version, and agree to be accountable for all aspects of the work.

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Patient consent: All participants gave written informed consent before taking part. No identifiable medical information is included in this article.

Data sharing: No additional data are available.

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Appendix

Table 2: Prevalence of clinically significant PTSS at each time point

Variable	Values	Baseline: ASDS ≥56		Eight months: PCL-S ≥44	
Total		60/219	(27.40%)	29/109	(26.61%)
Gender	Male	46/166	(27.71%)	19/79	(24.05%)
	Female	14/53	(26.42%)	10/30	(33.33%)
Age	18-25	14/57	(24.56%)	6/19	(31.58%)
	26-35	19/59	(32.20%)	9/30	(30.00%)
	36-45	13/43	(30.23%)	8/22	(36.36%)
	46-65	11/42	(26.19%)	5/25	(20.00%)
	66+	3/18	(16.67%)	1/13	(7.69%)
Ethnicity	White, White British	37/163	(22.70%)	20/90	(22.22%)
	Black, Black British	12/23	(52.17%)	5/8	(62.50%)
	Asian, Asian British	6/17	(35.29%)	2/5	(40.00%)
	Mixed, Multiple, Other	5/16	(31.25%)	2/6	(33.33%)
Mechanism	Violent injury	28/143	(19.58%)	19/86	(22.09%)
	Accidental injury	32/76	(42.11%)	10/23	(43.48%)

Table 3: Prevalence of clinically significant depressive symptoms at each time point

Variable	Values	Baseline: HADS-D ≥8		Eight months: HADS-D ≥8	
Total		72/219	(32.88%)	34/109	(31.19%)
Gender	Male	51/166	(30.72%)	24/79	(30.38%)
	Female	21/53	(39.62%)	10/30	(33.33%)
Age	18-25	19/57	(33.33%)	6/19	(31.58%)
	26-35	19/59	(32.20%)	12/30	(40.00%)
	36-45	18/43	(41.86%)	8/22	(36.36%)
	46-65	13/42	(30.95%)	5/25	(20.00%)
	66+	3/18	(16.67%)	3/13	(23.08%)
Ethnicity	White, White British	43/163	(26.38%)	23/90	(25.56%)
	Black, Black British	13/23	(56.52%)	7/8	(87.50%)
	Asian, Asian British	10/17	(58.82%)	2/5	(40.00%)
	Mixed, Multiple, Other	6/16	(37.50%)	2/6	(33.33%)
Mechanism	Violent injury	39/143	(27.27%)	24/86	(27.91%)
	Accidental injury	33/76	(43.42%)	10/23	(43.48%)

STROBE Statement—for article 'Violent injury predicts poor psychological outcomes after traumatic injury in a hard to reach population: an observational cohort study'

Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation	Status
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Done: page 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	Done: page 2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Done: page 3,4
Objectives	3	State specific objectives, including any prespecified hypotheses	Done: page 4
Methods			
Study design	4	Present key elements of study design early in the paper	Done: page 4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Done: page 5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	Done: page 5
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	Not applicable
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Done: page 5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Done: page 5
Bias	9	Describe any efforts to address potential sources of bias	Done: page 5
Study size	10	Explain how the study size was arrived at	Done: page 5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Done: page 5
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Done: page 5, 6
		(*b*) Describe any methods used to examine subgroups and interactions	Done: page 5, 6
		(*c*) Explain how missing data were addressed	Done: page 5
		(*d*) If applicable, explain how loss to follow-up was addressed	Done: page 5
		(*e*) Describe any sensitivity analyses	Done: page 5
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility,	Done: page 6

		confirmed eligible, included in the study, completing follow-up, and analysed	
		(b) Give reasons for non-participation at each stage	Done (to the extent possible) : page 6
		(c) Consider use of a flow diagram	No flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Done: page 6, 7
		(b) Indicate number of participants with missing data for each variable of interest	Done: page 6
		(c) Summarise follow-up time (eg, average and total amount)	Done: page 6
Outcome data	15*	Report numbers of outcome events or summary measures over time	Done: page 7, 8, 14
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Done: page 8
		(*b*) Report category boundaries when continuous variables were categorized	Done: page 5
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Not applicable
Discussion			
Key results	18	Summarise key results with reference to study objectives	Done: page 8, 9
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Done: page 9
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Done: page 9
Generalisability	21	Discuss the generalisability (external validity) of the study results	Done: page 9, 10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Done: page 10

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.

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Violent injury predicts poor psychological outcomes after traumatic injury in a hard to reach population: an observational cohort study

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Violent injury predicts poor psychological outcomes after traumatic injury in a hard to reach population: an observational cohort study

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Abstract

Background: People who experience physical trauma face a range of psychosocial outcomes. These may be overlooked by busy clinicians. While some risk factors are understood, understanding of the psychological effects of violent injury remains limited, particularly in UK settings. This study compared psychological outcomes following interpersonal violence and accidental injury, including the persistence of psychological distress.

Methods: A questionnaire survey was carried out at two time points of patients admitted to a large teaching hospital in London between July 2012 and April 2014. Participants were **c**onsecutive adult patients admitted to the Royal London Hospital with traumatic injuries, with 219 participants at baseline. Follow up survey was eight months later (*N* = 109). Standardised measures assessed symptoms of post-traumatic stress (PTSS) (Acute Stress Disorder Scale, PTSD Checklist) and depression (Hospital Anxiety and Depression Scale).

Results: PTSS and depressive symptoms affected 27% and 33% respectively at baseline. At eight months, 27% and 31% respectively reported these symptoms. The repeated measures were assessed with multilevel models: after adjusting for demographic factors, patients with violent injury showed more PTSS (*OR* 6.27, *95% CI* 1.90 to 20.66), and depressive symptoms (*OR* 3.12, *95% CI* 1.08 to 8.99).

Conclusions: There were high levels of psychological distress among traumatic injury patients. Violent injuries were associated with an increased risk of both post-traumatic and depressive symptoms. People vulnerable to distress would benefit from psychological support and hospital admission provides a unique opportunity to engage hard to reach groups in interventions.

Keywords: mental health, orthopaedic & trauma surgery, depression & mood disorders

Strengths and limitations of this study

This prospective study accessed a unique and hard to reach urban sample of injured patients, many of whom would typically resist engagement with research[1,2] and health services.[3]

It provides local-level information in a field where prevalences and risk factors vary considerably.

The significant differences in follow-up participant characteristics pose problems, however, the statistical approach minimised the detrimental effects of this bias.

Data on severity of injury were not available for all participants and could not be included in analyses. However, findings from other studies do not support an association between injury severity and PTSD,[4] suggesting injury severity would not have been an important confounder.

The modest sample size prevented further adjustments to the model, such as ethnicity or suspected gang violence.

Introduction

Violence and injury pose significant public health problems and violence is a leading cause of death and injury worldwide.[5] There are over 700,000 hospital admissions for accidental and violent injuries each year in England,[6] and 9.2% of injuries occur through violence,[7] with higher rates in metropolitan hospitals,[8] in men and those aged 16 to 25.[9]

There is currently no routine assessment of psychological symptoms in trauma settings,[9] and symptoms of psychological distress are rarely identified by clinical staff.[10,11] However, traumatic injuries have psychological as well as physical consequences.[12,13] US studies have reported high rates of psychological distress following trauma such as post-traumatic stress disorder (PTSD) and depression.[14–17] PTSD can occur following exposure to, or witnessing, traumatic events such as death, serious injury or sexual violence. Post traumatic symptoms (PTSS) include disturbing flashbacks, avoiding reminders, feelings of alienation and blame, and hyperarousal and reactivity, which persist for at least a month. Acute symptoms within the first month following trauma are recognised as acute stress disorder (ASD). Depression is a mood disorder characterised by depressed mood or loss of interest or pleasure with neurovegetative and cognitive symptoms and significant impairment.

The prevalence of psychological distress following traumatic injury varies widely in different patient populations and countries, and there are few data available on UK rates.[18] An international review, which included one study of motor vehicle collision patients in the UK, reported PTSS rates between 17.5% and 42% up to six months post-injury; the range was greater still at 12 months, ranging from 2%

to 36%.[19] Longitudinal studies show that PTSS prevalence falls over time.[19,20] American and Australian studies report rates of depressive symptoms ranging from 60% at baseline,[16] to 31% at six months,[14,16] with rates at one year between 9% and 16%.[12,17] The variation in prevalence is likely due to differences in location, nature of injury and demographic profile. Although one UK study of non-violent injuries is in progress,[18] more studies are needed to plan NHS care.

Vulnerability to violent injury

Conflict in the world is increasing, not just in wars but also in civilian settings, through violent protests, football match violence, armed robbery and street gangs. Civilians injured through violence are at greater risk of PTSS and more persistent symptoms than those who experience non-violent injuries.[12,14,21,22] However, there is conflicting evidence on whether violent injury is associated with depressive symptoms.[14,23] Better recognition and treatment of those at risk of psychological sequelae would improve their quality of life and functioning.

Certain groups are more vulnerable to violent injury, including socio-economically deprived people, ethnic minorities, and young men,[8,24] and deprivation is often a determinant of violent injuries with violence being used to secure more resources or to protest about deprivation.[25] Rates of both violence and poor mental health are high in deprived urban areas.[26] For example, people in South East London have much higher rates of exposure to trauma than those in other European inner cities, as well as higher rates of PTSS, mental disorder and substance abuse. [27,28] In Hackney, East London, 9% of men report belonging to a gang compared with 1% across Britain[29] and East London boroughs are among those with the highest deprivation in England.[30] Hard to reach groups – including ethnic minorities, survivors of violence, people living in disadvantaged areas, those with mental health problems and youths at risk of criminal and gang involvement – are under-researched,[1] and tend to resist engaging with researchers[2] as well as health services.[3]

The variation in rates of psychological distress and the particular challenges in inner cities demonstrate the need for more 'local thinking' on mental health.[28] In this study, we tested the hypothesis that violent injury is associated with both depressive symptoms and PTSS, and assessed risk factors for persistence of PTSS and depressive symptoms in patients attending a teaching hospital and major trauma centre in East London.

Methods

This was an observational cohort study of inpatients admitted following accidental or violent injury.

Setting

Recruitment took place at the Royal London Hospital between July 2012 and April 2014. Participants were identified from consecutive patients discussed at bi-weekly multidisciplinary meetings of the major trauma and oral and maxillofacial surgery teams.

Participants

The inclusion criteria were: admitted as hospital inpatients under major trauma or oral and maxillofacial trauma; aged 18 or more; English-speaking. The exclusion criteria were: active psychosis; admission following deliberate self-harm; under the influence of alcohol or illegal substances; cognitive impairment based on a Glasgow Coma Score (GCS) below 15 and on the advice of clinical staff.

All participants provided informed consent in writing. Baseline measures were collected in hospital with a follow-up postal questionnaire at eight months. All measures were self-report questionnaires, and we used published thresholds to identify clinically significant symptoms.

Measures

Baseline PTSS were measured using the Acute Stress Disorder Scale (ASDS),[31] using a threshold of scores ≥56 which the measure's creators found to be the most accurate predictor of subsequently developing PTSD. Follow up PTSS were measured using the PTSD Checklist – Specific version (PCL-S),[32] with a threshold of scores ≥45. A psychometric analysis of the PCL-S among civilian trauma patients identified this threshold as having the highest diagnostic efficiency.[32] Depressive symptoms at baseline and follow up were measured using the Hospital Anxiety and Depression Scale (HADS),[33] with a threshold of scores ≥8. This threshold has been widely used and reported to have good sensitivity for identifying psychiatric morbidity.[17,34,35] Mechanism of injury was established from clinical information and provided a binary exposure variable of violent or accidental injury. Injury Severity Scores (ISS) were collected from clinical records in major trauma, but were not available for oral and maxillofacial trauma patients, and therefore could not be used in analyses. Demographic information was also collected.

Statistical analysis

Using previous findings on trauma survivors,[36] it was calculated that a sample size of 67 in each group was required to test the hypothesis that mean scores on the PCL-S would be at least five points higher among participants injured through violence than among those injured accidentally. Calculations used a two-sided significance of 0.05 and a power of 0.9. Smaller sample sizes were required for the HADS. Higher numbers were sought at baseline because of anticipated difficulties in following up participants.

Sensitivity analyses used univariate logistic regressions to explore differences in follow up. To understand simple associations in the data, we used Chi squared tests and univariate logistic regressions. To test the longitudinal hypotheses, we used logistic multilevel models for repeated measures, with bootstrapping to produce more robust confidence intervals. Multilevel models allowed all participants' questionnaires to be included in the final statistical models whether participants had contributed to one or both waves, thus increasing statistical power. Missing data were not imputed. Outcomes for PTSS and depressive symptoms were assessed separately. When adjusting multilevel models, they were subjected to a likelihood ratio test after estimation to ensure optimal modelling of the variation.

We considered P values of less than 0.05 to be statistically significant. Statistical analyses were carried out using Stata statistical software (version 14). Power calculations were carried out using G*Power (version 3.1.7).

Results

Description of the data

Of 829 patients admitted to the ward during the study period (July 2012 to April 2014), 467 met the study criteria. Of these 467, 225 (48.2%) consented and were recruited to the study, 219 (46.9%) of whom provided useable baseline data. Baseline measures were collected within 21 days after injury (mean days 4.27, *95% CI* 3.72 to 4.82). The main reason patients were excluded was a lack of an opportunity to approach patients due to surgical or rehabilitation procedures, or excessive pain or nausea (22.9%, *N* = 190). Recruitment to the study did not differ by age or gender.

Of the 219 baseline participants, 109 (49.8%) responded to follow up at eight months (mean days 228.23, *95% CI* 218.18 to 238.28), providing a total of 328 questionnaires for use in multilevel models. Reasons for loss to follow up were not known.

There were significant group differences in those who did follow up. Participants injured through interpersonal violence were significantly less likely to respond to follow up (*OR* 0.29, *95% CI* 0.16 to 0.52), as were those with clinically significant PTSS (*OR* 0.36, *95% CI* 0.19 to 0.67) or depressive symptoms (*OR* 0.40, *95% CI* 0.22 to 0.72) at baseline.

Sample characteristics

Participants were predominantly male and young; over a third of participants had been injured through interpersonal violence (Table 1).

		Violent injury/Total	(%)
Total sample		76/219	(34.7)
Gender	Male	66/166	(39.8)
	Female	10/53	(18.9)
Age	18-25	29/57	(50.9)
	26-35	25/59	(42.4)
	36-45	16/43	(37.2)
	46-65	5/42	(11.9)
	66+	1/18	(5.6)
Ethnicity	White, White British	40/163	(24.5)
	Black, Black British	18/23	(78.3)
	Asian, Asian British	9/17	(52.9)
	Mixed, Multiple, Other	9/16	(56.3)

Table 1: Proportion of the sample injured violently overall and within each demographic group

Violent injury was more common among young, male and ethnic minority groups. Among the violently injured group, 34 (44.7%) had been injured through suspected gang violence.

Outcome data

More than one quarter of participants reported PTSS, both among all baseline participants, and among those responding at eight months (Figure 1). PTSS were more common after violent injury. Exact values are provided in Supplementary table 1.

Almost one third of participants reported depressive symptoms at baseline and at eight months (Figure 2). Those injured violently were more likely to have depressive symptoms. Exact values are provided in Supplementary table 2.

Main results

In longitudinal models, violent injury significantly increased the odds of PTSS (unadjusted *OR* 6.41, *95% CI* 2.05 to 20.04; adjusted for age and gender *OR* 6.27, *95% CI* 1.90 to 20.66) and depressive symptoms (unadjusted *OR* 3.47, *95% CI* 1.26 to 9.57; adjusted for age and gender *OR* 3.12, *95% CI* 1.08 to 8.99).

Discussion

Principal findings

This is the first UK prospective study of the persistence of psychological distress in people admitted with injuries to an inner city major trauma centre. The prevalence of both PTSS and depressive symptoms was high at baseline and follow up, with over a quarter of participants experiencing clinically significant symptoms of PTSS and up to a third reporting clinically significant symptoms of depression. These figures are likely to be underestimates as follow-up rates among those with psychological distress were lower. These rates are substantially higher than the 5.5% prevalence of PTSD in a London community sample[27] and 11.4% prevalence of depressive symptoms in the UK general population.[37] A large proportion of participants in this study represent a group that is hard to engage in follow up and into research studies. The sample comprised predominantly young men and over a third of participants had been injured through interpersonal violence. Violent injury was more common among young, male and ethnic minority groups and 44.7% of these individuals had been injured through suspected gang violence.

Previous studies in other countries have reported that rates of psychological distress following injury decrease over time.[19,20] However, in this population, symptoms persisted and this may be partly due to the high proportion of participants injured through violence, as PTSS have been shown to remain high among victims of violence.[12,22] We found that the prevalence of depressive symptoms in the overall sample also remained high, which has not been described previously. Those injured violently may have had ongoing experiences of violence, contributing to the persistence of distress.

Violent injury was a significant risk factor for both PTSS and depressive symptoms, increasing the odds of PTSS by a factor of six (*OR* 6.27, *95% CI* 1.90 to 20.66), and the odds of depressive symptoms by a factor of three (*OR* 3.12, *95% CI* 1.08 to 8.99). This increased risk of depressive symptoms following violent injury accords with one previous study.[23]

The sample included in this study provides a unique insight into the psychological needs of trauma patients in an East London hospital setting, many of whom are hard to reach. There were limitations in follow-up, however, this suggests that the prevalences reported at follow up are likely to be an underestimate. This reinforces the need for routine assessment, intervention and signposting to support services in this population. It was not possible to use a clinical interview to confirm suspected psychiatric diagnoses. Further limitations include the inability to consider variables in the analyses such as severity of injury, experiences of trauma following discharge, ethnicity, or suspected gang violence.

Implications

Given the high prevalence and persistence of distress in injury victims, there are clearly unidentified and unmet needs. In the high pressure environment of trauma care, and in longer term recovery from trauma, remarkably little attention is paid to mental health. NHS guidelines favour 'watchful waiting' for PTSS, with a follow up at one month. However, the present findings suggest that early identification and intervention may be essential in some cases. This concurs with the suggestions of others studying trauma.[38,39]

Traumatic injury patients, including those with significant psychological symptoms, often lack insight into their conditions[40] and can struggle to access counselling services.[41] This puts a greater onus on healthcare workers to identify individuals at risk.[10] Trauma settings need appropriate staff to assess patients' psychological needs and to initiate the delivery of care.

Stereotyped attitudes to trauma patients may create a further barrier to psychological care, with some staff in primary and secondary care believing that patients are themselves responsible for their injuries and that they do not merit psychological support.[41,42] Furthermore, trauma healthcare workers in the UK report that the environment is not conducive to forming therapeutic relationships, and that there is a gap between the ideal, compassionate care they would like to provide, and the time-pressured reality.[43] Gaps can occur in the transfer from secondary to primary care, where there is a need for continuity.[41,44]

Young people involved in gangs are likely to have poor experiences of healthcare, as well as educational and social care systems.[1] Trauma care is one of the key contact points within these systems where intervention may be possible, and it has been suggested that, in areas where gang activity is common, all individuals being treated by health services should be asked about gang membership.[29] Hospital admission may thus provide a unique opportunity for intervention. An American intervention targeted hospitalised teenagers with evidence of violent behaviour and alcohol use: a brief hospital intervention improved violent behaviour and reduced alcohol use at follow up.[45] Such initiatives can be highly effective, and could help seize unique 'teachable moments'.

Contributors: ER participated in the design, data collection, data analysis, and manuscript preparation. KB participated in the design, data analysis and manuscript preparation. MS participated in data analysis. IH participated in the receipt of funding, design and data collection. AK participated in the receipt of funding, design, data collection and manuscript preparation. All

authors contributed to manuscript development and approved the final version, and agree to be accountable for all aspects of the work.

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Patient consent: All participants gave written informed consent before taking part. No identifiable medical information is included in this article.

Data sharing: No additional data are available.

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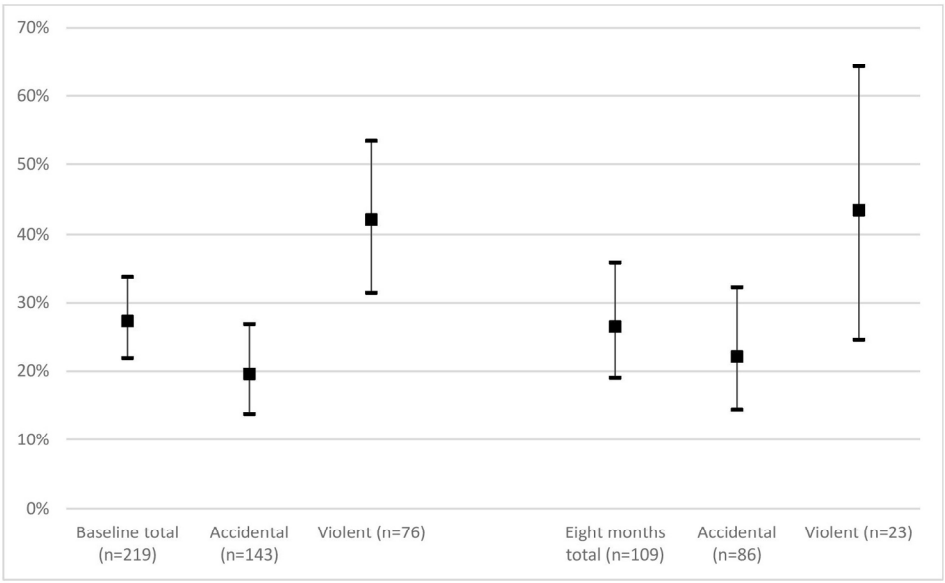

Figure 1: Prevalence of clinically significant PTSS at baseline and eight months, 95% CI. Threshold: ASDS ≥56 at baseline, PCL-S ≥44 at eight months.
Figure 1
169x110mm (300 x 300 DPI)

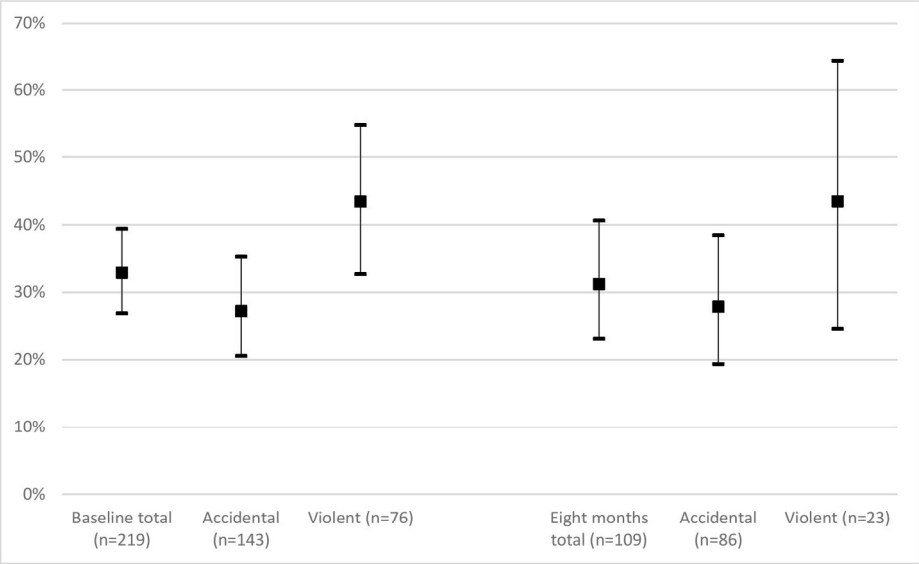

Figure 2: Prevalence of clinically significant depressive symptoms at baseline and eight months, 95% CI. Threshold HADS-D ≥8.
Figure 2
173x114mm (300 x 300 DPI)

Appendices

Supplementary table 1: Prevalence of clinically significant PTSS at each time point

Variable	Values	Baseline: ASDS ≥56 (N=219)		Eight months: PCL-S ≥44 (N=109)	
Total		60/219	(27.40%)	29/109	(26.61%)
Gender	Male	46/166	(27.71%)	19/79	(24.05%)
	Female	14/53	(26.42%)	10/30	(33.33%)
Age	18-25	14/57	(24.56%)	6/19	(31.58%)
	26-35	19/59	(32.20%)	9/30	(30.00%)
	36-45	13/43	(30.23%)	8/22	(36.36%)
	46-65	11/42	(26.19%)	5/25	(20.00%)
	66+	3/18	(16.67%)	1/13	(7.69%)
Ethnicity	White, White British	37/163	(22.70%)	20/90	(22.22%)
	Black, Black British	12/23	(52.17%)	5/8	(62.50%)
	Asian, Asian British	6/17	(35.29%)	2/5	(40.00%)
	Mixed, Multiple, Other	5/16	(31.25%)	2/6	(33.33%)
Mechanism	Accidental injury	28/143	(19.58%)	19/86	(22.09%)
	Violent injury	32/76	(42.11%)	10/23	(43.48%)

Supplementary table 2: Prevalence of clinically significant depressive symptoms at each time point

Variable	Values	Baseline: HADS-D ≥8 (N=219)		Eight months: HADS-D ≥8 (N=109)	
Total		72/219	(32.88%)	34/109	(31.19%)
Gender	Male	51/166	(30.72%)	24/79	(30.38%)
	Female	21/53	(39.62%)	10/30	(33.33%)
Age	18-25	19/57	(33.33%)	6/19	(31.58%)
	26-35	19/59	(32.20%)	12/30	(40.00%)
	36-45	18/43	(41.86%)	8/22	(36.36%)
	46-65	13/42	(30.95%)	5/25	(20.00%)
	66+	3/18	(16.67%)	3/13	(23.08%)
Ethnicity	White, White British	43/163	(26.38%)	23/90	(25.56%)
	Black, Black British	13/23	(56.52%)	7/8	(87.50%)
	Asian, Asian British	10/17	(58.82%)	2/5	(40.00%)
	Mixed, Multiple, Other	6/16	(37.50%)	2/6	(33.33%)
Mechanism	Accidental injury	39/143	(27.27%)	24/86	(27.91%)
	Violent injury	33/76	(43.42%)	10/23	(43.48%)

STROBE Statement—for article 'Violent injury predicts poor psychological outcomes after traumatic injury in a hard to reach population: an observational cohort study'

Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation	Status
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Done: page 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	Done: page 2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Done: page 3,4
Objectives	3	State specific objectives, including any prespecified hypotheses	Done: page 4
Methods			
Study design	4	Present key elements of study design early in the paper	Done: page 4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Done: page 5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	Done: page 5
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	Not applicable
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Done: page 5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Done: page 5
Bias	9	Describe any efforts to address potential sources of bias	Done: page 5
Study size	10	Explain how the study size was arrived at	Done: page 5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Done: page 5
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Done: page 5, 6
		(*b*) Describe any methods used to examine subgroups and interactions	Done: page 5, 6
		(*c*) Explain how missing data were addressed	Done: page 5
		(*d*) If applicable, explain how loss to follow-up was addressed	Done: page 5
		(*e*) Describe any sensitivity analyses	Done: page 5
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility,	Done: page 6

		confirmed eligible, included in the study, completing follow-up, and analysed	
		(b) Give reasons for non-participation at each stage	Done (to the extent possible) : page 6
		(c) Consider use of a flow diagram	No flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Done: page 6, 7
		(b) Indicate number of participants with missing data for each variable of interest	Done: page 6
		(c) Summarise follow-up time (eg, average and total amount)	Done: page 6
Outcome data	15*	Report numbers of outcome events or summary measures over time	Done: page 7, 8, 14
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Done: page 8
		(*b*) Report category boundaries when continuous variables were categorized	Done: page 5
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Not applicable
Discussion			
Key results	18	Summarise key results with reference to study objectives	Done: page 8, 9
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Done: page 9
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Done: page 9
Generalisability	21	Discuss the generalisability (external validity) of the study results	Done: page 9, 10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Done: page 10

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.