

Psychiatric consequences of needlestick injury

B. Green¹ and E. C. Griffiths²

¹Faculty of Health and Social Care, University of Chester, Chester CH1 1SL, UK, ²Department of Animal and Plant Sciences, University of Sheffield, Sheffield S10 2TN, UK.

Correspondence to: B. Green, Faculty of Health and Social Care, University of Chester, Riverside Campus, Castle Drive, Chester CH1 1SL, UK. Tel: +44 (0)1244 51100; fax: +44 (0)1244 511300; e-mail: bgreen@chester.ac.uk

Background	Needlestick injuries (NSIs) are a common occupational hazard with potential physical health effects, including viral infections such as hepatitis and HIV. Less appreciated are the psychiatric consequences of NSIs, potentially including post-traumatic stress disorder (PTSD) and adjustment disorder (AD).
Aims	To study psychiatric consequences of NSIs by diagnosis, duration and severity of depressive symptoms.
Methods	Case control study from patients referred to a psychiatric trauma clinic diagnosed according to ICD-10 diagnostic research criteria guidelines. The Beck Depression Inventory (BDI) was administered to measure depressive symptomatology and assess differences in depression severity between psychiatric trauma patients who had or had not experienced an NSI, and for relationships between the severity of depression and time since NSI using linear models.
Results	There were 17 NSI cases and 125 controls. NSI patients had moderately severe depressive symptoms (mean BDI score 22.7 15), which was similar to 125 non-NSI trauma patients. 13 of these 17 cases had AD and four had PTSD. None contracted infections from their NSI, but most described secondary effects of psychiatric illness on occupational, family and sexual functioning. Severity of depressive symptoms declined with time after NSI, but psychiatric illness lasted 1.78 months longer for every month a NSI patient waited for seronegative test results ($P < 0.05$).
Conclusions	Enduring psychiatric illness can result from NSIs with a severity similar to other psychiatric trauma. Swift delivery of test results may reduce the duration of depression associated with NSI. Occupational health professionals need to be aware of the psychiatric and physical effects of NSIs.
Key words	Adjustment disorder; anxiety; depression; needlestick; needlestick injury; occupational health; psychiatric disorder; PTSD.

Introduction

Many workers face daily occupational exposure to the hazard of a needlestick injury (NSI). In the UK there were 3773 reported occupational exposures from 1997 to 2007 to high risk body fluids. In data collected between 2000 and 2007, 76% were percutaneous injuries, mainly incurred by medical and nursing staff in hospitals, and 9% among ancillary staff [1]. Seroconversion risks in these cases were 1.6% for hepatitis C virus and 0.37% for HIV [1]. Noncompliance with occupational health policies regarding NSIs is commonplace; studies have found between 26 and 59% of medical students and nurses who had an NSI did not report it to occupational health [2,3,4,5,6].

Beyond health care settings the Health and Safety Executive in the UK notes NSIs in police, prison service staff, parks staff, transport staff customs and excise, funeral directors, car breaking and construction/demolition industries [7]. In 6 years in one US airport there were 14 reported NSIs [8]. Of 1000 surveyed veterinarians in Queensland, Australia 75% had at least one NSI in the previous 12 months [9]. Two-thirds of Australian prison officers come across used needles in prison settings and 7% have had NSIs [10]. Two hundred and seventy-four children presented with NSIs to two hospitals in Canada between 1988 and 2006 following injuries in settings such as public parks [11].

NSIs pose a significant economic burden. Work absences among Californian NSI cases numbered 903 between 1992–2003, including workers such as nurses,

orderlies, janitors, maids and doctors. Seven per cent of these NSIs led to more than 31 days of work loss [12]. The estimated annual cost to the UK's National Health Service of NSIs through insulin administration is £600 000 [13]. Additional costs from NSIs include litigation. In 2010 a UK health worker was awarded £58 000 in a case against their employer following an NSI that resulted in physical consequences (hepatitis B infection) and mental distress, with the pay-out based on their inability to work because of needle phobia following the NSI [14].

While the occupational hazard of NSIs is acknowledged, studies on their health consequences have tended to address the risks of blood-borne infection from NSIs, rather than the psychiatric effects of NSIs. However, many patients, like the children in the Papenburg *et al.* study, may not contract a blood-borne infection, but may still exhibit severe psychiatric pathologies [11]. Depressive symptoms have been associated with NSIs in medical students in Japan and the authors recommended mental health screening for students suffering NSI [15]. In Korea, 71% of health care workers had experienced NSIs and had significantly higher scores for depression and anxiety [16]. However, such studies are rare and further research is greatly needed [15,16].

The lack of psychiatric NSI research is reflected by official publications and policies. For instance a recent UK government report focussed exclusively on potential 'physical' health consequences of NSIs, mentioning anxiety only twice and making no reference to low mood or psychiatric disorders [1]. The EU directive (2010) on the prevention of NSIs in health care makes passing reference to the requirement for counselling services post injury, but is silent about the psychiatric consequences of NSIs [17].

The skew of the academic and policy literature on occupational hazards of NSIs toward physical risks reflects a tacit assumption that workers experiencing NSIs may merely be temporarily and mildly distressed, and not suffering severe psychiatric illness. However, the severity of psychiatric trauma in NSI patients has not yet been addressed in the literature.

We describe, to our knowledge, the first NSI case series from a psychiatric trauma clinic and compare the severity of illness among these NSI patients with a control group of non-NSI psychiatric patients. We tested whether NSI psychiatric disorders had similar duration and severity to non-NSI psychiatric disorders and whether the duration of psychiatric illness was related to time waited for negative serology results.

Methods

A case series of all post-NSI patients referred to a psychiatric trauma clinic were interviewed by a consultant psychiatrist, and diagnoses were made according to the ICD-10 diagnostic research criteria (DCR-10) [18]. All patients were given a Beck Depression Inventory (BDI)

[19]. Cases were interviewed between 2005 and 2008 and studied retrospectively.

To test the hypothesis that NSI might only yield less severe or shorter lasting cases of distress compared with other psychiatric trauma we compared the case series with a simultaneous series of 125 patients referred to the same clinic suffering non-needlestick related trauma. These patients had suffered other kinds of trauma, such as road traffic accidents, falls at work, etc. The control group patients were all diagnosed according to the same criteria (DCR-10) and also received a BDI II [18,19].

All NSI patients eventually received negative serology results, i.e. were deemed physically healthy despite the occupational hazard incurred so we present results relating only to their mental health.

We present typical vignettes of patients to illustrate some of the significant features and psychopathology associated with NSIs (see Boxes 1–3). Specific details have all been altered to preserve anonymity.

All but four NSI patients completed a BDI II. The BDI is calculated using a 21-question multiple-choice self-report inventory, one of the most widely used instruments for measuring the severity of depression [19]. We hypothesized that longer waiting times for test results (test wait times) would increase the duration of psychiatric illness. Linear regressions ($n = 13$) were conducted to investigate the relationship between BDI scores or duration of psychiatric illness and the length of time between injury and final reassurance following blood tests. The hypothesis here was that increased test wait times would be positively associated with the duration of the psychiatric illness. We used two-way ANOVA to compare the duration of psychiatric illness between NSI and non-NSI trauma patients and between adjustment disorder (AD) and post-traumatic stress disorder (PTSD) diagnoses (two levels of each factor). Interactions were tested for but were removed under model selection when $P > 0.05$. For statistical analysis, linear models were done in R version 2.15.1 [20]. All means are given SD. Ethical approval for the study came from the Cheadle Royal Hospital Ethics Committee.

Box 1. Case history 1

A 45-year-old coach driver was checking her coach at the end of her shift when she saw a dislodged seat. She attempted to shift the seat back into place but was stuck by a hypodermic syringe that had been left under the seat. The needle went through the palm of her hand. She developed an adjustment disorder characterized by low mood and anxiety, intrusive thoughts about the possibility of getting AIDS, poor sleep, reduced appetite and hence weight loss that alarmed her further and absent libido. Her symptoms resolved on reassurance after final satisfactory blood tests at 6 months.

Box 2. Case history 2

A 36-year-old health care worker in an accident and emergency department was emptying a clinic bin. She was replacing a bag when a needle, which had been incorrectly disposed of, pierced her leg. She was immediately shocked and worried and tried to make it bleed. She talked to the doctor on duty and he tried to reassure her that they had not had any knowingly infected patients in but she was not reassured. She was worried that she had been exposed to an infectious disease such as HIV or hepatitis or another disorder and underwent a course of injections over the next week, which gave her diarrhoea. The injections then moved to monthly. She also had to have regular blood tests to check on whether she had seroconverted and was suffering from hepatitis B or C or HIV. She received the all clear from blood tests approximately 6 months later. Her anxiety gradually subsided thereafter.

Box 3. Case history 3

A 40-year-old postal worker was emptying a letterbox when a needle that had been discarded in the letterbox went into the ball of his thumb. He looked at the needle in his hand and instantly thought about 'HIV'. He embarked upon a series of tests, associated with tearfulness, anxiety, restless sleep and loss of interest or pleasure in normally pleasurable pastimes. He avoided sex with his wife for 6 months until his tests were finally clear. This led to arguments in their relationship. Even after professional reassurance he still is not worry free and says, 'I am not altogether reassured even now, no one can guarantee things 100%—I try to block it out and not think or talk about it'.

Results

There were 17 NSI patients included in the case series (mean age 38.6 ± 2.8 , range 24–61). Thirteen (77%) of them were male. Neither age nor sex was associated with any measured aspect of psychiatric health (linear models not significant (NS); $P > 0.05$).

Patients represented various occupations, five (29%) of which were in the health sector (nurses and paramedics). Other occupations involved included police officers, porters, cleaners, a builder, a manager and one unemployed person. All 17 injuries followed exposure to an occupational hazard and occurred at work.

Four of the cases (24%) described an initial period of up to 2 days of acute anxiety, disbelief, tremor and

profound sleeplessness consistent with an acute stress reaction. Thirteen of the cases (76%) had a diagnosis of AD. Four (24%) met the guidelines for PTSD according to ICD-10 diagnoses [18]. One case of AD had comorbid alcohol dependence.

BDI scores were available for 13 (77%) patients (mean score 22.8 ± 13.5 , min = 6, max = 52) indicating moderately severe depressive symptoms. The further in the past the NSI occurred, the lesser the depressive pathology measured by BDI score (Figure 1, linear regression $y = 41.7 - 1.83x$, $F_{1,10} = 6.01$, $P < 0.05$, $r^2 = 0.37$, $n = 12$ [having removed outlier with Cook's distance > 0.5 , the bottom left point on Figure 1]).

The average length of psychiatric illness following NSI assessed after attendance at the clinic was 9.3 ± 6.1 months. The average wait for negative blood test results was 4.6 ± 0.7 months. Duration of psychiatric illness increased with length of wait for test results (Figure 2, linear regression $y = 3.29 + 1.77x$, both measured in months, $F_{1,14} = 8.36$, $P < 0.05$, $r^2 = 0.37$, $n = 16$, one patient missing data for time waiting for test results).

NSI patients with AD repeatedly said that although accident and emergency staff or occupational health staff had reassured them that the chances of seroconversion were small they focused on the fact that there was still a 'possibility' of seroconversion and thus did not feel reassured.

There were 67 controls with AD (non-NSI), mean age of 45.1 ± 1.7 , range 17–77, and 55% were male. There were 58 controls with PTSD (non-NSI), mean age 41.7 ± 1.6 , range 18–77 and 50% were male. Neither age nor sex was associated with severity of depression in non-NSI AD or PTSD patients (linear models NS).

Analysis using two-way ANOVA showed the duration of illness to be significantly shorter in NSI patients compared with non-NSI patients ($P < 0.01$) and in AD patients compared with PTSD patients ($P < 0.01$) (see Table 1). The BDI score was significantly higher in PTSD patients than AD patients ($P < 0.05$) but not significantly different between NSI and non-NSI patients. In neither the duration of illness nor the BDI ANOVAs was there an interaction between the NSI and diagnosis factors.

Discussion

Our study found that psychiatric disorders in NSI patients were similar to other trauma-related psychiatric illness in severity, but while they last for 9 months on average, this was not as long as other psychiatric trauma patients. Psychiatric illness following NSIs had major impacts on work attendance, family relationships and sexual health.

These 17 cases are a small sample but still represent the largest case series studied to date. The cases were referred to a single psychiatric clinic only after

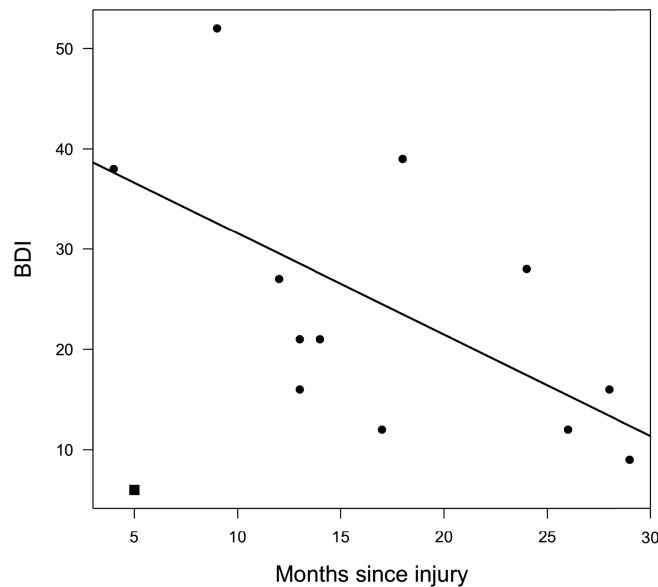


Figure 1. BDI-II decreases with months since needlestick injury.

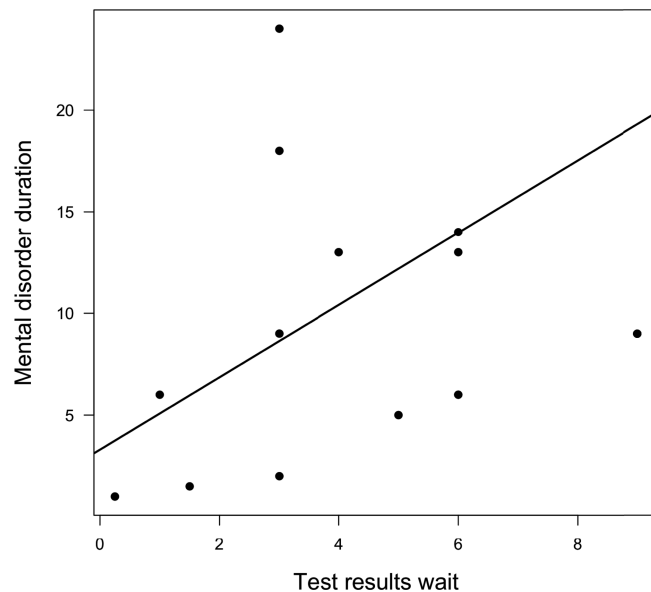


Figure 2. Patients waiting longer for physical test results after NSI had longer mental disorders (both measured in months).

developing psychiatric problems and therefore may not be representative of all NSIs. This study is retrospective and further systematic clinical studies are needed to estimate potential bias.

The cases we describe presented with anxiety associated with perception of continued unacceptable risk, and whose recovery was delayed the longer the wait for definitive blood test results. Cockcroft *et al.* attributed patient's anxiety after accidental exposure to blood and other body fluids to their 'perception' of risk, rather than the 'actual' risk [21]. Management of risk perception may help to mitigate psychiatric illness post-NSI, such as counselling that emphasises reassurance rather than

risk, and efficient provision of accurate reassurance via blood tests.

Psychiatric illness following NSI can also have secondary effects, such as on family functioning or work absence. Blenkhorn & Odd noted that out of 40 NSIs among clinical waste handlers there were no seroconversions, but that there were two 'prolonged leave of absences' due to 'anxiety/stress disorder' [22]. Several of the cases we describe reported deterioration in their sexual relationships following advice to use barrier contraception. Some abstained from sex rather than place their partner at risk. These inhibitions coupled with irritability due to AD or PTSD contributed to relationship

Table 1. Mean (SD) BDI scores and illness duration of NSI patients and non-NSI psychiatric patients with AD and PTSD

		AD	PTSD
BDI score	NSI	22.7 (15.0)	23.3 (11.3)
	Non-NSI	23.2 (12.8)	29.1 (11.9)
Duration of illness (months)	NSI	8.0 (6.2)	13.5 (3.7)
	Non-NSI	16.7 (9.9)	20.9 (11.0)

See text for significant results from two-way ANOVAs.

difficulties. Detachment and irritability in cases of PTSD adversely affected parenting styles.

There are many different occupations throughout the community exposed to NSIs [7], which is reflected in the cases we describe. Consequently occupational advice that focuses on health care workers [1] should be revised to account for the broad occupational mix of those exposed to NSIs.

Further research should ensure that the psychological impacts of NSI are quantified and sufficiently addressed and should determine the best clinical management practices for NSIs in order to minimize psychiatric injury. One such recommendation from our study that needs further study is the psychiatric benefits offered by swifter serological testing. Prospective research could be hampered by under-reporting of NSIs. A retrospective study asking staff if they have ever had an NSI and screening for remembered symptoms is subject to recall bias. Whether NSI non-reporters and NSI reporters differ psychologically is also an interesting question. Non-reporters may exhibit the psychological defence mechanism of denial and reporters may have intrinsically higher levels of anxiety about their health, but these hypotheses need further testing.

The direct and indirect annual costs of psychiatric morbidity due to NSIs to employers and the economy are likely to have been either ignored or significantly underestimated. It is an open question whether psychiatric health burden following NSIs outweighs physical effects. Occupational health physicians should be more aware of the risks of psychiatric disorder amongst patients with NSIs and manage these in a more strategic or pro-active way to prevent occupational effects on absence, productivity, or social functioning.

Key points

- Needlestick injury patients can have substantial psychiatric illness.
- Depression severity in needlestick injury patients is similar to other psychiatric trauma patients.
- Duration of psychiatric illness is associated with length of time waiting for blood test results.

Acknowledgements

Thanks to our research assistant Clare McMonnies for collating information.

Conflicts of interest

None declared.

References

1. Health Protection Agency. *Eye of the Needle: United Kingdom Surveillance of Significant Exposures to Bloodborne Viruses in Healthcare Workers*. London: Health Protection Agency, 2008.
2. Saleem T, Khalid U, Ishaque S, Zafar A. Knowledge, attitudes and practices of medical students regarding needle stick injuries. *J Pakistan Med Assoc* 2010;**60**:151–156.
3. Salzer HJF, Hoenigl M, Kessler HH *et al*. Lack of risk-awareness and reporting behavior towards HIV infection through needlestick injury among European medical students. *Int J Hyg Envir Heal* 2011;**214**:407–410.
4. Sharma GK, Gilson MM, Nathan H, Makary MA. Needlestick injuries among medical students: incidence and implications. *Acad Med* 2009;**84**:1815–1821.
5. Kable AK, Guest M, McLeod M. Organizational risk management and nurses' perceptions of workplace risk associated with sharps including needlestick injuries in nurses in New South Wales, Australia. *Nurs Health Sci* 2011;**13**:246–254.
6. Varsou O, Lemon JS, Dick FD. Sharps injuries among medical students. *Occup Med (Lond)* 2009;**59**:509–511.
7. Health and Safety Executive. *Online Needlestick Injury Advice*. <http://www.hse.gov.uk/healthservices/needlesticks/> (5 June 2010, date last accessed).
8. Dorevitch S, Lacey SE, Abelmann A, Zautcke J. Occupational needlestick injuries in a US airport. *J Occup Environ Med* 2010;**52**:551–554.
9. Leggat PA, Smith DR, Speare R. Exposure rate of needlestick and sharps injuries among Australian veterinarians. *J Occup Med Toxicol* 2009;**4**:25.
10. Larney S, Dolan K. An exploratory study of needlestick injuries among Australian prison officers. *Int J Prison Health* 2008;**4**:164–168.
11. Papenburg J, Blais D, Moore D *et al*. Pediatric injuries from needles discarded in the community: epidemiology and risk of seroconversion. *Pediatrics* 2008;**122**:e487–e492.
12. Leigh JP, Wiatrowski WJ, Gillen M, Steenland NK. Characteristics of persons and jobs with needlestick injuries in a national data set. *Am J Infect Control* 2008;**36**:414–420.
13. Trueman P, Taylor M, Twena N, Chubb B. The cost of needlestick injuries associated with insulin administration. *Br J Community Nurs* 2008;**13**:413–417.
14. UNISON. *Compensation Claims From Those Injured by Syringe Needles Could Run Into The Thousands*. <http://www.unison.org.uk/news/features/0211needlesticks.asp> (5 July 2012, date last accessed).
15. Wada K, Sakata Y, Fujino Y *et al*. The association of needlestick injury with depressive symptoms among first-year medical residents in Japan. *Ind Health* 2007;**45**:750–755.

16. Sohn J-W, Kim B-G, Kim S-H, Han C. Mental health of healthcare workers who experience needlestick and sharps injuries. *J Occup Health* 2006;**48**:474–479.
17. Council Directive 2010/32/EU. *Implementing the Framework Agreement on Prevention from Sharps Injuries in the Hospital and Health Care Sector Concluded by HOSPEEM and EPSU*. Official Journal of European Union, 2010. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32010L0032:EN:NOT> (5 July 2012, date last accessed).
18. Cooper JE. *Guide to ICD-10 Classification of Mental and Behavioural Disorders: With Glossary and Diagnostic Criteria for Research DCR-10*. London: Churchill Livingstone, 1994.
19. Beck AT, Steer RA, Ball R, Ranieri W. Comparison of Beck Depression Inventories -IA and -II in psychiatric outpatients. *J Pers Assess* 1996;**67**:588–597.
20. R Development Core Team. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing, 2012. <http://www.R-project.org/> (5 July 2012, date last accessed).
21. Cockcroft A, Oakley K, Gooch C, Mastin S. Anxiety and perception of risk of HIV and hepatitis B infection among health-care workers reporting accidental exposures to blood and other body fluids. *AIDS Care* 1994;**6**:205–214.
22. Blenkarn JI, Odd C. Sharps injuries in healthcare waste handlers. *Ann Occup Hyg* 2008;**52**:281–286.

doi:10.1093/occmed/kqt044

Top 10 most cited papers from 2010

1. **Psychosocial work environment and stress-related disorders, a systematic review**
K. Nieuwenhuijsen *et al.*
Occupational Medicine 2010;**60**(4):287–286.
2. **Shift work: coping with the biological clock**
Josephine Arendt
Occupational Medicine 2010;**60**(1):10–20.
3. **Systematic review of the prevalence of suicide in veterinary surgeons**
B. Platt *et al.*
Occupational Medicine 2010;**60**(6):436–446.
4. **Further validation of computer-based prediction of chemical asthma hazard**
Martin Seed and Raymond Agius
Occupational Medicine 2010;**60**(2):115–120.
5. **Predictors of employees' early retirement intentions: an 11-year longitudinal study**
Monika E. von Bonsdorff *et al.*
Occupational Medicine 2010;**60**(2):94–100.
6. **Long-term respiratory symptoms in World Trade Center responders**
Matthew P. Mauer *et al.*
Occupational Medicine 2010;**60**(2):145–151.
7. **Musculoskeletal disorders among Irish farmers**
A. Osborne *et al.*
Occupational Medicine 2010;**60**(8):598–603.
8. **Cancer survivors' and employers' perceptions of working following cancer treatment**
E. A. Grunfeld *et al.*
Occupational Medicine 2010;**60**(8):611–617.
9. **Work-associated irritable larynx syndrome**
R. F. Hoy *et al.*
Occupational Medicine 2010;**60**(7):546–551.
10. **Prevalence of beryllium sensitization among aluminium smelter workers**
O. A. Taiwo *et al.*
Occupational Medicine 2010;**60**(7):569–571.