

2016-10-27

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<http://hdl.handle.net/10026.1/12609>

10.12968/bjon.2016.25.19.1064

British Journal of Nursing

Mark Allen Healthcare

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The impact of sharps injuries on student nurses: a systematic review

Kevin Hambridge, Andrew Nichols and Ruth Endacott

ABSTRACT

Aims and objectives: The purpose of this review was to discover the impact of sharps injuries in the student nurse population. **Background:** much is known and reported about sharps injuries in registered nurses, but there has been a lack of published evidence regarding sharps injuries within the student nurse population. **Method:** A systematic review of nursing, health and psychology databases was conducted. The limits set were publications between 1980 and 2014 in the English language. Studies were identified then, following a rigorous critical and quality appraisal with validated tools, were selected for the systematic review. **Results:** A total of 40 articles met the inclusion criteria, reporting studies conducted in 18 countries. Psychological and physical impacts of sharps injuries in student nurses were reported, such as fear, anxiety and depression, although these impacts were not quantified using a validated instrument. **Conclusion:** The impact of sharps injuries can be severe, both psychological and physical. This systematic review shows that further research is needed into this, especially in under-researched areas such as the UK, to establish the impact of sharps injuries within this population. Further research would also aid the education and prevention of this harmful problem. The review also emphasises the psychological issues relating to sharps injuries, the impact these can have on individuals and the support and counselling that student nurses require after injury. **Relevance to practice:** These findings highlight the potential psychological issues that can result from sharps injuries in this population

Key words: Student nurse ■ Sharps injury ■ Needlestick injury ■ Risk ■ Safety ■ Inoculation ■ injury

Sharp devices, or sharps, are items capable of piercing the skin and include needles, surgical instruments, lancets, scalpels and glass (Hersey and Martin, 1994; Bandalier, 2003; World Health Organization, 2003). Sharps injuries are one of the main categories of accidents experienced by healthcare staff, and have been described as an 'important public health concern' (Pathak et al, 2012: 639).

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Accepted for publication: August 2016

Sharps injuries are not a recent phenomenon. During the 1990s, warnings were made about hazards and risks of sharps injuries (Yassi and McGill, 1991), with Albertoni et al (1992: 541) arguing that occupational exposure to infectious agents had been a significant concern 'for some time'. In today's diverse healthcare environments, most employees run the risk of accidental exposure to blood and bloodborne pathogens.

More than 20 bloodborne pathogens can be transmitted through percutaneous injuries (Collins and Kennedy, 1987; Morgan, 2000). More recently, this estimation was increased to at least 60 pathogens (Tarantola et al, 2006). The three most common bloodborne pathogens that can be transmitted via percutaneous injuries to healthcare workers are: the human immunodeficiency virus (HIV); the hepatitis B virus (HBV); and the hepatitis C virus (HCV) (Jayanth et al, 2009).

Every sharps injury has potentially severe consequences for the staff member, causing 'distress' and 'physical damage' at the very least (Watterson, 2004). Reis et al (2004a) described how students exposed to biological hazards experience not only the fear of acquiring potential infections such as HIV, HBV and HCV, but also had feelings of 'insecurity' and 'low self-esteem'. This is echoed by Gupta et al (2008), who found that sharps injuries can have an effect on healthcare workers' quality of life, and can cause great apprehension, angst and fear for themselves, their family and their colleagues, as well as feelings of shame and low self-confidence (Gonzalez-Medina and Le, 2011).

Sharps injuries have other effects, including the direct cost, for example post-exposure medical treatment and resources, as well as indirect costs, such as disability, missed work days and absenteeism (Sharma et al, 2010; Bassil, 2012). There is also an economic impact on the individual (Trueman et al, 2008).

In relation to student nurses, the prevalence rates of sharps injuries range from 3% (n=6) (Li et al, 2008) to 100% (n=100) (Trivedi et al, 2013). Undergraduate healthcare students often handle piercing/cutting devices while training, which exposes them to the risk of acquiring infections (Gir et al, 2008). They are at a high risk of exposure to bloodborne pathogens when they become involved in patient investigations and treatments during their clinical placements (Hussain et al, 2012). By their very nature of being students, they are less experienced (Karadağ, 2010; Reis et al, 2004b) in the clinical setting and less skilful (Cheung et al, 2010) when handling needles and sharps, which exposes them to potential injury.

Other possible reasons put forward to explain the increased risk of sharps injury student nurses are insufficient attention to

personal safety (Cheung et al, 2012), manual skills that are under-developed (Ozer and Bektas, 2012), eagerness to learn new procedures (Karadağ, 2010; Ozer and Bektas, 2012) and anxiety (Reis et al, 2004b).

The extent, type and impact of sharps injuries among pre-registration student nurses was chosen as a topic to explore because authors have argued that there is a dearth of evidence and published studies related to this subject (Hou and Shiao, 2001; Elliott et al, 2005; Blackwell et al, 2007; Petrucci et al, 2009; Karadağ, 2010; Hambridge, 2011).

Methods

The question asked in this systematic review is: 'What are the extent, type and impact of sharps injuries in the pre-registration nursing student population?' As of 2014, an extensive research of the literature found no systematic review on this topic.

This systematic review was conducted in six stages:

- Development of the search strategy with inclusion and exclusion criteria
- Search for articles
- Screening of articles
- Critical appraisal of the articles
- Data extraction from the chosen articles
- Aggregation of the data.

A comprehensive search of nursing, health and psychology databases was undertaken, which included: BMJ Journals collection; Business Source Complete (EBSCO); CINAHL Plus with Full Text (EBSCO); BMJ Clinical Evidence; the Cochrane Library (Wiley); Internurse; Medline (EBSCO); PubMed; PsycArticles, PsycINFO; ScienceDirect; SwetsWise; Trip (Turning research into practice); and UK PubMed Central.

Relevant studies were also identified by searching the following grey literature databases: the National Research Register; Clinicaltrials.gov; Google Scholar; Sigle; theses and dissertations (UK and worldwide); the PQDT (open); and EThOS (British Library Electronic online service). The Intute, Department of Health, NHS, Monitor (regulator for health services in England), Health Protection Agency, Centers for Disease Control and Prevention and Trove (finding Australian theses) websites were also searched.

Keywords were chosen to aid the retrieval of pertinent articles. Those used were 'adult student nurse', 'pre-registration', 'student of nursing', 'student nurse', 'sharp injury', 'sharps', 'sharp injuries', 'needlestick', 'needlestick injury', 'needlestick injuries', 'inoculation', 'needle prick', 'accidents', 'incidents', 'needle stick', 'occupational injury', 'occupational injuries', 'biological exposure incident', 'percutaneous exposure', 'blood borne infection', 'incidence', 'prevalence', 'harm', 'psychological harm', 'experiences', 'impact', 'under-reporting', 'non-reporting', 'RCT', 'survey', 'case study', 'ethnography', 'action research', 'phenomenology', 'qualitative', 'experimental design (pre-post)' and 'mixed methods designs'.

The inclusion criteria were related to pre-registration student nurses who had experienced a sharps injury, including needlestick injuries. This systematic review included all studies relating to sharps injuries that affected these students caused by needles, scalpels and blades, suture and stitch cutters, blood

lancets, glass, scissors and razors. Articles published worldwide from 1980 to 2014 were included. This is because AIDS was first recognised as a disease in 1981 (Sharp and Hahn, 2011) and there is a relationship between AIDS and HIV and sharps injuries.

Both quantitative and qualitative studies were examined for inclusion. The quantitative component of the review considered experimental study designs including randomised controlled trials, non-randomised controlled trials, quasi-experimental, before and after studies, prospective and retrospective cohort studies, case control studies, analytical cross-sectional studies, epidemiological study designs including case series, individual case reports and descriptive cross-sectional studies.

The qualitative component of the review considered studies that focus on qualitative data, including phenomenology, grounded theory, ethnography and action research.

Original articles and review articles, including systematic and narrative reviews, were considered. The exclusion criteria were: articles not published in English; articles with a focus on self-harm, or the effect of an injury on a patient; and articles reporting an audit or quality improvement project.

The screening process was conducted in three distinct stages:

- Based on the title
- Based on the abstract
- Based on the full text.

The search identified 190 articles; following screening, 40 articles were eligible for inclusion in the review. The process is shown in *Figure 1*.

It was imperative to appraise the quality and relevance of the articles to decide whether the findings could be included in this review. After studies of an acceptable design were selected, an in-depth assessment for the risk of various biases was conducted. Critical and quality appraisal of the potential studies was conducted using tools appropriate to the study method.

Systematic reviews were appraised using the '10 questions to help you make sense of a review' critical appraisal tool (Critical Appraisal Skills Programme (CASP), 2013). Evidence for the tool's effectiveness is scarce but it has been recommended by the National Institute for Health and Care Excellence (2014).

Papers employing a survey were assessed using the Crombie framework (Crombie, 1996), a checklist suitable for appraising descriptive surveys (Holly, 2010).

Qualitative articles were assessed using the CASP (2006). This tool has been widely used, allows rapid evaluation and is suitable for different types of qualitative design (Ricci-Cabello et al, 2012).

The case study included in this review was critically appraised using the Critical Appraisal of a Case Study tool (Centre for Evidence-Based Management, 2013). Evidence for its effectiveness is scarce but its use has been promoted by the Centre for Evidence Based Medicine (2014).

The Support Unit for Research Evidence tool for critically appraising intervention/experimental and controlled observation studies was used to appraise quasi-experiments (Cardiff University, 2012).

Quantitative data were extracted from papers using the MASTARI data extraction instrument, while qualitative data was

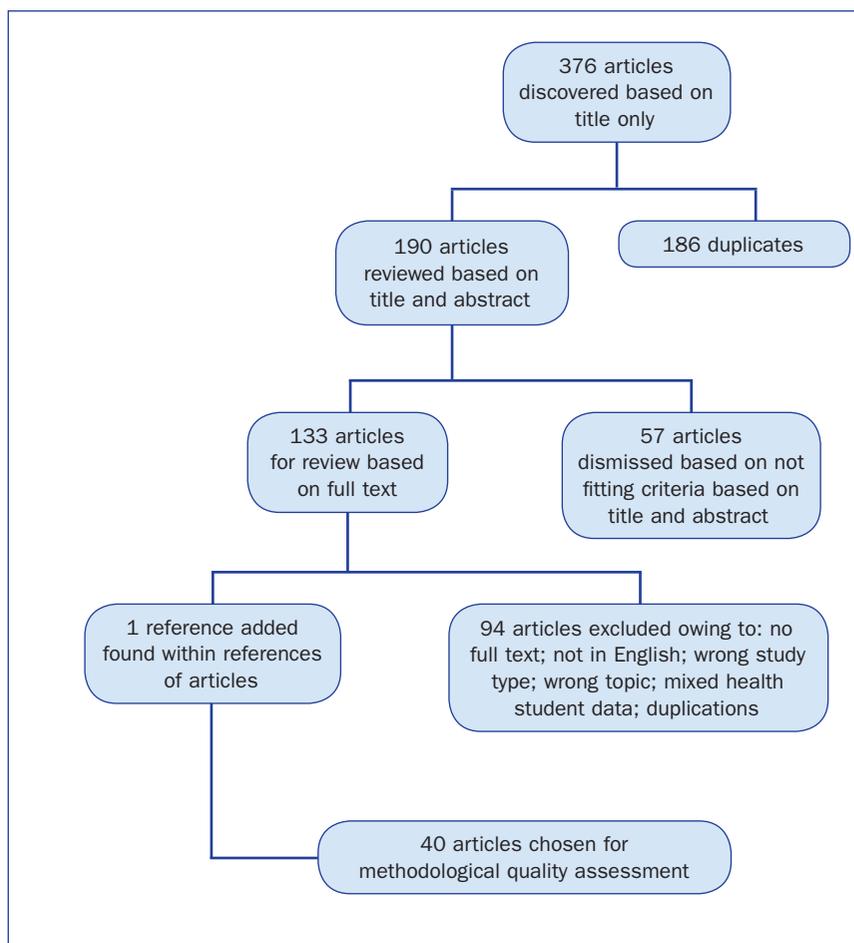


Figure 1. Process of article selection

extracted from papers using the JBI QARI data extraction form for interpretive and critical research (Joanna Briggs Institute, 2014).

Results

In total, 40 studies met the inclusion criteria for the systematic review: 34 surveys; 4 quasi-experiments; 1 case study; and 1 qualitative study (Table 1). Some studies reported data from a range of healthcare students; where possible, data for student nurses were extracted and are reported here.

Impact of sharps injuries

Only one study explored the experiences of student nurses who had sustained sharps injuries. Naidoo (2010) used a qualitative phenomenological approach with a sample of eight student nurses in South Africa. From the study, four themes were reported: traumatic incident; reaction to the traumatic incident; intervening factors; and need for support.

Traumatic incident

Student nurses gave an 'account of the incident'; they provided rich detail even though the incident may have happened up to a year previously. They knew the precise date and time of the sharps injury. The students also described how the injury transpired by 'setting the scene'.

Reaction to the traumatic incident

The respondents spoke of their 'physiological reaction' to the sharps injury. These responses included being 'shocked', 'sweating', wanting to 'run away and scream', 'tears' and 'crying'. There were reports of the 'emotional reaction of the student and family'. Reactions included being 'fearful of becoming HIV positive', having an 'out of body experience' and feeling 'overwhelming fear', 'anxiety', 'depression' and 'numb'.

The respondents reported a 'lack of care from the staff in the service setting', with some staff being 'very unsympathetic'. The incident was defined as being 'nerve wracking', with associated 'blame from family'. It was reported that one respondent's 'family was angry' and 'didn't talk to me for the rest of the day'.

Respondents reported the 'reaction to treatment' including the side effects of the post-exposure prophylactic drugs, such as sickness, dizziness and nausea, which affected their attendance at university and on the practice placement.

Respondents spoke of the 'reaction to nursing practice' whereby they felt distressed when re-entering the practice placement as they felt they were 're-living the injury'. One respondent said they would have considered suicide if seroconversion occurred. One student still felt 'numb' 2 months after the sharps injury, fearing they may have acquired HIV.

Intervening factors

A lack of awareness about sharps injury reporting among respondents was described. Two nursing students did not report their injuries because of the 'negative support and unavailability of the nursing staff'. Respondents reported poor knowledge of registered nurses concerning treatment and counselling after a sharps injury. This caused a delay in treatment and a lack of counselling support for some students. Some respondents reported that, owing to their 'submissive behaviour', they commonly carried out procedures that were outside their scope of practice, which may have contributed to the sharps injuries.

Need for support

Respondents generally spoke of supportive family and friends, who were described as 'sympathetic' and 'supportive'. Some respondents felt that some nursing staff in the practice setting were not supportive. However, the clinical supervisors from the higher education institute were 'excellent'. Students felt 'guided' through the system and were directed to counselling offered by the university.

One other study provided qualitative data on the consequences of the sharps injury on students. Reis et al (2004b) described how they reported negative feelings of 'anger', 'insecurity', 'concern', 'fear', 'low self-esteem', 'frustration', 'incapacity', 'incompetence' and 'fear of infection e.g. HIV' following a sharps injury.

None of the studies sought to examine the impact of having a sharps injury using a validated instrument to measure anxiety or depression.

Discussion

A total of 40 papers were reviewed. The main area of investigation was the impact of sharps injuries in a pre-registration adult branch nursing student population.

Impact of sharps injuries

The single qualitative study investigating the experiences of nursing students who had sustained sharps injuries (Naidoo 2010) highlighted the feelings of 'fear [and] anxiety' experienced by nursing students who had sustained a sharps injury in South Africa. This is echoed by Lee et al (2005), who found in a review of prospective studies that healthcare workers experience significant fear, anxiety and emotional distress following a needlestick injury, sometimes resulting in occupational and behaviour changes. Sustaining a sharps injury is stressful, and the higher rates of anxiety in these practitioners could put them at a higher risk of future sharps injuries (Sohn et al, 2006). Meanwhile, Zhang and Yu (2013) reported that 15.2% of healthcare workers recounted manifestations of emotional distress, such as anxiety, worry, frustration, panic and even extremity numbness after experiencing a sharps injury.

In a study of trainee doctors, Naghavi et al (2013) found that sharps injuries are associated with human costs in terms of stress and anxiety, and persistent symptoms could meet the diagnosis criteria for post-traumatic stress disorder. They also found that 12% of doctors who had experienced at least one needlestick injury during their training reported symptoms consistent with post-traumatic stress disorder. Worthington et al (2006) reported two cases of post-traumatic stress disorder after needlestick injuries to two doctors from an HIV-positive patient.

Occupational exposure to bloodborne pathogens can be a frightening experience; healthcare workers may be scared and a few might develop long-term psychiatric consequences (Gerberding, 2003). Student nurses talked of 'depression' and feeling like a 'huge cloud over my head' after a sharps injury; as mentioned above, one had considered suicide if seroconversion occurred (Naidoo, 2010).

Student nurses' fear of becoming HIV positive (Reis et al, 2004b; Naidoo, 2010) is mirrored by Zhang and Yu (2013), who reported that 93.9% of healthcare workers indicated that the major factor inducing negative psychological changes was the fear of HIV infection.

Respondents in the study by Naidoo (2010) spoke of their 'need for support', with many praising supportive family, friends and clinical supervisors but saying that nursing staff were not as sympathetic and there appeared to be a 'lack of counselling support'. Zhang and Yu (2013) concluded that discovering the ideal type, content and timing of psychological interventions is crucial to lessen anxiety in healthcare workers who sustain a needlestick injury.

Wicker et al (2014) stated that understanding of the psychological impact of needlestick injuries is limited because published studies are scarce, while Zhang and Yu (2013) contend that published research into the psychological impact of sharps injuries is limited, compared to studies into the incidence, situations when it happens, risk factors and economic costs. Great efforts are made to prevent needlestick and sharps injuries, but the psychological aspects of these injuries have received little attention (Sohn et al, 2006).

It appears there are potentially huge psychological issues for practitioners following a sharps injury, with only one qualitative

KEY POINTS

- Sharps injuries can have severe, lasting psychological and physical effects
- Students are at risk of these injuries because they are less skilful and experienced, are eager to learn new procedures or because a submissive nature means they carry out procedures outside their scope of practice
- After a sharps injury, student nurses experience fear, anger, numb, low self-esteem, insecurity, anxiety, depression and fear of infection, especially with HIV
- Support was commonly given by friends, family and higher education institutions but rarely by nurses
- Only one qualitative study explored the effect of a sharps injury on student nurses; it is therefore an under-researched area
- Further research in this area would help to prevent sharps injury the education and prevention of this harmful problem

study found that explored the potential impact on student nurses. This is therefore an under-researched area which requires further investigation.

Conclusion

This systematic review identified gaps in understanding and shows that further research is needed into this topic, especially in surprisingly under-researched areas of the world such as the UK. Further research would also further aid education and the assessment and management of risks.

The findings also emphasise the psychological issues relating to sharps injuries, the impact they can have and the support and counselling that students nurses require after an injury. **BJN**

Declaration of interest: none

A more comprehensive table looking at the 40 studies included in the review is available from the Editor.

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CPD reflective questions

- Reflect on the principles of safely handling sharps, such as needles and glass, within the clinical placement and while simulating skills
- How might you develop your practice to prevent sharps injuries in the future?
- Consider how you might feel if you unfortunately sustained a sharps injury, and think about the support that you would expect from your colleagues, friends and organisation

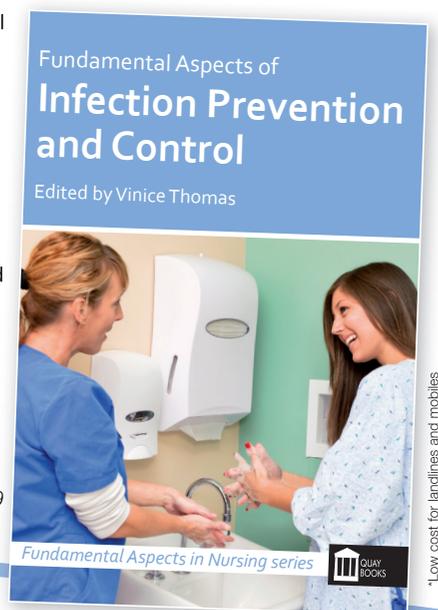
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Table w1. The 40 studies included in the review

Reference (country) study design	Key findings
Albertoni et al (1992) (Italy) Survey	9.5% of 1 164 first year students had had an NSI; 26% of 1 612 second and third year student nurses had had an NSI ($p < 0.001$)
Askarian et al (2012) (Iran) Survey	75% did not report their injury. Reasons were: not knowing the reporting mechanism; did not realise that all NSIs required reporting; did not know to whom to report the injury
Aslam et al (2010) (Pakistan) Survey	45% (n=36) of sample experiencing an NSI in a previous month were student nurses
Blackwell et al (2007) (US) Survey	A total of 9 out of 96 received an NSI which is a rate of 9.4%. Only 4 out of 9 students (44.4%) reported the incident; 22.2% (2 out of 9) students experiencing NSIs reported having only 3–5 hours of sleep on the night before the incident; 33.3% (n=3) of injuries occurred on a medical-surgical unit
Cheung et al (2012) (Hong Kong) Survey	Prevalence of 5.9% (n=52) of NSI/SIs over past 12 months. NSI location: 53.2% (n=25) on medical wards; 29.8% (n=14) on surgical wards. NSI devices: 75% (n=42) injection needles. Procedure: 27.8% (n=15) occurred when removing a needle cap. Other factors: 62.5% (n=35) blamed 'carelessness'. Reporting NSIs: 60.7% (n=34) chose not to report the NSI
Hussain et al (2012) (India) Survey	76.4% (n=68) were the cases of sharp instrument injuries in the past year. 60.2% (n=41) had had two episodes of the injury. 73.5% (n=50) of injuries occurred during IV/IM injection. 80.8% (n=55) occurred with a hollow bore needle
Irmak and Baybuga (2011) (Turkey) Survey	19.4% (n=60) said they had injuries from NSIs. The most common device was a syringe needle (54%, n=34), followed by glass items (33.3%, n=21). 60% (n=36) occurred when giving IV/IM injections, followed by from a broken ampoule (25% n=15). The most common area of injury was the finger (81.4%) Location: medical clinics (43.3% n=26) and surgical clinics (56.7% n=34). 68.3% (n=41) NSIs were unreported
Karadağ (2010) (Turkey) Survey	35.5% of the students had received an NSSI. 66% (n=33) were caused by a broken ampoule or vial while. 28% (n=14) were caused by a syringe needle. 84% (n=42) did not report the incident
Kermode et al (2005) (India) Survey	48.1% of student nurses had had a percutaneous sharps injury within the last year
Kim et al (2001) (Korea) Survey	Student nurses had a better level of knowledge relating to 'avoiding injury from used needles' than medical students. Student nurses had a poor level of knowledge relating to 'putting the cap back on the used needle before disposing of it', but a better level of knowledge than medical students
Lachowicz and Matthews (2009) (South Africa) Survey	28.26% (n=13) of student nurses had sustained a sharps injury
Li and Scott (2008) (China) Survey	Six respondents (3%) had experienced an NSI
Lukianskyte et al (2011) (Lithuania) Survey	78% (n=78) of student nurses had had an NSI. 59% (n=46) occurred in the procedures room; 15% (n=12) occurred in the patient's room. 49% (n=39) occurred during breaking of the ampoule. 64% (n=50) were due to inattention/haste. 92% (n=72) did not report the incident
McCarthy and Britton (2000) Canada) Survey	14% (n=9) of 64 student nurses had had an NSI
Mengal et al (2008) (Pakistan) Survey	12.8% (n=25) had had one NSI; 9.2% (n=18) had had two NSIs; 3.6% (n=7) had had more than two 9.1% (n=5) of those who were exposed to blood and blood products, did not reported the injury
Mitra et al (2010) (India) Survey	98.4% (n= 187) had had an accidental needle prick. Only 18.4% (n=35) reported the injury to the authority
Muralidhar et al (2010) (India) Survey	85.3% (n=64) had had a needlestick injury in the preceding year
Naidoo (2010) (South Africa) Phenomenological study	Four themes: Traumatic incident—including 'account of the incident' and 'setting the scene'; Reaction to the traumatic incident—including 'physiological reaction', 'emotional reaction of the student and family', 'reaction to treatment' and 'reaction to nursing practice'; Intervening factors—including 'knowledge of student', 'knowledge of professional staff in service setting' and 'preparedness to practice'; Need for support—including 'support from family and friends', 'support from staff in service settings' and 'support from staff at the higher education institution
Ozer and Bektas (2012) (Turkey) Survey	Overall prevalence rate of 33% (n=94). 14.4% (n=41) occurred with a glass item. NSI prevalence was 31.4% (n=27) in the first year. NSI prevalence was 44.4% (n=28) in the second year. NSI prevalence was 39.4% (n=28) in the third year. NSI prevalence was 18.6% (n=13) in the fourth year. Most common cause: 10% (n=7) occurred with a glass item
Petrucci et al (2009) (Italy) Survey	First year students had a higher probability of skin and percutaneous contamination than those in the second and third years
Reis et al (2004b) (Brazil) Survey	40% (n=50) reported to have been injured in some type of accident with cutting and piercing objects or had contact of biological material with their skin or mucosa . 51% (n=37) of injuries were caused by piercing objects; 44% of injuries were caused by cutting objects. The main objects causing accidents were needles; among cutting objects (ampoules, scissors, glass vials), medication ampoules were the most common. Most affected areas: 90.2% (n=65) occurred on the fingers . 22.2% (n=16) related to 'lack of attention/distraction; 13.9% (n=10) related to 'inexperience'. The students reported negative feelings of 'anger'; 'insecurity'; 'concern'; 'fear'; 'low self-esteem'; 'frustration'; 'incapacity'; 'incompetence'; 'fear of infection e.g. HIV'

Salelkar et al (2010) (India) Survey	6.4% (n=3) student nurses had had a NSI in the previous year 33% (n=1) of student nurses had reported the NSI
Scaggiante et al (2013) (Italy) Case study	Student nurse injured on the second finger of the right hand when re-capping a 23-gauge needle after taking a blood sample. The source was a 72-year-old woman who was weakly positive for anti-HCV. Three months after the injury, a relevant increase in transaminases with a low viral replication activity was observed in the student, indicating HCV infection. She was treated with pegylated interferon plus ribavirin for 24 weeks. The student was 'cured' 6 months later
Schaffer (1997) (USA) Survey	31 incidents of percutaneous exposure
Schmid et al (2007) (Germany) Survey	20/68 student nurses consulted the occupational physician as a result of occupational exposure to blood or other body fluids, the vast majority of which were caused by NSSI
Sharma et al (2010) (India) Survey	94.2% (n=40) of student nurses had had one or more NSI (the highest of all other health workers) . 25% (n=10) had had a NSI in the last month. 28.6% (n=12) had a NSI whilst re-capping. 38.8% (n=16) reported the NSI to their supervisor or senior
Shiao et al (2002) (Taiwan) Survey	Prevalence rate was 61.5% (n=352). 42.6% (n=150) were caused by a hollow bore syringe needle; 21.3% (n=75) were caused by a glass item; 14.8% (n=52) occurred during re-capping; 19.3% (n=68) happened when opening of ampoule or vial; 86.9% (n=306) were not reported
Small et al (2011) (Namibia) Survey	25% (n=49) had had a NSI; 58.8% (n=20) were injured only once; 26.5% (n=9) were injured more than once; 45% (n=22) of those students who sustained an NSI never reported it; 27% (n=17) of all injuries occurred in clinics; 27% (n=17) of all injuries occurred in medical wards
Smith and Leggat (2005) (Australia) Survey	13.9% (n=38) reported a NSI in the previous year. Prevalence: 4.3% (first year); 11.4% (in the second year); 40.4% (in the third year). 37% caused by a syringe; 22% caused by a glass item; 20% caused by an insulin syringe; 45% occurred in the skills laboratory. Of the 38 students reporting NSI, 15.8% had had 2-5 events. 34% of those reporting a NSI were injured while opening the cap; 26% of those reporting a NSI were injured when opening an ampoule. 39.5% of NSIs were not reported
Talas (2009) (Turkey) Survey	49% (n=230) reported sustaining NSSI. Most injured students (63.5%) had had two or more NSSIs The most frequent site was the hand (98.7%). 29.3% of injuries occurred in the second year, 36.1% in the third year and 34.3% in the fourth year. 43% (n=168) occurred with medical ampoules and serum bottles; 42% (n=166) occurred with hollow bore needles; 74% (n=169) happened on wards; 70% (n=160) reported that the cause was 'manual skills were under-developed'; 27% (n=62) reported that the cause was 're-capping a needle'; 56.1% (n=129) of NSSIs were unreported to their clinical instructor or hospital staff
Tetali and Choudhury (2006) (India) Survey	Mean number of injuries per person per year was 1.9 (SD=0.7). 25% (n=16) student nurses had had a sharps injury in the previous year; 55% of injuries were caused by re-capping . Non-reporting (n=43)
Trivedi et al (2013) (India) Quasi-experiment	100% had experience NSI by needles; 55% from blood-filled needles; 86% struck by stylet of IV catheter; 31% had NSI by surgical blade/scalpels. After training, there was a significant (p<0.001) improvement in knowledge of prevention and management of NSI
Unver et al (2012) (Turkey) Survey	Proportion sustaining NSSIs: 56.5% (n=13) of second year students; 53.1% (n=17) of third years; 51.2% (n=44) of fourth years; 52.5% (n=74) of all years. Second years: 53.8% (n=7) were caused by injection needles; 84.6% (n=11) did not report the NSSI. Third years: 52.9% (n=9) when using an injection needle; 82.4% (n=14) did not report the NSSI. Fourth years: 43.1% (n=19) caused by injection needle; 88.6% (n=39) did not report the NSSI
Vandijck et al (2008) (Belgium) Survey	10.5% of students reported at least one NSI. 71.2% of students officially documented the NSI
Wang et al (2003) (China) Quasi-experiment	Knowledge of universal precautions increased with training. 1.42 injuries per student nurse year (95% CI 1.05, 1.87). Injuries occurred most commonly when giving an injection (24%); the most common sources of sharps injuries were IV needles (44%), and syringe needles (32%)
Yang et al (2004) (Taiwan) Survey	50.1% (n=264) of responders sustained one or more NSSI. Average number of NSI/SIs per student was 8 times/year (4.9 NSIs/year and 3.1 SIs/year. The largest number occurred in internal medicine and surgery departments. 42.1% were caused by syringe needles; 39% (n=103) reported the incident
Yang et al (2007) (Taiwan) Quasi-experiment	Pre-test: 1999: 50.1% (n=264) of students reported NSSI at least once in clinics during the internship training. Only 39% reported the events. 50.5% (n=54) reported a NSSI. Average frequency of NSI/SI was 8.1/year. Post-test: NSI/SI decreased significantly to 25.2% (n=27). Average frequency of NSI/SI was 2.7 times/year. Reporting rates increased 1.5 times to 55.6%
Yao et al (2010) (China) Survey	1144 NSIs in the 246 student nurses. Average of 4.65 events/student nurse. Surgery: 20.54% (n=235). 54.07% (n=133) had had 2-5 injuries. 96.24% (n=1101) were not reported
Yao et al (2013) (China) Quasi-experiment	Before education: average of 4.65 events/student of NSI. 1144 NSIs occurred in the 246 student nurses; surgery (235 events, 0.955 events/student); medicine (230 events, 0.935 events/student); 54.06% (n=133) had had 2-5 NSIs; 25.18% (n=288) caused by student handling the needle; 96.24% (n=1101) were not reported After education: average 0.163 events/student; 40 NSIs in total; surgery 0.016 events/student; medicine (0.008 events/student; 2% (n=5) had 2-5 NSIs; 12.5% (n=5) happened when handling the needle; 97.5% (n=39) reported the NSI
Zungu et al (2008) (South Africa) Survey	15.6% (n=15) student nurses declared that they had experienced an NPI sometime during their clinical practice. Only 7.3% of respondents had reported the incident. Reasons for non-reporting: 41.1% (n=3) due to fear of HIV testing; 31.7% (n=2.3) due to fear of disciplinary action; 13.6% (n=1) due to 'did not know where/to whom to report; 13.6% (n=1) due to 'fear of confidentiality'

NSI=needlestick injury; SI=sharps injury; NSSI=needlestick or other sharps injury; IM=intramuscular; IV=intravenous