






Predicting needlestick and sharps injuries in nursing students: Development of the SNNIP scale

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Abstract

Aim: To develop an instrument to investigate knowledge and predictive factors of needlestick and sharps injuries (NSIs) in nursing students during clinical placements.

Design: Instrument development and cross-sectional study for psychometric testing.

Methods: A self-administered instrument including demographic data, injury epidemiology and predictive factors of NSIs was developed between October 2018–January 2019. Content validity was assessed by a panel of experts. The instrument's factor structure and discriminant validity were explored using principal components analysis. The STROBE guidelines were followed.

Results: Evidence of content validity was found (S-CVI 0.75; I-CVI 0.50–1.00). A three-factor structure was shown by exploratory factor analysis. Of the 238 participants, 39% had been injured at least once, of which 67.3% in the second year. Higher perceptions of "personal exposure" (4.06, SD 3.78) were reported by third-year students. Higher scores for "perceived benefits" of preventive behaviours (13.6, SD 1.46) were reported by second-year students.

KEYWORDS

cross-sectional, Health Belief Model, knowledge, needlestick, nursing students, prevention, questionnaire, sharps injuries, validation

1 | INTRODUCTION

Healthcare workers (HCWs) are an occupational category involved in exposure-prone procedures (EPPs) and therefore at risk of sharps-type injuries and exposure to blood-borne diseases. Indeed, blood-borne biological hazards are the major occupational risk factors for healthcare professionals (Angadi, Davalgi, & Vanitha, 2016). In particular, hepatitis B virus (HBV), hepatitis C virus (HCV) and human

immunodeficiency virus (HIV) represent statistically significant occupational biological hazards involved in blood-borne transmission due to needlestick and sharps percutaneous injuries (PIs) (Risshitelli, Harris, McCauley, Gershon, & Guidotti, 2001; Westermann, Peters, Lisiak, Lamberti, & Nienhaus, 2015; Young, Arens, Kennedy, & Laurie, 2007).

Out of the 35 million HCWs worldwide, 3 million experience percutaneous exposures to blood-borne pathogens yearly, with an

See Appendix for the Collaborators list.

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impact on health and safety, and an economic burden related to follow-up, treatment and other consequences (Angrup, Kamlesh, Chand, Anuradha, & Lata, 2013; Cooke & Stephens, 2017). There is also evidence to suggest that this could be higher due to under-reporting on needlestick injuries by health workers (Papadopoli, Bianco, Pepe, Pileggi, & Pavia, 2019).

In Europe, data show a 1-year incidence of PIs equal to 31.8% (95% CI 25.0–38.5) with an estimated risk of transmission of blood-borne pathogen infections in susceptible HCWs of 30%, 0%–0.5% and <0.3% for HBV, HCV and HIV, respectively (Auta et al., 2018). Moreover, according to a recent review of the literature, prevalence rates of sharps injuries range from 1.4–9.5 per 100 HCWs, resulting in a weighted mean of 3.7/100 HCWs per year (Elsevier, Arias-Guillén, Gorke, & Arens, 2014).

As stated by the Italian Study on HIV Occupational Risk (SIROH), injuries caused by occupational exposure to biological risks represent the most notified type of injuries among HCWs including staff in training and nursing students, equalling 41% of the total notifications, of which two-thirds are the result of needlestick injuries (NSIs), and one-third of sharps injuries. The observed seroconversion rate following percutaneous injuries was 0.14% and 0.08% for HIV pre- and post-HAART (highly active antiretroviral therapy), respectively, 0.25% for HCV and 0.41% for HBV in unvaccinated workers (Deuffic-Burban, Delarocque-Astagneau, Abiteboul, Bouvet, & Yazdanpanah, 2011; The SIROH Collaborative Group).

The Italian Legislative Decree 81/2008 contains a specific section about “Protection from sharps and needlestick injuries in the healthcare setting” (Titolo X-bis) providing recommendations about the application of prevention and control measures to reduce exposure to this occupational risk (Italian Legislative decree n. 81 of 9 April 2008). Moreover, the National Prevention Plan (PNP) 2014–2018, presented by the Italian Ministry of Health, underlined the need to improve actions and strategies to prevent occupational injuries and diseases and to ensure occupational health and safety. Indeed, the Italian PNP 2014–2018 highlighted the reduction of infectious diseases in different settings, including the occupational one, as a major priority (National Prevention Plan 2014–2018).

The Italian occupational health and safety legislative framework considers healthcare students (HCSs) as equivalent to HCWs in relation to their exposure to occupational risks. Previous studies have shown an increased risk of needlestick and sharps injuries among medical and nursing students occurring during their clinical placements, and postgraduate medical students during their residency practice (Bernard, Dattilo, & Laporte, 2013; Di Bari, De Carli, Puro, & The SIROH Collaborative Group, 2015; Lauer et al., 2014; Wicker, Nürnberger, Schulze, & Rabenau, 2008). The accidental exposure to potentially infected blood or other body fluids among HCSs has been investigated in different countries: in Germany and USA, an annual incidence of 60% of students had reported NSIs by the end of their studies (Cheung, Ching, Chang, & Ho, 2012; Hambridge, Nichols, & Endacott, 2016). In Italy, Petrucci and co-authors showed a prevalence of such injuries of 10.3% among nursing students

during their clinical placements (Petrucci, Alvaro, Cicolini, Cerone, & Lancia, 2009).

Nursing students seem to be at a higher risk of injuries than staff nurses, at least in part due to a lack of clinical skills/experience, as suggested by young workers in other occupational categories (European Agency for Safety and Health at Work; Veronesi, Giudice, & Agodi, 2018). Nevertheless, there is a lack of research on NSIs among nursing students, especially across the different years of their curriculum (Cheung et al., 2012; Hambridge et al., 2016). Injuries in this occupational category have an impact that can be severe both on a psychological and on a physical level (Cooke & Stephens, 2017). As shown by several authors, frequent under-reporting further limits the correct assessment of injury rate among nursing students (Choi et al., 2017; Kessler et al., 2011; Ouyang et al., 2017).

Several authors have underlined the important contribution of specific injury prevention training, with the aid of simulation sessions and supervision of tutors, and the adequate implementation of precautionary procedures and improvements of reporting protocols, in reducing the risk of exposure (Rubbi et al., 2018; Veronesi et al., 2018). However, literature reporting the incidence and/or effectiveness of injury prevention and control is limited, resulting in a knowledge gap (Schmitz, Figueira, & Lampron, 2019). A thorough understanding of the epidemiological characteristics, determinants and students' behaviours contributing to occupational NSIs is required to plan effective occupational health interventions and educational programmes aimed at reducing the risk of exposure in healthcare workers and students. An important element of this is an instrument that is specific to the needs of nursing students with regard to NSIs.

A review of the national and international literature on NSIs and the instruments used to investigate it was performed, and two instruments were found. The first was an unvalidated epidemiological data collection chart related to the injuries of health professionals, which investigated the details of the reported injuries (e.g. type of supervision, description of the injury dynamics, knowledge and training of the professional/student with regard to safety procedures). This approach in the Italian context has not been validated to date. The second instrument was developed by Yousafzai, Siddiqui, and Janjua (2013), to investigate the perception of health professionals about the use of universal precautions in the context of first-level care facilities. Based on the dimensions of the Health Belief Model, this instrument evaluates personal exposure to the phenomenon under study, the severity of the condition that may derive from it, the benefits, the barriers and the perceived self-efficacy. We concluded that neither of these instruments was entirely suitable for our study; therefore, we considered that it was necessary to develop a new instrument specific to the needs of nursing students.

This study is an important first step, in terms of feasibility and quality, of a future larger national multicentre study, which will be conducted by two National Working Groups of the Italian Society of Hygiene, Preventive Medicine and Public Health, namely the Italian Study Group of Hospital Hygiene and the Occupational Health & Safety Group.

The research questions guiding the study were as follows: “Is it possible to develop an instrument to measure attitudes towards NSIs in nursing students?”; And “is the instrument psychometrically sound?”

2 | THE STUDY

2.1 | Aim

This study aimed to develop and validate a new instrument to investigate the predictive factors of NSIs in nursing students during clinical placements. The new instrument was developed based on the Health Belief Model. The aim of the Health Belief Model (HBM) is to gain a better understanding of health behaviours by studying individuals' attitudes and beliefs (Abraham & Sheeran, 2007). The HBM consists of a series of six components about the adoption of a healthy action by an individual. In our study, the HBM was adopted as follows: (a) perceived susceptibility to blood infections and sharps injuries; (b) perceived severity of infections; (c) perceived benefits of an action; (d) perceived barriers to action; (e) a prompt for action; and (f) perceived self-efficacy in carrying on the required action. In this study, we used an instrument with all six of the HBM constructs based on validated scales to assess the frequency, knowledge, attitudes and beliefs of sharps injuries (SIs) in nursing students.

2.2 | Design

First, a cross-sectional observational design was used to obtain data from students currently enrolled in the second and third years of the bachelor's degree programme in nursing (first-year students were excluded as they still do not use needles or sharps during their clinical placements). Second, the new instrument's reliability, content validity and underlying dimensions were measured using exploratory factor analysis (EFA).

2.3 | The instrument

To develop the “Student Nurse Needlestick Injury Prediction” (SNNIP) scale, we adapted the instrument originally used by Yousafzai et al. (2013), making several substantial changes that we believe improves the tool and focuses more significantly on injuries. The SNNIP scale has a demographics and an epidemiological section that the original one does not have. We also amended the “perception of disease severity” section, adding content that amends the focus from blood and transmission of disease to injuries.

The section “personal exposure” explores the perception about the risk of injuries and then of being infected which was not measured in Yousafzai et al. (2013) instrument. The section “perception of barriers” of our instrument has new items that focus on sharps or

needle injuries and not on general precaution or correct behaviours. We have shortened the section “self-efficacy” to two items from six and adapting the questioning to “how often” rather than “to what extent do you agree?” We removed the section on “universal precautions at workplace”) because it did not focus on sharps injury or the HBM framework. We also amended the knowledge section of the original instrument.

Our revised instrument—the SNNIP scale—consisted of three main sections: (a) demographic data; (b) injury epidemiology; and (c) items about predictive factors about sharps and needlestick injuries. The first section includes questions about the participant, general personal data, maintaining anonymity, the type of diploma/degree obtained during secondary school education, the year they are currently attending at the university, the number of departments attended for clinical training activities and the wards where the clinical placement took place. In addition, candidates were also asked about their immune status for HBV and about the training on health and safety in the workplace offered at their university.

The second section regards the epidemiology of injuries through 11 questions. First, students were asked to state the frequency of the injuries suffered during their clinical placements and to describe up to three different episodes, through multiple-choice questions. Two specific questions concern the device: the first one describes the device, while the second explores whether the accident occurred with a clean or a contaminated device. This section is repeated three times so that the description of up to three events can be collected.

In the third section, students were asked to express their opinion, choosing between different options, about some statements about risk perception, adherence to precautionary measures, individual concern about the phenomenon and the use of personal protective equipment. The final questions focused on the students' knowledge of how to use a list of nine devices, the disposal of sharp medical devices and the knowledge of the protocols to follow in case of injury in the workplace. This third section is structured as described below, through some items with the opportunity to answer on a Likert scale:

1. “Personal exposure” was investigated through two items with the opportunity to answer on a 4-point Likert scale from “none” = 0–“high” = 3. Higher mean values indicate a higher perception of personal exposure to the condition investigated.
2. “Perceived severity of condition” was investigated with four items with the opportunity to answer on a 5-point Likert scale from “totally agree” = 5–“totally disagree” = 1. Higher mean values indicate a greater perception of the severity of the condition.
3. “Perceived benefits” were investigated with three items with the opportunity to answer on a 5-point Likert scale from “totally agree” = 5–“totally disagree” = 1. Higher mean values indicate a higher perception of the benefits.
4. “Perceived barriers” were investigated through 11 items with the opportunity to reply on a 5-point Likert scale from “totally agree” = 2–“totally disagree” = –2. Positive responses indicate the presence of barriers, while the negative ones indicate the lack of barriers.

5. "Self-efficacy" was investigated through two items with the opportunity to answer on a 4-point Likert scale from "never" = 0–"always" = 3. Higher values indicate a greater perception of self-efficacy.
6. "Knowledge" related to two macro areas: the procedures and protocols to be used, and the devices. The first part was investigated through two items, with three possible answers "Yes," "No" and "I know they exist, but I do not know them." The second part focuses on the knowledge on how to use 9 devices: this section included Yes = 1/No = 0 answers. Higher scores indicate a greater knowledge about devices.

2.4 | Participants and setting

Non-probabilistic convenience sampling was performed. A minimum enrolment of 10 people per item (10:1) of the instrument was necessary to conduct a factor analysis (Gaskin & Happell, 2014); therefore, a total of about 200 surveys were returned. Before starting data collection, inclusion and exclusion criteria for enrolment were provided to obtain an accurate and representative sample for the analysis. In one university department of nursing, all the students attending the second or third year of a bachelor's degree programme in nursing or third-year students who still had not passed all their examinations in the prescribed period of time, who had read the information sheet and who agreed to participate in the project were considered eligible.

2.5 | Data collection

Data were collected using the structured self-administered instrument either printed on paper or online, between October 2018–January 2019. The aim and the relevance of the study was illustrated to the students during a motivational meeting conducted by a member of the research team.

2.6 | Data analysis

A descriptive statistical analysis was conducted. The characteristics of the sample were described in terms of mean values and frequencies, and the data related to the epidemiology of occupational injuries. For the "predictive factors" section of the instrument, data were coded and the total scores about the individual dimensions of the instrument were calculated; these values are described in terms of central tendency values, frequencies and percentages. The dimensions of the instrument were also analysed using principal components analysis. All the statistical analyses were performed using IBM SPSS v20.0.

2.7 | Psychometric testing

Content validity was evaluated using a panel of experts ($N = 6$), who were asked to indicate the relevance of each item on a 4-point Likert

scale from "not relevant" = 1–"very relevant" = 4. The sample mainly included nurses and occupational physicians, with a teaching role in nursing and in occupational health and safety in the healthcare setting.

Discriminant validity was also evaluated to identify whether the developed instrument detected the proposed construct. We investigated whether students, who had directly experienced sharps or needlestick injury, would manifest a higher level of knowledge about the prevention and management of injuries due to sharps or needlestick injuries during clinical placements, compared with those who had no direct experience of injury.

For the principal components analysis, Kaiser–Meyer–Olkin (0.74) and Bartlett's test for sphericity ($p < .001$) confirmed the sample adequacy for an exploratory factor analysis. The 18 questions with a Likert-type response were entered into an exploratory factor analysis. A parallel analysis using the Monte Carlo approach was performed, and the number of factors was determined by comparing the eigenvalues calculated from our data and the one from the random data set, and this indicated that there were probably three factors present; these were rotated using the Varimax procedure.

2.8 | Ethical considerations

The study was approved by the Regional Ethics Committee of the Liguria Region (Registration No. 296/2018). Authorization from the General Director of the hospital where the students did their clinical placements was obtained. Data were collected after obtaining written informed consent from all the participants. All the data were anonymized and processed in an aggregated form, by assigning an alphanumeric code to each participant.

3 | RESULTS

Of the students invited to participate (250), 238 agreed representing a 95.2% return rate (77.5% females, 70.8% attending the second year, mean age 23.5 years; SD 4.67). The students attended a mean of 5 (SD 2) wards during their clinical placements, mainly in the wards of general medicine (86.13%), orthopaedics (49.58%), neurology (48.94%) and general surgery (47.06%). More than half of the students (55.8%) reported having protective anti-HBs antibody titres (≥ 10 mIU/ml) and having received specific training on health and safety in the workplace (99.2%), mostly through online lessons provided by the Prevention and Protection and Occupational Health Services of their University (70.1%). The remaining characteristics of the sample are shown in Table 1.

More than one-third of the students (39%) reported they had been injured at least once with a sharp or a needlestick, and nearly half of these (48.9%) experienced more than one injury (range: 2–6). Most injuries occurred during the second year (67.3%), mostly in the wards of general medicine (48.6%) and general surgery (42.1%). Most of the injuries occurred during "drug administration" (68%),

TABLE 1 Sample characteristics (mean age 25.5 SD 4.67)

	% (N)
Gender	
Male	22.5 (53)
Female	77.5 (183)
High school	
Scientific or classic high school	68.2 (161)
Technical school	17.4 (41)
Professional school	14.4 (34)
Year of attendance	
Second	70.7 (167)
Third	14 (33)
Late	15.3 (36)
Clinical placements	
San Martino Teaching Hospital	18.1 (43)
Galliera Teaching Hospital	14.3 (34)
Local Health Centre ASL 1	5.5 (13)
Local Health Centre ASL 2	9.3 (22)
Local Health Centre ASL 3	36.3 (86)
Local Health Centre ASL 4	6.3 (15)
Local Health Centre ASL 5	10.1 (24)
Clinical placements, mean (SD)	5.5 (2.42)
Training on safety in the workplace	
Yes	99.2 (234)
No	0.8 (2)
Students' blood drawn to test HBsAb	
Yes	85.2 (202)
No	5.1 (12)
Don't remember	9.7 (23)
Antibody titre results ^a	
Protective (≥ 10 mUI/ml)	55.8 (111)
Not protective (≤ 10 mUI/ml)	12.6 (25)
Don't remember	31.7 (63)

Note: N = 238.

Abbreviations: HBsAb, hepatitis B surface antibody; SD, standard deviation.

^aStudents replied "Yes" to HBsAb test question

followed by "handling sharps and needlesticks" (18.4%). The devices that mainly caused injury were vials (68.5%) and infusion syringes (15.8%). Of the 147 injuries reported by the students, 8.8% occurred with a contaminated device: 15.4% of these participants did not access the emergency department because "not deemed necessary" (55.6%) or because "I considered the risk was low or none" (44.4%); a complete set of data related to injuries is shown in Table 2.

The levels of "personal exposure," "perceived severity of condition," "perceived benefits," "perceived barriers," "self-efficacy," and "knowledge" about the safe management of sharps and needlesticks in clinical placements are shown in Table 3. Overall, our results

TABLE 2 Types of injuries^a

	% (N)
Year of attendance	
First	19 (28)
Second	67.3 (99)
Third	5.4 (8)
Over third year	8.2 (12)
Setting	
General medicine ward	48.6 (68)
General surgery ward	42.1 (59)
Operating room	3.6 (5)
Community	5.7 (8)
Procedure	
Drug administration	68 (100)
Management of sharps and needlesticks	18.4 (27)
Recapping needlestick	5.4 (8)
Disposable sharps and needlestick	5.4 (8)
Care procedures	2.7 (4)
Devices caused injuries	
Disposable syringes	15.8 (23)
Hypodermic needles	4.8 (7)
Disposable safety blood lancets	1.4 (2)
Needles for vacuum withdrawal	2.1 (3)
Butterfly needles	4.1 (6)
Vials	68.5 (100)
Scissors	1.4 (2)
Needles	0.7 (1)
Scalpels	1.4 (2)
Status of devices that caused injuries	
Clear	91.2 (134)
Contaminated	8.8 (13)
Admissions to ED due to injuries caused by contaminated devices	84.6 (11)

Note: N = 147.

Abbreviation: ED, emergency department.

^aRespondents could indicate >1 injury.

showed a greater perception of "personal exposure" in third-year students (4.1, SD 3.78), and a greater "perceived severity of the condition" (16.2, SD 0.95). Instead, with respect to "perceived benefits," it was mostly the second-year students who perceived the importance of implementing preventive behaviours (13.6, SD 1.46) and that there were fewer barriers to their use in clinical placements (-11.8, SD 6.54). Finally, while over third-year students who still had not passed all their examinations in the prescribed period perceived a higher level of self-efficacy (4.5, SD 0.95), third-year students were those who had the best "knowledge about device use" (7.1, SD 1.03).

TABLE 3 The levels of “personal exposure,” “perceived severity of condition,” “perceived benefits,” “perceived barriers,” “self-efficacy” and “knowledge” about safe management of sharps and needlesticks in clinical placements

Subscales	Mean (SD)		
	Second-year students	Third-year students	Over third-year students
Personal exposure ^a	3.98 (1.23)	4.06 (1.12)	3.78 (1.12)
Perceived severity of condition ^b	15.84 (2.66)	16.16 (2.95)	15.19 (3.07)
Perceived benefits ^c	13.63 (1.46)	13.50 (1.81)	13.46 (1.50)
Perceived barriers ^d	-11.80 (6.54)	-11.25 (8.27)	-9.58 (5.94)
Perceived self-efficacy ^e	3.83 (1.46)	4.31 (1.35)	4.53 (0.95)
Knowledge of devices ^f	5.95 (2.00)	7.06 (1.03)	6.38 (1.88)

^aLikert scale of 2 items (range 0–6).

^bLikert scale of 4 items (range 4–20).

^cLikert scale of 3 items (range 3–15).

^dBipolar Likert scale of 11 items (range -22 to +22).

^eLikert scale of 2 items (range 0–6).

^fScale of 9 binary items (range 0–9).

3.1 | Psychometric properties

The instrument showed a fair level of content validity at the scale (S) and item (I) levels, respectively: S-CVI = 0.75; I-CVI = 0.50 – 1.00. A *t* test for independent samples demonstrated a statistically significant difference ($p < .001$) between the two groups, confirming the hypothesis and therefore that the instrument has a positive construct validity (Polit & Tatano-Beck, 2017). EFA produced 3 factors: “perceived barriers” (which explained 26.8% of the variance), “perceived severity of condition” (15.5%) and “perceived benefits” (10.9%). Moreover, a parallel analysis using the Monte Carlo approach was performed, and the number of factors was determined by comparing the eigenvalues calculated from our data and the one from the random data set. Then, the Monte Carlo parallel simulation indicated a solution with three factors. Cronbach's alpha for each component that was identified from the factor analysis was as follows: “perception of barriers” $\alpha = .86$; “perceived severity of condition” $\alpha = .84$; and “perception of benefits” $\alpha = .66$ (Table 4).

4 | DISCUSSION

To our knowledge, this is the first survey using a validated instrument for investigating knowledge and assessing predictive factors about sharps and needlestick injuries among nursing students during clinical placements. This is only the first step in the framework of a larger national multicentre project aimed at collecting reliable information underpinning the implementation of preventive measures and reducing occupational injuries among young trainees during their clinical training.

Our instrument, which we called the “Student Nurse Needlestick Injury Prediction” (SNIPP) scale, was built by adapting the items included in the instrument adopted by Yousafzai et al. (2013). Like the original instrument, this new one consists of six sections related to the Health Belief Model, and the type of questions and answers

remained unchanged in their form, but the content was adapted to the topic and to a different population. Since the present study was the first to use this new instrument, further research on it is highly desirable to have comparable data that could be shared and discussed in the scientific community, also with the aim to improve its current potential.

The Italian Legislative Decree 81/2008 equates healthcare students to healthcare workers, due to their exposure to several occupational hazards and risks, including biological ones. Nursing students are young workers that perform dangerous procedures during their clinical placements, with potential exposure to the most common blood-borne agents in the healthcare setting, such as HBV, HCV and HIV. With respect to the preventive measures adopted to address this issue, the findings obtained in this study highlighted that only about half of the students reported a seroprotective titre against HBV infection. This underlines the importance of testing it during the preventive medical examination in the context of the Occupational Health Surveillance Programs currently foreseen by the Italian law. Previous data about similar populations (i.e. medical students with a comparable mean age) from our research group showed seroprotective anti-HB titres higher (70%) than those reported in the present investigation (Bini et al., 2018; Dini et al., 2017). This discrepancy could be easily explained as a recall bias during the completion of the instrument. It is noteworthy that more than one-third of the participants reported an NSI during their clinical training, half of which with repeated exposures. The overall prevalence of injuries reported in the study sample was relevant, even if in line with previous data reported in the literature, ranging from 6.2%–49% (Irmak & Baybuga, 2011; Karadağ, 2010; Petrucci et al., 2009; Rubbi et al., 2018; Talas, 2009; Vandijck, Labeau, De Somere, Claes, & Blot, 2008). Other findings from the present study could be useful for educators and tutors employed in the healthcare settings to address students' knowledge gaps, consequently implementing more targeted (both theoretical and practical) educational sessions on

TABLE 4 Exploratory factor analysis and Cronbach's alpha

Factor	Eigenvalue	Cronbach's alpha	Items	Factor loading			Communality
				1	2	3	
Perceived severity of condition	15.82	.84	Doing a job that involves the use of needles and sharps is dangerous	-0.033	0.830	-0.006	0.683
			Doing a job that involves contact with other people's body fluids, such as blood, is dangerous	-0.007	0.822	0.058	0.690
			I am worried I could have an injury during my clinical placement	0.067	0.816	0.008	0.679
			I am worried about being infected or contracting a disease due to sharps or needlestick injuries	-0.053	0.812	0.143	0.671
Perceived benefits	10.10	.66	I think by taking the necessary precautionary measures, we can reduce the likelihood of sharps or needlestick injuries	-0.079	-0.005	0.767	0.594
			I believe the lack of adherence to the necessary precautionary measures may increase the likelihood of negative outcomes	0.029	0.099	0.759	0.583
			I believe that the benefits derived from the use of precautionary measures are greater than the burden of complying with them	-0.079	0.086	0.754	0.586
Perceived barriers	27.29	.86	I do not know the precautionary measures to protect me from sharps or needlestick injuries in clinical placements	0.744	-0.062	-0.048	0.484
			Sometimes, I do not use the precautionary measures necessary to avoid sharps or needlestick injuries	0.734	-0.058	0.017	0.522
			Sometimes, I do not use the precautionary measures necessary to avoid sharps or needlestick injuries because my colleagues do not use them	0.720	-0.008	0.011	0.542
			I believe that using precautionary measures may offend patients	0.715	-0.041	0.095	0.505
			In emergency situations, it is not possible to protect myself from the risk of sharps or needlestick injuries because the patients' needs are more important	0.705	0.010	0.053	0.334
			In contexts where the risk of sharps or needlestick injuries is low, I do not always have to protect myself from the risk	0.676	-0.150	-0.161	0.391
			At the beginning of the clinical placement, I was not properly trained on the correct precautionary measures to avoid sharps or needlestick injuries	0.612	0.028	-0.128	0.410
			Wearing protective equipment makes me feel uncomfortable	0.609	0.0206	-0.265	0.560
			Wearing protective equipment makes it difficult to work	0.581	0.007	-0.269	0.500
			Implementing precautionary measures for all patients is costly for the hospital	0.574	0.062	-0.036	0.326
The adoption of precautionary measures is not easily applicable in the context of the clinical placement I am attending	0.564	0.013	0.087	0.518			

the correct use of personal protective equipment (PPE) and medical devices, to finally enforce preventive behaviours aimed at reducing the occupational risk of injuries. This is also the case for occupational health professionals, who can gather further important information concerning risk assessment, providing tailor-made information and improving adherence to preventive recommendations, such as vaccinations during regular health surveillance visits.

The fundamental importance of these activities is demonstrated by the results of the study itself, confirming previous results in the literature (Suliman et al., 2018): the finding that seniority increases awareness about the exposure and the severity of conditions, and knowledge concerning devices and their correct use. In this regard, it is worth noting that second-year students deem specific training and preventive measures as the most beneficial.

4.1 | Limitations

Data were limited to a convenience sample of second- and third-year students and only from one institution. The first-year students were deliberately excluded from this study because they were not exposed during their clinical training to the occupational risks investigated in the instrument. However, we cannot exclude that some useful information may have been missed as a consequence of the criteria adopted to select the study sample. In addition, Cronbach's alpha for the factor "perception of benefits" was $<.7$

5 | CONCLUSION

The availability of a new reliable instrument aimed at obtaining a thorough understanding of the epidemiological characteristics, determinants and the workers' behaviours contributing to occupational NSIs is certainly useful to acquire and improve specific knowledge in this field and to consequently plan effective interventions aimed at reducing the risks of exposure among healthcare workers, and the SNNIP scale was suitable for investigating undergraduate nursing students' knowledge and risk perception about percutaneous needlestick and sharps injuries. The data obtained in this study could improve our understanding of the extent of the issue and aid the implementation of specific courses to improve the health and safety of nursing students, and other healthcare students.

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CONFLICT OF INTEREST

Roger Watson, Editor in Chief, and Mark Hayter, Editor of the Journal of Advanced Nursing, hold honorary positions at the University of Genoa where the study was conducted.

AUTHOR CONTRIBUTIONS

AB, PD, LS, MZ, GD, PD: Substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data. AB, PD, MZ, GD, RW, ND, MH: Manuscript drafting and critical revision for important intellectual content. All authors gave final approval of the version to be published. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content. All authors agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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