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Nursing Students' Perceptions on Sharps Injuries Risk, Prevalence, and Double-gloving as a Prevention Strategy: Implications for Online Graduate Nursing Education

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Abstract

In the United States, 385,000 healthcare staff experience sharps injuries annually, costing the healthcare system over one billion dollars. double-gloving can reduce perforations by up to 71-85%. The problem is that healthcare personnel often do not utilize double-gloving. This study was performed to identify the perceptions, perceived barriers, and prevalence of double-gloving among nursing students, who have the highest rate of sharps injuries. A cross-sectional survey-based study was conducted in 2023 for 737 nursing students at a California-based university. Based on the Health Belief Model, the Student Nurse Needlestick Injury Prediction (SNNIP) Scale was validated using a Likert Scale. Data were analyzed using SPSS, under the Chi-Square and Independent Sample T-tests. Of 162 participants, most were white females, aged 25-40, Bachelor/BSN program, 5-10 years experienced, and 34% with at least one sharps injury. While 88.6% were single-gloved upon injury, 21.3% routinely double-gloved (Universal Rate: 43%). Participants agreed with the risks of sharps injuries and their severity, but disagreed with double-gloving efficacy for prevention (21.3% vs 71-85%). There was a 25% glove allergy induction (standard: 8-12%). Nursing students had insight regarding the seriousness of sharps injuries, their complications, and the necessity of prevention strategies. Simultaneously, their perceptions of double-gloving with the necessity of education in this regard were unsatisfactory. Therefore, continuous education and training regarding double-gloving, especially through online courses and e-learning credentials, because of their worldwide accessible and acceptance due to compliance with the healthcare personnel's busy schedule, must be encouraged. Moreover, interdisciplinary collaboration with supervisory bodies such as the CDC or FDA for glove quality assessment is another main recommendation of this study.

Keywords: *Nursing Students' Perception, Sharp Injuries Prevalence, double-gloving*

Nursing Students' Perceptions on Sharps Injuries Risk, Prevalence, and Double-gloving as a Prevention Strategy: Implications for Online Graduate Nursing Education

In the healthcare industry, protecting healthcare personnel is important to maintain the desired organizational outcomes and provide the highest rate of patient-employee satisfaction (Harrod et al., 2019). One of the potential risks for healthcare personnel in their organizational duties is sharps injuries-related complications (Loscalzo et al., 2022). According to the Exposure Prevention Information Network (EPINet), sharps injuries are penetrating stab wounds of sharp objects such as syringe needles, knives, scalpels, or surgical blades that can result in exposure to blood or other body fluids (International Safety Center, 2022). These injuries can occur during operations, venipunctures, procedures, sanitizing, sterilization, and waste disposal (King & Strony, 2022; Sriram, 2019).

In the United States, 385,000 healthcare staff experience sharps injuries annually, costing the healthcare system over one billion dollars (Centers for Disease Control and Prevention [CDC], 2020). The global prevalence of sharps injuries was found at 25.2%, with the highest rate among nursing students (Datar et al., 2022). The most common sharps injuries happen during venipuncture, with nurses and their associates (i.e., lab technicians) comprising 42-44% of reported cases (Bennett et al., 2019; CDC, 2020). Physicians, operative or procedural room staff, and even ancillary workers (i.e., janitorial staff) are also at risk during inappropriate sharps disposal (Loscalzo et al., 2022). Per reports, almost 40% of the incidents occur after usage and before disposal, 41% during procedures, and 15% within disposal (CDC, 2020).

Sharps injuries can result in blood-borne infections such as hepatitis B (HBV), hepatitis C (HCV), and human immunodeficiency (HIV) viruses (Bennett et al., 2019; Loscalzo et al., 2022). The significant effects of sharp injuries on healthcare organizations include reduced productivity rates, systematic costs (such as the medical expenses of injured staff or hiring temporary personnel to cover injured staff on sick leave), and psychosomatic illnesses treatment resulting from blood-borne infections (Hambridge, 2022; Harrod et al., 2019; Sriram, 2019). The average cost to treat someone with a sharp injury has been estimated at $3,042 (CDC, 2020). These costs are attributed to laboratory tests for exposed staff, consultations, and post-exposure follow-ups (Ridell et al., 2015). Also, there are costs related to a leave of absence for injured staff, and this may diminish organizational outcomes (CDC, 2020; OSHA, 2008).

With about 1,000 daily sharps injuries in the United States for more than 6,000 healthcare centers, an extra $400 daily cost for every organization is predicted (CDC, 2020). The U.S. Food and Drug Administration (FDA) (2020), has projected more than $100,000 in annual underestimated expenditures for any hospital if a single daily sharp injury happens. One strategy to prevent sharps injuries and reduce related care costs is to wear gloves, and the FDA has considered latex material the standard glove (FDA, 2020). Notably, when gloves are worn for multiple uses, they begin to break down with microscopic perforations in latex and are not as effective in preventing sharps injuries. Research has indicated that double-gloving can reduce perforations by 71-85% (Mischke et al., 2014; Becker's Healthcare, 2021).

While sharps injuries cost the healthcare system over one billion dollars annually (CDC, 2020), there is a lack of understanding of why healthcare personnel often do not utilize double-gloving as an effective sharps injuries preventive strategy (Lipson et al., 2018). Nursing students are at high risk for sharps injuries due to their limited personal experience (Bagnasco et al., 2020). The Health Belief Model (HBM) is a theoretical framework that uses several factors to describe and predict healthcare behaviors with six major constructs (Abbas, 2021; Jones et al., 2015; LaMorte, 2021; Sweeny et al., 2020). Therefore, a quantitative exploratory and descriptive survey-based study was conducted to evaluate nursing students' experience and perceptions of sharp injury risk, severity of the risk, and knowledge of prevention strategies (Bagnasco et al., 2020).

Methods and Materials

This research incorporated a quantitative methodology using a nonexperimental, cross-sectional design to survey active nursing students in both undergraduate and graduate degree programs (Setia, 2016; Wang & Cheng, 2020). Email-based data collection via surveys was chosen to maintain a confidential relationship between the researcher and the participants (Bartliff et al., 2022; Yun et al., 2023). The Student Nurse Needlestick Injury Prediction (SNNIP) Scale (Bagnasco et al., 2020) was validated with permission under Likert (Jebb et al., 2021). The SNNIP Scale includes three main sections including demographic data, epidemiology of the injury, and sharps injuries predictive factors (Table 1).

Table 1

Survey Constructs, Survey Items, and Interpretation

Construct	Survey Items (See Note)	Interpretation
Perceived Severity and Susceptibility of Sharps Injuries (4 items)	a. Tasks and procedures involving sharp objects are dangerous. b. Procedures involving patients' body fluids, such as blood, are dangerous. c. Sharps injuries can happen to clinical and non-clinical staff. d. Sharps injuries can lead to serious blood-borne diseases such as hepatitis B or C and HIV.	Higher mean values of survey items indicate greater perceived severity and susceptibility of sharps injuries
Perceived Benefits and Efficacy of double-gloving (6 items)	a. Sharps injuries are preventable. b. double-gloving is the preferred method of protection. c. More education and training on the benefits of double-gloving as a preventive strategy would prevent sharps injuries. d. Non-adherence to sharps injury prevention protocols increases the risk of injury or infection. e. Non-adherence to sharps injury prevention protocols increases the risk of unnecessary costs for the hospital. f. For sharps injuries, the benefits of complying with prevention protocols outweigh the burden of complying.	Higher mean values of survey items indicate greater perceived benefits and efficacy of double-gloving to prevent sharps injuries
Perceived Barriers to double-gloving (7 items)	a. Patients would be offended if they noticed that healthcare personnel were double-gloving while treating them. b. double-gloving is too uncomfortable for healthcare personnel to use as a preventive strategy for sharps injuries. c. double-gloving takes too much time for healthcare personnel to use as a preventive strategy for sharps injuries. e. In emergencies, healthcare personnel do not have the time to double-glove due to patient priorities. f. There are not enough gloves available for all department personnel to double-glove. g. double-gloving is too costly for hospitals as a prevention strategy for sharps injuries. h. double-gloving is not an effective prevention strategy due to the prevalence of latex and talc powder allergies.	Higher mean values of survey items indicate greater perceived barriers to using double-gloving as a prevention strategy

Note. 5 – Strongly Agree; 4 - Agree; 3 - Disagree; 2 – Strongly Disagree; 1 – Not applicable

The survey invitation emails were sent via QuestionPro (questionpro.com), an independent research firm, to the organizational email addresses of all nursing students at a California-based, private, non-profit university after receiving Institutional Review Board approval to conduct the study. Nursing students who replied to the surveys in response to the researcher's invitation email were the participants (Wu et al., 2022). Data were downloaded from the QuestionPro database and analyzed with the Statistical Package for Social Sciences (SPSS), Version 29, using Chi-Square and Independent Sample T-test.

Results

The study was conducted over four weeks. Active undergraduate and graduate nursing students (n = 737) at the university were invited to participate (United States Department of Labor, 2022; University of California San Francisco, 2023). From these invitees, 162 people decided to participate in the study, with a response rate of 21.98% (162/737). Based on the responses, most of the study participants were white, 25-40 years of age, female students in Bachelor/BSN degree programs who had more than 5 years of healthcare experience in different departments of hospitals as nurses or nursing assistants. Considering the global exposure rate of 25.2% worldwide (Datar et al., 2022), the prevalence of 34.0% for sharps injuries among the study participants was noteworthy. The frequency of sharps injuries had a meaningful association with the type of procedure, including the highest frequencies for injections among sterile and re-cap processes for unsterile procedures. Also, 21.3% of the participants routinely double-gloved while 88.6% of the injured nursing students were single-gloved at the time of the incident (Table 2).

Table 2

Demographic Characteristics with Crosstabulation of Age Group, Degree Program, and Work Experience of Survey Participants (n=97)

	# (%)
Age Group	
<25	6 (6.2)
25-40	37 (38.1)
41-60	29 (29.9)
>60	1 (1.0)
Missing/Unknown	24 (24.7)
Gender	
Female	58 (59.8)
Male	14 (14.4)
Missing/Unknown	25 (25.8)
Race/Ethnicity	
Asian	13 (13.4)
Black or African American	12 (12.4)
Hispanic or Latino	12 (12.4)
Middle Eastern or North African	0 (0)
Multiracial or Multiethnic	1 (1.0)
Native American or Alaska Native	1 (1.0)
White	33 (34.0)
Native Hawaiian/Pacific Islanders	1 (1.0)
Missing/Unknown	24 (24.7)
Length of Nursing Experience	
None Reported	34 (35.1)
< 5 years	12 (12.4)
5 – 10 years	25 (25.8)
11 – 20 years	10 (10.3)
>20 years	16 (16.5)
Nursing Degree Level	
Bachelors/BSN level	42 (43.3)
Masters/Graduate Certificate level	9 (9.3)
Doctoral Level	22 (22.7)
Missing/Unknown	24 (24.7)
Experienced Sharps Injuries	
No	41 (42.3)
Yes	33 (34.0)
Missing/Unknown	23 (23.7)
Number of Sharps Injuries	
None	68 (70.1)
Once or Twice	19 (19.6)

Few (3-4 times)	8 (8.2)
Many (5+ times)	2 (2.1)
Double-gloving	
No	56 (42.3)
Yes	6 (21.6)
Missing/Unknown	35 (36.1)

	Experienced Sharps Injuries		
	Yes	**No**	χ^2
Age Group			
<25	1 (3.2)	4 (10.0)	7.63
25-40	12 (38.7)	25 (62.5)	
41-60	17 (54.8)	11 (27.5)	
>60	1 (3.2)	0 (0)	
Length of Nursing Experience			
< 5 years	4 (12.1)	8 (19.5)	6.06
5 – 10 years	10 (30.3)	15 (36.6)	
11 – 20 years	5 (15.2)	5 (12.2)	
>20 years	11 (33.3)	5 (12.2)	
Nursing Degree Level			
Bachelors/BSN	13 (40.6)	29 (72.5)	9.29**
Masters/Graduate Certificate	4 (12.5)	5 (12.5)	
Doctorate	6 (15.0)	15 (46.9)	

Note. **p < 0.01

Related to the construct of risk and severity of sharps injuries, 91.8% of the participants believed that sharps injuries-related tasks and procedures are dangerous, with the same results for body fluid procedures-related dangerousness. They considered a 97.3% chance for clinical and non-clinical staff to be at risk of sharps injuries during duties. Participant nursing students believed in the evolution of serious blood-borne diseases such as hepatitis B or C and HIV after sharps injuries at 97.3% too.

Regarding nursing students' perception of double-gloving as a prevention strategy for sharps injuries, although 77.5% of the participants believed in sharps injuries prevention strategies, only 35.6% of them believed in the importance of double-gloving. Concurrently, 68.1% of the participants believed in the unnecessary nature of double-gloving for sharps injuries. It was noted that 15.5% of the participants believed their patients would feel disrespected if they double-gloved, and 31.9% of them had found double-gloving uncomfortable.

With 26.4% perceiving double-gloving as a time-wasting process, 61.6% of the participants believed that double-gloving has interfered with patient priorities, and 25% were concerned about glove materials allergy induction, while the standard rate is 8-12% for healthcare workers (American Dental Association, 2023).

Nursing students' perception of barriers to utilizing double-gloving was a major concern. Survey results in this regard showed that 48.4% of the participants believed in the lack of enough supplies of gloves in the healthcare facilities. However, it was notable that 32.3% believed in the costliness of double-gloving for hospitals. The final construct examined the impact of sharps injury training. Survey results presented a positive perception of current training at 45.2%, while 54.8% disagreed (Table 3).

Table 3

Summary of Findings by Health Belief Model Construct (n=73)

Health Belief Model Construct	Summary of Findings
Risk and Severity of Sharps Injuries	Over 90% of survey respondents agreed or strongly agreed with the risk and severity statements. The level of awareness of sharps injuries risk is high among nursing students in the sample.
Efficacy of double-gloving to prevent sharps injuries	Only 36% of respondents agreed or strongly agreed that double-gloving was an important prevention strategy for sharps injuries.
The practicality of double-gloving as a prevention strategy	The majority of survey respondents did not perceive double-gloving as impractical except under emergency conditions. Almost 70% felt double-gloving was not necessary to reduce sharps injuries.
Importance of adherence to established safety protocols	High level of agreement (>90%) to the importance of adhering to established safety protocols in helping to prevent sharps injuries.
Institutional barriers to double-gloving as a prevention strategy	The majority of respondents perceived no institutional barriers (e.g., supply or costs) to double-gloving.
Importance of training on double-gloving to prevent sharps injuries	A slight majority (54.8%) disagreed that more training on the benefits of double-gloving would reduce sharps injuries.

Conclusion

Nursing students who participated in this study expressed strong agreement with both the risks of incurring sharps injuries and the potential severity that can accompany these injuries in the healthcare setting. Similarly, respondents reported a high level of agreement with the importance of prevention and safety protocols and perceived few institutional barriers to double-gloving (i.e., excessive cost or supply limitations). Consistent with the Health Belief Model (Houghbaum et al., 2022; LaMorte, 2019; O'Dwyer et al., 2019), nursing students accurately recognized their risk of exposure to sharps injuries and were motivated to take precautions to prevent them from happening.

Nursing students were in large agreement that double-gloving was not an effective strategy to prevent sharps injuries. It was interesting that many of the perceived barriers to double-gloving (e.g., taking too much time, patients being offended, double-gloving being too uncomfortable, etc.) were soundly rejected by most of the respondents. Instead, a high number of respondents reported a lack of confidence in the efficacy of double-gloving to prevent sharps injuries. This perception, expressed by many participants, runs counter to the published evidence (Lipson et al., 2018; Zhang et al., 2021).

The literature encompasses the same results for nursing students' sharps injuries involvement, which was 34% in this study (39% for Bagnasco et al., 2020; and 34% for Black Thomas, 2020). In concordance with Bagnasco and colleagues' study (2020), a greater prevalence of sharps injuries for nursing students with 1-5 years of experience confirmed the reality that higher experience and education could be helpful in sharps injuries prevention. This study found a 21.3% belief in double-gloving, while the global perception rate has been 71-85% (Becker's Healthcare, 2021; Mischke et al., 2014).

The highest prevalence of sharps injuries in this study among sterile procedures for injections and re-cap among unsterile procedures was in alignment with the literature (Bagnasco et al., 2020). There was a 25% concern about glove material allergy induction for this study's respondents, while the standard rate is 8-12% for healthcare workers (American Dental Association, 2023). It seems that, other than educational improvement regarding sharps injuries and double-gloving, the quality of products and manufacturers' evaluation may be a new field of research to educate students about allergic reactions, too.

The focus of this study was the perceptions of nursing students related to their potential risk for sharps injuries, utilizing double-gloving as a sharps injuries prevention strategy, perceived barriers of utilizing double-gloving, and the impact of sharps injuries and double-gloving training (Van Wicklin, 2015). Based on the results and their interpretations, nursing students had enough insight regarding the significance of sharps injuries; their personal, organizational, clinical, and financial complications; and the necessity of prevention strategies. Their perceptions regarding double-gloving as one of the most recommended preventive methods for sharps injuries (FDA, 2020), besides the necessity of its education and training (Cicek-Senturk et al., 2019), were not satisfactory.

Based on the results from this study, there are three recommendations for practice. First, healthcare leaders should facilitate a culture of learning and open reporting regarding sharps injuries to include robust analysis of root causes and the effectiveness of prevention and safety procedures. Multiple evidence-based prevention strategies and the comparative effectiveness of each should be incorporated into organizational policies and procedures.

Second, a better and more transparent reporting system of sharps injuries at the facility, state, and national levels is required. This should include making more data publicly available on procedures with high incidence rates and the epidemiology of preventative measures. This publicity is important since the lack of transparent and detailed contextual data prohibits the analysis of preventative strategies and effectiveness.

Third, the results of this study can inform evidence-based decisions of healthcare administrators, such as educational plans or organizational safety policies (Ospina et al., 2020; Wagner et al., 2019). Since it has been proven that there is no significant difference between traditional and online learning outcomes (Stemp et al., 2022), the implementation of online courses and e-learning credentials due to their worldwide accessibility and acceptance due to compliance with the healthcare personnel's busy schedule, must be encouraged. As a result, increasing the need for double-gloving education and training at the licensure program level seems necessary, and educational curriculum periodical revisions in this regard would be beneficial.

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