

Recapping actions, knowledge, and use of safety boxes with the incident of needle stick injuries in nurses at the inpatient installation of the Gadjah Mada University Academic Hospital, Yogyakarta

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Abstract

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Purpose: Data from the Occupational Health and Safety (OHS) and Sanitation Unit of the Gadjah Mada University Academic Hospital (RSA UGM) recorded 98 work accident cases from 2021 to 2023, with needle stick injuries (NSI) being the most frequent. Most of these incidents occurred among nurses in the inpatient department. Several risk control measures have been implemented, yet they have not proven fully effective. This research aims to examine the relationship between recapping practices, knowledge, and safety box utilization with the incidence of NSI, and to analyze risk control efforts for NSI among nurses in the RSA UGM inpatient department. **Methods:** A mixed-methods study was conducted using a cross-sectional design for the quantitative phase, which was analyzed descriptively, followed by qualitative interviews to explore risk control measures. A proportional random sampling technique recruited 80 nurses and 5 key informants from hospital management. **Results:** Recapping ($p = 0.041$) and knowledge ($p = 0.005$) showed significant associations with NSI (90% CI, 0.12–0.79). Nurses practicing recapping were 0.35 times less likely to experience NSI, and those with high knowledge had a 0.2 times lower risk. The utilization of safety boxes showed no significant association with NSI ($p = 0.246$). **Conclusion:** Recapping practices and knowledge are significant factors associated with NSI in inpatient nurses at RSA UGM. Existing risk control measures require improvement through various educational materials, peer sharing, and more comprehensive and effective training methods.

Keywords: health workers; needle stick injuries; nurses; risk control; safety practices

INTRODUCTION

Needle stick injury (NSI) is a pressing occupational safety issue in healthcare settings worldwide. The World Health Organization (WHO) reports that more than 2 million healthcare workers, out of the 35 million employed globally, suffer needle stick injuries annually. These NSIs lead to approximately 16,000 hepatitis C cases, 66,000 hepatitis B cases, and 1,000 HIV cases each

year among healthcare workers. Similarly, the Centers for Disease Control and Prevention (CDC) and the European Agency for Safety and Health at Work (EU-OSHA) report over 385,000 and 1,000,000 NSIs annually in hospitals across the United States and Europe, respectively [1]. The Indonesian Ministry of Health Regulation No. 66 of 2016 on Hospital Occupational Health and Safety states that hospitals, as healthcare service providers, are high-risk workplaces

for hospital staff, patients, patient companions, visitors, and the surrounding environment [2]. The primary hazard from sharp injuries is the potential transmission of blood-borne viruses, notably hepatitis B, hepatitis C, and HIV [3].

In Indonesia, the incidence of NSI remains alarmingly high, with studies reporting that 38–73% of healthcare workers have experienced such injuries. Nurses are particularly at risk, being the most affected group [4,5]. A preliminary study conducted at RSA UGM, based on data from the OHS and Sanitation Unit from 2021 to 2023, recorded 89 work accidents, with the inpatient unit accounting for the highest number at 48 cases (54%).

Azwar (2010) describes a system as comprising interrelated and interdependent elements that can be grouped into six components: input, process, output, impact, feedback, and environment [6]. The Infection Prevention and Control Committee (IPC) at RSA UGM has undertaken several NSI risk control measures to comply with hospital occupational safety standards. These include: 1) annual infection prevention and control (IPC) training; 2) provision of syringe holders, though these are deemed less effective during emergencies compared to recapping, particularly as some nurses are accustomed to recapping; 3) availability of safety boxes, though some nurses still fail to position them close to the procedure area; 4) Joint supervision between the OHS unit, IPC, nursing heads, and designated supervisors; and 5) provision of personal protective equipment (PPE).

Despite the implementation of various measures, NSIs remain a concern. This persistent issue has prompted researchers to investigate the relationship between recapping practices, knowledge, and safety box utilization with NSI incidence, and to examine the effectiveness of the risk control measures implemented for inpatient nurses at RSA UGM.

METHODS

This research employed a mixed-methods approach. The quantitative phase used a cross-sectional design analyzed descriptively, followed by a qualitative phase involving in-depth interviews. The independent variables were recapping practices, knowledge level, and safety box utilization, while the dependent variable was the incidence of NSI. The study population consisted of nurses working in the inpatient department of Gadjah Mada University Academic Hospital (UGM). The quantitative sample consisted of 80 nurses selected using proportionate random sampling. In the qualitative phase, five key informants

from hospital management played a crucial role in providing insights and perspectives. Quantitative data were obtained using a validated questionnaire. Bivariate analysis was performed using the chi-square test, while multivariate analysis applied logistic regression. All statistical analyses were conducted using STATA version 17. Qualitative data were collected through in-depth interviews with key informants, followed by data triangulation involving representatives from hospital management. Thematic analysis was conducted using ATLAS.ti software.

The data analysis included univariate analysis to describe the frequency distribution of respondents, bivariate analysis with the chi-square test to examine the association between independent and dependent variables, and multivariate analysis using linear regression to assess the effect of independent variables on the dependent variable. The study commenced after respondents provided informed consent, a crucial step in ensuring the ethical conduct of research. All respondent data were kept confidential, further reinforcing our commitment to ethical conduct. Ethical approval was obtained from the Medical and Health Research Ethics Committee (MHREC), Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada (Ref. No. KE/FK/0365/EC/2024).

RESULTS

Among the 80 participating nurses, the majority (60%) were under 31 years of age, and most were female (91.25%). Furthermore, most nurses (57 nurses) had more than three years of work experience. In terms of education, 68 nurses (60%) held a Diploma IV.

Table 1. Characteristics of respondents (n=80)

Variables	n	%
Age (years)		
≤31	48	60.00
>31	32	40.00
Gender		
Man	7	8.75
Woman	73	91.25
Year of service (years)		
≤3	24	30.00
>3	56	70.00
Level of education		
D3	32	40.00
D4/S1/Ners	48	60.00
Training		
Yes	51	63.75
Never	29	36.25
Recapping actions		
Do not	46	57.50
Do recapping	34	42.50
Education		
Low	18	22.50
High	62	77.50
Safety box utilization		
Low	64	80.00
High	16	20.00

Among the 80 participating nurses, the majority (60%) were under 31 years of age, and most were female (91.25%). Furthermore, most nurses (57 nurses) had more than three years of work experience. In terms of education, 68 nurses (60%) held a Diploma IV, Bachelor's, or Nurse's degree. Most had attended relevant training (63.75%). Regarding safety practices, 57.5% did not perform recapping, 77.5% demonstrated a high level of knowledge of NSI, and 80% showed low utilization of safety boxes. Table 1 shows the characteristics of respondents. Recapping actions, knowledge, and use of safety boxes with the incidence of needle stick injuries are attached in Table 2.

Table 2. Association between recapping practices, knowledge, and safety box utilization and NSI

Variables	NSI incidence				p-value
	Ever n	Ever %	Never n	Never %	
Recapping practices					
No	27	49	19	76	0.024*
Yes	28	51	6	24	
Knowledge					
Low	7	13	11	44	0.002*
High	48	87	14	56	
Utilization of safety boxes					
Low	41	75	23	92	0.070*
High	14	25	2	8	

Table 3. Influence recapping actions, knowledge with NSI on nurses in inpatient settings

Variables	Coeff	OR	p-value	90% CI Coeff		90% CI OR	
				Min	Max	Min	Max
Action recapping							
Do	-1.02	0.35	0.041*	-1.9	-0.07	0.120	0.79
Knowledge							
High	-1.60	0.20	0.005*	-2.5	-0.60	0.070	0.50
Use of safety boxes							
High	-0.96	0.38	0.246	-2.3	0.40	0.096	1.49

Constanta : 0.92; Probability > Chi² 0.0017; Pseudo R² 0.1524

*Significant (p < 0.1); No significant (p > 0.1) mark Which most tall; Coeff = Coefficient Regression; OR = Odds Ratio ; CI = Confidence Interval.

The Pseudo R² value of 0.1524 indicates that recapping practices and knowledge explained 15.24% of the variation in NSI incidence, with the remaining 84.76% likely attributable to other factors. Recapping practices and knowledge were found to be important factors in reducing the incidence of needlestick injuries. The effect of recapping practices and knowledge on needlestick injury incidence is evident in Table 3.

Risk control of needle stick injuries

The risk control of needle stick injuries at RSA UGM was analyzed qualitatively through interviews with five key informants from the management. These informants included the Director of Human Resources,

The results of the analysis showed a statistically significant association between recapping practices and NSI incidence (p = 0.024; 90% CI). Among nurses who did not recap, as many as 27 nurses (49%) had experienced NSI, while among those who recaptured, at least 6 nurses (24%) had never experienced NSI.

Knowledge level was significantly associated with NSI (p = 0.002; 90% CI). Nurses with high knowledge had a lower proportion of NSI cases (57%) compared to those with low knowledge (13%). The utilization of safety boxes was not significantly associated with NSI incidence (p = 0.070; 90% CI). Among those with high utilization, only 17.5% had experienced NSI, compared to 28.75% among those with low utilization.

The results of logistic regression analysis showed that recapping actions had a significant effect on the incidence of NSIs, with a p-value of 0.041 (90% CI: 0.12–0.79) and an odds ratio (OR) of 0.35. This indicates that nurses who performed recapping had a 0.35 times lower likelihood of experiencing NSIs compared to those who did not perform recapping. Furthermore, nurses with high knowledge had a 0.2 times lower likelihood of experiencing NSIs compared to those with low knowledge.

the OHS Units, the Infection Prevention and Control Committee (IPC), the Head of Nursing, and the Head of Inpatient Department.

Policies/SOPs

The results of interviews meticulously using the reliable ATLAS.ti software, showed that dissemination of policies/SOPs had been carried out at least once a year, not only for accreditation purposes but also whenever new employees were recruited and when policies/SOPs were updated.

“This has also been done once a year, there is IPC refreshment, but whenever an incident occurs, we share it again through the WhatsApp group.” (Informant A2)

“For new employees, we cannot determine how many times a year it happens. It depends on HR needs, but every time there are new staff, we conduct dissemination. For regular training, yes.” (Informant A4)

The disseminated policies/SOPs had been enforced fairly well. Needle stick injuries are included under the occupational health policies managed by the OHS unit in collaboration with the IPC. These policies are distributed in soft file format to each ward through the designated Person In Charge (PIC).

“Usually, we hand it over to the ward supervisors. If there is a new procedure, we deliver it hierarchically from the head of the division then the installation, and finally the ward supervisors. We request that they share it. So, we distribute it in soft file format.” (Informant A3)

However, optimization is still necessary for certain aspects of NSI risk control that require correction or enhancement. Overall, the policy was deemed sufficient and up-to-date. It was recommended that periodic reviews specifically address needle stick injuries.

“Some aspects may require periodic analysis of NSI incidents. What exactly causes them? It may be the product, for example, insulin syringes that have a cap, which is not safe enough, and so on.” (Informant A2)

Funding

Interviews analyzed using ATLAS.ti revealed that funding for NSI risk control had been allocated in the hospital budget. This funding included treatment for affected nurses and provision of facilities and infrastructure. The budget is not managed directly by the specific departments but is submitted to and managed entirely by the Occupational Health and Safety (OHS) unit. The hospital directors were committed to allocating budgets specifically for addressing occupational accidents.

“Of course, funding already exists. We also have routine MCU programs. In addition, funding related to occupational safety and health for staff is definitely allocated. The OHS unit knows the budget details.” (Informant A4)

Facilities and infrastructure

According to the interviews, facilities for NSI risk control in the Inpatient Department of RSA UGM were already available, including safety boxes, eyewash

stations, PPE, vaccines, and educational videos on NSI prevention.

“We provide safety boxes in three sizes: 12.5 L, 5 L, and 3 L. These are provided so they can be carried easily during procedures. The hope is that after injections, staff can immediately dispose of syringes into the box without transit, which increases the risk of NSI. We also provide hepatitis B vaccines and prevention videos.” (Informant A3)

Training

According to the interviews, training on NSI has been integrated into the basic education and training program. This training is conducted at least once a year, with refresher sessions every six months, organized by the OHS unit in collaboration with IPC. However, gathering staff in one place and at a specific time for these training sessions was deemed to be less effective.

“For syringe disposal, we coordinate with IPC. We make daily rounds to the wards to ensure compliance. IPC also checks adherence. We also prepare new educational videos. Conducting training for everyone at once is ineffective. Online training is also difficult, because we cannot ensure whether participants really understand. Therefore, we rely on ward supervisors and conduct direct inspections.” (Informant A3).

Post-exposure management

Post-exposure management and monitoring consisted of a reporting system, evaluation of risk control effectiveness, and nurse feedback. Interviews revealed that the reporting system at RSA UGM was seamlessly integrated into the electronic health record (EHR) system called Sistema, which was directed to OHS and IPC for further analysis, ensuring a streamlined process.

“Reports can be submitted through a system called Sistema. The OHS unit conducts the analysis, but the ward head must also review incidents. The input is recorded in the occupational accident reporting system.” (Informant A2)

Constraint/obstacle

Interviews revealed that NSI risk control faced barriers, including human factors, safety culture, staff shortages, educational methods, vaccine availability, and a shortage of IPC personnel.

“This is related to changing habits, building safety culture, and how staff control factors. Most issues occur because of rushing, not because of carelessness but lack of composure, being in a hurry, or fatigue leading to loss of focus.” (Informant A2)

DISCUSSION

Recapping practices

A survey conducted by researchers found that, in practice, nurses have implemented recapping actions using the correct technique, with one hand holding the scoop. However, some nurses still use two hands because they feel more comfortable with this technique. The questionnaire results showed that 51% of nurses who practiced recapping had experienced NSI, compared to 49% of those who did not recap. These findings are consistent with Kusnan (2019), who reported that 3 out of 10 nurses still used the two-hand method, which increases the risk of injury [4]. Similarly, Arianingrum (2022) highlighted that non-compliance with safe injection procedures, including unsafe recapping, reflects low awareness and insufficient dissemination of safety policies [7].

Utilization of safety boxes

The survey results found that the use of safety boxes for nurses in the inpatient department of RSA UGM has been implemented optimally. After acting, the nurse followed the recapping procedure using the one-hand scoop technique and placed the syringe waste into the safety box in accordance with the correct procedure. They ensured that the needle did not penetrate the safety box provided on the procedure trolley during the injection. In an interview with the person in charge of K3, the nurse had already facilitated a safety box in three sizes: 12.5 liters, 5 liters, and 3 liters, to make it easier for nurses to carry it to the treatment area.

The use of safety boxes indicates that as many as 41 nurses (51.25%) in the low category of safety box use have experienced injury incidents and stabbed themselves with a needle. Temporary on nurse which 2 nurses (2.5%) were included in the high category for the use of safety boxes, and experienced needle stick injuries. In this study, the use of safety boxes was found to have a significant relationship with the incidence of needlestick injuries. needle stick (p-value = 0.07). From these results, it can be concluded that nurses are quite adept at understanding and utilizing safety boxes.

Contrary to Wibowo’s (2023) research, which found a discrepancy in behavior among three nurses in administering drugs intravenously. Nurses should

bring a safety box and eliminate syringes using a transit system (in the tray), then dispose of them in the safety box located in the drug preparation area [8]. Alfulayw et al. (2021) revealed behavior that can result in injury, including needle injection, other close return needle injection, using excessively sharp objects, not using personal protective equipment, no safety box available, lack of control, education that is not enough for nurses, inadequate waste disposal, and sharp reactions in patients. The incidence of NSI over 26 months was 8.4% among all participants. Nurses were the most affected staff group (52.5%), primarily due to needle disposal (58.9%) [9].

Knowledge

The results demonstrated a strong relationship between knowledge level and NSI incidence. Knowledge has a significant relationship with the incidence of needle stick injuries, with a p-value of 0.002. Nurses who have high knowledge have experienced needle stick injuries. Forty-eight nurses (87%) experienced needle stick injuries, while seven nurses (13%) with low knowledge experienced needle stick injuries. Nurses with high knowledge levels had significantly lower odds of experiencing NSI.

Training sessions are conducted at least once a year, with refresher programs held every six months, coordinated by the OHS unit and the Infection Prevention and Control Committee (IPCC). However, large-group training was perceived as less effective, leading to alternative strategies such as educational videos and direct inspections. While high knowledge significantly reduces NSI risk, it does not entirely prevent injuries, as situational factors such as rushing, workload, and non-cooperative patients also play a role. Kusnan (2019) similarly noted that even with adequate knowledge, gaps in safe injection practices persist, underscoring the need for continuous reinforcement [4]. Knowledge acts as a predisposing factor for occupational safety behavior, aligning with the view that better knowledge fosters safer practices [10].

Recapping practices and knowledge of needle stick injuries in nurses at the inpatient

This study demonstrates that recapping and knowledge influence the incidence of needlestick injuries. Interviews were conducted with the Head of Nursing.

This can be caused by factors other than haste, which can lead the nurse to carry out recapping actions without taking safe precautions, including attitude, lack of focus, workload, and patient conditions that make it

challenging to perform injections in bright light. Several factors influence a nurse's workload, including the ever-changing patient condition, the average number of hours of care required to provide direct patient care, and the number of additional tasks that a nurse must do [11]. An excessive workload will affect a nurse's ability to work safely according to procedure. The results of the study showed that nurses who recapped procedures had a 0.35 times lower chance of experiencing a needle stick injury. This is in line with the study by Arianingrum (2022), which shows that there is a significant influence between nurses' behavior and the prevention of needle stick injuries. Nurses with poor behavior prevent needle stick injuries 176,250 times less often than nurses with good behavior [7]. Furthermore, nurses with high knowledge have a 0.2 times lower chance of being pricked by a needle than nurses with low knowledge. Good knowledge can serve as a foundation for individuals to develop practical skills, thereby reducing the likelihood of NSI incidents and the associated risks [12].

Risk control of needle stick injury incidents among nurses in the inpatient

The dissemination of policies/SOPs on NSI management in the inpatient department of RSA UGM has been carried out correctly. Dissemination is conducted at least once a year, during staff recruitment, and whenever new policies are implemented. The OHS unit, in collaboration with IPC, is responsible for this. Implementation requires optimization and periodic review whenever needle stick injuries occur. Establishing OHS policies is a fundamental step and a manifestation of the hospital's commitment to occupational health and safety management. Policy establishment also reflects the institution's readiness to integrate occupational safety into routine hospital activities [13].

Funding for NSI risk control is allocated in the hospital budget, covering treatment for affected nurses, vaccination, equipment, and training, and is fully managed by the OHS unit. This is consistent with Sirait (2021), who noted that organizations generally utilize resources such as environment, methods, materials, machinery, finances, and others to achieve organizational goals [14].

Facilities for NSI risk control in the inpatient department of RSA UGM are adequate, including safety boxes of various sizes (12.5 L, 5 L, 3 L), hepatitis B vaccines, eyewash stations, PPE, and educational videos. The availability of adequate facilities and infrastructure is critical, as inadequacy can negatively impact staff performance and workplace comfort [15].

Training related to NSI at RSA UGM is part of the basic education and training program, conducted at least annually with six-month refreshers by the OHS unit in collaboration with IPC. However, group training is considered less effective, so the hospital supplements these efforts with educational videos, direct inspections, and monitoring by ward supervisors. This aligns with Susilowati (2020), who emphasized that training is designed to improve knowledge, technical skills, and employee performance through principles such as participation, repetition, relevance, transfer, and feedback [16].

Post-exposure management and monitoring of NSI in the inpatient department are integrated into the electronic reporting system, "Sistema," which is directed to the OHS unit and IPC for further analysis. Mallapiang (2019) highlighted that NSI management includes reporting to OHS and IPC for laboratory testing and investigation. If results are negative, observation continues throughout the incubation period, while positive results lead to treatment by OHS [17]. Evaluations are conducted regularly following incidents and through quarterly reports that involve OHS, nursing, and IPC. Nurses actively provide feedback via direct discussions or WhatsApp groups. This is consistent with Juarsa (2023), who emphasized the importance of compliance, behavior, commitment, and competence in implementing a safety culture, supported by monitoring and evaluation programs facilitated by information systems [18].

Nevertheless, challenges persist in implementing NSI risk control, including unsafe work habits, an incomplete safety culture, fluctuating staff numbers, insufficient supplies of hepatitis vaccine, and shortages of PPE personnel. These hinder effective risk control and require further attention. Suwondo (2019) similarly reported that occupational health and safety programs were hindered by inadequate training, weak communication, and inconsistent supervision, which limited the establishment of safe work habits [19].

Efforts to control the risk of needle stick injuries in the inpatient department of RSA UGM can be improved through collaboration between the OHS installation and IPC by increasing the variety of training materials. Refresher sessions can be enriched with sharing or exchanging experiences between nurses as users and the IPC Committee or hospital management as mediators. Optimization of the electronic reporting system is also necessary to ensure effective monitoring and prompt responses to needle stick injury incidents, as well as to increase nurses' awareness of reporting occupational accidents, thereby fostering a culture of safety in the workplace.

Nurses in the inpatient department of RSA UGM should increase their vigilance and knowledge regarding the management of needle stick injuries. Nurses must comply with occupational safety procedures, including the correct recapping technique, to minimize the risk of needlestick injuries.

Future researchers may focus on exploring the relationship between the use of safety boxes and the incidence of needlestick injuries. Future research may also examine work habits and the safety climate among nurses in greater depth. Moreover, studies conducted in different hospital units or healthcare institutions would provide more comprehensive results, which could serve as a helpful comparison in determining effective and efficient strategies for controlling the risk of needle stick injuries.

CONCLUSION

There is an association between recapping practices and the incidence of needle stick injuries among nurses in the inpatient department of RSA UGM. Nurses who performed recapping had 0.35 times lower odds of experiencing NSI compared to those who did not recap.

There is an association between knowledge and the incidence of needle stick injuries among nurses in the inpatient department of RSA UGM. Nurses with high knowledge had 0.2 times lower odds of experiencing NSI compared to those with low knowledge. There is an association between safety box utilization and the incidence of needle stick injuries among nurses in the inpatient department of RSA UGM. However, the utilization of safety boxes was not significantly associated with NSI.

Policy dissemination has been conducted at least annually, during new staff recruitment, and when policies are updated. The OHS unit implements its initiatives in collaboration with IPC. Funding for NSI risk control is included in the hospital budget, covering treatment, vaccination, equipment, and training, and managed by the OHS unit. Facilities provided include safety boxes in various sizes, hepatitis B vaccines, eyewash stations, and PPE. Training is conducted at least annually, with six-month refreshers provided through educational videos and direct inspections. Reporting and evaluation of NSI are integrated into the electronic reporting system (Sistema). Challenges in NSI risk control include unsafe work habits, an incomplete safety culture, fluctuating numbers of healthcare workers, ineffective educational methods, insufficient vaccine availability, and shortages of PPE.

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