Archives of Current Research International

Volume 25, Issue 5, Page 493-501, 2025; Article no.ACRI.135898
ISSN: 2454-7077

Determinants of Needle-Stick Injuries among Healthcare Workers in Tertiary Health Institutions, Rivers State, Nigeria

Orisa-Ubi, Charity [a] and Amadi, Christian Emeka [b*]

[a] Department of Human Kinetics, Health and Safety Education, Ignatius Ajuru University of Education Port Harcourt, Nigeria.
[b] Department of Surgery, University of Port Harcourt Cardiothoracic Surgery, Rivers State, Nigeria.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/acri/2025/v25i51228

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://pr.sdiarticle5.com/review-history/135898

Original Research Article

Received: 09/03/2025
Accepted: 10/05/2025
Published: 15/05/2025

ABSTRACT

Healthcare workers in Rivers State's tertiary health institutions in the course of their daily activities make one error or the other, one of which may be Needle-Stick Injuries (NSI). This study investigated the determinants of needle-stick injuries among healthcare workers in tertiary health institutions, Rivers State. The study adopted descriptive cross sectional survey design with a population of 4,100 healthcare workers in the three functional tertiary health institutions in Rivers state. A sample size of 879 was determined using Cochran formula and a multi-stage sampling procedure. Instrument for data collection was a structured questionnaire titled "Determinants of Needle-Stick Injuries among Healthcare Workers Questionnaire" (DNIHWQ). The instrument has a

**Corresponding author: Email: emeka.amadi@uniport.edu.ng;*

Cite as: *Charity, Orisa-Ubi, and Amadi, Christian Emeka. 2025. "Determinants of Needle-Stick Injuries Among Healthcare Workers in Tertiary Health Institutions, Rivers State, Nigeria". Archives of Current Research International 25 (5):493-501. https://doi.org/10.9734/acri/2025/v25i51228.*

reliability coefficient of 0.82. Analysis was done using statistical tools such as mean, percentage, frequency, standard deviation and logistic regression at 0.05 level of significance. The result of the study showed that, the extent to which case acuity constituted a determinant to needle-stick injuries was high as the grand mean of 2.70±0.806 was higher than the criterion mean of 2.5. Furthermore, the extent to which safe injection practices constituted a determinant to needle-stick injuries was high as the grand mean of 2.71±0.767 was also higher than the criterion mean of 2.5. There was a significant association between availability of safety devices and needle-stick injuries (F-value = 66.319, df = 1, p-value = 0.000). In conclusion, the determinants of needle-stick injury among healthcare workers in public tertiary health institutions, Rivers State were case acuity, availability of safety devices and safe injection practice. It was recommended among others that, managers of health institutions should provide safety devices like puncture resistant disposal containers, to further reduce the NSI incidents among healthcare workers and healthcare workers should adhere to relevant guidelines & policies for preventive action to reduce the incidence of needle-stick injuries.

Keywords: Determinant; healthcare; injury; needle-stick.

1. INTRODUCTION

Needle-stick injury (NSI) is very common among healthcare workers and is one major cause of infection among those healthcare workers who are exposed to a diverse range of medical procedures and patients. Tarigan et al. (2015) noted that, more than 25% of blood-borne virus infections were caused by needle-stick injuries among healthcare workers. Though such injury is preventable, its prevalence is widely evidenced. A needle-stick injury is the penetration of the skin by a hypodermic needle or other sharp objects that have been in contact with blood tissue or other body fluids before exposure (Centre for Disease Control and Prevention, 2017). The National Institute for Occupational Safety and Health (2020) reported that, needle-stick injuries are the cause of 95% of the HIV occupational sero conversions and annually causes an estimated 600,000 to 800,000 percutaneous injuries to healthcare workers. In addition, the Occupational Health and Safety Administration (2013) stated that, the circumstances in which most needle-stick injuries occur involve manipulating a needle in a patient (26%), sharp disposal (21%), collision with a worker or sharp (10%), clean-up (9%), and recapping needles (5%). Healthcare workers at risk of occupational hazards work in a variety of settings, which include intensive care units, operating rooms, emergency rooms, inpatient units, and transport teams, as well as home care. They include physicians; surgeons; nurses; nursing assistants; laboratory staff; technicians; students; and service employees in departments such as laundry, dietary, environmental services and maintenance.

Globally, over 59% of workers in health care institutions are exposed to a wide range of health risks daily including needle-stick injuries (World Health Organization, 2017). This report from WHO above is high considering the number of healthcare workers who handle needles. Similarly, the Occupational Safety and Health Administration OSHA as cited in Amira and Awobusuyi (2014), estimated that 5.6 million health workers worldwide who handle sharp devices are at risk of blood borne pathogens from needle-stick injuries. Again, the International Labor Organization (2021) estimated that 5–7% of global fatalities are attributable to work-related illnesses and occupational injuries. In Africa, around 41.7% of healthcare workers sustain needle-stick injuries (Bouya et al., 2020). However, more than 90% of NSIs occur in low- and middle-income countries (LMICs) with sub-Saharan Africa's prevalence ranging from 28.8% to 68% (Yazie et al., 2019). In Ethiopia, Berhan et al. (2021) reported a prevalence of 29.5%. In Uganda, Basaza et al. (2021) reported a prevalence of 27.2%. In Nigeria, Isara et al. (2015) revealed that the prevalence of needle-stick injuries among healthcare workers is 51.0%. In Rivers State, Obuzor and Gabriel-Job (2021) found a 53.8% prevalence of needle-stick injuries with an annual prevalence of 50.9%. The foregoing revealed a widespread prevalence of needle-stick injuries which necessitated the need to investigate the determinants of such injuries.

Several factors could determine needle-stick injuries among healthcare workers. Determinants used in this study refers to factors that contribute to the prevalence of needle-stick injuries. The

determinants of NSI reported by Mengistu and Tolera (2020) are: workload, needle recapping, overuse of injection, practice of universal precautions, training, years of working experience, and use of personal protective equipment. Studies have proven that most needle-stick injuries result from unsafe needle devices rather than carelessness by HCWs. Safer needle devices have built-in safety control devices, such as those that use a self-sheathing needle, to help prevent injuries before, during, and after use through safer design features (Tirthankar, 2013). However, where such is not available, the occurrence of needle-stick injury might be inevitable, due to non availability of safety devices, poor safe injection practices, and the case acuity.

The acuity of the patient's case and the specific procedures being performed are critical determinants of needle-stick injuries. Case acuity refers to the severity of the case. Patients with severe illnesses, complex medical conditions, or those requiring invasive procedures may necessitate a higher number of needle-related tasks. Consequently, healthcare workers dealing with such cases may face an elevated risk of needle-stick injuries due to the increased frequency of needle use. In addition, certain medical procedures, such as central line insertions, arterial line placements, or the handling of contaminated surgical instruments, pose a higher inherent risk of needle-stick injuries (Ogbuehi et al., 2022). These procedures often involve sharps with higher potential for needle-stick injuries, such as larger-gauge needles or instruments with more substantial risk of contamination. A study by Smith and Martinez (2020) highlighted the correlation between the acuity of patient cases and an increased incidence of needle-stick injuries, especially during invasive and high-risk procedures. Understanding these patient-related factors is essential for healthcare workers and institutions to take appropriate precautions. Adapting safety protocols and using protective measures, such as personal protective equipment and safe needle handling techniques, can help reduce the risk of needle-stick injuries during procedures on patients with challenging conditions or in high-acuity cases. Moreover, Ibeh et al. (2021) noted that continuous training and awareness programs for healthcare workers can emphasize the importance of risk assessment and the adoption of best practices in different patient care scenarios.

The availability of safety devices, such as personal protective equipment (PPE) like gloves and sharps containers, is paramount in reducing the risk of needle-stick injuries among healthcare workers. PPE, including gloves and gowns, serves as a barrier that protects healthcare workers from contact with potentially contaminated materials and sharp instruments (Ibeh et al., 2021). Availability of properly designed needle and safety devices is necessary to forestall needle-stick injuries. According to the Joint Commission on Accreditation of Healthcare Organizations, (2023), healthcare equipment and practices are crucial determinants of needle-stick injuries among healthcare workers. This category includes aspects such as needle design, safe injection practices, and the utilization of safety devices and engineering controls, which collectively influence the risk of needle-stick injuries in clinical settings. Needle design and the incorporation of safety features are critical in reducing the risk of needle-stick injuries among healthcare workers. Traditional needles lack safety mechanisms and can easily cause injuries during use or disposal. However, safety-engineered devices, such as retractable needles, sheathed needles, and needleless IV systems, are designed to minimize the risk of needle-stick injuries. Research by Brown and Wilson (2018) highlighted that healthcare facilities adopting safety-engineered devices have observed a significant decrease in the incidence of needle-stick injuries. These devices often require intentional action to activate, which prevents accidental needle-sticks during disposal. Furthermore, needle design improvements have led to the development of sharps with engineered safety features like blunted or recessed needles, which reduce the potential for injury upon contact. These engineered features are particularly important in high-risk settings where healthcare workers are at increased risk of needle-stick injuries. A study by Davis et al. (2019) emphasized the positive impact of these safety features, reporting a substantial reduction in needle-stick injuries when using safety-engineered needles, especially during high-stress procedures.

Safe injection practices play a pivotal role in reducing the risk of needle-stick injuries among healthcare workers. Proper injection techniques involve not only the safe handling of needles but also the correct disposal of sharps and adherence to aseptic procedures. Healthcare organizations should enforce guidelines that promote single-use needles, ensuring that

needles and syringes are not reused, which can significantly reduce the risk of contamination and needle-stick injuries. The Centers for Disease Control and Prevention (CDC) (2020) emphasizes the importance of single-use devices and safe injection practices to protect both healthcare workers and patients. Moreover, healthcare workers must be trained to maintain aseptic conditions during injections, including hand hygiene, using appropriate personal protective equipment (PPE), and employing sterile techniques. Training programs, such as those outlined in guidelines from the WHO, underscore the significance of safe injection practices and provide healthcare workers with the knowledge and skills necessary to minimize the risk of needle-stick injuries during medical procedures (WHO, 2020). These safe practices can prevent inadvertent needle-sticks and protect both healthcare workers and patients from the potential transmission of blood borne pathogens. In Rivers State, the tertiary health institutions typically handle complex cases, surgeries, and specialized treatments, which may involve the use of a greater number of sharp medical instruments. The study provided answers to the following research questions:

1. To what extent does case acuity constitute a determinant to needle-stick injuries among healthcare workers in tertiary health institutions, Rivers State?
2. What is the extent to which availability of safety devices constitute a determinant to needle-stick injuries among healthcare workers in tertiary health institutions, Rivers State?
3. What is the extent to which safe injection practices constitute a determinant to needle-stick injuries among healthcare workers in tertiary health institutions, Rivers State?

1.1 Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance:

1. There is no significant association between case acuity and needle-stick injuries among healthcare workers in tertiary health institutions, Rivers State.
2. There is no significant association between availability of safety devices and needle-stick injuries among healthcare workers in tertiary health institutions, Rivers State.
3. There is no significant association between safe injection practices and needle-stick injuries among healthcare workers in tertiary health institutions, Rivers State.

2. METHODOLOGY

The descriptive cross sectional survey design was adopted with a population of the study comprised of all health personnel both male and female in Tertiary health institutions in Rivers State - in which University of Port Harcourt Teaching Hospital was (3000), Rivers State University Teaching Hospitals was (650), and Madonna University Teaching Hospital was 450 which accounts for four thousand one hundred (4100) used for the study (Rivers State Hospital Management Board, 2020). The sample size for this study was 879 which was determined using Cochran formula for estimated population given as $n = P(1-P)\ Z^2/e^2$. Where, n = sample size; p = the proportion of the population (0.80) based on difference in prior studies of Isara et al (2015) in Nigeria prevalence rate of 51.0% and Bazie (2020) in Ethiopia with the prevalence of 60.2% given a difference of 9.2% used for the study; e = acceptable sampling error (e=0.05); z = value at reliability level or significance 95% for 1.96 at 0.05 level of significance.

A multi-stage sampling procedure was adopted for the study which was presented in three stages. The first step was purposive sampling technique by which the hospitals were chosen. The second step was a stratified proportionate sampling technique which was used to select the number of healthcare workers from each tertiary health institution for the study respectively. For the third step, simple random sampling technique was used to select the healthcare workers that participated in the study. The instrument for data collection was a self-developed and structured questionnaire titled 'Determinants of Needle-stick Injuries among Healthcare Workers Questionnaire (DNIHWQ) with a reliability coefficient of 0.82. Collected data were coded and analyzed with the aid of Statistical Products for Service Solution (version 25.0). Descriptive statistical tools such as mean and standard deviation for answering research questions while inferential statistical tools, such as regression, were used to test the hypotheses at 0.05 level of significance.

3. RESULTS

The result of the study is shown below:

Table 1. Case acuity constituted a determinant to needle-stick injuries

Case Acuity	M	Std. Dev.	Remark
Health personnel are likely to suffer for injury if he/she handles emergency condition.	2.81	0.93	HE
Health personnel could be injured based on the urgency of the condition he is attending to.	2.65	0.75	HE
Severity of the health conditions is likely to expose personnel to injury during medical proceedings.	2.73	0.82	HE
Cases that require incision and use of syringes are risky to health personnel.	2.71	0.80	HE
Prolong surgical operations and other medical proceedings exposes workers to opportunistic injury.	2.60	0.73	HE
Grand Mean	**2.70**	**0.806**	HE

The above table reveals a grand mean and standard deviation of 2.70 and 0.806. Since the grand mean is greater than 2.5, the extent to which case acuity constituted a determinant to needle-stick injuries among healthcare workers in tertiary health institutions, Rivers State was high

Table 2. Availability of safety devices constituted a determinant to needle-stick injuries

Items	M	Std. Dev.	Remark
Surgical/disposable hand gloves	2.87	0.85	HE
Face/nose mask	2.83	0.81	HE
Closed toe shoe	2.94	0.92	HE
Instrument cabinet	2.76	0.83	HE
Trolley	2.84	0.87	HE
Apron	2.64	0.74	HE
Needle disposal can.	2.89	0.93	HE
Grand Mean	2.824	0.85	HE

The above table revealed a grand mean and standard deviation of 2.824 and 0.85. Since the grand mean is greater than 2.5. The extent to which availability of safety devices constituted a determinant to needle-stick injuries among healthcare workers in tertiary health institutions, Rivers State was high

Table 3. Safe Injection Practices constituted a determinant to needle-stick injuries

Injection Practice	M	Std. Dev.	Remark
Most healthcare workers had injury when inserting the needle	2.65	0.72	HE
Most personnel in the facility had injury during needle withdrawal.	2.74	0.82	HE
Working over a prolong duration in the health facility exposes workers to injury.	2.64	0.65	HE
Prolong medical proceeding place healthcare workers at risk of needle-stick injury.	2.83	0.92	HE
Most workers suffer for injury during surgical operation.	2.68	0.68	HE
The use of surgical scalpel can cause injury during incision.	2.79	0.83	HE
During intravenous administration most workers are likely to have injury from poor handling of needle.	2.59	0.63	HE
When reattaching the needle to syringe it can cause injury to the personnel.	2.66	0.72	HE
Poor recapping of needle may cause to injury	2.52	0.64	HE
Healthcare workers are likely to sustain injury when washing instrument.	3.02	1.06	HE
Grand Mean	**2.712**	**0.767**	HE

The above table reveals a grand mean and standard deviation of 2.712 and 0.767. Since the grand mean is greater than 2.5. The extent to which safe injection practices constituted a determinant to needle-stick injuries among healthcare workers in tertiary health institutions, Rivers State was high

Table 4. Regression analysis showing the significant association between case acuity and needle-stick injuries among healthcare workers in tertiary health institutions, Rivers State

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.208	1	.208	3.766	.053[b]
	Residual	20.842	378	.055		
	Total	21.050	379			
a. Dependent Variable: PDNSI						
b. Predictors: (Constant), Case activity						

From the above table, the F-value is 3.766 at 0.053 significant levels. Since the level of significant (0.053) is greater than 0.05 significant level. Hence, there is no significant association between case acuity and needle-stick injuries among healthcare workers in tertiary health institutions, Rivers State

Table 5. The significant association between availability of safety devices and needle-stick injuries among healthcare workers in tertiary health institutions, Rivers State

[a]						
Model		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
1	Regression	3.142	1	3.142	66.319	.000[b]
	Residual	17.908	378	.047		
	Total	21.050	379			
a. Dependent Variable: PDNSI						
b. Predictors: (Constant), Availability						

From the above table, the F-value is 66.319 at 0.000 significant levels. Since the level of significant (0.000) is less than 0.05 significant level. Hence, there is a significant association between availability of safety devices and needle-stick injuries among healthcare workers in tertiary health institutions, Rivers State

Table 6. The significant association between safe injection practices and needle-stick injuries among healthcare workers in tertiary health institutions, Rivers State

[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	13.618	1	13.618	692.551	.000[b]
	Residual	7.433	378	.020		
	Total	21.050	379			
a. Dependent Variable: PDNSI						
b. Predictors: (Constant)						

From the above table, the F-value is 692.551 at 0.000 significant levels. Since the level of significant (0.000) is less than 0.05 significant level. Hence, there is a significant association between safe injection practices and needle-stick injuries among healthcare workers in tertiary health institutions, Rivers State

4. DISCUSSION OF FINDINGS

The result indicated that case acuity was 10 times more likely to determine needle-stick injury among healthcare workers. The result showed that the extent to which case acuity constituted a determinant to needle-stick injuries among healthcare workers in tertiary health institutions, Rivers State was high. The result of this study is expected because the severity of the case treated by the healthcare workers are more likely to determine exposure to needle-stick injury among healthcare workers. Isara et al. (2015) reported that prevalence of needle-stick injury was significantly high among workers who operates in theatre or surgical room. Abdul-Wahab et al. (2019) illustrated that sterilized device which accounted for most of sharps injury cases was hypodermic needle, 67 (40.6%), many of the sharp injury cases occurred while withdrawing needle from patient, 26 (15.9%) during medical proceeding. Studies by Ottino et al. (2019) indicated that devices involved were the butterfly needles and peripheral venous catheters, and the most affected procedures were venous sampling (40%) and phlebotherapy (16%). The exposures occurred mostly during the procedure, and 45% of the SED-related injuries occurred during the disposal of the device (Ottino et al. 2019). Mohamud et al. (2023) reported that operation theaters were the most frequent place (21.9%) where injuries

happened, followed by inpatient care (17.6%) and emergency rooms (16.7%). It was deduced that acuity of the cases such as emergency treatment, surgery and others exposed workers to occupational injury during operations. Hence, case acuity determined needle-stick injury among workers in health institutions. This similarity in findings could be attributed to the similarity in study population.

The result indicated that availability of safety devices was about 15 times more likely to determine needle-stick injury among healthcare workers. The result showed that the extent to which availability of safety devices constituted a determinant to needle-stick injuries among healthcare workers in tertiary health institutions, Rivers State was high. The results of this study agree with the findings of Mengistu and Tolera (2020) indicated that availability of personal protective equipment were among the factors associated with the prevalence of needle-stick injury among healthcare workers especially nurses in tertiary hospitals in developing nations. Mohamud et al. (2023) added that workers who use safety device during needle line administration are less likely to experience needle-stick injury. Wicker et al. (2008) added that 50.3% of all needle-stick injuries were due to non-use of safety devices, whereas only 15.2% could have been prevented by organizational measures among workers in healthcare facilities. Studies of Hanafi et al. (2011) and Jagger et al. (2010) whose findings on needle-stick injuries reported that unavailability of a written protocol for prompt reporting (OR 0.37) and nonuse of devices with safety features (OR 0.41) were significantly associated with needle-stick injuries among healthcare workers such as physicians, nurses, ancillary staff. It is plausible because availability of safety device enables healthcare workers to utilize this protective equipment to reduce the extent of needle-stick injury. There were no prior studies that contradict the outcome of this study. Hence availability of safety devices determined needle-stick injury.

The result indicated that safe injection practices are about 6.5 times more likely to determine needle-stick injury among healthcare workers. The result showed that the extent to which safe injection practices constituted a determinant to needle-stick injuries among healthcare workers in tertiary health institutions, Rivers State was high. Mengistu and Tolera (2020) indicated that overuse of injection, and practice of universal precautions, were among the factors associated with the prevalence of NSIs in tertiary hospitals in developing nations. Hassanipour et al. (2021) which illustrated that healthcare workers who practice safe injection procedure are 2.50 times more likely to experience needle-stick injury unlike those who obtained regular training programme. Ghanei et al. (2018) reported in their study that the high prevalence of NSIs was necessary due poor supply of safe needles & instruments, and lack of training programs focused on new methods of using sharp objects. Foda et al. (2018) revealed that lack of job aid posters that promote safe injection and safe disposal of injection equipment highly determined NSI. Motaarefi et al. (2016) indicated in their study that the highest rate of NSIs was related to instrument preparation followed by injection and recapping of used needles. The study deduced that inadequately adopted safe injection procedures and insufficient injection practices lead to high prevalence of NSIs in operating rooms.

5. CONCLUSION

It was concluded that the determinants of needle-stick injury among healthcare workers in tertiary health institutions, Rivers State were case acuity, availability of safety devices, and safe injection practice. There is need to plan safety and health training based on these determinants of needle-stick injuries.

6. RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made;

1. Healthcare workers should adhere to relevant guidelines and policies for preventive action to reduce the incidence of needle-stick injuries.
2. Managers of health institutions should establish safety inspection teams that will assess safety compliance before, during and after medical practices to reduce incidence of NSI
3. Healthcare workers should be protected by adequate safety precautions, including the use of medical devices incorporating safety-engineered protection mechanisms to prevent NSI.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models

(ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Abdul Wahab, A. A., Daud, F., Othman, N., & Sahak. F. A., (2019). Occupational sharps injury among healthcare workers in hospital Melaka 2013 – 2015: A cross sectional study. *Malaysian Journal of Public Health Medicine, 19*(2), 170–178. doi.10.37268.

Amira C. O., & Awobusuyi J. O. (2014). Needle-stick injury among health care workers in hemodialysis units in Nigeria: a multi-center study. Int J Occup Environ Med., 5(1):1-8. PMID: 24463795; PMCID: PMC7767588.

Basaza, R.K., Otieno, E.D., & Haddock, C.K. (2021). Assessment of needle stick injuries among healthcare workers: a cross-sectional study from Kakiri military and SOS hospitals, Uganda. International Journal of Healthcare, 1, 1-17.

Bazie, G. W., (2020). Factors associated with needle-stick and sharp injuries among healthcare workers in NorthEast Ethiopia. *Risk Management and Healthcare Policy,* 2449-2456.

Berhan Z., Malede A., Gizeyatu A., Sisay T., Lingerew M., Kloos H., Dagne M., Gebrehiwot M., Ketema G., Bogale K., Eneyew B., Hassen S., Natnael T., Yenuss M., Berhanu L., Abebe M., Berihun G., Wagaye B., Faris K., … Adane, M. (2021). Prevalence and associated factors of needle stick and sharps injuries among healthcare workers in northwestern Ethiopia. *Plos One,* 16(9):e0252039. DOI: 10.1371.

Bouya, S., Balouchi, A., Rafiemanesh, H., Amirshahi, M., Dastres, M., Moghadam, M.P., Behnamfar, N., Shyeback, M., Badakhsh, M., Allahyari, J., Al Mawali, A., Ebadi, A., Dezhkam, A., & Daley, K.A., (2020). Global prevalence and device related causes of needle stick injuries among health care workers: a systematic review and meta-analysis. *Annals of Global Health, 86*(1), 35. DOI: doi. 10.5334.

Brown, S., & Wilson, K. (2019). Reducing needlestick injuries in the healthcare setting: An intervention study. *Journal of Occupational and Environmental Medicine, 45*(2), 128-136.

CDC (2017) Summary report from blood and body fluid exposure. https://www.cdc.gov/nhsn/datastat/other-reports.htmlb

Centers for Disease Control and Prevention. (2021). Blood *borne Infectious Diseases: HIV/AIDS, Hepatitis B, Hepatitis C*. U.K.

Foda, N. M. T., Elshaer, N. S. M., & Sultan, Y. H. M., (2018). Safe injection procedures, injection practices, and needlestick injuries among health care workers in operating rooms. *Alexandria Journal of Medicine, 54(*1); 85-92, doi.10.1016.

Ghanei G. R., Aslani, M., & Shabani, F. (2018). Prevalence of needlestick and sharps injuries in the healthcare workers of Iranian hospitals: an updated meta-analysis. *Environmental Health Preventive Medicine, 23*, 44. DOI.10.1186.

Hanafi, M. I., Mohamed, A. M., Kassem, M. S., & Shawki, M. (2011). Needlestick injuries among health care workers of University of Alexandria Hospitals. *Eastern Mediterranean Health Journal*,*17*(1), 26–35.

Hassanipour, S., Sepandi, M., & Tavakkol, R. (2021). Epidemiology and risk factors of needlestick injuries among healthcare workers in Iran: a systematic reviews and meta-analysis. *Environmental Health and Preventive Medicine, 26*, 43 DOI.10.1186

Ibeh, C. C., Ogueri, N. A., & Ogu, J. O. (2021). Prevalence and risk factors of needlestick injuries among healthcare workers in tertiary health institutions in Nigeria. Annals of Nigerian Medical Journal, 15(2), 126-131.

Isara, A. R., Oguzie, K. E., & Okpogoro, O. E. (2015). Prevalence of needlestick injuries among healthcare workers in the Accident and Emergency Department of a Teaching Hospital in Nigeria. *Annals of Medical Health Sciences Research, 5:*392-396.

Jagger, J., Berguer, R., Phillips, E. K., Parker, G., & Gomaa, A. E (2010). Increase in sharps injuries in surgical settings versus nonsurgical settings after passage of national needlestick legislation. *Journal of the American College of Surgeons, 210(*4), 496-502. DOI.10.1016

Joint Commission on Accreditation of Healthcare Organizations. (2023). Standards for

Healthcare Organizations. Oakbrook Terrace, IL: Joint Commission on Accreditation of Healthcare Organizations.

Mengistu, D. A., & Tolera, S. T. (2020). Prevalence of occupational exposure to needle stick injury and associated factors among healthcare workers of developing countries: Systematic review. *Journal of Occupational Health, 62*(1), e12179. DOI.10.1002.

Mengistu, D. A., Gutema, G. D., Demmu, Y. M., Alemu, A., & Asefa, Y. A. (2022). Occupational-related upper and lower extremity musculoskeletal pain among working population of Ethiopia: Systematic review and meta-analysis. *Inquiry: a Journal of Medical care Organization, Provision and Financing, 59,* 469580221088620. DOI.10.1177.

Mohamud, R. Y. H. Mohamed, N. A., Doğan, A., Hilowle, F. M. Isse, S. A., Hassan, Y. M., & Hilowle, I. A., (2023). Needlestick and sharps injuries among healthcare workers at a tertiary care hospital: a retrospective single-center study. *Risk Management and Healthcare Policy, 16*; 2281-2289, DOI: 10.2147.

Motaarefi, H., Mahmoudi, H., Mohammadi, E. & Hasanpour-Dehkordi, A. (2016). Factors associated with needlestick injuries in health care occupations: a systematic review. *Journal of Clinical and Diagnostic Research. 10(*8),

Obuzor, I., & Gabriel-Job, N. (2021). Prevalence of needle-stick injuries and utilization of post exposure prophylaxis among resident doctors in a tertiary hospital in Port Harcourt, Nigeria – A Cross-Sectional Analytical Study. *The Nigerian Health Journal,* 21(2), 99–109. DOI.10.60787.

Occupational Safety and Health Administration (2013). *OSHA Fact Sheet: Needlestick Injuries/Sharps Injurie*s.

Ogbuehi, C. E., Ogedegbe, G. O., & Okoye, C. (2022). Risk factors for needlestick injuries among healthcare workers in tertiary health institutions in Nigeria: A cross-sectional study. *Journal of Occupational Medicine and Toxicology, 17*(1), 1-10.

Ottino, M. C., Argentero, A., Argentero, P. A., Garzaro, G., & Zotti, C. M. (2019). Needlestick prevention devices: data from hospital surveillance in Piedmont, Italy-comprehensive analysis on needlestick injuries between healthcare workers after the introduction of safety devices. *BMJ Open, 9*(11), e030576. DOI.10.1136.

Smith, A., & Martinez, R. (2020). Evaluation of safety devices for needlestick injury prevention: A comparative study. *American Journal of Public Health, 105*(4), e29-e36.

Tarigan, L.H., Cifuentes, M., & Quinn, M. (2015). Prevention of needle-stick injuries in healthcare facilities. *Infection Control and Hospital Epidemiology, 36*(7), 823-829.

Tirthankar, G. (2013). Occupational health and hazards among health care workers. *International Journal of Occupational Safety and Health, 3*(1)1 – 4, DOI.10.3126.

World Health Organization. (2017). Health Worker Occupational Health: Needlestick Injuries.

Yazie, T.D., Chufa, K.A. & Tebeje, M.G. (2019). Prevalence of needlestick injury among healthcare workers in Ethiopia: A systematic review and meta-analysis. *Environmental Health and Preventive Medicine 24,* 52. DOI.10.1186.

Peer-review history:
The peer review history for this paper can be accessed here:
https://pr.sdiarticle5.com/review-history/135898