

Assessment of Knowledge, Attitude and Prevalence of Needle Stick Injury Among Healthcare Workers in Hospitals of Oredo Local Government Area, Edo State.

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ABSTRACT

Needle-stick injury and inadvertent exposure to blood products is perhaps the most common professional hazards in the field of medicine and healthcare. This study was aimed to assess the knowledge, attitude and prevalence of needle stick injury among health workers in hospitals of Oredo local government area, Benin City. Descriptive cross-sectional study design using multistage sampling technique was carried out among 347 health workers in Oredo Local Government Area, Edo State. Data was collected using an interviewer-administered structured questionnaire. Data was obtained and analyzed using IBM SPSS version 22.0. Analysis employed descriptive and inferential statistics. Level of statistical significance was set at $p < 5\%$. Majority 224 (67.9%) of the respondents are females. The average age distribution of respondents is 29 years. Majority of respondents are Christian (86.7%), Most of the respondents work at a government owned healthcare centres 253(76.7%). The study revealed 314 (95.2%) of the respondents have heard of needle stick injury. About 250(79.2%) of the respondents believed that an antiretroviral therapy center should be contacted less than 2 hours after a case of needle stick injury. Also, the results showed that a majority of the healthcare workers feel that needle stick injury is neglected sometimes. Results showed 221(67%) of the respondents have experienced needle stick injury only once in the past 12 months, while 15(15.6%) can't recall the number of times it has occurred. Conclusively, majority of health workers had knowledge of needle stick injury. The overall attitude of healthcare workers to needle stick injury is positive for the majority of respondents. The prevalence of needle sick injury is low among health workers as majority have not experienced needle stick injury in the last 12 months and about half that number experiencing it once in the same time frame. It is recommended re-training of healthcare workers on preventive mechanisms of needle sticks injury be sustained in hospitals.

Keywords: Attitude; healthcare workers in hospitals; Knowledge; Prevalence; Needle stick injury; Edo State.

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INTRODUCTION

Needle stick injury is a severe occupational health hazard worldwide and around 3 million health care workers sustain needle stick injuries and/or sharps injuries each year¹. In the USA, up to 800,000 sharp injuries have been estimated each year². In 2011, US EPINet™ reported 16.5 injuries per 100 occupied beds in 23 hospitals³⁻⁸. The estimated risk of transmission of HCV is between 3% and 10%⁹. Transmission rate of HIV following needle stick injury is 0.3%⁹ and 0.1%¹⁰ following mucous membrane exposure. However, if the source has very high viral load, transmission risk increased by greater than tenfold.¹¹⁻¹⁶ In a study by Al Qadire, students had moderate knowledge on NSI prevention (6.6 out of 10, SD = 2.1) comparable to previous works.¹⁷⁻³⁰ Studies done on medical and dental students show moderate to high knowledge; surprisingly, nurses and other healthcare workers' knowledge on NSI was low.³¹⁻³³

MATERIALS AND METHODS

Study Area

Edo State lies roughly between longitude 06° 04'E and 06° 43'E and latitude 05° 44'N and 07°'N of the equator. It is bounded in the south by Delta State, in the west by Ondo State, in the north by Kogi State and in the east by Kogi and Anambra States. Edo occupies a total land area of 19,794 square kilometers and a total population of 2.16 million in 1991, of which 50.13 percent were males. The average population density for the state is 109 persons per square kilometer, which is slightly above the national level. There are also 6 comprehensive health centers, 239 primary health centers, 34 health clinics, 15 health posts, 124 private maternity centers, 117 private clinics, 76 medical centers, 39 medical laboratories, 10 dental clinics and optometric clinics in Edo state (Edo State Health Management Board).

Study Design

Descriptive cross-sectional design was deployed in this study.

Study Population

The study was carried out among health care workers of hospitals in the Oredo local government area, Benin City.

Selection Criteria

Health care workers in the Oredo local government area who are actively in clinical practice. Also recruited, Health care workers, who consent to the study. Those excluded were health care workers who were not in clinical practice.

Duration Of The Study

The study was carried out in 6 months between June 2022 and December 2022.

Sample Size Determination

This was calculated using the Cochran's formula for descriptive study.

$$n = Z^2 pq / d^2$$

where,

n = minimum sample size

z = standard normal deviation = 1.96 at 95% confidence interval.

p = prevalence

$$q = 1 - p = 1 - 0.655 = 0.345$$

d = degree of accuracy desired set at 0.05

Substituting the above in the equation, $n = (1.96)^2 \times 0.655 \times 0.345 / (0.05)^2$

$$n = 347.24$$

$$n = 347$$

7% of the sample size was added to make up for non-responses. In order to provide an allowance for non-response, a 7% margin was used.

$$nf = n / 1 - nr$$

Where:

nf = Final sample size

n = Minimum sample size

nr = Non-response of 7%

$$nf = 347 / 1 - 0.07$$

$$= 347 / 0.9337 = 324$$

Sampling Technique

Multistage sampling technique was used to select health care workers that participated in this study.

Stage 1: Selection of hospitals

Four hospitals were selected using convenience sampling technique in this study namely Edo specialist hospital, Central hospital, Benin medical care and Lily hospital all located in Oredo Local government area.

Stage 2: Selection of respondents

Respondents were selected using simple random sampling technique from health care workers in each of the four selected hospitals in Oredo local government area.

Data Management

Data for this study was collected using a standardized structured self-administered questionnaire. The questionnaire contains close ended questions.

Method Of Data Collection

Quantitative method of data collection with the use of interviewer administered questionnaires was used. Informed consent was gotten from the respondents and respondents was assured of confidentiality and anonymity of respondents.

Pretesting

The questionnaire was pretested among healthcare workers of UBTH, Benin City. 10% of sample size in the proportion was used for pretesting. The aim was to test the questionnaire for correctness and appropriate understanding by the respondents to aid appropriate collection of data. Appropriate corrections were made where applicable to the questionnaire before commencement of this survey.

Data Analysis

Scoring

Age Age of respondents was grouped according to the WHO classification of adults: Which are above the ages of 18

Knowledge of Needle Stick Injury

The knowledge of needle stick injury among Healthcare

workers of Oredo Local government Area was assessed using a total of 11 questions comprising of 38 items addressing all knowledge domains (awareness of needle stick injury, definition of needle stick injury, source of information, likely causes of needle stick injury, precaution for needle stick injury). A score of 1 was given for correct response and 0 for wrong response. The maximum achievable score was 27 and a minimum of 0.

The scores were converted to percentages and grouped as follows:

Good Knowledge: scores $\geq 50.0\%$

Poor Knowledge: scores 49.9 and less

Attitude Towards Needle Stick Injury

A total of 6 questions was used to assess the attitude of the respondents towards substance abuse using a 2-point likert scale.

The most correct response was given a score of 1 and the least correct response was given a score of 0, giving a minimum score of 0 and a maximum score of 8.

The total attitude score obtained was converted to percentages and graded as follows:

Those with scores 50% or greater have a good attitude while those with scores less than 50% have a poor attitude

Prevalence Of Needle Stick Injury

The prevalence of needle stick injury among healthcare workers of Oredo Local government Area was assessed using a total of 16 questions comprising of 50 items addressing all prevalence domains (experiences of needle stick injury, prevalence of needle stick injury, materials leading to injury, associated activities of needle stick injury, type of injury, post exposure treatments). A score of 1 was given for correct response and 0 for wrong response. The maximum achievable score was 27 and a minimum of 0.

Ethical Consideration

Ethical clearance was obtained from Health Research Committee of Irrua Specialist Teaching Hospital. Confidentiality and anonymity of respondents was assured.

RESULTS

From survey carried out, 330 respondents participated in answering questionnaires and the results are presented in sections as followed:

Table 1 showed, 224 (67.9%) of the respondents are females, while 106 (32.1%) are males. The average age distribution of respondents is 29 years of age. The minimum and maximum ages observed are 18 and 56 years respectively. The total number of respondents is 330. Majority of respondents are Christian (86.7%), Islam is 11.2%, while African Traditional Religion is 1.8%. Others* - "Free Spirit". Most of the respondents work at a government owned healthcare centre at 76.7%, while the remaining 23.3% work at private owned healthcare centres.

Table 2 above showed 314 (95.2%) of the respondents have heard of needle stick injury. The awareness of what needle stick injury is among the respondents is good.

Table 3 above showed 320 (98.5%) respondents agree that needles should be disposed into the appropriate container after use.

Lastly 98.4% of them think NSI should be reported to the appropriate authority.

Table 4 showed majority of respondents cited their source of information concerning NSI as Infection Prevention guidelines 297 (92.3%) respondents.

Table 5 showed 305 (93.8%) of respondents agree that HIV can be transmitted through NSI. 87.7% thinks HBV can be transmitted and 71% think that HCV can be transmitted through NSI.

Table 6 showed most of the 278 respondents (84.8%) think that needle recapping is a likely cause of NSI. About 173 (52.7%) think that heavy workload is a likely cause

Table above 7 showed 259 (79.2%) of the respondents believes that an antiretroviral therapy center should be contacted less than 2 hours after a case of NSI.

Table 9 above showed Injection needles was the material that caused the most NSIs among respondents (86.7%).

About 72.4% of them were injured while recapping the needles. 76 of the 105 respondents that experienced NSI during this period, experienced it during the day. And 86.1% of them got injured in the ward. 47.6% of the respondents claim that the injury was superficial.

Table 8 above 61 (64.1%) of the respondents have experienced NSI only once in the past 12 months, while 15% can't recall the number of times it has occurred.

The table 10 above showed the actions of respondents after/during NSI. 65% of them washed with soap, water and Dettol after injury. 68.6% took post-exposure prophylaxis.

Table 9 above showed about 64.8% of the respondents reported the injury to the appropriate authority, and from the 35.2% who didn't report, the majority of them (78.4%) didn't report it because it was only a minor injury.

Table 10 about 97% of the nurses had their gloves on during the time of the injury. And 78% of them made use of the safety box.

Table 11 above showed that 237 (71.8%) of respondents have IP guidelines in their facilities. Almost all respondents have been trained on infection prevention (98.2%). And a fair number of them have been vaccinated for Hep-B 208 (63%).

Table 1: Socio-demographic characteristics of respondents

Gender			
		Frequency	Percent
	Male	106	32.1
	Female	224	67.9
	Total	330	100.0
Age			
N			330
Mean			29.28
Minimum			18
Maximum			56
Religion		Frequency	Percent
	Christianity	286	86.7
	Islam	37	11.2
	African Traditional Religion	6	1.8
	Others*	1	.3
	Total	330	100.0
Place of work		Frequency	Percent
Government-Owned healthcare centres		253	76.7
Private-Owned healthcare centres		77	23.3
Total		330	100.0
Educational Status			
		Frequency	Percent
	Diploma	65	19.7
	Bachelor's Degree and Above	265	80.3
	Total	330	100.0
Working experience (in years)			
N			330
Mean			4.6691
Minimum			.00
Maximum			22.00
Working hours per week			
N			330
Mean			41.2212
Minimum			7.00
Maximum			100.00
Ethnic Group		Frequency	Percent
	Bini	106	32.1
	Delta Igbo	18	5.5
	Esan	35	10.6
	Etsako	21	6.4
	Hausa	15	4.5
	Igbo	40	12.1
	Itsekiri	19	5.8
	Owan	16	4.8
	Urhobo	28	8.5
	Yoruba	25	7.6
	Others*	6	2.1

Table 2: KNOWLEDGE OF NEEDLE STICK INJURY

	Frequency	Percent
Yes	314	95.2
No	16	4.8
Total	330	100.0

TABLE 3: GENERAL KNOWLEDGE OF NEEDLE STICK INJURY

DO YOU KNOW ABOUT UNIVERSAL PRECAUTION GUIDELINES?	N = 327	Percentage (100%)
Yes	228	69.7
No	99	30.3
CAN INFECTIONS BE TRANSMITTED THROUGH NSI?	N = 327	Percentage (100%)
Yes	308	94.2
No	19	5.8
AN IMPORTANT MEASURE TO PREVENT NSI IS NO RECAPPING OF NEEDLES:	N = 319	Percentage (100%)
Yes	285	89.3
No	34	10.7
NEEDLES SHOULD BE DISPOSED INTO THE APPROPRIATE CONTAINER AFTER USE:	N = 325	Percentage (100%)
Yes	320	98.5
No	5	1.5
NEEDLE STICK INJURIES SHOULD BE REPORTED TO APPROPRIATE AUTHORITY:	N = 322	Percentage (100%)
Yes	317	98.4
No	5	1.6

TABLE 4: SOURCES OF INFORMATION CONCERNING NSI (MULTIPLE RESPONSE)

SOURCE OF INFORMATION CONCERNING NSI	N = 321	Percentage
School curriculum	152	47.6%
Infection Prevention guidelines	297	92.3%
Refresher training	Nil	Nil
Senior Colleagues	48	15%
Journal updates	13	4%
Other*	6	1.8%

Key: Others* - Internet 4(1.2%), Books 2(0.6%)

Table 5: EXAMPLES OF INFECTIONS THAT CAN BE TRANSMITTED THROUGH NSI (MULTIPLE RESPONSE)

Examples of infections that can be transmitted through NSI include;	N = 325	Percentage
HBV	285	87.7
HCV	231	71
Pneumonia	Nil	Nil
HIV	305	93.8
Cancer	12	3.7

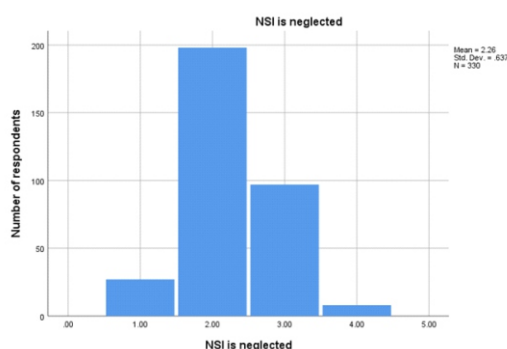
Table 6: LIKELY CAUSES OF NSI (MULTIPLE RESPONSE)

What are the likely causes of NSI?	N = 328	Percentage
Heavy workload	173	52.7
Self-Negligence	112	34.1
Non cooperating patient	97	29.6
Lack of PPE	63	19.2
Tiredness	121	36.9
Inattention	82	25
Ignorance	44	13.4
Needle recapping	278	84.8
Others	Nil	Nil



Table 7: WHEN TO CONTACT AN ANTIRETROVIRAL THERAPY CENTER IN CASE OF NSI

	N = 327	Percentage
Less than 2 hours	259	79.2
Within 48 hours	50	15.3
Within 1 week	18	5.5

**Figure 1: NSI neglect among healthcare workers**

Keys: 1.00 = Always
 2.00 = Sometimes
 3.00 = Rarely
 4.00 = Never

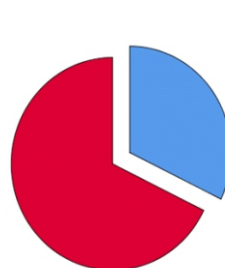
Have you experienced any needle stick injury in the past 12 months?

Fig. 2: experience of any needle stick injury in the past 12 months?		Frequency	Percent	Valid Percent
	Yes	105	31.8	32.2
	No	221	67.0	67.8
	Total	326	98.8	100.0
Missing	System	4	1.2	
Total		330	100.0	

Figure above showed the occurrence of NSI among the nurses of Ikpoba Okha local government area is fairly rare as only 31.8% of respondents have experienced needle stick injury in the past 12 months.

Table 8: Frequency Of NSI Occurrence Among Respondents

	Frequency	Percent
Once	61	64.1
2-4 times	23	24.2
>5 times	6	6.3
Can't recall	15	

TABLE 9: INFORMATION RELATING TO THE INCIDENTS

	Frequency (n = 105)	Percent
WHAT WERE THE MATERIALS LEADING TO THE INJURY? (MR)		
Injection needles	91	86.7
Suturing needles	43	41
Cannula	22	21
Others	Nil	Nil
WHAT WAS THE ACTION ASSOCIATED WITH THE INJURY? (MR)		
During use	42	40
While recapping	76	72.4
Device left on the table, floor, or other inappropriate places	11	10.5
While disposing	15	14.3
After Disposal	Nil	Nil
WORKING SHIFT DURING WHICH NSI WAS SUSTAINED:		
Day	76	72.4
Night	29	27.6
WORKING AREA WHERE NSI WAS SUSTAINED: (MR)		
Ward	82	86.1
Clinic	69	72.5
Theatre	8	8.4
Emergency	27	28.4
INJURY TYPE:		
Superficial	50	47.6
Moderate	43	41
Deep	12	11.4

TABLE 10: RESPONDENTS ACTIONS AFTER NSI

	WHAT WAS YOUR RESPONSE IMMEDIATELY AFTER INJURY?	N = 105	Percentage
	Washed with soap and water	22	21
	Applied Dettol or any other disinfectant	11	10.5
	Washed with soap and water and also applied Dettol	65	62
	Washed with water alone	1	1
	Did nothing	6	5.7
	DID YOU TAKE POST-EXPOSURE PROPHYLAXIS AFTER THE NSI?		
	Yes	72	68.6
	No	33	31.4
	DID YOU REPORT THE NSI TO THE APPROPRIATE AUTHORITY?		
	Yes	68	64.8
	No	37	35.2
		N = 37	
	Fear of stigma/discrimination	Nil	Nil
	Unaware of reporting	2	5.4
	Was only a minor injury	29	78.4
	Too embarrassed to report	Nil	Nil
	Lack of time to report	6	16.2
	Not bothered to report	Nil	Nil
	Others	Nil	Nil
	DID YOU USE HAND GLOVES AT THE TIME OF INJURY?		
	Yes	97	92.4
	No	8	7.6
	DID YOU USE SAFETY BOX?		
	Yes	78	74.3
	No	27	25.7

Table 11: RESPONDENTS LEVEL OF PROTECTION AGAINST INFECTIONS ARISING FROM NSI

DOES YOUR FACILITY HAVE INFECTION PREVENTION (IP) GUIDELINES?	N = 330	Percentage
Yes	237	71.8
No	93	28.2
HAVE YOU RECEIVED ANY TRAINING ON INFECTION PREVENTION?		
Yes	324	98.2
No	6	1.8
HAVE YOU COMPLETED YOUR HEP-B VACCINATION?		
Yes	208	63
No	122	37

DISCUSSION

From research carried out, 95.2% of the respondents have heard of needle stick injury. The awareness of what needle stick injury is among the respondents is good. This contradicts a study by Al Qadire³⁰, students had moderate knowledge on NSI prevention (6.6 out of 10, SD = 2.1) comparable to previous works³¹. However findings are in compliance with studies done on medical and dental students show moderate to high knowledge³²; however, nurses and other healthcare workers' knowledge on NSI was low³³ which differs from this study.

From results gotten, respondents generally think that NSIs should be reported immediately. About 300 out of 324 who attempted the question believes that it should be reported immediately. 79.2% of the respondents believes that an antiretroviral therapy center should be contacted less than 2 hours after a case of NSI. Also, The results helps to show that a majority of the healthcare workers feel that NSI is neglected sometimes. The mean score of the responses was 2.26.

The occurrence of NSI among the healthcare workers of

Oredo local government area is fairly rare as only 31.8% of respondents have experienced needle stick injury in the past 12 months. 61% of the respondents have experienced NSI only once in the past 12 months, while 15% can't recall the number of times it has occurred.

Results in this study shows 61% of the respondents have experienced NSI only once in the past 12 months, while 15% can't recall the number of times it has occurred. According to a study by Galougahi¹⁸ which is a lower reading than our results, about 22.15% of nursing workers had at least one exposure to NSIs in last year, 46.2% during last 5 years, and 56.96% during professional life.

The maximum working hours per week of respondents was 100 hours, the minimum recorded was 7 hours, and the average working hours for all was 41.2 hours per week. Results showed 265 respondents have a Bachelor's degree or a higher qualification. Respondents with monthly salary of 450 to 1000 Ethiopian Birr (1 US Dollar = 22.00 Ethiopian Birr) were about six times more likely to report occupational NSSI than HCWs with salary of 2001 to 8379 birr (AOR = 5.73, 95 % CI: 1.71, 19.23).²⁷

CONCLUSION

Majority of health workers had knowledge of needle stick injury. The overall attitude of healthcare workers to needle stick injury is positive for the majority of respondents. The prevalence of needle stick injury is low among health workers as majority have not experienced needle stick injury in the last 12 months and about half that number experiencing it once in the same time frame. It is recommended re-training of healthcare workers on preventive mechanisms of needle sticks injury be sustained in hospitals.

Recommendation

To Healthcare Workers

They should ensure preventive measures when handling needles. In cases where needle stick injury occurs, incident should be reported to the right authorities.

To Hospital Management

Protective materials should be made available to all health care workers to enable steps taken in avoiding needle stick injury.

Training programs should be organized to enlighten nurses especially those with lower work experience and educational background on the risks and management of needle stick injuries.

To The State Government

There should be policies put in place to protect health workers and improve funding of protective materials and hazard allowances.

Awareness programs on safety measures for health care workers and steps should be taken to tackle patients overload for healthcare workers.

Study Limitations

- i. The study relied on the information provided by the respondents and was limited by errors that may be introduced due to recall bias, language or prejudice.
- ii. Some respondents didn't submit filled questionnaires hence sample size increased by 7% of the minimum sample size.

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Conflict of Interest

Authors sponsored the research out of pocket . Non declared.

REFERENCES

1. World Health Organization. The World Health Report. Geneva: WHO 2002. Available online at: <http://www.who.int/whr/2002/chapter4/en/index8.html>.
2. Centers for Disease Control and Prevention: NIOSH Publications and Products . Preventing Needlestick Injuries in Health Care Settings (2000-108) 1999. Available online at: <http://www.cdc.gov/niosh/docs/2000-108/>
3. Memish ZA, Assiri AM, Eldalatony MM, and Hathout H.M. Benchmarking of percutaneous injuries at the Ministry of Health hospitals of Saudi Arabia in comparison with the United States hospitals participating in Exposure Prevention Information Network (EPINet™). *International Journal of Occupational and Environmental Medicine* 2015. 6:26–33. doi: 10.15171/ijoem.2015.467
4. Deisenhammer S, Radon K, Nowak D, Reichert J. Needlestick injuries during medical training. *Journal of Hospital Infection*. 2006;63(3):263-7.
5. Jayanth ST, Kirupakaran H, Brahmadata KN, Gnanaraj L, and Kang G. Needle stick injuries in a tertiary care hospital. *Indian Journal of Medical Microbiology*. 2009;27(1):44-7.
6. Pery J, Parker G, and Jagger J. EPINET report: 2003 percutaneous injury rates. *Advanced Exposure Preview*. 2005;7:2-45.
7. Mehta A, Rodrigues C, Ghag S, Bavi P, Shenai S and Dastur F. Needle stick injuries in a tertiary care center in Mumbai, India. *Journal of Hospital Infections*. 2005;60(4):368-73.
8. El-Hazmi M, Al-Majid M and Fahad M. Needle

- stick and sharps injuries among health care workers: a 5-year surveillance in a teaching center in Saudi Arabia. *Biomedicine* 2008;Res. 19:133–40.
9. Trim JC and Elliot T.S. A review of sharps injuries and preventative strategies. *Journal of Hospital Infections*. 2003;53(4):237-42.
 10. Ippolito G, Puro V and De Carli G. The risk of occupational human immunodeficiency virus infection in health care workers. *Italian Multicenter Study. Achieve of Internal Medicine* 1993 ;153(12):1451-8.
 11. Yazdanpanah Y, De Carli G, Miguères B, Lot F, Campins M and Colombo C. Risk factors for hepatitis C virus transmission to health care workers after occupational exposure: a European case-control study. *Clinical Infectious Diseases* 2005;41(10):1423-30.
 12. Puja S, Anupam W and Vikas A. Managing Needle-Stick Injury. *Researchgate*. 2016; 699-702
 13. Levy BS, and Wegman DH. (Eds.). Occupational hygiene. In *Occupational health: Recognizing and preventing work-related disease and injury* 2000. (4th ed., pp. 161-180). Philadelphia, PA: Lippincott Williams and Wilkins
 14. Baer DM, Wolf MM, and Risley TR. Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis* 1968, 1, 91-97.
 15. Salazar MK. (Ed.). Scientific foundations of occupational and environmental health nursing practice. In *Core curriculum for occupational and environmental health nursing* (3rd ed., pp. 119-151). St. Louis, MO: Elsevier.
 16. Gielen AC and Sleet D. Application of behavior-change theories and methods to injury prevention. *Epidemiologic Reviews* 2006, 2003 25(1), 65-76.
 17. Mbaisi EM, Ng'ang'a Z, Wanzala P, and Omolo J. Prevalence and factors associated with percutaneous injuries and splash exposures among health-care workers in a provincial hospital, Kenya. *Pan African Medical Journal* 2010 ;14:10.
 18. Erhabor O, Ejele OA, and Nwauche CA. Epidemiology and management of occupational exposure to blood borne viral infections in a resource poor setting: The case for availability of post exposure prophylaxis. *Niger Journal of Clinical Practice*. 2007;10:100–4.
 19. Omorogbe VE, Omuemu VO, and Isara AR. Injection safety practices among nursing staff of mission hospitals in Benin City, Nigeria. *Annals African Medicine* 2012;11:36–41.
 20. Isara AR, Oguzie KE, and Okpogoro OE. Prevalence of Needle stick Injuries Among Healthcare Workers in the Accident and Emergency Department of a Teaching Hospital in Nigeria. *Annals of Medical Health Science Research*. 2015 5(6): 392–396.
 21. Prüss-Üstün A, Rapiti E, and Hutin YJ. Sharps Injuries: Global Burden of Disease From Sharps Injuries to Health-Care Workers 2003. Available online at: <https://apps.who.int/iris/handle/10665/42743>
 22. Wilburn SQ, and Eijkemans G. Preventing needlestick injuries among healthcare workers: a WHO-ICN collaboration. *International Journal of Occupational and Environmental Health*. 2004 10:451–6. doi: 10.1179/oeh.2004.10.4.451
 23. Gupta A, Anand S, Sastry J, Krisagar A, Basavaraj A, Bhat SM. High risk for occupational exposure to HIV and utilization of post-exposure prophylaxis in a teaching hospital in Pune, India. *BMC Infectious Diseases* 2008. 8:142. doi: 10.1186/1471-2334-8-142
 24. Prüss-Üstün A, Rapiti E, and Hutin Y. Estimation of the global burden of disease attributable to contaminated sharps injuries among health-care workers. *American Journal of Medicine*. 2005 48:482–490. doi:10.1002/ajim.20230
 25. Trim JC, and Elliot TS. A review of sharps injuries and preventative strategies. *Journal of Hospital Infections* 2003 53:237–242. doi:10.1053/jhin.2002.1378

26. Hanrahan A, and Reutter L. A critical review of the literature on sharps injuries: epidemiology, management of exposures and preventions. *Journal Of Advanced Nursing* 1997 1:144–154
27. Yazdanpanah Y, De Carli G, and Miguere B. Risk factors for hepatitis C virus transmission to health care workers after occupational exposure: a European case-control study. *Clinical Infectious Diseases* 2005 41(10):1423–1430
28. Cardo DM, Culver DH, and Ciesielski CA,. A case-control study of HIV seroconversion in health care workers after percutaneous exposure. *National English Journal of Medicine*. 1997 337:1542–1543
29. Hofmann F, Wittmann A, Kralj N, Schroebl A. Gasthaus, K. Immunologischer und Sicherheitstechnischer Schutz vor HBV-, HCV- und HIV-Virusinfektionen [Immunological and technical prevention of infection with HBV, HCV and HIV]. *Anästh Intensivmed* 2006. 47:S37–S66
30. Al Qadire, M., Ballad, C.A.C., Al Omari, O. *et al.* Prevalence, student nurses' knowledge and practices of needle stick injuries during clinical training: a cross-sectional survey. *BMC Nurs* **20**, 187 (2021). <https://doi.org/10.1186/s12912-021-00711-2>
31. Suliman M, Al Qadire M, Alazzam M, Aloush S, Alsaraireh A, Alsaraireh FA. Students nurses' knowledge and prevalence of needle stick injury in Jordan. *Nurse Educ Today*. 2018;60:23–7.
32. Kapoor V, Gambhir RS, Singh S, Gill S, Singh A. Knowledge, awareness and practice regarding needle stick injuries in dental profession in India: a systematic review. *Nigerian Med J*. 2013;54(6):365.
33. Arafa AE, Mohamed AA, Anwar MM. Nurses' knowledge and practice of blood-borne pathogens and infection control measures in selected Beni-Suef hospitals Egypt. *J Egypt Public Health Assoc*. 2016;91(3):120–6.

