Research

Burden and Risk Factors for Sharp Injuries among Healthcare Workers in a Ugandan Tertiary Hospital: a Cross-Sectional Study

Citation: Irumba P, Masereka EM, Kakongi N, Mugerwa H, Kimera E, Rugumayo C, Kamukama R, Apuulison DF, Nabawanuka B. "Burden and Risk Factors for Sharp Injuries among Healthcare Workers in a Ugandan Tertiary Hospital: a Cross-Sectional Study" (2025) *Infermieristica Journal* 4(3): 227-235. DOI: 10.36253/if-3535

Received: June 7, 2025

Revised: July 28, 2025

Just accepted online: September 30, 2025

Published: September 30, 2025

Correspondence: Irumba Pauline – Address: Mountains of the Moon University, Fort Portal, Uganda; Mail: rumbahot.93@gmail.com

Data Availability Statement: All relevant data are within the paper and its Supporting Information files. This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination, and proofreading process, which may lead to differences between this version and the Version of Record.

Competing Interests: The author(s) declare(s) no conflict of interest.

Irumba Pauline[1], Enos Mirembe Masereka[1], Kakongi Nathan[1,2], Mugerwa Herbert[3], Emmanuel Kimera[1], Rugumayo Charles[1], Kamukama Robert[1], Apuulison David Friday[1], and Brenda Nabawanuka[1]

[1] Department of Nursing, Mountains of the Moon University, Fort Portal City, Uganda
[2] Department of Biochemistry, Mbarara University of Science and Technology, Mbarara City, Uganda
[3] Department of Surgery, Fort Portal Regional Referral Hospital, Fort Portal City, Uganda

Abstract

Introduction. Uganda's efforts for sharps handling, and their waste management are restrained due to shortage of equipment and supplies resorting to alternatives that may not meet standards. The aim of this study was to provide a current detailed account of the prevalence of sharp injuries, and independent risk factors for these injuries among healthcare workers in a resource limited setting.

Methods. A hospital based cross sectional study was conducted among healthcare professionals offering care in a 333-bed capacity tertiary care facility. A self-administered questionnaire was used. Prevalence, and sociodemographic characteristics were determined using descriptive analysis. Univariate and multivariate binary logistic regression analyses were conducted to explore the independent factors associated with risk of sharp injuries.

Results. 147 health professionals participated in this study, and majority (57.14%) were females. The median age in years was 38.48 with an interquartile range of (30.87-47.35). The period prevalence of sharps injuries was 40.14% (1 in 3), and health professionals with at least one training in sharp handling, and disposal a year were less likely to have sharps injuries that year (aOR=0.1, 95% CI=0.01-0.48, p=0.006). Work related stress increased the odds of sharps injuries (aOR=4.3, 95% CI=1.2-

9.8, p=0.005).
Discussion. The overall prevalence of sharp injuries is high. Multidimensional factors including psychological stress, limited flexibility in hospital policies, and less training on sharps handling and disposal every year were associated with sharps injuries. Feasible hospital interventions including simulation-based training, digital education on sharps handling, and disposal should be implemented by hospital administration. While this training on sharps handling, and disposal may be important, its efficacy should be ascertained through repeated studies. Support through allocation of resources, and capacity building from ministry of health, and partners could be of help.

Keyword: Sharps, Injuries, Needlestick Injuries, Biomedical Waste, Hospitals, Health Personnel.

Introduction

Sharps are potentially hazardous through cuts or wounds and they include needles, blades, parts of infusion sets, scalpels and broken glasses.[1,2] These items require special handling as they can expose healthworkers to blood borne pathogens.[3,4] Over 3 million healthcare workers have been affected globally by either occupational injury or disease due to exposure from sharps.[5,6] These injuries account for ≥ 85% of all occupationally related infection transmission.[7] Africa has one of the highest incidence (51%) of sharp-related injuries.[8] The high burden of HIV infection correlates with the high number of occupational injuries despite exposure, and impact of sharps injuries rarely monitored.[9] Several health facilities including regional referral hospitals in Uganda have shortage of both human, and non-human resources including sharps containers, consequently health facilities resort to hard cover containers that do not meet standards.[10] Needlestick injuries were found to be high among health workers in Kampala and northern Uganda often resulting in exposure to infectious fluids through these injuries.[11,12] At our study site, 1 in 6 health professionals received post exposure prophylaxis (PEP) due to needle stick injuries alone excluding other forms of sharps injuries in the years 2020, 2021 and 2022 respectively.[13] Therefore, this study aimed to ascertain the burden of sharp injuries, and its covariates to develop measures for mitigating sharps injuries including a comprehensive tracking and management system for sharps injuries.

Methods

The STROBE guidelines were followed in this study.

Study design and setting

This was a hospital based cross sectional study conducted at the Fort Portal Regional Referral Hospital (FPRRH), also known as Buhinga Hospital located in Fort portal City in the Rwenzori region of Uganda. It is one of the regional referral government hospitals with a bed capacity of 333. Participants were from different departments in the hospital including outpatient department clinics, internal medicine, surgery, paediatrics, intensive care unit, theatre, laboratory, pharmacy, psychiatry, radio-imaging, obstetrics and gynaecology.

Participants and sample size estimation

From August 2023 to October 2023, health professionals who handled sharp items, and generated and disposed of sharp waste participated in the study. They were selected for this study because they are the main drivers of sharps waste in the healthcare facilities. They also transmit knowledge on sharp waste handling. and management to other health workers, and waste handlers in this health facility. In 2022, 217 healthcare professionals were involved in the treatment and care of patients with FPRRH. All were considered eligible to participate in the

study as they were appointed staff in the hospital. These healthcare professionals comprised of medical doctors, nurses, midwives, pharmacists, allied healthcare professionals mainly clinical officers, laboratory experts, imaging experts, and therapists. However, health professionals who were out of station during the study period due reasons such as leave, official duties were not included. Those who were in the hospital, on any form of therapy in the facility were also not included in the study.

The Kish Leslie's formula, and a modified formula for finite population were employed on 217 health professionals involved in care of patients during 2022 to get 152 participants.[14,15]

Using the Kish Leslie's formula:[14]

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

where:

- n = desired sample.
- Z = normal deviate set at 1.96 which corresponds to 95% confidence interval.
- p = proportion of 41.5% was used from the pooled prevalence of sharps injuries in the operating room by.[16] P = 0.415.
- d = permitted error = 5%, 0.05 at 95% confidence interval.
- q = 1-p.

$n = 1.96^2 \times 0.415 \times (1 - 0.415) / 0.05^2$
$n = (3.8416 \times 0.415 \times 0.585) / 0.0025$
$n = 0.93264444 / 0.0025$
$n = 373.058 \sim 373$

Therefore, the sample size was 373 health professionals, but since the total population of health professionals is less than 10,000 and also higher than the total study population in the study site, another modified formula for finite population was used to correct the sample size.[15]

$nf = \frac{n}{1+\frac{n-1}{N}}$ where nf is the minimum sample size.

n is the sample size calculated using the general formula.

N is the total population of the health professionals in the referral hospital.

$= \frac{373}{1+\frac{373-1}{217}} = 373 \times \frac{217}{589} = 137.42 = 138$ participants.

Considering the 10% non response rate;

$\frac{10}{100} \times 138 = 13.8 \sim 14$

Total sample size was 138 + 14 = 152

Therefore, 152 participants were to be considered for the study.

Study Procedure

A self-administered questionnaire was used to collect data from the participants. The questionnaire had both open and close ended questions in three main sections; demographic data, prevalence of sharps injuries, and associated risk factors respectively. The questionnaire was developed in relation to the standards set by the World Health Organization.[2] Questions were tailored to concepts of handling sharp items, and disposal. These main sections with inquiries were on; demographic data, risk factors for sharps injuries including procedures for management of sharps waste. Prior the study, the questionnaire was used on health professionals in private health facility on four different occasions; then responses evaluated and rated on similarity. These questionnaires were administered by trained registered nurses who gave participants same instructions prior filling questionnaires. Three independent researchers, two at a mid-career level while one at a senior career level assessed and rated responses. Re-tests were done with improved versions of the questionnaires. Categorical variables were cross tabulated to ascertain percentage agreement of test and re-test results. Improvements were made from the first draft to the final one used.

A stratified random sampling method in which the study population was grouped into homogeneous strata as nurses and midwives, doctors, interns and allied health professionals. Random samples were obtained from each strata using a random number generator. Names of participants in each stratum were assigned numbers beginning with one to the last number corresponding to the number of individuals in each stratum. The number of members in each stratum was proportionate to its stratum population in the hospital.

Two independent undergraduate trained registered nurses were used as research assistants throughout the data collection exercise. They

received a one-week training on data collection exercise. They also had a two (2) year experience on data collection from previous other health related studies. Data were collected from 147 participants (96.7%). The non-response rate was initially set at 10%. We minimized under coverage using a higher sample size, stratification to ensure that all health care provider groups in the hospital are well represented. Participation was without any form of coercion, and we followed up sampled participants to get their feedback. Data were collected during their free time to avoid interrupting duties during daytime to minimize chances of forgetting due to work related tension and time constraint.

Statistical Analysis

Data were entered into excel, and cleaned prior importation into STATA v 17.0.[17] Categorical variables like sex were summarized as frequencies, and percentage. Continuous variables like age were summarized using median and interquartile ranges. The period prevalence of sharp injuries was determined based on the proportion of participants who experienced any sharp related injuries. The odds ratios along with their 95% CI were calculated using a binary logistic regression. This helped establish factors associated with the risk of sharps injuries. Variables with a *p*-value <0.2 as determined by univariate analysis and relevancy based on previous literature were included in the model. A multivariate analysis was performed. The p value was set to 0.05. While assessing for confounding statistically, the highest limit was set at 10%. Variables in the model that yielded > 10% were considered as potential confounders. Assessment for possible interaction was done. The variance inflation factors (VIFs) were used to assess any relationship between the independent variables. Variables with VIFs either close to one or less than 5 were considered to have minimal strength, and effect on other covariates. A variance inflation factor (VIF) close to one was considered not likely to be affected by multicollinearity while a VIF above 5 indicated high collinearity. A decision to retain independent variables with high a VIF would depend on the clinical significance, and evidence from previous studies. High VIF would be resolved by LASSO regression. Logical model building was done using a stepwise forward regression.

Ethical consideration

Ethical approval was obtained from the Research Ethical Committee of Mbarara University of Science and Technology (IRB NO MUST-2023-858). Authorization was requested to the research committee of Fort Portal Regional Referral Hospital; then the hospital administration. Informed consent was obtained from all study participants.

Results

Participant characteristics

A total of 147 participants were included in this study. Most of the participants (84 out of 147, 57.14%) were females. The median age was 38.48, (IQR=30.87-47.35), and majority of the participants (89 out of 147, 60.54%) were nurses as shown in Table 1.

Prevalence of Sharps Injuries

The period prevalence of sharps injuries was 40.14% (59 out of 147 participants had sharp injuries).

Associated risk factors for sharps injuries

The results of the univariate and multivariate binary logistic regressions are presented in Table 2. At the univariate regressions, factors significantly associated with a risk of acquiring sharps injuries were; being a medical doctor vs an allied professional (OR=3.6, 95% CI=1.18-10.95, *p*=0.024), presence of work-related stress (OR=2.9, 95% CI=1.11-7.79, *p*=0.030), and limited flexibility on working hours (OR=2.7, 95% CI=1.10-6.42, *p*=0.030). At the multivariate regression, factors significantly associated with a risk of acquiring sharps injuries were; presence of work-related stress (aOR=4.3, 95% CI=1.2-9.8, *p*=0.005), training once a year on sharps management (aOR=0.1, 95% CI=0.01-0.48, *p*=0.006), and limited flexibility on working hours (aOR=5.2, 95% CI=2.40-9.30, *p*=0.030).

Discussion

In our study centre, we found out that the period prevalence of sharp injuries was 40.14 percent. This translated into at least one in

Table 1. Sociodemographic characteristics of total participants and those injured/non injured in a year.

Characteristic	Injured n (%)	Not injured n (%)	Total n (%)
Age group			
18-24	1 (0.68)	2 (1.36)	3 (2.041)
25-34	30 (20.41)	23 (15.65)	53 (36.054)
35- 44	14 (9.52)	30 (20.41)	44 (29.932)
45-54	10 (6.80)	26 (17.69)	36 (24.490)
> 55	4 (2.72)	7 (4.76)	11 (7.483)
Sex			
Male	26 (17.69)	37 (25.17)	63 (42.857)
Female	33 (22.45)	51 (34.69	84 (57.143)
Professions			
Nurses	30 (20.41)	59 (40.14)	89 (60.544)
Medical Doctors	18 (12.25)	9 (6.12)	27 (18.367)
Pharmacists	1 (0.68)	2 (1.36)	3 (2.041)
Allied professionals	10 (6.80)	18 (12.25)	28 (19.048)
Education			
Tertiary certificate	4 (2.72)	12 (8.16)	16 (10.884)
Diploma	29 (19.73)	47 (31.97)	76 (51.701)
Undergraduate degree	20 (13.61)	25 (17.01)	45 (30.612)
Master's degree	6 (4.08)	4 (2.72)	10 (6.803)
Years of experience			
< 1	9 (6.12)	2 (1.36)	11 (7.483)
1-2	4 (2.72)	3 (2.04)	7 (4.762)
3-4	8 (5.44)	10 (6.80)	18 (12.245)
5-10	16 (10.88)	21 (14.29)	37 (25.170)
> 10	22 (14.97)	52 (35.37)	74 (50.340)
Department			
Surgery	16 (10.88)	18 (12.25)	34 (23.129)
OBGY	13 (8.84)	19 (12.93)	32 (21.769)
Pediatrics	9 (6.12)	7 (4.76)	16 (10.884)
Internal medicine	7 (4.76)	18 (12.25)	25 (17.007)
Outpatient	6 (4.08)	14 (9.52)	20 (13.605)
Psychiatry	3 (2.04)	3 (2.04)	6 (4.082)
Theatre	3 (2.04)	0 (0.00)	3 (2.041)
ICU	2 (1.36)	1 (0.68)	3 (2.041)
Pharmacy	0 (0.00)	1 (0.68)	1 (0.680)
Laboratory	0 (0.00)	2 (1.36)	2 (1.360)
Radio-imaging	0 (0.00)	4 (2.72)	4 (2.721)
Ophthalmology	0 (0.00)	1 (0.68)	1 (0.680)

Legend: OBGY = Obstetrics and Gynecology; ICU = Intensive Care Unit

Table 2. Logistic regression analysis of factors associated with sharps injuries.

Covariate	Category	Unadjusted OR (95% CI)	*p*	Adjusted OR (95% CI)	*p*
Sex	Female	1		1	
	Male	1.1 (0.56-2.11)	0.808	2.9 (0.61-3.78)	0.177
Profession	Allied professional	1		1	
	Medical Doctor	3.6 (1.18-10.95)	0.024	2.7 (0.23-10.90)	0.435
	Nurse	0.9 (0.38-2.23)	0.845	0.8 (0.11-4.45)	0.784
	Pharmacist	0.9 (0.07-11.20)	0.935	3.4 (0.01-16.92)	0.700
Education	Tertiary certificate	1		1	
	Diploma	1.9 (0.55-6.29)	0.324	5.49 (0.62-10.73)	0.126
	Undergra-duate	2.4 (0.67-8.59)	0.178	2.6 (0.21-12.83)	0.457
	Master's	0.4 (0.08-2.54)	0.164	0.1 (0.06-2.00)	0.088
Years of experience	1-2	1		1	
	<1	3.4 (0.4-28.75)	0.266	0.6 (0.2-11.72)	0.836
	3-4	0.6 (0.1-3.5)	0.570	0.04 (0.02-1.06)	0.054
	≥5	2.2 (1.4-5.68)	0.405	1.1 (1.04-2.52)	0.056
Shortage of sharps containers	Yes	1		1	
	No	1.7 (0.87-3.38)	0.118	3.9 (0.89-9.24)	0.071
Design of sharp containers	No	1		1	
	Yes	0.7 (0.33-1.54)	0.388	0.7 (0.10-4.52)	0.688
Work related stress*	No	1		1	
	Yes	2.9(1.11-7.79)	0.030	4.3 (1.2-9.8)	0.005
Training on sharps management**	Never trained	1		1	
	Once a year	0.7 (0.34-1.47)	0.347	0.1 (0.01-0.48)	0.006
	Twice a year	0.4 (0.15-1.05)	0.063	0.3 (0.05-1.70)	0.172
Hospital policy on working hours	Flexible	1		1	
	Limited flexibility	2.7 (1.1-6.42)	0.030	5.2 (2.40-9.30)	0.030
Safety engineered devices for sharps handling available in the unit	Not available	1		1	
	Available	1.0 (0.44-2.12)	0.921	3.4(0.51-12.59)	0.210
Know how to use safety engineered devices	No	1		1	
	Yes	2.1 (0.98-4.68)	0.058	6.3 (0.92-13.60)	0.061
Re-usable sharps containers in the unit	Not available	1		1	
	Available	1.4 (0.53-3.7)	0.492	4.2 (0.51-34.47)	0.181

Legend: OR = odds ratio; CI = confidence interval; *p* = *p*-value.
* Stress: A state of worry or mental tension caused by a difficult situation.
** Training: Acquisition of knowledge as a result of instruction in a formal scheduled course of study.

three health professionals experiencing sharp injuries almost every year. This prevalence of sharp injuries in our study centre underscores the burden of this occupational hazard now in the limelight. There is a possibility of this burden to soar if its recognition, and attempts to mitigate risks remain in vain. The overall prevalence of sharp injuries in several studies ranged from 10 percent to 60.5 percent.[18-22] The consistency in the burden needle stick injuries was observed, of which one in four (1 in 4) of the health professionals suffered from needle stick injuries alone every year. This is much higher when compared to a study by who reported 3 in 10 health workers being affected by these injuries.[23] However, participants' ability to recall, and fear of outcomes from their participation could either increase or reduce the prevalence noted above.

Sharps related injuries were significantly associated with psychological stress. Table 2, and the final model (Sharps Injury = 0.269+ 0.21 Stress+ 0.46 of sharps container design - 0.09 training once a year-0.01 Male) also indicated an association between psychological stress, and sharp injuries. Sustained psychological stress in all forms tends to affect human performance which can alter the level of precision, decision making while in an encounter with any sharp item. Related results were also reported in studies in German,[24] Turkey[25] and several developing countries.[26] Our study site is a referral hospital that is often resource restrained while receiving a high number of patients. Health professionals may have to work several procedures for longer hours without rest using limited resources which predispose them to burnout, stress, and subsequent sharp injuries. Living in a Sub Saharan Africa country like Uganda, with distinct cultural and economic challenges poses a level of stress in addition work related stressors.[27] Recent studies reported that stressors, and burnout significantly affect human performance resulting in erroneous mistakes.[28,29]

Having trained at least once a year once a year was associated with a reduced likelihood of any form of sharp injury. These trainings are mainly part of the national infection prevention and control strategy. The level of protection against sharp injuries due to education on sharps, and management could not be fully ascertained in this study. Although reported low level of evidence that education, and training on sharps could reduce the overall burden of sharps injuries, skills in healthcare practice improve with routine, and consistent education, and training.[30,31] It is necessary to evaluate the efficacy of training programs in hospitals in reducing the overall burden of sharps injuries. With the continued growth of digital technology in Uganda, the education about sharps could be tailored to audio-visuals, applications which can make learning easier and enjoyable compared sitting in lectures, ground rounds which are not attended by all health professionals. It could be vital if continuous medical/nursing education for our health professionals is approached multidimensionally with innovative digital technology, and routine real time simulations. Without routine education, and aid posters in the health facility, individuals may handle, dispose of sharps inappropriately.

Sharp related injuries can occur because of multidimensional determinants. Limited flexibility in hospital policies including working hours, rest, and recuperation were significantly associated with higher odds (5.2) of sharp injuries. Studies have reported a need for health institutions to support health professionals through effective policies.[32-34] If policies do not promote the totality in the overall wellbeing of healthcare workers, they are more likely to affect their performance. The fact that the study was conducted in a resource restrained tertiary health facility in Sub Saharan Africa, findings may be restricted to similar settings. Overall, the study could be limited by participants capacity to recall accurate responses for the questions during data collection, and fear related to possible findings after their submission.

Implications of the study

The current hospital infection prevention and control committee should broaden to incorporate a subcommittee that focuses on sharps handling, and disposal. This subcommittee should draft, implement, and audit protocols for sharps handling, and management. A functional reporting system for sharps injuries should be instituted, and implemented.

This will facilitate the basis for quality improvement, thereby facilitate reduction in sharps injuries in the hospital.

Conclusion

The period prevalence of sharps injuries in FPRRH in Uganda was relatively high. Shortage of resources together with mishaps in sharps waste management, and work-related stress may contribute to the overall occurrence of sharps injuries. It is crucial that the hospital recognizes this occupational hazard for redress. The likelihood of an increased burden is imminent, if no suitable measures are instituted. To begin with, awareness of sharp injuries together with a clear track record in every department in the hospital. Intervention studies on the efficacy of education, and training towards reduction of sharps injuries may be implemented. Feasible hospital policies on sharps handling, and disposal should be drafted, and promoted as well. Partners and key stakeholders of the hospital including ministry of health should consider resource mobilization, and provision as a key priority in the mitigation of sharp injuries.

References

1. Alwali A, Shaheen A, Ahmed M, Mansour Z, Kanou L, AlQanoa B, et al. Awareness and prevalence of needle stick injuries among cleaners and health-care providers in Gaza Strip hospitals: a cross-sectional study. The Lancet. 2021;398:S12. https://doi.org/10.1016/S0140-6736(21)01498-7
2. WHO. Safe management of wastes from health-care activities. 2nd Edition ed. Yves Chartier JE, Ute Pieper, Annette Prüss, Philip Rushbrook, Ruth Stringer, William Townend, Susan Wilburn and Raki Zghond, editor. Malta2014. Accessed via: Safe management of wastes from health-care activities, 2nd ed.
3. Auta A, Adewuyi EO, Tor-Anyiin A, Edor JP, Kureh GT, Khanal V, et al. Global prevalence of percutaneous injuries among healthcare workers: a systematic review and meta-analysis. Int J Epidemiol. 2018;47(6):1972-80. https://doi.org/10.1093/ije/dyy208
4. Fadil RA, Abdelmutalab NA, Abdelhafeez SA, Mazi W, Algamdi S, Shelwy MM, et al. Pattern and risk factors of sharp object injuries among health care workers in two tertiary hospitals, Al Taif-Kingdom of Saudi Arabia 2016–2018. Saudi Journal of Biological Sciences. 2021;28(11):6582-5. https://doi.org/10.1016/j.sjbs.2021.07.031
5. Mengistu DA, Tolera ST. Prevalence of occupational exposure to needle-stick injury and associated factors among healthcare workers of developing countries: Systematic review. Journal of occupational health. 2020;62(1):e12179. https://doi.org/10.1002/1348-9585.12179
6. Bouya S, Balouchi A, Rafiemanesh H, Amirshahi M, Dastres M, Moghadam MP, et al. Global Prevalence and Device Related Causes of Needle Stick Injuries among Health Care Workers: A Systematic Review and Meta-Analysis. Ann Glob Health. 2020;86(1):35. https://doi.org/10.5334/aogh.2698
7. Musa S, Peek-Asa C, Young T, Jovanovic N. Needle stick injuries, sharp injuries and other occupational exposures to blood and body fluids among health care workers in a general hospital in Sarajevo, Bosnia and Herzegovina. International journal of occupational safety and health. 2014;4(1):31. https://doi.org/10.3126/ijosh.v4i1.9847
8. Hosseinipalangi Z, Golmohammadi Z, Ghashghaee A, Ahmadi N, Hosseinifard H, Mejareh ZN, et al. Global, regional and national incidence and causes of needlestick injuries: a systematic review and meta-analysi. Eastern Mediterranean Health Journal. 2022;28(3):233-41.
9. Oluwatosin OA, Oladapo MM, Asuzu MC. Needlestick injuries among health care workers in Ondo State, Nigeria. International Journal of Medicine & Public Health. 2016;6(1). doi. 10.4103/2230-8598.179757
10. Reagan M. Evaluating Medical Waste Sorting Methods and Ultimate Disposal Across Various Health Units at Kampala International University Teaching Hospital. https://doi.org/10.59298/INOSRES/2023/2.13.1000
11. Alitubeera PH, Mutanda JN, Aggrey M, Kobusingye OC, Biribawa C, Tusubira A, et al. Prevalence, correlates of occupational percutaneous injuries and use of post exposure prophylaxis against HIV, hepatitis B among health workers in Kampala, Uganda-May 2016. Journal of Interventional Epidemiology and Public Health. 2021;4(13). https://doi.org/10.37432/jieph.2021.4.3.42
12. Odongkara B, Mulongo G, Mwetwale C, Akasiima A, Muchunguzi H, Mukasa S, et al. Prevalence of occupational exposure to HIV among health workers in Northern Uganda. International Journal of Risk & Safety in Medicine. 2012;24(2):103-13. https://doi.org/10.3233/JRS-2012-0563
13. 13. Health Management Information System H. Unpublished work, Post Exposure Prophylylaxis Register. 2022.
14. Kish L. Survey sampling. Oxford, England: Wiley; 1965.
15. Chaudhuri A, Dutta T. Determining the size of a sample to take from a finite population. Statistics and Applications. 2018;16(1):37-44. Accessed via: 3_Arijit_Chaudhuri2018_1_EdujfYV.pdf
16. Bevan V, Blake P, Radwan RN, Azzopardi E. Sharps and needlestick injuries within the operating room: Risk prone procedures and prevalence meta-analysis. Journal of Perioperative Practice. 2023;33(7-8):200-10. https://doi.org/10.1177/17504589221103810
17. Cox NJ. Speaking Stata: The largest five—A tale of tail values. The Stata Journal. 2022;22(2):446-59. https://doi.org/10.1177/1536867X221106436
18. Ghanei Gheshlagh R, Aslani M, Shabani F, Dalvand S, Parizad N. Prevalence of needlestick and sharps injuries in the healthcare workers of Iranian hospitals: an updated meta-analysis. Environ Health Prev Med. 2018;23(1):44. https://doi.org/10.1186/s12199-018-0734-z
19. Saadeh R, Khairallah K, Abozeid H, Al Rashdan L, Alfaqih M, Alkhatatbeh O. Needle Stick and Sharp Injuries Among Healthcare Workers: A retrospective six-year study. Sultan Qaboos Univ Med J. 2020;20(1):e54-e62. https://doi.org/10.18295/squmj.2020.20.01.008
20. Bilek Ö, Kiran S, Duygulu S, Yıldız AN. The Awareness and Empowerment Aspects of the Needlesticks and Other Sharps Injuries and Reporting in Nursing Education: A Cross-Sectional Survey. Workplace Health & Safety. 2022;70(9):421-30. https://doi.org/10.1177/21650799211049810
21. Liyew B, Sultan M, Michael M, Tilahun AD, Kassew T. Magnitude and determinants of needlestick and sharp injuries among nurses working in Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia. BioMed

research international. 2020;2020(1):6295841. https://doi.org/10.1155/2020/6295841
22. Abalkhail A, Kabir R, Elmosaad YM, Alwashmi AS, Alhumaydhi FA, Alslamah T, et al. Needle-stick and sharp injuries among hospital healthcare workers in Saudi Arabia: a cross-sectional survey. International journal of environmental research and public health. 2022;19(10):6342. https://doi.org/10.3390/ijerph19106342
23. Sharew NT, Mulu GB, Habtewold TD, Gizachew KD. Occupational exposure to sharps injury among healthcare providers in Ethiopia regional hospitals. Annals of occupational and environmental medicine. 2017;29:1-7. https://doi.org/10.1186/s40557-017-0163-2
24. Kaur M, Mohr S, Andersen G, Kuhnigk O. Needlestick and sharps injuries at a German university hospital: epidemiology, causes and preventive potential - a descriptive analysis. Int J Occup Med Environ Health. 2022;35(4):497-507. https://doi.org/10.13075/ijomeh.1896.01854
25. Korkmaz N, Şentürk GÇ, Tekin A, Gürbüz Y, Sevinç G, Tütüncü EE, et al. Rates of underreported needlestick and sharps injuries among healthcare workers in Turkey: in the light of Infection Control Committee data. International Journal for Quality in Health Care. 2022;34(2). https://doi.org/10.1093/intqhc/mzac012
26. Rai R, El-Zaemey S, Dorji N, Rai BD, Fritschi L. Exposure to occupational hazards among health care workers in low-and middle-income countries: a scoping review. International journal of environmental research and public health. 2021;18(5):2603. https://doi.org/10.3390/ijerph18052603
27. Henley P, Lowthers M, Koren G, Fedha PT, Russell E, VanUum S, et al. Cultural and socio-economic conditions as factors contributing to chronic stress in sub-Saharan African communities. Canadian Journal of Physiology and Pharmacology. 2014;92(9):725-32. https://doi.org/10.1139/cjpp-2014-0035
28. Chen Y-H, Tsai C-F, Yeh C-J, Jong G-P. Is burnout a mediating factor between sharps injury and work-related factors or musculoskeletal pain? World Journal of Clinical Cases. 2021;9(25):7391. http://dx.doi.org/10.12998/wjcc.v9.i25.7391
29. Pousa PCP, Lucca SRd. Psychosocial factors in nursing work and occupational risks: a systematic review. Revista brasileira de enfermagem. 2021;74(suppl 3):e20200198. https://doi.org/10.1590/0034-7167-2020-0198
30. Cheetham S, Ngo HT, Liira J, Liira H. Education and training for preventing sharps injuries and splash exposures in healthcare workers. Cochrane Database of Systematic Reviews. 2021(4). https://doi.org/10.1002/14651858.CD012060.pub2
31. Goniewicz K, Goniewicz M, Włoszczak-Szubzda A, Burkle FM, Hertelendy AJ, Al-Wathinani A, et al. The importance of pre-training gap analyses and the identification of competencies and skill requirements of medical personnel for mass casualty incidents and disaster training. BMC public health. 2021;21:1-11. https://doi.org/10.1186/s12889-021-10165-5
32. Shanafelt T, Trockel M, Ripp J, Murphy ML, Sandborg C, Bohman B. Building a program on well-being: key design considerations to meet the unique needs of each organization. Academic Medicine. 2019;94(2):156-61. https://dx.doi.org/10.1097/ACM.0000000000002415
33. Shanafelt T, Stolz S, Springer J, Murphy D, Bohman B, Trockel M. A blueprint for organizational strategies to promote the well-being of health care professionals. NEJM Catalyst Innovations in Care Delivery. 2020;1(6). DOI: 10.1056/CAT.20.0266
34. Rieckert A, Schuit E, Bleijenberg N, ten Cate D, de Lange W, de Man-van Ginkel JM, et al. How can we build and maintain the resilience of our health care professionals during COVID-19? Recommendations based on a scoping review. BMJ Open. 2021;11(1):e043718. https://doi.org/10.1136/bmjopen-2020-043718