

# Assessment of needle stick injuries among healthcare workers: a cross-sectional study from Kakiri military and SOS hospitals, Uganda

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## Research

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# Abstract

**Background:** The Ugandan military medical services work together with the civilian public health system to deliver quality healthcare. This Partnership is the mainstay of health service delivery in Uganda. The burden of needle stick injuries (NSIs) is increasing in Uganda's larger health industry; however, data on needle stick injury in military and public health facilities is lacking. No published data exist on comparative studies for a mix of facilities both military and civilian health settings. This study represents the first time this issue has been studied in a military or public health hospital in Uganda.

**Methods:** A hospital-based, cross-sectional study was conducted in July 2018 to September 2019 in Kakiri Military and SOS Hospitals in Uganda using a structured questionnaire. Respondents were purposively selected based on the objectives of study, occupation status and department (N = 310).

**Results:** The overall prevalence of NSIs among respondents was 27.2% and prevalence rates for the two facilities was nearly identical. The largest percentage of NSIs occurred during drawing venous blood samples (49.4%). Significant predictors of NSI were gender, occupational status, age, poor knowledge on prevention and post exposure of NSI, and less professional experience. Infection control practices were lacking in both selected health facilities.

**Conclusion:** Over a quarter of HCWs in Uganda reported NSIs, which places them at significant health risk. Fostering the practice of universal precautions, best infection control practices and training of healthcare workers on bio-safety measures can reduce the prevalence of NSIs.

**Trial Registration:** Not Applicable

## Background

The healthcare system of Uganda is a mixed system in which the largest proportion of healthcare (71%) is provided by the public health sector while non-state health entities (for-profit and not-for profit providers at 9% and 21% respectively) providing the remaining. [1,2] The country has a total of 6, 929 health facilities and a workforce of 39,000 operate the health sector while burdened with a 27% net vacancy rate. [3,4] Uganda's health sector has experienced tremendous challenges delivering care due to political anarchy, ethnic conflicts, civil wars, and military crises in the Great Lakes Region of Africa. Uganda's healthcare system ranked 149th out of 191 countries in the world by WHO and spends only 7.4 % of its GDP on health care. [5,6] Uganda's per capita health expenditure is USD \$51 which far below the international threshold USD \$90 and Uganda's Health Sector Development Plan target of USD \$97. [7] Furthermore, Uganda is the only country in East African region without any form of national universal insurance coverage. [8] Further straining the healthcare system, Uganda is the largest host of refugees in Africa and third in the world. [9]

Globally, needle stick injuries (NSIs) are among the most serious hazards among healthcare workers (HCWs) with more than two million occurring annually [10]. It's estimated that globally and in Africa

around 44.5% and 41.7% of HCWs respectively sustain NSIs. [10] 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%. [11,12] The prevalence rate is highest at 58% in Kenya and 52.9% in Tanzania. [13,14] NSIs have long plagued the Uganda healthcare system, where the ongoing epidemics of HIV/AIDS and other blood borne infections make these injuries particularly problematic. In the most recent national data (2003), the incidence rate of NSI in Uganda was estimated at 44% of healthcare workers per year. [15] More recent data on NSI in Uganda is scanty and based on small samples of providers. Hulem surveyed 79 nursing students in a rural Ugandan hospital and found that 25.3% had experienced NSI with 50% of those from sources potentially infected with HIV [16]. In a survey of healthcare workers in the Gulu district in Uganda, Odongkara and colleagues discovered that 46% had been exposed to potentially infectious body fluids, with NSI accounting for 27.7% of exposures [17] Otherwise, little empirical data exists for recent NSI prevalence or risk factors in Uganda.

Uganda also faces difficulties with addressing NSIs in its healthcare workforce. Structural barriers include overworked staff due to the shortage of HCWs and a dearth of training on preventing NSI. [18] In addition to gaps in knowledge and skills of healthcare workers, Uganda is at higher risk of NSI due to inadequate infection and prevention control care [19,20]. Despite that, Uganda developed its own policies and programs in non-communicable disease (NCD) prevention and control (including prevention of NSIs) and passed the Occupational and Safety Health legislation in 2006. [18,21] Similar to many other LMICs, there is lax implementation of policy interventions and enforcement standards to protect healthcare workers from exposure and reduction of NSIs and unsafe infection control practices are common. [22,23] This supports the need for ongoing research into prevalence and risk factors for NSIs among sectors of the Ugandan healthcare system.

Because of the need to provide adequate healthcare care for military personnel, since 1986 provision of care to military personnel from the Chieftaincy of military medical services within the Uganda Peoples Defense Forces (UPDF) was established out of necessity to provide care for military personnel. Included in the public sector are UPDF medical services are considered part of the public sector of the Uganda healthcare system. Unfortunately, no study to date has been conducted on NSIs in Uganda's military health service. Thus, the aim of this study is to determine and compare the prevalence and risk factors of needle stick injuries among healthcare workers in two hospitals (one military and one private charity), both serving military personnel and public.

## **Methodology**

### **Study Aim**

The aim of the study was to determine prevalence and risk factors of needle stick injuries among healthcare worker in Kakiri military and SOS hospital in Uganda who have at least 6 months of professional experience. Military personnel often receive care from the SOS Hospital in addition to the Kakiri Military Hospital.

## **Setting**

Uganda is a landlocked country in East Africa. There are currently 135 districts and 2,184 Sub-Counties (the layer below the districts); there is no regional government. This study was conducted in the Kakiri Sub-County located at Wakiso District in the central area of the country about 26.3 km northwest of Kampala, the capital city of Uganda. Kakiri Sub-County has a population of 39,137. [24] The study was done from July to September 2018 at the Kakiri Military Hospital and the SOS Hospital (SOS Hermann Gmeiner Hospital). The Kakiri Military Hospital is located with the 1st Division Military Barracks of the UPDF while the SOS hospital is situated at SOS Children's Village Uganda, a Non-Government Organization (NGO).

## **Inclusion/Exclusion Criteria**

Military and civilian healthcare workers, with a minimum employment experience of six (6) months at Kakiri Military and SOS hospitals who consented to participate in the study. Healthcare workers recruited were staff in hospitals (doctors, nurses, laboratory technologists, dentists, and ancillary staff) who have contact with needles, syringes and sharp instruments due to their responsibilities. Those who did not consent to participate in the study, those on leave, and those mainly performing administrative duties were excluded from the study.

## **Survey Methods**

### **Data collection procedure**

A mixed method approach was employed, which included a review of incident reports of NSIs at each hospital and a self-report questionnaire completed by healthcare worker participants.

### **Self-Report Questionnaire**

A structured, pre-tested questionnaire was used in this study. Items were adapted from previous studies of NSIs among health care workers. [15,25,26] Epidemiologists of the chieftaincy of military medical services and infection control provided feedback during the development of the questionnaire and face validity was established. The survey was conducted in English. The questionnaire was pilot tested with 20 healthcare workers at Masaka Mechanized Battalion near Kakiri Military Barracks prior to execution with study volunteers.

### **Sampling Methods**

A stratified random sampling was utilized to select the respondents from the two hospitals. First, the total number of health care workers was identified. Respondents lists were used as sampling framework to select a proportionate random sample of eligible respondents drawn by occupation group (stratum) to participate in survey. The occupational strata were doctors, nurses, laboratory technicians, and support staff.

## **Operational definition**

A needle stick injury was defined as a wound caused by a needle point or other penetrating devices.

## **Statistical modeling**

Data was analyzed using Statistical Package for the Social Sciences (SPSS) version 16. Categorical variables are presented as percentages. Logistic regression modeling was used to evaluate risk factors of NSI. The chi-square test was used to assess significance of the relationship between the variables. A Pearson correlation matrix was used to assess multicollinearity among the predictors. P values < 0.05 was used to define statistical significance.

# **Results**

## **Response rate and demographic characteristics**

All the 283 HCWs recruited agreed to participate, giving a response rate of 100%. Table 1 shows the demographic characteristics of the respondents by age, gender, job categories, years of experience and shift schedule. The participants were within age range from 22 to 59 years and mean ( $\pm$  SD)  $33.56 \pm 6.41$  years. The majority of participants were within age range from 30 to 34 years (57.7%). Among the 283 respondents, a majority (53%) were nurses, followed by ancillary staff (35.6%), laboratory technologists (6.1%) and doctors (5.3%).

Table 1  
Demographic characteristics of respondents

<b>Characteristics</b>	<b>KMH (f)</b>	<b>SOS H (f)</b>	<b>Overall (f)</b>	<b>Percent (%)</b>
<b>Age (years)</b>				
40 and above	40	13	53	18.7
35–39	58	20	78	27.6
30–34	83	16	99	34.9
29 – 25	42	9	51	18.1
20–24	1	1	2	0.7
<b>Gender</b>				
Male	85	16	101	35.7
Female	139	43	182	64.3
<b>Job Category</b>				
Doctors	10	5	15	5.3
Nurses	122	28	150	53.0
Laboratory Tech	13	4	17	6.1
Ancillary Staff	79	22	101	35.6
<b>Years of Experience</b>				
1–5	28	20	48	17.0
6–10	82	11	93	33.0
11–15	55	7	62	22.0
16–20	40	9	49	17.0
>20	19	12	31	11.0
<b>Shift Schedule</b>				
Morning (6am-1pm)	79	21	100	35.3
Afternoon (2pm-6pm)	67	17	84	30.0
Evening (7pm-9pm)	30	9	39	13.7
Night (10pm-5am)	48	12	60	21.0
Notes: KMH = Kakiri Military Hospital, SOS H = SOS Hermann Gmeiner Hospital, f = frequency				

## Prevalence And Characteristics Of Needle Stick Injuries

The overall prevalence of needle stick injuries reported among HCWs in the previous 12 months was 27.2 % (N = 77). The prevalence of NSIs for each hospital was nearly identical (Kakiri Military Hospitals 27.2% vs. SOS Hospital 27.1%); thus, characteristics and risk factors for NSIs were evaluated for all participants. Table 2 provides characteristics of NSIs among HCSs. The majority of NSIs was percutaneous injuries (57.1%) and the most common injured anatomic body site was the fingertips at 79.2%. The NSIs occurred mostly during drawing venous blood samples (49.4%) and was precipitated mostly by HCWs error (51.9%).

Table 2  
Needle Stick Injury Characteristics

<b>Exposure</b>	<b>Number</b> <b>(n = 77 total)</b>	<b>Percent</b>
Types of NSI	44	57.1
Percutaneous	13	16.9
Laceration	18	23.4
Exposure to Body fluids	2	2.6
Exposure to patients' blood		
Body Site of Exposure	61	79.2
Fingertips	11	14.3
Hand	5	6.5
Arms		
Type of Procedure Involved	38	49.4
Drawing venous blood samples	16	20.8
Setting up IV line	3	3.8
Conduction of delivery	13	16.9
Surgical operation	4	5.2
Injection administration	1	1.3
Handling cadaver in mortuary	2	2.6
Environmental cleaning		
Reasons for Injury	40	51.9
Health care worker error	30	39
Patient caused	7	9.1
Accidental injury by a colleague	18	23.4
Reported incident	59	76.6
Yes		
No		

## Factors Associated With Needle Stick Injury

Factors associated with NSI are presented in Table 3. The prevalence of NSIs was higher in male HCWs than women (38.8% vs. 22.7%,  $p = 0.006$ ). The HCWs with 20 years or more experience were the least likely to sustain a NSI (11.9%) while those with 15 or fewer years of experience had a NSI rate of more than 30%. The HCWs on the Morning (6 am to 1 pm; 37.0%) and Night (10 pm to 5 am; 29.4%) shifts were the most likely to experience a NSI. Only about a quarter (23.4%) of those who experienced a NSI reported it to their hospital. The NSI was much higher among those who used PPE (45.3%) versus those who didn't (9.7%), likely due to a difference in job tasks.

Table 3  
Factors associated with Needle Stick Injury

Variable	NSI Yes	NSI No	Prevalence (%)	Odds ratio (95% CI)	P-value
<b>Age (years)</b>					
20–24(n = 4)	1	3	25		
25–29(n = 28)	17	11	60.7	0.21(0.01–2.34)	0.2
30–34 (n = 109)	26	83	25.7	0.96(0.09–9.65)	0.97
35–39 (n = 89)	12	77	13.5	2.13(0.20- 22.28)	0.52
> 40(n = 53)	21	32	39.6	0.50(0.04–5.21)	0.6
<b>Gender</b>					
Female (n = 203)	46	157	22.7		
Male (n = 80)	31	49	38.8	0.46(0.26–0.80)	0.006
<b>Work experience (years)</b>					
1–5(n = 45 )	15	30	33.3	Ref	
6–10 (n = 63)	26	37	31.7	0.71(0.32–1.57)	0.4
11–15(n = 60 )	20	40	33.3	1.00 (0.44–2.27)	1.0
16–20 (n = 48)	8	40	16.7	2.50(0.93–6.66)	0.06
>20 (n = 67)	8	59	11.9	3.68(1.40–9.67)	0.008
<b>Work Shift</b>					
Morning: 6am-1pm (n = 127)	47	80	37.0	Ref	
Afternoon: 2pm-6pm (n = 73)	13	60	17.8	2.7(1.34–5.45)	0.005
Evening: 7pm-9pm (n = 49)	7	42	14.3	3.5(1.46–8.47)	0.004
Night: 10pm-5am (n = 34)	10	24	29.4	1.4(0.62–3.2)	0.41
<b>PPE Availability</b>					
Available (n = 108)	18	90	16.7	0.39(0.21–0.71)	0.002

KMH -Kakiri Military Hospital, SOS H- SOS Hospital, NSI-Needle Stick Injury, PPE-Personal Protective Equipment

Variable	NSI Yes	NSI No	Prevalence (%)	Odds ratio (95% CI)	P-value
Not Available (n = 175)	59	116	33.7		
<b>Use of PPE</b>					
Yes (n = 139)	53	86	38.1	3.08(1.76–5.37)	0.0001
No (n = 144)	24	120	16.7		
KMH -Kakiri Military Hospital, SOS H- SOS Hospital, NSI-Needle Stick Injury, PPE-Personal Protective Equipment					

## Discussion

The health and wellbeing of workforce is fundamental to the achievement of the organization's current goals and future ambitions in both civil and military settings. More so, safety is a priority in the military. Nonetheless, needle-stick injury is still a silent challenge in Uganda's health system. Nearly 27.2% of the sample experienced NSI during their career service. This rate was considerably lower than the national prevalence rate at 46%; however, the most recent national data was from 2003. [15] This is also slightly lower than the findings in other similar studies in Ethiopia, Malaysia and China which is 29.3%, 27.9% and 27.5% respectively. [12, 26, 27] In contrast, rates of NSI were higher than that found in Australia (17.7%) and much lower than findings from South Korea, Iran and Pakistan at 74% ,42.5% and 94% respectively. [28, 29] The relatively low prevalence rate of NSI in our sample (27.2%) does not necessarily reflect fewer injuries and good adherence to safety guidelines given the lack of reporting systems in Uganda. Developed countries like Germany and South Korea with robust reporting systems, standard operating procedures and accurate injury surveys have reported higher rates of NSI at 31.4% and 74% indicate that NSI is a serious challenge to healthcare industry. [29, 30] Thus, there may be significant underreporting of NSIs among HCWs in Uganda compared to nations with higher reported rates.

We found that female HCWs had a higher rate of NSIs compared to their male counterparts (59.7% vs. 40.3). This finding aligns with previous studies. [10, 29] and is likely due to fact that the number of female healthcare workers is by far higher than males in Ugandan hospitals. Indeed, many female HCWs are nurses who are on the frontline and are responsible for high-risk-activities. More so, women are more likely to experience stress at work than men due to gender inequality, often poor remuneration and burden of familial roles thus, more exposed to occupational risks. [31, 32] This contradicts studies done in USA where males were 4.5 times and in Nigeria were 10 times more likely to be injured than female HCWs. [23, 30] Similar to studies conducted in India at 70% and Iran at 57%, in this study the morning shift indicated the highest rate of NSI at 61%. [33, 34] This might be due to the small number of HCWs attending to the increased patient load at this period than any other shift. One study conducted in Ethiopia, in contrast, found that NSIs were most likely to occur on the night shift. [28]

The NSIs mostly occurred during drawing venous blood samples accounting for 49.4% of all incidents. [35, 36] However, several studies done indicate that most of the NSI occur during recapping of needles and injection. [37, 23] Kargin and Akyol [38] indicated in a study conducted in 3 hospitals in Turkey NSI were mainly attributed by injection needles at 35.8%. In another cross-sectional study done by Joukar et al. in 8 teaching hospitals of Rasht in Iran [39] the NSI were mainly due to recapping at 37.1%.

The underreporting of NSI by HCWs is documented in several studies ranging from 22–99%. [22, 27] The rate of reporting of NSI was 23.4% in this study, which is low compared with several studies. [37, 29] Furthermore, Bowman and Bohnker showed that underreporting of NSI was more prevalent in the civil health system than US military facilities. [40] This is in contrast with the findings of this study where NSI prevalence was similar in the two hospitals. Many reasons cited for underreporting were perception of low-risk infection, ignorance that it should be reported, time constraint and incident reporting protocols. [28] In contrast, in a study done by Maniar et al. [22] indicated that there was no underreporting among healthcare workers. Unfortunately, in Uganda HCWs do not consider incident reporting protocol with immense gravity. In this study, reasons adduced for underreporting were perception of low risk infection transmission at 68.9%.

### **Limitations Of The Study**

Although this study has added depth and breadth to the picture of needle stick injury among healthcare workers it was cross-sectional in design. Hence, variables identified as being significantly associated with NSI may not be assumed to be predictive. A more accurate estimation of the number of and the types of NSI among healthcare workers would be to validate self-reports with administrative records, which was not possible for this study given the lack of an adequate reporting system in Uganda. Given this study is based on self-reports from HCWs, there is a likelihood of underreporting due to social desirability and recall bias respectively is likely.

## **Conclusion**

Health and safety coupled with administrative controls will always remain a top priority in Health care industry. The implementation of PPE and development of institutional policies to achieve this goal more effectively is of obvious benefit to Uganda's health system. The risk factors associated with needle stick injury identified in the models proposed, including younger age, early work shifts, and lack of training on safety should inform future efforts to reduce NSIs in Uganda. Considering the health and legal concerns from NSIs, there is a need to evaluate work safety policies, infection control practices and universal precaution tools in Ugandan health facilities. Finally, systems to track and intervene on NSIs is sorely needed in countries like Uganda.

### **What The Paper Adds**

Little data exists on NSIs in Uganda, with the more recently national data being over 18 years old. This study identified the prevalence and risk factors contributing to needle stick injury among Healthcare

workers in the military health systems of Uganda along with a public facility. NSIs occurred in over a quarter of HCWs and were associated with risk factors such as younger age, time of day, and type of procedure which could inform prevention efforts.

## **Abbreviations**

HCWs: Healthcare Workers; UPDF: Uganda Peoples Defense Forces; NCD: Non- Communicable Diseases; NSIs: Needle Stick Injuries; LMIC: low middle-income countries; WHO: World Health Organisation; HBV: Hepatitis B Virus; HCV: Hepatitis C Virus; GDP: Gross Domestic Product; SSA: sub-Saharan Africa; NGO: Non-Government Organization; PPE: Personal Protective Equipment; KMH: Kakiri Military Hospital.

## **Declarations**

### **Supplementary information**

The questionnaire and data set available from the corresponding author on request.

### **Ethics approval and consent to participate**

Ethical approval was obtained from the Ethics Committee of International Health Science University and UPDF 1<sup>st</sup> Division Kakiri Barracks. All respondents were informed of the study purpose and procedure in detail and volunteered to participate in this study. Written informed consent was obtained from all respondents prior to the study.

### **Consent for publication**

Not applicable.

### **Availability of data and materials**

All data generated or statistical analyses during this study are included in this published article.

### **Competing interests**

The authors declare that they have no competing interests

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### **Authors' contributions**

RKB was responsible for the survey, statistical analysis and interpretation of the data. EDO was responsible for the survey, statistical analysis and interpretation of the data. CKH was responsible for advising on statistical analyses and editing the manuscript. All authors wrote, read and approved the final manuscript.

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