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Needlestick Injury Exposure and Knowledge among Sudanese Healthcare Workers, in Khartoum State

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ABSTRACT

Needle stick injuries (NSIs) are one of the most common routes for the spread of blood-borne infections, including HIV and hepatitis B and C is through needle stick injuries (NSIs), posing significant occupational risks to healthcare workers (HCWs). In environments where occupational safety practices are insufficient, these risks are heightened. This study aimed to assess the exposure and knowledge of NSIs among HCWs in Khartoum State. A hospital-based cross-sectional study was conducted between September 2022 and March 2023. A total of 300 healthcare workers participated by completing a structured questionnaire. The survey covered demographic data, exposure to needle stick injuries, and post-exposure actions. Data was analyzed using version 23 of SPSS. Frequencies and percentages were calculated for categorical variables. The Exposure of NSIs among healthcare workers in the past six months was 38.7% (116/300). Of those injured, 21.3% (64/300) experienced one injury, while 12.7% (38/300) had two injuries, and 5% (15/300) reported three or more injuries. A significant portion (58.3%) of injuries went unreported, mainly due to being too busy or perceiving the exposure as insignificant. The primary causes of NSIs were improper needle recapping and handling. Recapping needles with two hands was a common practice, with 37% of healthcare workers doing so incorrectly. The Exposure of NSIs among HCWs was moderate, but underreporting and unsafe practices, such as needle recapping, remain problematic. Strengthening awareness, improving reporting systems, and encouraging the use of personal protection equipment and other safety protocols are essential to reduce NSI risks and improve occupational safety.

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INTRODUCTION

Needlestick injuries (NSIs) occur when sharp medical instruments, such as IV cannulas, hypodermic needles, or blood collection needles, inadvertently puncture the skin. Inadequate handling, hazardous disposal, or dangerous behaviors like recapping needles, transferring specimens carelessly, or failing to dispose of needles in appropriate puncture-proof containers are frequently the causes of these injuries [1]. Healthcare professionals face significant occupational hazards from needle stick injuries and similar exposures due to their daily exposure to sharp objects. About 3 million HCWs are impacted by these incidents each year, making them a major global occupational hazard [2]. In addition to causing physical harm, NSIs are a significant source of bloodborne diseases such as hepatitis B, hepatitis C, and HIV" [3]. Additionally, studies revealed that HBV can persist for up to a week in the right circumstances and has been detected on incorrectly disposed of needles, raising the possibility of infection [4].

Sharps injuries put additional strain on healthcare services and resources, in addition to posing health risks and causing emotional distress among healthcare workers, which results in missed workdays [5]. Healthcare workers who suffered from such injuries in 2000 experienced 16,000 cases of hepatitis C (HCV), 66,000 cases of hepatitis B (HBV), and 1,000 cases of HIV. These infections have a major impact because estimates indicate that between 2000 and 2030, they will cause 736 premature deaths from HIV, 261 from HBV, and 145 from HCV [6]. The three primary medical devices that cause most of these injuries are hollow-bore needles, suture needles, and IV equipment. However, the most common cause of injuries among preoperative nurses and surgical staff is suture needles [7]. Percutaneous injuries are frequent during surgery, which raises the possibility of exposing patients and medical personnel to bloodborne infections [8]. Sharps injuries are

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significantly increased when universal precautions are not followed, which doubles the likelihood of getting hurt [9]. The frequency of these incidents is higher among nursing students and nurses than among other healthcare workers [10]. Because most of the nursing education takes place in clinical settings, students practice vital skills like giving injections, taking blood samples, and implementing glucometer-based blood glucose testing under the observation of their teachers. However, they are more likely than seasoned nurses to sustain needlestick injuries (NSIs) because of their inexperience and lack of knowledge when it comes to handling needles and other sharp objects [11].

Researcheshas also revealed that many healthcare professionals, including nursing students, are not sufficiently informed about the hepatitis B virus (HBV) and the measures that should be taken to avoid bloodborne infections. The Joint United Nations Program on HIV/AIDS and the World Health Organization (WHO) advise rigorous adherence to standard precautions to shield healthcare personnel from exposure to bloodborne pathogens like hepatitis and HIV to reduce these risks. Employing standard PPE (gloves, gowns, masks, and face shields). when necessary, as well as practicing safe injection techniques, are some of these precautions [12].

The risk of HIV transmission can be significantly mitigated through implementing a dependable system for reporting injuries and guaranteeing the prompt administration of post-exposure prophylaxis (PEP), as per UK guidelines [13]. One important component of workplace initiatives aimed at lowering the spread of bloodborne infections is the prevention of needlestick injuries (NSIs). By adhering to established PEP protocols, the risk of disease transmission can be reduced after exposure. The prompt administration of hepatitis B immune globulin (HBIG), the hepatitis B vaccine, and/or HIV PEP when required, as well as the prompt Thorough assessment of the source and exposed person, represents critical components in exposure incident management guidelines for healthcare workers (HCWs) exposed to bloodborne pathogens. Testing should be done to keep an eye out for possible infection in cases of HCV exposure [14].

With the ability to spread over 20 distinct bloodborne pathogens through bodily fluids, Needlestick injuries (NSIs) represent one of the most common occupational hazards in healthcare environments. These injuries pose a significant risk of transmitting bloodborne pathogens, including human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV). The purpose of this research was to evaluate Sudanese healthcare workers' exposure, expertise, and knowledge of NSIs.

METHODS

This descriptive cross-sectional study was conducted in hospitals across Khartoum State, Sudan, between September 2022 and March 2023. The study aimed to assess the Exposure and Knowledge of Sudanese healthcare workers (HCWs) regarding needle stick injuries (NSIs). The study population comprised HCWs from various roles, including house officers, medical officers, registrars, consultants, laboratory technicians, and nurses, who were actively working in hospitals in Khartoum State during the data collection period. Inclusion criteria included all HCWs employed and working in the participating hospitals throughout data collection. The participants were allocated to the study population using the random systematic sampling technique The sample contained (N=340) calculated using the infinite sample size formula for estimating exposure, however, due to logistical constraints, the final number of responses collected was 300. Data were collected using a structured questionnaire designed to gather information on demographic characteristics, exposure to NSIs, and knowledge regarding their prevention and management. The questionnaire also assessed participants' knowledge and attitudes toward NSIs. The tool was adapted based on a previously validated questionnaire from a similar Knowledge, Attitudes, and Practices (KAP) study conducted in the same context [15]. Trained research assistants administered the questionnaires to HCWs during their work shifts across various departments in the participating hospitals. Participants were briefed on the study's purpose, and written informed consent was obtained prior to participation. Collected data were kept confidential and anonymous. Data were entered into statistical software, and Descriptive statistical analysis was performed, presenting categorical data as frequencies and relative percentages. The study, titled "Sudanese Healthcare Workers' Needle Stick Injury Exposure and Knowledge," The research was carried out in compliance with ethical guidelines governing studies with human participants. Ethical approval was obtained from the Ethics Committee of the University of Medical Sciences and Technology (UMST). Each participant provided written informed consent before being included in the study.

RESULTS

A study was conducted at hospitals within Khartoum State, consisting of 300 healthcare professionals. Female participants constituted a majority, representing 58% (n=174) of the study population, while males comprised the remaining 42% (n=126). Medical Officers comprised the largest professional group, accounting for 38.7% (n=116) of the participants. Nurses followed, representing 32.33% (n=97). The remaining participants were distributed across various other healthcare professions, including House Officers/Under Training (9.7%, n=29), Registrars (9.5%, n=27), Laboratory Technicians (8.7%, n=26), and

Consultants (1.67%, n=5). 44% (n=132) were aware of the last universal precautions guidelines for needle stick injury. Only 32.3% (n = 97) attended a biosafety course before. Of those who attended a biosafety course before, 75 of them were trained. 59.7% (n=179) reported the presence of occupational health services in their hospital. 37% reported good knowledge of the local hospital policy regarding needlestick injuries.

Table 1. Knowledge of healthcare workers (HCWs) regarding needle stick injuries (NSIs)

Knowledge		
Question	**Frequency**	**%**
1. Are you familiar with the term 'post-exposure prophylaxis' (PEP)		
Yes	208	69.3
No	92	30.7
Total	300	100
2. Hepatitis B virus (HBV) is efficiently transmitted through exposure to infected blood		
Yes	295	98.3
No	1	0.3
I don't know	4	1.3
Total	300	100
3. Hepatitis B virus (HCV) is efficiently transmitted through exposure to infected blood		
Yes	265	88.3
No	22	7.3
I don't know	13	4.3
Total	300	100
4. HIV AIDS efficiently transmitted through exposure to infected blood		
Yes	289	96.3
No	5	1.7
I don't know	6	2
Total	300	100
5. In case of a needlestick injury, your immediate action should be		
Wash the affected area thoroughly with soap and running water	133	44.3
Clean the wound with an antiseptic solution	104	34.7
Rinse with water only	56	18.7
Wash with water and an antiseptic	2	0.7
Take immunoglobulin	1	0.3
Running water over the site of the stick	1	0.3
Put my hand under running tap water	1	0.3
Open running water under my hand for 5 minutes	1	0.3
Nothing to do	1	0.3
Total	300	100
6. For needlestick exposures involving HCV-positive patients, direct viral detection via HCV RNA PCR should be performed at 6 weeks post-exposure.		
Yes	142	47.3
No	19	6.3
I don't know	139	46.3
Total	300	100
7. For needlestick injuries involving HCV-positive patients, HCV antibody testing should be conducted at 4-6 months post-exposure.		
Yes	119	39.7
No	40	13.3
I don't know	141	47
Total	300	100
8. All occupational sharps injuries must be reported immediately following facility protocols.		
Yes	279	93
No	21	7
Total	300	100
9. Use recapping technique after the needle is done		
Yes	249	83

No	51	17
Total	300	100
10. Technique of recapping		
One hand	189	63
Two hands	111	37
Total	300	100

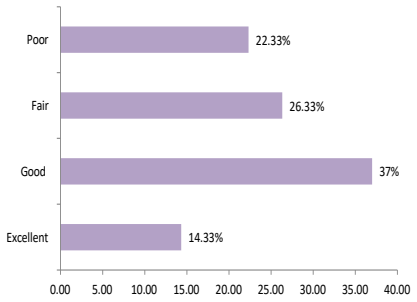

Figure 1. Knowledge of the local hospital policy toward needle stick injury

Among the 300 participants, the distribution of needle stick injuries in the last six months is as follows:

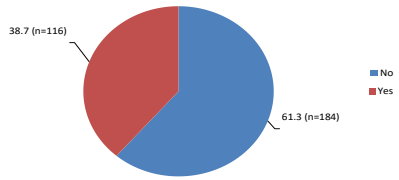

Figure 2: Exposure of needle stick injury.

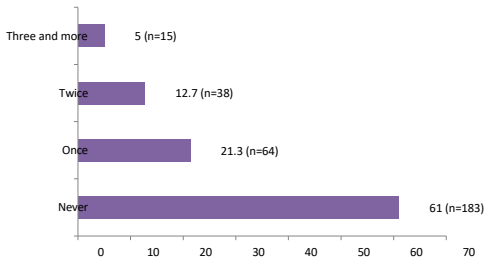

Figure 3: frequency of needle stick injury during the last six month

DISCUSSION

Needle stick injuries (NSIs) are a major occupational risk for healthcare workers (HCWs), posing a key pathway for the transmission of bloodborne infections such as HIV, hepatitis B, and hepatitis C viruses. The risk of NSI transmission is exacerbated in settings characterized by suboptimal occupational safety protocols. This study investigated the Exposure and Knowledge of NSIs among HCWs within Khartoum State, Sudan, and evaluated HCW knowledge and exposure practices concerning NSI prevention and management.

The results of this study indicate a moderate level of needle stick injury (NSI) exposure among healthcare workers (HCWs). In Khartoum State, Sudan, 38.7% of the participants reported at least one incident in the previous six months. This exposure aligns with studies conducted in similar settings, such as in Ethiopia and Saudi Arabia, where exposure rates varied due to factors like training, work environment, and access to personal protective equipment (PPE) (16,17) A significant observation from the study was the high rate of unreported incidents (58.3%), attributed primarily to time constraints and perceived insignificance of the exposure. This underreporting trend is consistent with findings in other studies, underscoring the need to address barriers to reporting, as timely intervention is crucial for reducing occupational risks (18).

The study showed that while a majority of HCWs understood the risks associated with NSIs, gaps in practice and preventive measures remained, particularly in the use of PPE. For example, only 37.3% of the HCWs wore gloves during NSI-prone procedures, often citing lack of availability as the reason. The need for stricter adherence to PPE usage has been emphasized in the literature, as it serves as a critical preventive measure against exposure to bloodborne pathogens (19). Additionally, 83% of participants practiced needle recapping, with 37% using a two-handed technique, a method widely recognized as unsafe. This finding is in line with the World Health Organization's (WHO) recommendations against recapping needles to prevent injury risks (20).

Post-exposure prophylaxis (PEP) uptake was also notably low, with less than a quarter of HCWs seeking PEP following an incident, despite general awareness of its importance. This underutilization of PEP is problematic as it may increase the risk of disease transmission in cases of high-risk exposure. Comparable studies, such as those conducted in sub-Saharan Africa, report similar findings and suggest that ongoing training and monitoring are essential to ensure PEP protocol compliance (21).

The study identified significant associations between NSI occurrence and specific healthcare procedures, particularly blood sampling and suturing. Disposable syringes and suture needles were the most common devices involved, supporting findings from previous research where similar devices posed high injury risks for HCWs (22, 23). Furthermore, injuries were frequently reported in

high-stress and high-traffic environments, such as emergency and operating rooms, indicating that certain departmental practices and workflow pressures may contribute to increased injury risk (24). Several factors that have been shown to reduce NSI rates in healthcare settings were identified, including regular training, the establishment of reporting systems, and adherence to standard safety protocols. Studies have demonstrated that educational interventions on universal precautions and NSI prevention can significantly improve knowledge and reduce injury rates
(25). The need for comprehensive educational programs is evident from the low percentage (32.3%) of HCWs in this study who had attended a biosafety course, a finding that is consistent with studies conducted in developing countries where resources for training and protective measures may be limited (26). The findings underscore the urgent need for structured interventions to strengthen NSI prevention measures in Sudanese healthcare facilities. These interventions should encompass regular training programs, ensuring an adequate supply of personal protective equipment (PPE), and promoting a culture of prompt reporting following any exposure. To mitigate NSI-related risks effectively, it is recommended that occupational health services be strengthened, post-exposure prophylaxis (PEP) be readily accessible to healthcare workers (HCWs), and an environment be fostered where all injuries are reported and addressed without fear of reprisal.
However, this study was subject to several limitations. Primarily, ongoing conflict within the study area posed significant financial and logistical challenges. The war significantly impacted the daily lives of both researchers and participants, potentially affecting data collection and the overall feasibility of the study. Specifically, the conflict resulted in a reduction of the planned sample size from 340 to 300. This reduction may have decreased the statistical power of the study, potentially limiting the ability to detect subtle but significant differences or associations. Furthermore, the conflict could have introduced selection bias, as certain healthcare workers may have been less accessible or willing to participate due to safety concerns, potentially affecting the generalizability of the findings to the broader population of HCWs in Khartoum State.

CONCLUSION

This study highlights the ongoing occupational health challenges associated with needle stick injuries (NSIs) among healthcare workers (HCWs) in Khartoum State, Sudan. Despite general awareness of NSI risks and transmission pathways of bloodborne pathogens like HIV, HBV, and HCV, there remain critical gaps in preventive practices, reporting, and post-exposure management. The study identified significant areas needing improvement, including training on universal precautions, consistent use of personal protective equipment (PPE), particularly gloves, and adherence to safe needle-handling protocols, such as avoiding two-handed recapping. Additionally, the low uptake of post-exposure prophylaxis (PEP) highlights a gap in immediate response practices that could mitigate transmission risks following exposure incidents.
Strengthening hospital policies on occupational safety, coupled with regular and comprehensive training for HCWs on NSI prevention and PEP protocols, is essential. Additionally, creating supportive environments for immediate injury reporting, along with ensuring availability of PPE and PEP, is crucial for reducing NSI occurrences and improving HCW safety. This study reinforces the need for a structured, multi-faceted approach to NSI prevention and control to protect HCWs in Sudan and similar settings, ultimately improving the overall standard of healthcare safety.

Ethical Approval and Consent to Participate:
Ethical approval was obtained from the Ethical Committee of the University of Medical Sciences and Technology (UMST). Prior to participation, written informed consent was secured from all study participants.

Competing Interests:
The authors declare that they have no competing interests.

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