AWARENESS AND PRACTICE OF INJECTION SAFETY AMONG THE STAFF NURSES WORKING IN EL-BEYDA MEDICAL CENTER

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ABSTRACT:
Background: Needlestick injuries (NSIs) are a major occupational hazard for health care workers (HCWs), particularly nurses, and are an important route of transmission for blood-borne infections such as hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV). Injection safety remains a neglected area in many low- and middle-income countries, and data from Libyan hospitals are scarce.

Objectives: To assess nurses' awareness and practices related to injection safety, to determine the prevalence and patterns of NSIs, and to identify selected factors associated with NSIs among nurses working in El-Beyda hospitals, Libya.

Methods: A hospital-based cross-sectional study was conducted among 220 nurses working in different departments of El-Beyda hospitals. Data were collected using a structured, self-administered questionnaire and an observation checklist. The questionnaire assessed socio-demographic and professional characteristics, awareness of injection safety, self-reported injection practices, history and circumstances of NSIs, HBV vaccination status, and previous training. Descriptive statistics were used to summarize the data, and the chi-square (χ^2) test was applied to examine associations between NSI occurrence and selected variables. A p-value of <0.05 was considered statistically significant.

Results: Most participants were female (77.0%) and aged 20–30 years (43.18%). Overall, nurses demonstrated generally good awareness of injection safety; the majority recognized that NSIs can transmit blood-borne infections and were aware of key preventive measures such as handwashing, glove use, and proper sharps disposal. Nevertheless, unsafe injection practices were common. More than three-quarters of nurses reported always or frequently recapping needles after use, a considerable proportion reported bending needles before disposal, and nearly one-third admitted occasional reuse of syringes or needles. Only about one-third always used gloves when administering injections.
The prevalence of NSIs was high: approximately 66.8% of nurses reported having experienced at least one NSI, and more than one-third reported multiple NSIs. Hasty work and needle recapping were the most frequently reported contributing factors, followed by lack of precautions during blood drawing and intravenous (IV) insertion. HBV vaccination coverage was very low; only 22.27% of nurses reported being vaccinated against HBV. None of the nurses reported formally documenting their NSIs through an institutional reporting system.
There was a statistically significant association between NSI occurrence and years of work experience ($\chi^2 = 8.270$, $p = 0.016$), with the highest NSI prevalence observed among nurses with 5–9 years of experience. Awareness level was also significantly associated with NSIs ($\chi^2 = 6.665$, $p = 0.036$), although higher awareness was paradoxically linked to higher reported NSI prevalence, likely reflecting reporting bias. No significant associations were found between NSIs and academic qualification, previous training on injection safety, or regular supervision ($p > 0.05$).

Conclusion: Despite generally good awareness of injection safety among nurses in El-Beyda hospitals, unsafe practices and a high prevalence of needlestick injuries persist. The combination of frequent NSIs, extremely low HBV vaccination coverage, and almost complete absence of NSI reporting indicates a serious and preventable occupational health problem. There is an urgent need for

comprehensive interventions, including mandatory HBV vaccination for all at-risk staff, practical skills-based training focused on eliminating needle recapping and other unsafe practices, ensuring adequate supplies of personal protective equipment and safety boxes, and establishing a simple, non-punitive NSI reporting and follow-up system to protect nurses and improve patient safety.

Keywords: needlestick injuries; injection safety; nurses; hepatitis B virus; occupational exposure; Libya.

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INTRODUCTION

The World Health Organization defines injection safety as "an injection administered with appropriate equipment, causing no harm to the recipient, exposing the provider to no avoidable risk, and resulting in no waste that poses a danger to the community" (World Health Organization, 2010). Health care workers (HCWs) are at high risk of acquiring blood-borne infections such as those caused by hepatitis B virus (HBV) through needlestick injuries (NSIs)..

Injections are found to be the most common health care procedure in both formal and informal health care sectors nowadays. (Bolarinwa OA, et al., 2012 & Akeem BO, et al., 2011) It is estimated that each year at least 50% of the world's injections are administered unsafely, mainly in developing countries. (World Health Organization, 2010).

The practices of unsafe injections not only harm the patient but also carry risks to the health care workers (Gyawali S, et al., 2013). According to WHO estimation in 2000, unsafe injection was responsible for 501000 deaths in the past and will be responsible for 9 million years of life lost between 2000 and 2030. (World Health Organization, 2010). A report from the United States suggests that unsafe injection practices were responsible for 18 outbreaks of viral hepatitis between 2001 and 2011. Needlestick injury (NSI) is defined as an unintentional penetration of the skin by a needle or other sharp object that has been in contact with blood or body fluids (Akeem BO et al., 2011; Gyawali S et al., 2013). NSIs among health care workers (HCWs) are a common and serious occupational hazard. According to World Health Organization (WHO) estimates, approximately 1 in every 10 HCWs worldwide experiences at least one NSI each year (Arafa A et al., 2012).

Many blood-borne infections can be transmitted through unsafe injections and NSIs, including human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV) (Prüss-Üstün A et al., 2003; Hauri A et al., 2004). The World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) have emphasized that most NSIs can be prevented by adhering to standard precautions and using safety-engineered devices. Universal precautions, appropriate use of personal protective equipment (PPE), and proper sharps disposal are therefore critical components of safe injection practices (Gurung NS et al., 2010; Siddique K et al., 2008; WHO, 2010).

Safe injection practices comprise a series of preventive measures designed to ensure the administration of injections to patients is conducted safely; a "safe injection" must not harm the recipient, must protect the healthcare provider from potential risks, and must not create hazardous waste for the community (WHO, 2002). Four main potential risks might pose a direct patient hazard, namely re-use of injection equipment, where administration of about 16 billion injections are encountered worldwide with about 40% of which involves re-use of injection equipment (Hauri A, et al.,2004) accidental needle stick injuries (NSIs) for health care provider resulting in a total of 3 million accidental NSIs in a WHO survey (Pruss-Ustun A,etal.,2003) ; overuse of injections, where various surveys conducted in different settings indicated a high (up to 56%) (Hutin YJ, etal.,2003) and unsafe sharps, waste disposal, where inappropriate collection and disposal of sharp wastes put the health care practitioner and the waste handler including the community at risk of sharps injuries with consequential blood-borne infections (WHO,2010).

Safe injection practices are integral to standard precautions, designed to ensure fundamental patient safety and provider protection. This requires the proper administration of injections by a qualified healthcare professional, utilizing complete aseptic techniques and sterile devices (such as syringes and needles), followed by appropriate disposal in a puncture-proof sharps container. Proper disposal of injectable equipment is essential to prevent the reuse of disposable syringes and to reduce the potential risks faced by healthcare workers (HCWs). Inadequate syringe disposal and needlestick injury incidents indicate a significant disparity between healthcare providers' knowledge and their practices; thus, modifications in injection-related behaviors are necessary, potentially achieved by ongoing training and consistent auditing and supervision. Following the training of healthcare workers on injection safety and waste management, there was a notable reduction in behavior related to needle recapping and an increase in the utilization of safety boxes (Mantel C, et al., 2007).

List of abbreviations
NSI – Needlestick injury
NSIs – Needlestick injuries
HBV – Hepatitis B virus
HCWs – Health care workers
WHO – World Health Organization
CDC – Centers for Disease Control and Prevention
PPE – Personal protective equipment
IV – Intravenous
PCL – Proficiency Certificate Level (Nursing)
PBN – Post Basic Nursing (or the correct term used in your setting)
BN – Bachelor of Nursing
BScN – Bachelor of Science in Nursing

The aim of the study is to assess awareness and the practice of injection safety and to determine the factors associated with it among nurses working in El-B Medical Center.
Material and methods: A cross-sectional study was carried out in El-Beyda hospitals from March 2023 to June 2023. A sample size of 220 nurses was selected randomly. A questionnaire and observation checklist were used to gather the information. Nursing education, work experience, and training on injection safety (universal precautions).

Study design and setting: This hospital-based cross-sectional study was conducted at El-Beyda hospitals (El-Beyda Medical Center), located in El-Beyda city, Libya. The study focused on nurses working in different clinical departments where injections and invasive procedures are routinely performed.

Study population and sample the target population consisted of all nurses providing direct patient care in the selected hospitals during the study period. A total of 220 nurses were included using a convenient sampling method based on availability and willingness to participate. Inclusion criteria were: (1) being a registered nurse or auxiliary nurse currently employed in the hospital, (2) having at least six months of clinical experience, and (3) being involved in injection administration and/or handling of sharp instruments. Nurses who were on long-term leave or refused to participate were excluded.

Data collection tools Data were collected using a standardized, structured questionnaire and an observation checklist. The questionnaire consisted of two main parts:
- Part I: socio-demographic and professional characteristics (age, sex, marital status, years of work experience, nursing qualification, and work area).
- Part II: items assessing awareness of injection safety, self-reported injection practices, and experience with needlestick injuries (NSIs), including frequency and circumstances of NSIs, post-exposure actions, and training on universal precautions.

The observation checklist was used to assess actual injection practices and sharps disposal behaviors in clinical areas, including handwashing before injection, use of gloves, recapping and bending of needles, reuse of syringes or needles, and use of safety boxes for sharps. Where applicable, the questionnaire and checklist were adapted from existing WHO guidance on safe injection practices, with minor contextual modifications to fit the local setting.

Tools of study: A standardized questionnaire, separated into two parts, was utilized to evaluate awareness, safe injection procedures, and incidents of unintentional NSIs and sharps disposal. The questionnaire was adapted from the World Health Organization (WHO) Revised Injection Assessment Tool (Tool C) with minor contextual modifications (WHO, 2008).

Results: A cross-sectional study indicates that there were 220 nursing cases in El-Beyda hospitals in El-Beyda city through the collection of data, as shown in Table 1, during the period from March 2023 to June 2023. From our data**,** Figure (1) shows that out of 220 nurses, females (77%) were more prominent than males (23%).

Table 1: Description of study population (n=220)

Variables	***n***	***%***
Current age in years		
20-30	*95*	***43.18***
31-40	*54*	***24.54***
41-50	*52*	***23.63***
51-60	*18*	***8.18***
> 60	*1*	***0.45***
Nursing qualification		
Auxiliary Nurse Midwife	*3*	***1.36***
Staff Nurse (PCL Nursing)	*7*	***3.18***
PBN	*90*	***40.90***
BScN and above	*120*	***54.54***
Work experience in years		
0-4	*65*	***29.54***
5-10	*50*	***22.73***
≥10	*105*	***47.72***
Training on injection safety		
Received	*182*	***82.72***
Not received	*38*	***17.27***
Immunization against HBV		
Immunized	*49*	***22.27***
Not immunized	***172***	***78.18***

Table 1 shows that more than half of the nurses (54.5%) had a Bachelor of Science in Nursing (BScN) degree or higher, while 40.9% held Post Basic Nursing (PBN) qualifications. A small proportion were staff nurses with a Proficiency Certificate Level (PCL) in Nursing (3.18%), and only 1.36% were auxiliary nurse midwives.

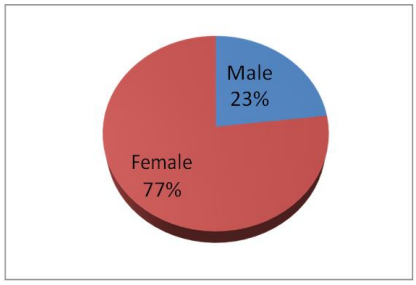

Figure 1: sex distribution

Figure 2 shows the age distribution among the 220 nurses. Our data shows that 43.18% were within the age group 20–30 years, followed by 24.5% at 31-40, 23.6% in the age group 41-50, and 8.18% within the age group 51-60.

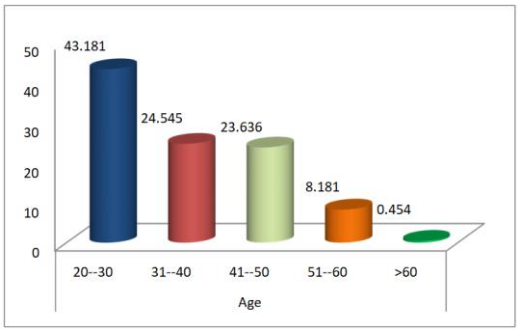

Figure 2: Age distribution

Most of the nurses (47.7%) had more than ten years' experience, followed by (29.5%) with experience of four years and (22.7%) with less than ten years of experience. Only more than two-thirds (82.7%) had received training on universal precaution and injection safety. Similarly, Figure 3 shows that only 22.2% of the nurses were vaccinated against hepatitis B virus (HBV), while the remaining 77.8% had not received HBV vaccination.

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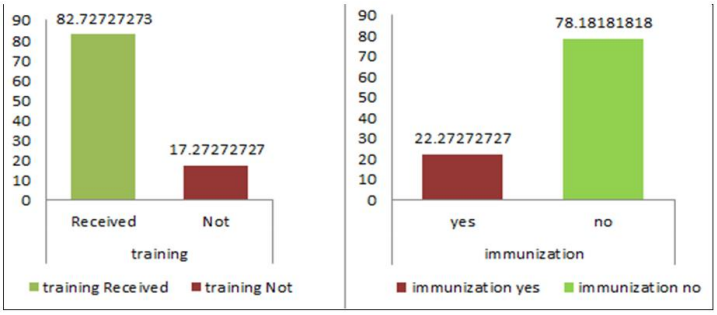

Figure 3: received training and vaccinated against HBV

In Table 2, our study indicated that awareness of diseases transmitted by NSI, appropriate disposal of used sharps, non-reuse of syringes and needles, and the use of dry cotton for cleaning the injection area was very high (around or above 90%). Awareness of hand washing before injection (86.36%) and the need to wear gloves (83.18%) was also high. However, awareness regarding the risk of recapping needles after use was lower (60.9%).

Most of the nurses (60.9%) reported that they practiced recapping, and many (61%) reported that they practiced recapping regularly. Only one nurse (0.45%) reported reusing the same syringe and needle for the same patient; about 219 nurses (99.5%) did not reuse syringes.

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Table 2: Awareness of injection safety (n=220)

Awareness on	***(n≈ yes) %***	***(n≈ No) %***
Diseases transmitted by NSI	(202) 91.81%	(18) 8.18 %
Possible causes of NSI	(193) 87.72%	(27) 12.27%
Measures to be taken after NSI	(150) 68.18%	(70) 31.81%
recapping of needles after use	(134) 60.90%	(86) 39.09%
Hand washing proceeding injection	*(190) 86.36%*	*(30) 13.63%*
Use of gloves proceeding injection	*(183) 83.18%*	*(37) 16.81%*
Appropriate disposal after use	*(201) 91.36%*	*(19) 8.63%*
No use of used syringes or needle	*(219) 99.54 %*	*(1) 0.45%*
Use of dry cotton for cleaning area	*(198) 90%*	*(22) 10%*

Table 3: Exposure to Needle Stick Injury (n=220)

Variables	n	%
Frequency of NSI		
Not at all	*73*	*33.2*
At least one time	*67*	*30.4*
Two-five times	*82*	*36.4*
Cause for NSI (n=158)		
Recapping needles	*162*	*73.6*
Lack of precaution in IV inserting	*109*	*49.5*
Hasty works	*171*	*77.7*
Lack of precautions in drawing blood	*146*	*66.3*
Applied preventive measures		
Applied	*5*	*2.27*
Not applied	*215*	*97.7*
Reported NSI to institution		
Reported	*0*	*0*
Not reported	*220*	*100*

Overall, exposure to NSIs among the 220 nurses was reported as follows: 33.18% had never experienced an NSI, 30.45% had experienced it once, and 37.27% had experienced NSIs more than two times (Figure 4).

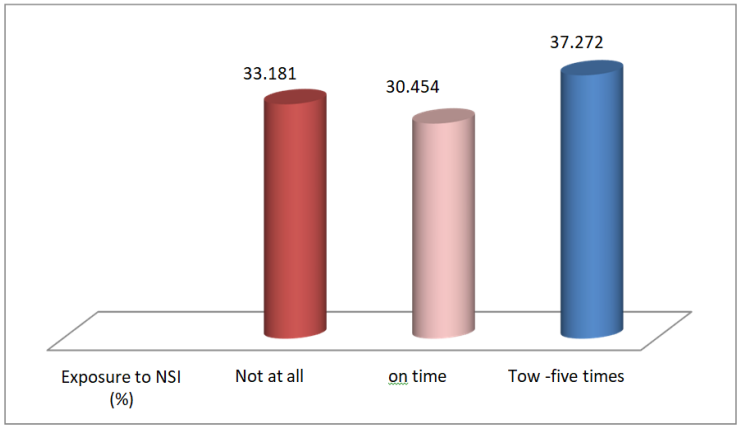

Figure 4: Exposure to needlestick injury (NSI)

According to table 5, of 220 nurses, a high percentage (57.3%) of respondents report always recapping needles. This is an unsafe practice, as recapping is a major cause of needlestick injuries. Worryingly, only 5.9% state they always avoid recapping. The majority (71.8%) of respondents report never reusing the same syringes and needles, which is a positive finding and a fundamental aspect of safe injection practice. However, 2.3% of reports are always reusing them, which is a critical lapse in safety. The majority (51.4%) report never bending needles or syringes. However, a notable portion (15.5%) always bends them. Bending is an unsafe practice that increases the risk of injury and is not recommended. A strong majority (63.2%) report always washing hands before proceeding with injection. Only 1.8% never wash their hands. This number indicates a generally good adherence to this basic infection control measure. The adherence to wearing gloves is mixed. While 32.7% always wear them, a larger combined percentage (47.7%) report doing so sometimes (33.6%) or never (14.1%). Glove use is lower than handwashing, suggesting an area for improvement. Most respondents (66.4%) report always using dry cotton for cleaning the injection area. This shows good compliance with preparation procedures.

Table 5: Injection safety practice (n=220)

Variables	N	%
Recapping needles		
Always	126	57.3
Frequently	46	20.9
Sometimes	35	15.9
Never	13	5.9
Reusing the same syringes and needles		
Always	5	2.3
Frequently	7	5.5
Sometimes	50	22.7
Never	158	71.8
Bending of the needles or syringes		
Always	34	15.5
Frequently	16	7.3
Sometimes	57	25.9
Never	113	51.4
Washing hand proceeding injection		
Always	139	63.2
Frequently	43	19.5
Sometimes	34	15.5
Never	4	1.8
Wearing gloves proceeding injection		
Always	72	32.7
Frequently	43	19.5
Sometimes	74	33.6
Never	31	14.1
Using dry cotton for cleaning area		
Always	146	66.4
Frequently	12	5.5
Sometimes	36	16.4
Never	26	11.8

Table 6: Association of needle stick injury with different variables

Variables	Incidence of needle stick injury			Chi-square	P-value
	Yes	No	Total		
Academic qualification in nursing					
Auxilary nurse midwife	32 (71.1)	13 (28.9)	45	2.112	0.348
Staff Nurse (PCL nursing)	109 (74.1)	38 (25.9)	147		
BN/BScN and Above	17 (60.7)	11 (39.3)	28		
Work experience					
0-4 years	133 (72.7)	50 (27.3)	183	8.270	0.016*
5-9 years	16 (88.9)	2 (11.1)	18		
≥ 10years	9 (47.4)	10 (52.6)	19		
Training on injection safty					
Received	51 (76.1)	16 (23.9)	67	0.881	0.348
Not received	107 (69.9)	46 (30.1)	153		
Regular supervision					
Yes	103 (73.6)	37 (26.4)	140	0.585	0.444
No	55 (68.8)	25 (31.2)	80		
Level of awareness					
Good	95 (74.8)	32 (25.2)	127	6.665	0.036*
Average	48 (75.0)	16 (25.0)	64		
Poor	15 (51.7)	14 (48.3)	29		

***Statistically significant**
Figure in parentheses shows percentage

Table 6 examines the relationship between various professional and training factors and the incidence of needlestick injury (NSI). The statistically significant associations ($P < 0.05$) are particularly important, as they suggest a genuine relationship between the variables.

Work Experience (P = 0.016): The highest incidence of NSI (88.9%) is found among those with 5-9 years of work experience; the lowest incidence (47.4%) is observed in the most experienced group (≥ 10 years).

The findings suggest that the risk of NSI may peak in the mid-career stage (5-9 years); the decrease in NSI for those with 10 years suggests that long-term experience and mastery of procedures lead to safer practices. Level of Awareness (P = 0.036): respondents with poor awareness reported the lowest incidence of NSI (51.7%), while those with good or average awareness reported a higher incidence (74.8% and 75.0%, respectively).

This is a counterintuitive finding. One might expect lower NSI incidence with adequate awareness. This could be due to reporting bias: individuals with good awareness may be more aware of the occurrence of NSI and thus more likely to accurately report them; individuals with poor awareness may be less likely to recognize or report a minor NSI.

Non-Significant Associations (P > 0.05): Academic Qualification in Nursing (P = 0.348).
The difference in NSI incidence across different academic levels (Auxiliary Nurse Midwife, Staff Nurse, BN/BScN, and Above) is not statistically significant. The highest incidence is among staff nurses (74.1%). Training on Injection Safety (P = 0.348) There is no statistically significant correlation between the acquisition of injection safety training and the incidence of needlestick injuries (NSIs). Those who received training had a slightly higher NSI incidence (76.1%) than those who did not receive training (69.9%).

This suggests that the presence of training may not be enough: the quality, content, and application of the training need to be evaluated and improved to translate knowledge into safer behavior. Regular Supervision (P = 0.44): The presence of regular supervision did not have a statistically significant effect on NSI incidence.

DISCUSSION

This study assessed injection safety practices and the prevalence of needle stick injuries (NSI) among 220 nurses in El-Beyda hospitals. The demographic analysis revealed a predominantly female workforce (77%) with a relatively young age profile, as the majority (43.18%) were between 20 and 30 years old.

A critical finding of this study is the disconnect between high theoretical awareness and unsafe practical application. While awareness regarding the transmission of diseases via NSI (91.8%) and the need for proper disposal (91.3%) was high, dangerous practices remain prevalent. Specifically, the recapping of needles, a major risk factor for injury, was practiced by a significant majority, with 60.9% of nurses reporting this behavior. Furthermore, 57.3% of respondents admitted to always recapping needles. This suggests that knowledge alone is insufficient to ensure safety compliance.
In terms of occupational health protection, the study found a critical gap in immunization coverage. Despite the high risk of exposure, only 22.2% of nurses were immunized against Hepatitis B Virus (HBV).
Statistically, work experience showed a significant association with NSI (P = 0.016), peaking in mid-career nurses (5-9 years of experience). Interestingly, training on injection safety showed no significant reduction in NSI incidence, suggesting that current training programs may be theoretical rather than behavioral in nature.

This study found 38 of the nurses (17.2%) had not received training on injection safety. The finding of this study is not consistent with studies conducted in Ethiopia.
(Aderaw Z., 2013) (66.9%) and in Bangladesh (Chowdhury AKA, et al., 2014) (73%). Many studies [1, 2, 14-17] highlighted that the less attention provided in training in developing countries was associated with needless-stick injuries. Vaccination against Hepatitis B among the nurses in this study was slightly lower (22.2%) than in studies conducted in Pokhara (82.3%), Rawalpindi (Siddique K, et

al., 2010) (82.7%), and Karachi (93%). Special attention must be provided to establish provision of HBV immunization to all the employees**.**

The findings of this study revealed that 39.0% of nurses were aware of no recapping after giving an injection, which is about half of a study conducted in Surat (Bhandari TR, et al., 2012) in 2011 (64%). Various studies (Adejumo PO, et al., 2013 & Zafar A, et al., 2008) suggested recapping as one of the contributing factors for NSI. A self-reported questionnaire showed that almost all the nurses (86.3%) were aware of handwashing before injection practice in this study, but a study conducted in Kathmandu (Bhandari TR., et al., 2008) showed only 72.9% were aware of it. This study indicated 83.1% of nurses were aware of the use of gloves while giving injections, which is slightly lower when compared with the study conducted in Surat, India (Bhandari TR, et al., 2012 in 2011), where all nurses were aware of it, but much higher than a study conducted in Kathmandu (66.1%). Nearly all (96.4%) nurses were aware that used syringes and needles should be discarded in a puncture-proof container or safety box, while a study conducted in Nigeria (Adejumo PO, et al., 2014) found that about three-fourths (76.1%) of nurses were aware of this practice. NSI is an important cardinal indication of poor injection safety practices by health workers. (Akeem BO, et al., 2011) However, this study found that 66.8% of nurses were exposed to NSI, like a study conducted in a tertiary care teaching hospital in Pokhara (70.79%). But it is lower than a study conducted in a tertiary care hospital in India (Gurung NS, et al., 2010) (80.1%). This high rate of exposure to NSI is primarily caused by the widespread practice of recapping needles. The risk of transmission of bloodborne disease due to NSI is high among all health care workers.

CONCLUSION

This study revealed that, although nurses in El-Beyda hospitals have generally good awareness of injection safety, unsafe injection practices and a high prevalence of needlestick injuries (NSIs) remain major problems. Recapping and bending of used needles, occasional reuse of syringes and needles, inconsistent use of gloves, and inadequate post-exposure actions were common. Approximately two-thirds of nurses reported having experienced at least one NSI, and more than one-third reported multiple NSIs.

The situation is further aggravated by very low coverage of hepatitis B virus (HBV) vaccination among nurses and the near-complete lack of formal NSI reporting. Factors such as mid-career work experience and high workload contributed to NSIs, while academic qualification, existing training, and supervision did not show a protective effect. These findings highlight an urgent need for effective, system-wide interventions to improve injection safety, protect nurses from occupational hazards, and reduce the risk of transmission of blood-borne infections in El-Beyda hospitals.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

1. **Implement a mandatory HBV vaccination program** for all nurses and other at-risk health care workers, free of charge and with proper documentation, to address the very low hepatitis B virus (HBV) immunization rate.
2. **Strengthen training on injection safety** by shifting from predominantly theoretical sessions to practical, skills-based programs that emphasize elimination of needle recapping, avoidance of bending or breaking needles, safe sharps handling, and correct post-exposure management after NSIs.
3. **Ensure continuous availability of essential supplies**, including puncture-proof sharps containers (safety boxes), personal protective equipment (PPE) such as gloves, and adequate hand hygiene facilities in all clinical areas where injections are administered.
4. **Establish a simple, non-punitive NSI reporting and follow-up system** that encourages nurses to promptly report injuries, ensures timely access to post-exposure prophylaxis and counseling, and generates reliable data for monitoring and prevention.
5. **Address workload and work organization issues** by reviewing staffing levels and workflow in high-risk units, with the aim of reducing hasty work and time pressure that contribute to unsafe practices.

6. **Integrate regular monitoring and supportive supervision** focused specifically on injection practices and sharps disposal, using observation checklists and feedback, to reinforce safe behaviors and identify areas needing improvement.
7. **Promote a culture of safety** within the hospital by engaging nursing leadership, infection prevention and control committees, and hospital management in continuous quality improvement initiatives related to injection safety and occupational health.

Ethical Approval

An ethical approval to conduct this research has been obtained from the research studies office of Omer Al-Mukhtar University.

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