

Assessment of Knowledge, Attitude & Practice of Primary Health Care Workers Toward Needle Stick Injury

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Abstract

Background: Needle stick injuries (NSIs) are the percutaneous injuries that are caused by needles, such as hypodermic needles, blood collection needles, intravenous stylets, and needles used to connect parts of intravenous delivery systems. This study aimed to improve safety of health care workers (HCWs) and hence improve their performance.

Methods: This an interventional study was conducted on 104 personell of primary health care centers (PHCs) including health care workers (physicians, nurses, technicians) of both sexes, who were working in the PHC centers at Fakous district, Sharqia Governorate during from January 2020 to January 2021.

Results: There was high statistically significant association between history of needle stick injury and history of HBV vaccination as positive history of HBV vaccination (Three doses) was associated with positive history of needle stick injury. There was high statistically significant improvement in knowledge of the study participants about standard precautions of infection control after intervention except for waste disposal. Before intervention, the highest proportion of adequate knowledge was about waste disposal (93.3%) while the lowest proportion of adequate knowledge was about sterile instruments and devices (15.4%).

Conclusion: The effect of health education was remarkable in improving the development of knowledge and increasing awareness of health care providers about infection control guidelines.

Keywords: Needle stick injuries, Health Education, PHCs

INTRODUCTION:

Needle stick injuries (NSI) are wounds caused by needles that accidentally puncture the skin, are truly an occupational hazard for medical personnel⁽¹⁾.

These injuries are usually caused by hypodermic needles, blood collection needles, intravenous cannulas, etc. during use, recapping, transferring samples, post procedure cleaning, or disposal in non-puncture proof containers⁽²⁾.

Percutaneous injuries, caused by needle sticks and other sharps, are a serious concern for all health care workers (HCWs) and pose a significant risk of occupational transmission of blood borne pathogens⁽³⁾.

Because of the environment in which they work, many HCWs from physicians, surgeons, and nurses to house keeping personnel, laboratory technicians and waste handlers are at an increased risk of accidental needle stick and sharps injuries(4).

According to WHO, approximately 66000 HBV, 16000 HCV and 200-5000 HIV accidental infections occurs to HCWs each year(2).

The incidence of NSI is considerably higher than current estimates, due to gross under-reporting (often less than 50%). In USA 6,00,000 to 10,00,000 receive NSI from conventional needles and sharps every year, while in UK it is 1,00,000 HCWs/year. In India, authentic data on NSI are scarce. It is known that around 3-6 billion injections are given per year, of which 2/3rd injections are unsafe (62.9%) and the use of glass syringe is constantly associated with higher degree of unsafety(5).

In developing countries, the incidence of needlestick injuries is much higher. Several studies conducted in India, Nepal, Pakistan, Nigeria report that the annual incidence of NSIs is usually more than 50% (6).

Aim of the work:

This study was designed to assess knowledge, attitude & practice of PHC workers toward needle stick injury at Fakous district and to evaluate health education program about how to prevent & manage of NSI, so as to improve HCWs safety and hence improving their performance.

SUBJECTS AND METHODS:

This study was conducted on a sample of primary health care centers (PHCs) at Fakous district, Sharqia governorate during from January 2020 to January 2021. **Inclusion criteria were;** Health care workers (physicians, nurses, technicians) of both sexes, who are working in the PHC centers at Fakous district, Sharqia Governorate. Using OPEN-EPI, the sample size was calculated to be 104. Assuming that the total knowledge score before and after health education were 54.54% and 81.57% respectively at 95% CI and 80% power of test (7).

Sampling technique:

Through a multistage sampling technique, Fakous health district was selected randomly to represent Sharqia governorate (which administratively divided into 17 major cities according to **Sharkia.gov.eg, 2018**). The study was conducted at primary health care centers (PHCs) of Fakous district which were 37 centers. This study was done in 3 urban primary health care centers and 17 rural primary health care centers. According to the number of health care workers which were 556 the sample size was 104. The sample was collected by simple random sample technique (Health care workers including physicians, nurses and technicians).

Operational Design:

All subjects included in this study were interviewed and the questionnaire sheet was filled for each of them, including personal data, knowledge of the study participants about standard precautions of infection control, attitude of the study participants towards

infection control and infection control practice, to assess their knowledge, attitude towards needle stick injury and to assess the prevalence of needle stick injury then we made health education programme was structured and applied on the studied health care workers focusing in definition, type of NSI, prevention and post exposure prophylaxis, common diseases transmitted by NSI, how to deal if NSI has been happened, universal precautions specially hand hygiene and its importance, how to hand wash, how to hand rub, personal protective equipment and its importance. The visits to each selected center was done at different days in order to ensure complete week coverage. The observation was done after taking permission from each participant. The researcher started to fill the items of personal data & knowledge by asking the participants. All subjects included in this study were interviewed and the questionnaire sheet was filled in by them to assess their knowledge, attitude towards needle stick injury and to assess the prevalence of needle stick injury then health education programme about needle stick injury was introduced to them, after 3 months we repeated the questionnaire to evaluate the effect of health education programme. Filling the checklist took 10 – 30 minutes for each participant.

Administrative design & Ethical considerations:

Approval was obtained from an Institutional Reviewing Board at faculty of medicine Zagazig University (IRB): 5907-22-1-2020. Permission from the health directorate at Fakous district was taken. Informed consent from the participant was taken after explaining the purpose of the study. They were reassured about the strict confidentiality of any obtained information, and about that the study result would be used only for purpose of search.

Data analysis:

The collected data were coded, entered, presented, and analyzed by computer using a data base software program, Statistical Package for Social Science (SPSS) version 20. For quantitative variables mean, standard deviation (SD), and median were computed. Qualitative data were represented as frequencies and percents. Independent t-test (t) was used for detection of difference between different quantitative variables. Chi square (X²) or Fisher's exact tests were used to detect relation between different qualitative variables. Pearson correlation (r) was used to find the association between total score of knowledge and practice. Binary logistic regression analysis was used for prediction of the most significant factors. Probability value is considered significant at 0.05.

RESULTS:

Table (1): Demographic characteristics and history of NSI related data of the study participants:

Demographic characteristics	Study participants (n=104)
Age (years): Mean ± SD Range	37.3 ± 8.3 25.0 – 58.0
Sex, n (%): Male Female	23 (22.1%) 81 (77.9%)
Occupation, n (%): Physician Dentist Nurse Technician	13 (12.5%) 12 (11.5%) 61 (58.7%) 18 (17.3%)
Qualification, n (%): Bachelor degree Nursing school diploma Technical institute	30 (28.9%) 56 (53.8%) 18 (17.3%)
Experience years: Mean ± SD Range	14.4 ± 8.6 0.2 – 38.0
Training courses on infection control, n (%): Yes No	55 (52.9%) 49 (47.1%)
History of needle stick injury, n (%): Positive Negative	18 (17.3%) 86 (82.7%)
History of HBV vaccination, n (%): Never One dose Two doses Three doses	21 (20.2%) 7 (6.7%) 0 (0.0%) 76 (73.1%)

SD: standard deviation

This table shows that mean age of the study participants was 37.3 years old, 77.9% were females, 58.7% were nurses, 53.8% had Nursing school diploma, mean experience years was 14.4, 52.9% had training courses on infection control, 17.3% had positive history of needle stick injury and 73.1% had three doses of HBV vaccine.

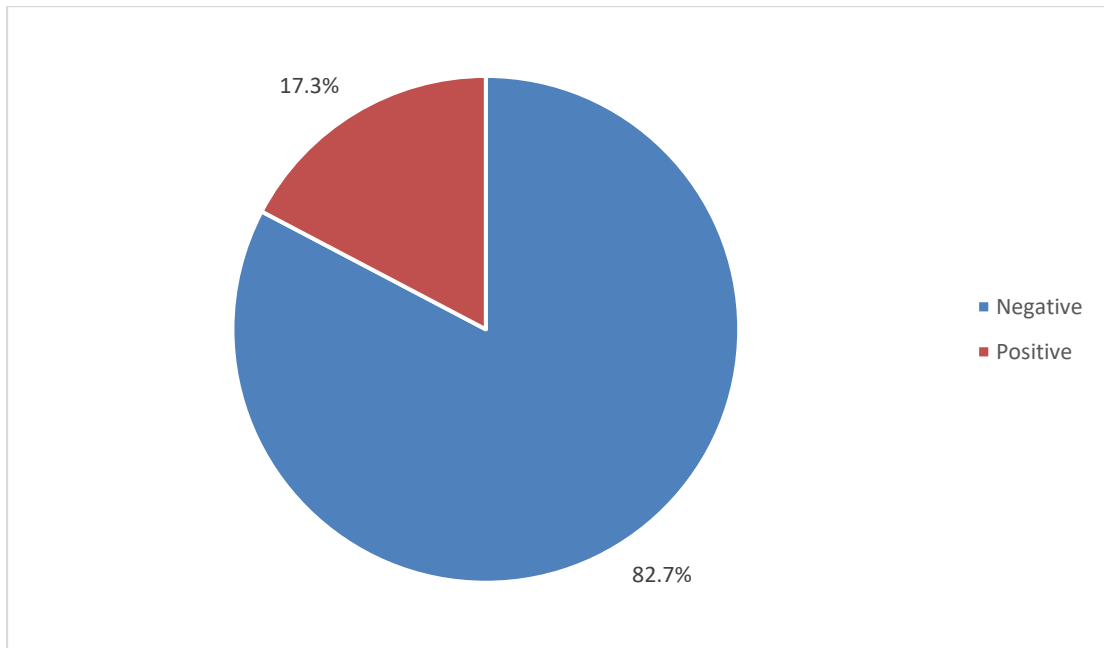


Figure (1): History of needle stick injury in the study participants:

Table (2): Association between history of needle stick injury and demographic characteristics of the study participants:

Demographic characteristics	History of needle stick injury		Test of sig.	P
	Positive (n=18)	Negative (n=86)		
Age (years): Mean \pm SD	36.4 \pm 8.3	38.5 \pm 8.3	t 1.3	0.2
Sex, n (%): Male (n=23) Female (n=81)	1 (4.3%) 17 (21.0%)	22 (95.7%) 64 (79.0%)	χ^2 3.5	0.06
Occupation, n (%): Physician (n=13) Dentist (n=12) Nurse (n=61) Technician (n=18)	3 (23.1%) 1 (8.3%) 13 (21.3%) 1 (5.6%)	10 (76.9%) 11 (91.7%) 48 (78.7%) 17 (94.4%)	χ^2 3.4	0.3
Qualification, n (%): Bachelor degree (n=30) Nursing school diploma (n=56) Technical institute (n=18)	4 (13.3%) 13 (23.2%) 1 (5.6%)	26 (86.7%) 43 (76.8%) 17 (94.4%)	χ^2 3.4	0.2
Experience years: Median Range	15.5 2.0 – 38.0	12.0 0.2 – 36.0	MW 1.3	0.2

Training courses on infection control, n (%):			χ^2	
Yes (n=55)	11 (20.0%)	44 (80.0%)	0.6	0.4
No (n=49)	7 (14.3%)	42 (85.7%)		
History of HBV vaccination, n (%):			χ^2	
Never (n=21)	0 (0.0%)	21 (100%)	47.1	<0.001
One dose (n=7)	1 (14.3%)	6 (85.7%)		HS
Three doses (n=76)	17 (22.4%)	59 (77.6%)		

χ^2 : Chi square test HS: Highly significant (P<0.01).
SD: standard deviation MW: Mann wittny test

This table shows that there was high statistically significant association between history of needle stick injury and history of HBV vaccination as positive history of HBV vaccination (Three doses) was associated with positive history of needle stick injury.

Table (3): Association between total knowledge level before intervention and demographic characteristics of the study participants:

Demographic characteristics	Total knowledge level		Test of sig.	P
	Adequate (n=33)	Inadequate (n=71)		
Age (years):			T	
Mean \pm SD	38.1 \pm 8.8	36.9 \pm 8.1	0.7	0.5
Sex, n (%):			χ^2	
Male (n=23)	8 (34.8%)	15 (65.2%)	0.1	0.7
Female (n=81)	25 (30.9%)	56 (69.1%)		
Occupation, n (%):			χ^2	
Physician (n=13)	9 (69.2%)	4 (30.8%)	16.2	0.001
Dentist (n=12)	7 (58.3%)	5 (41.7%)		S
Nurse (n=61)	13 (21.3%)	48 (78.7%)		
Technician (n=18)	4 (22.2%)	14 (77.8%)		
Qualification, n (%):			χ^2	
Bachelor degree (n=30)	19 (63.3%)	11 (36.7%)	19.6	<0.001
Nursing school diploma (n=56)	10 (17.9%)	46 (82.1%)		HS
Technical institute (n=18)	4 (22.2%)	14 (77.8%)		
Experience years:			MW	
Median	13.0	12.0	0.4	0.7
Range	0.2 – 38.0	2.0 – 36.0		
Training courses on infection control, n (%):			χ^2	
Yes (n=55)	21 (38.2%)	34 (61.8%)	2.2	0.1
No (n=49)	12 (24.5%)	37 (75.5%)		
History of HBV vaccination, n (%):			χ^2	
Never (n=21)	4 (19.0%)	17 (81.0%)	6.4	0.04
One dose (n=7)	0 (0.0%)	7 (100%)		S
Three doses (n=76)	29 (38.2%)	47 (61.8%)		

χ^2 : Chi square test HS: Highly significant (P<0.01).
SD: standard deviation MW: Mann wittny test S:significance

This table shows that there was high statistically significant association between total knowledge level before intervention and some demographic characteristics of the study participants. Physicians and dentists had significantly more adequate knowledge than nurses and technicians. Also, Bachelor degree was associated with more adequate knowledge. On other hand, none of participants who had one dose only of HBV vaccine, had adequate knowledge.

Table (4): Association between general attitude before intervention and demographic characteristics of the study participants:

Demographic characteristics	General attitude		Test of sig.	P
	Positive (n=85)	Negative (n=19)		
Age (years): Mean ± SD	38.2 ± 8.6	33.1 ± 5.1	t 2.5	0.01 S
Sex, n (%): Male (n=23) Female (n=81)	20 (87.0%) 65 (80.2%)	3 (13.0%) 16 (19.8%)	χ^2 0.5	0.5
Occupation, n (%): Physician (n=13) Dentist (n=12) Nurse (n=61) Technician (n=18)	13 (100%) 12 (100%) 49 (80.3%) 11 (61.1%)	0 (0.0%) 0 (0.0%) 12 (19.7%) 7 (38.9%)	χ^2 10.8	0.01 S
Qualification, n (%): Bachelor degree (n=30) Nursing school diploma (n=56) Technical institute (n=18)	30 (100%) 44 (78.6%) 11 (61.1%)	0 (0.0%) 12 (21.4%) 7 (38.9%)	χ^2 12.2	0.002 S
Experience years: Median Range	14.0 0.2 – 38.0	10.0 4.0 – 22.0	MW 2.4	0.01 S
Training courses on infection control, n (%): Yes (n=55) No (n=49)	50 (90.9%) 35 (71.4%)	5 (9.1%) 14 (28.6%)	χ^2 6.6	0.01 S
History of HBV vaccination, n (%): Never (n=21) One dose (n=7) Three doses (n=76)	10 (47.6%) 4 (57.1%) 71 (93.4%)	11 (52.4%) 3 (42.9%) 5 (6.6%)	χ^2 72.0	0.002 S

χ^2 :Chi square test S:significance

SD: standard deviation MW:Mann wittny test

This table shows that there was a statistically significant association between total attitude level before intervention and some demographic characteristics of the study participants. Physicians and dentists had significantly more positive attitude than nurses and technicians. Also, older age, higher experience years, bachelor degrees were associated with more positive attitude. History of attending training courses on infection

control was associated with positive attitude. All participants who had positive history of needle stick injury had positive attitude. History of receiving three doses of HBV vaccine was associated with positive attitude.

Table (5): Association between total practice level before intervention and demographic characteristics of the study participants:

Demographic characteristics	Total practice level		Test of sig.	P
	Satisfactory (n=60)	Unsatisfactory (n=44)		
Age (years): Mean ± SD	36.4 ± 8.3	38.5 ± 8.3	t 1.3	0.2
Sex, n (%): Male (n=23) Female (n=81)	15 (65.2%) 45 (55.6%)	8 (34.8%) 36 (44.4%)	χ^2 0.7	0.4
Occupation, n (%): Physician (n=13) Dentist (n=12) Nurse (n=61) Technician (n=18)	7 (53.8%) 6 (50.0%) 36 (59.0%) 11 (61.1%)	6 (46.2%) 6 (50.0%) 25 (41.0%) 7 (38.9%)	χ^2 0.5	0.9
Qualification, n (%): Bachelor degree (n=30) Nursing school diploma (n=56) Technical institute (n=18)	15 (50.0%) 34 (60.7%) 11 (61.1%)	15 (50.0%) 22 (39.3%) 7 (38.9%)	χ^2 1.0	0.6
Experience years: Median Range	12.0 0.2 – 38.0	14.5 2.0 – 34.0	MW 1.3	0.2
Training courses on infection control, n (%): Yes (n=55) No (n=49)	27 (49.1%) 33 (67.3%)	28 (50.9%) 16 (32.7%)	χ^2 3.5	0.06
History of HBV vaccination, n (%): Never (n=21) One dose (n=7) Three doses (n=76)	17 (81.0%) 5 (71.4%) 38 (50.0%)	4 (19.0%) 2 (28.6%) 38 (50.0%)	χ^2 7.0	0.03 S

χ^2 :Chi square test

S:significance

SD: standard deviation

MW:Mann wittny test

This table shows that there was a statistically significant association between total practice level before intervention and history of HBV vaccination as receiving three doses of HBV vaccine was associated with unsatisfactory practice.

Table (6): Binary logistic regression analysis of Total knowledge and General attitude with significantly related independent factors:

Variables	B	Wald	Sig.	Odds ratio (95% CI)
Adequate knowledge:				
Occupation (Physician)	2.9	16.6	0.001*	18.3 (4.5 – 74.0)
Occupation (Dentist)	1.7	6.1	0.01*	3.3 (1.3 – 8.6)
Occupation (Nurse)	0.04	0.28	0.6	1.0 (0.89 – 1.2)
Occupation (Technician)	-2.9	7.4	0.007*	0.04 (0.003 – 0.52)
Qualification (Bachelor degree)	1.8	6.2	0.01*	3.3 (1.3 – 8.6)
Qualification (Nursing school diploma)	22.5	0.001	0.99	2.2 (0.0 – 27.0)
Qualification (Technical institute)	-2.0	4.0	0.04*	0.14 (0.02 – 0.97)
History of HBV vaccination (Never)	-21.2	1.8	0.7	0.67 (0.45 – 1.8)
History of HBV vaccination (One dose)	-1.1	1.3	0.3	0.33 (0.05 – 2.2)
History of HBV vaccination (Three doses)	0.04	0.28	0.6	1.0 (0.89 – 1.2)
Positive attitude:				
Age	-0.6	3.0	0.08	0.56 (0.29 – 1.1)
Occupation (Physician)	2.2	18.1	0.001*	8.6 (3.2 – 23.5)
Occupation (Dentist)	0.76	5.4	0.02*	5.2 (1.9 – 27.8)
Occupation (Nurse)	18.0	0.001	0.99	6.6 (0.0 – 77.3)
Occupation (Technician)	-2.6	5.5	0.01*	0.05 (0.003 – 0.65)
Qualification (Bachelor degree)	1.7	6.2	0.01*	3.3 (1.3 – 8.6)
Qualification (Nursing school diploma)	0.61	1.8	0.7	0.67 (0.45 – 1.8)
Qualification (Technical institute)	-2.9	7.6	0.006*	0.04 (0.003 – 0.52)
Experience years	0.42	2.5	0.1	1.5 (0.91 – 2.5)
Training courses on infection control	-0.68	0.5	0.5	0.51 (0.08 – 3.1)
History of needle stick injury	22.0	0.001	0.99	8.1 (0.0 – 99.0)
History of HBV vaccination (Never)	-3.0	10.3	0.001*	0.05 (0.01 – 0.31)
History of HBV vaccination (One dose)	-2.7	7.3	0.007*	0.07 (0.01 – 0.48)
History of HBV vaccination (Three doses)	3.9	35.3	<0.001*	47.7 (13.3 – 170.8)

Binary logistic regression analysis revealed a significant model for the prediction of Total knowledge and General attitude.

Physicians and dentists had significantly more adequate knowledge while technicians had significantly the worst knowledge among healthcare providers. Bachelor degree was associated with more adequate knowledge while Technical institute was associated with inadequate knowledge. History of HBV vaccination was not significant in the regression model.

Regarding general attitude model, Physicians and dentists significantly more positive attitude while technicians had significantly more negative attitude. Bachelor degree was associated with more positive attitude while Technical institute was associated with negative attitude. Also, History of 3 doses of HBV vaccination was significantly associated with positive attitude but history of zero or one dose of HBV vaccination were significantly associated with negative attitude. Age, experience years, Training courses on infection control and History of needle stick injury were not significant in the regression model.

Table (7): Association between total knowledge level and attitude of the study participants before intervention:

Total knowledge level		
	r	P
General attitude	0.45	0.001

r: Pearson's correlation coefficient

This table shows that there was a statistically significant positive correlation between total knowledge level and attitude of the studied HCWs.

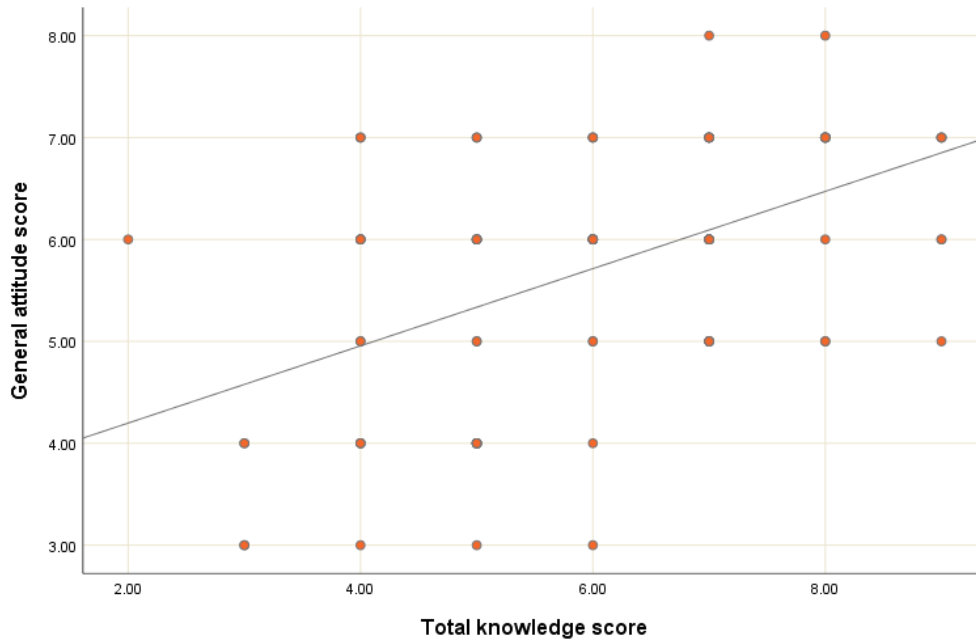


Figure (2): Correlation between total knowledge score and general attitude score of the study participants before intervention.

Table (8): Association between total knowledge level and practice of the study participants before intervention:

Total knowledge level		
	r	P
Total practice level	0.12	0.7

r: Pearson's correlation coefficient

This table shows that there was non-significant correlation between total knowledge level and practice of the studied HCWs.

Table (9): Association between attitude and practice of the study participants before intervention:

General attitude		
	r	P
Total practice level	- 0.04	0.8

r: Pearson's correlation coefficient

This table shows that there was non-significant correlation between attitude and practice of the studied HCWs.

DISCUSSION

In the current study, the mean age of the studied HCWs was 37.3 ± 8.3 , ranged 25 - 58 years old, males represented 22.1% of participants and females represented 77.9% (Table 1)

In the current study, physicians represented 12.5%, dentists 11.5%, nurses were 58.5% and technicians were 17.3% of studied personells (Table 1)

and this was in agreement with **El-Hazmi et al., 2008(8)** study that included 133 HCWs who reported NSIs, where nurses have been reported to be the major occupational group in their study (45%).

In our study, mean experience years was 14.4, 52.9% had training courses on infection control (Table 1)

In the current study, 28.9% of participants had Bachelor degree, 53.8% had Nursing school diploma and 17.3% had Technical institute (Table 1)

However in **Rapisarda et al., 2019(9)** study that included 3250 HCWs in Italy, where 32% had Bachelor degree, 35% had Masters degree and 15% had PhD.

In the current study, 18 person (17.3%) had positive history of needle stick injury, while 86 person (82.7%) had negative history of needle stick injury (Figure 1)

Salminen & Parantainen (2012)(10) revealed that needlestick injuries were the highest-ranking occupational injuries during 2006-2008 and made one fourth of the total occupational injuries. The study also reported more than fifty percent (54%) of needlestick injuries occurred among nurses, followed by 13% among physicians.

In our study the highest incidence of needle stick injuries was among female nurses (Table 2).

Muralidhar et al., 2010(4) study that consisted of 428 HCWs of various categories of a tertiary care hospital in New Delhi, and was carried out with the help of an anonymous, self-reporting questionnaire structured specifically to identify predictive factors associated with NSIs, among the HCWs with NSIs, nurses had the highest percentage 49(100%), followed by junior residents 21(87.5%), nursing students 64(85.3%), laboratory technicians 59(84.3%), interns 62(82.7%), senior residents 48(80%) and undergraduate students 40(53.3%), and this was in agreement with our study findings.

In contrast to our findings, **Salelkar et al., 2010(11)** study that included 622 HCWs in tertiary Indian hospital, as far as gender distribution was concerned 36.7% male and 34.2% female health care workers reported needle stick injuries however this difference was not statistically significant ($P=0.588$). Needle stick injuries were equally distributed across different work experience periods and no significant association was found between years of work experience and incidence of needle stick injuries.

In our study there was high statistically significant association between total knowledge level before intervention and some demographic characteristics of the study participants. Physicians and dentists had significantly more adequate knowledge than nurses and technicians. Also, Bachelor degree was associated with more adequate knowledge (**Table 4,figure 7,8**)

Gabr et al., 2018(12) study that included 2260 health care workers of 4 randomly chosen hospitals in Menoufia governorate documented that risk factors of NSIs included duration of working <15 years, being female, working as a para-medical, working in surgical ward, number of night shifts >2/week, absence of educational program sessions on prevention of NSIs, absence of firm hospital policies for NSIs and universal measures, recapping needles with two hand, not wearing gloves, and working >8 hours per day. In their study, less experienced health care workers were at higher risk of NSIs, which was in parallel with our study where the mean experience years was 14.4 ± 8.6 , ranged 0.2 - 38 years

Adams (2012)(13) states that there are variety of factors influencing needlestick or sharp injuries, type of devices and procedure undertaken, availability of training on safer sharp use and proper disposal, lack of knowledge and awareness of the consequences of NSIs. Similarly, duration of work experience and knowledge on universal precaution have significant correlation to needlestick injuries (**Holla et al. 2014)(14)**).

In the current study there was a statistically significant association between total attitude level before intervention and some demographic characteristics of the study participants. Physicians and dentists had significantly more positive attitude than nurses and technicians. Also, older age, higher experience years, bachelor degree were associated with more positive attitude. History of attending training courses on infection control was associated with positive attitude. all participants who had positive history of needle stick injury, had positive attitude. History of receiving three doses of HBV vaccine was associated with positive attitude (**Table 5**).

Recapping needles after use and the reluctance to wear protective gloves were independent risk factors for NSIs. Most published studies have recommended that training should be given in wearing gloves for every procedure in addition to using other protective equipment when dealing with patients to prevent occupational exposure to NSIs (**Yenesew et al., 2014)(15)**).

In the current study there was a statistically significant association between total practice level before intervention and history of HBV vaccination as receiving three doses of HBV vaccine was associated with unsatisfactory practice(**Table 6**).

Gabr et al., 2018(12) study illustrated that increased working hours, night shifts and negligence of universal precautions were also independent risk factors for NSIs.

Governmental hospitals are always overloaded, especially in certain wards like emergency and labor rooms. Therefore, health care workers are more likely to neglect and not to observe universal preventive measures (**Gourni et al., 2012**)(16).

The proportion of sharp injuries pertaining to each clinical specialty differed across various studies. These differences could be attributed to the type of sharp devices used and the variations in clinical practices between different health-care setting (**Tarantola et al., 2005**)(17).

Workplaces like Operation Theater, many years of work experiences, long working hours are commonly associated with the incidences of needlestick injuries in comparison to others (**Mideska & Fiyera, 2014**)(18).

In the current study, binary logistic regression analysis revealed a significant model for the prediction of Total knowledge and General attitude. Physicians and dentists had significantly more adequate knowledge while technicians had significantly the worst knowledge among healthcare providers. Bachelor degree was associated with more adequate knowledge while Technical institute was associated with inadequate knowledge. History of HBV vaccination was not significant in the regression model.

Regarding general attitude model, Physicians and dentists significantly more positive attitude while technicians had significantly more negative attitude. Bachelor degree was associated with more positive attitude while Technical institute was associated with negative attitude. Also, History of 3 doses of HBV vaccination was significantly associated with positive attitude but history of zero or one dose of HBV vaccination were significantly associated with negative attitude. Age, experience years, Training courses on infection control and History of needle stick injury were not significant in the regression model (**Table 7**).

This coincided with **Cui et al., 2018**(19) study who found that seniority and training programs were the risk factors associated with the occurrence of sharp injuries. HCWs whose seniority was > 20 years were associated with a decrease in risk for the occurrence of sharp injuries. However, HCWs who seldom attended training programs were associated with an increase in risk for the occurrence of sharp injuries. Sharp injuries often occur in HCWs whose seniority is of short duration. This may be the result of careless work, unskilled technology, nonstandard operations, and poor understanding of occupational safety (**Cui et al., 2018**)(19).

Cui et al., 2018(19) study showed the number of HCWs who often attended training programs was only 388 (43.1%), and 677 (75.1%) had standard infection prevention knowledge and showed that factors such as seniority, job category, title, education, department, and training more or less had an effect on the occurrence of sharp injuries ($P < 0.05$), and this was lower than what documented in our study where 52.9% attended training courses on infection control and 47.1% didn't attend. They also found that the incidence of sharp injuries among nurses (31.2%) was higher than that among doctors (19.9%). However, there was no statistically significant difference between male and female participants ($P = 0.103$). HCWs who seldom attended training programs were more prone to sharp injuries (33.3%) than those who often attended training programs (19.6%), and this was antagonistic to our results.

In the current study, there was a statistically significant association between total knowledge level and attitude of the study participants before intervention as all participants with adequate knowledge had positive attitude(**Table 8,figure 18**).

and this was antagonistic to **Meherdad et al (2013)(20)** reported significant increase in the number of reported NSIs after education intervention. The researchers argued that increased number of NSIs were because of increased knowledge and awareness about the needle stick injuries and reporting attitude rather than actual raise in the incidences of NSIs.

The results of **Abd-Ellatif et al., 2018(21)** study that included 76 internship nursing students in Assuit mentioned that 50 % of subjects had poor knowledge about the precautions to be taken to protect herself from needle stich injury before procedure in pretest, there was a highly significant statistical difference according to their performance about preparation of patient and equipment pre, during and after the procedure from pre to post program. This results was in line with **Melek, 2009(22)**, who reported that forty-nine percent of the students who responded sustained injuries; of these 74% were injured while onwards. The highest number (72.2%) had been injured by hollow-bore needles; 65.2% who were injured were not wearing gloves at the time of injury; 27% of injuries were associated with recapping the needle.

In the current study, there was no statistically significant association between total knowledge level and practice of the study participants before intervention(**Table 9**).

In the current study, there was no statistically significant association between attitude and practice of the study participants before intervention(**Table 10**).

This is in line with **Zhang, et. al., (2008)(23)**, in his comparative study on nursing students in Northern China which reported that the students showed a general absence of information on safety guidelines.

Hong Hong, et al., 2003(24), identified that structured training in prevention of occupational exposure to BBP improved knowledge and behavior and reduced the number of needle stick/sharp injuries among Chinese student nurses, compared with students who did not receive the training.

Conclusion:

In conclusion, the risk of exposure to NSIs is still high among health care workers. This underlines the importance of more comprehensive educational sessions in order to decrease the risk of acquisition of job-related blood-borne diseases.

The knowledge and practice of health care providers wasn't high enough in many of items of infection control in both urban and rural studied centers due to low training. The lack of knowledge, access or failure to use appropriate practice in the form of personal protective equipment contributes to increasing incidence of NSI among HCWs.

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