

ORIGINAL ARTICLE

Impact of Healthcare Workers Training on Safe Injection Practice at Fayoum University Hospitals

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ABSTRACT

Key words:
Injection safety,
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Background: Ensuring safe injection practice is one of the greatest challenges for healthcare system in developing countries. **Objectives:** to assess the injection safety practices by evaluating knowledge and practices of HealthCare Workers (HCWs) towards injection safety before and after training program, and to determine the incidence of needle stick injuries (NSIs) among HCWs. **Methodology:** A cross-sectional study was conducted at Fayoum University Hospitals from October 2016 to June 2017. Two hundreds HCWs working in eighteen departments were included. Questionnaire was used to collect information about knowledge, and 395 injection opportunities were observed using a standardized observation check list to detect practices of HCWs towards injection safety before and after training program. **Results:** Significant change in knowledge of HCWs was detected between pre and post training intervention ($p < 0.05$). Regarding the practices, significant improvement nearly in all items of observation checklist ($p < 0.05$) were observed. The incidence rate of NSI was 27/200 (13.5%). The best knowledge and practices mean percentage was obtained from neonatology staff ($p < 0.001$), and the poor knowledge ($p < 0.04$) and practices ($p < 0.02$) mean percentage were from internal medicine staff either pre or post training. **Conclusion:** Educational Intervention found to be effective in improvement of safety injection practices.

INTRODUCTION

A safe injection leads to protection of the recipient (patient) and health care workers (HCWs). Also it does not result in hazardous waste to community¹. Injection can spread infection to patient, health workers, waste handlers and even in common healthy people if not used and disposed properly².

Common infectious agents; Hepatitis B Virus (HBV), Human Immunodeficiency Virus (HIV), Hepatitis C Virus (HCV) and some bacterial infection; are related to unsafe injection practices. Some of these infectious agents can remain "silent" in the body for a long time before they cause symptoms. Thus, unsafe injections can lead to a silent epidemic that occurs many years after the original events³. Unsafe injection practices not only harm the patient but also carry risks to the (HCWs). Needle stick injury (NSI) is commonly encountered by the provider. Unfortunately, in developing countries, less number of HCWs are vaccinated against HBV and they work in adverse conditions where occupational hazards are very high compared to western countries⁴. Inappropriate disposal of syringes after injections is increasing significant health hazards and environmental pollution due to the

infectious nature of the waste. So, safe injection practice should involve administration of injection by a well-trained, qualified person using sterile syringe, needle, and disposing the used ones in a puncture-proof container. Any breach in the process makes the injections extremely unsafe and hazardous to HCWs as well as recipients².

Then interventions for promotion of injection safety make patients more informed consumers of health care services so that they demand safe injections, promote occupation safety of HCWs and safe disposal of injection equipment⁵. The aims of this study was to assess the injection safety practices and safe disposal of waste by evaluating knowledge and practices of HCWs towards injection safety at Fayoum University Hospitals, before and after training program. Also to determine the incidence of needle stick injuries among HCWs.

METHODOLOGY**Study design:**

A descriptive cross-sectional study (3 stages) to assess HCWs knowledge and practices of safety

injection and determine the incidence of needle stick injuries among HCWs.

Study setting:

The study was conducted over a period of 8 months from October 2016 to June 2017 at Fayoum University Teaching Hospitals (Surgical and Internal Medicine hospitals). Eighteen departments were included (general surgery, orthopedic, urology, cardiology, cardiothoracic intensive care unit (ICU), ENT, ophthalmology, surgical ICU, gynecology, operative rooms, medical ICU, pediatric, internal medicine, emergency rooms, pediatric ICU, neonatology, and outpatient clinics departments). The study included 200 HCWs (physicians and nurses of different age and sex).

Data collection:

The study included 3 stages:

Stage 1:

A structured self-administrated questionnaire was distributed to HCWs to assess the knowledge of HCWs about safety injection practices. Questions were formulated based on pre-existent questionnaires⁶. And according to WHO guidelines⁷ on the safety injection practices formed of the following two sections:

- First: demographic data which includes age, sex, occupation, name of the department.
- Second: included assessment of HCWs knowledge with: (4 questions about hand hygiene and use of personal protective equipment, 2 questions about skin preparation and 10 questions about giving safe injection and safe waste disposal, hepatitis B vaccination)

Practices of injections were observed using a standardized observation checklist (30 points), it included items about the facilities and precautions for injection safety (availability of labeled puncture-proof containers, and sterilized packed syringes). Three hundred and ninety five injections were observed. The right answer was scored as '2' and the wrong answer was scored as '0', with total score of "32" for knowledge and "60" for practice.

The incidence of needle stick injuries among HCWs were assessed by asking about previous (past) needle-stick injury. Good knowledge and practices were considered when obtaining a score over 75% while bad knowledge and practices were considered when the score below 50%⁸.

Stage 2:

Include intervention training program: A 48-hour, purposely-designed infection control education program was implemented for HCWs serving Fayoum University Hospital. It was structured as 2 hours sessions given twice a week for 12 weeks. This training consisted of lectures and practical demonstration. The educational program focused on safety injection practices: hand hygiene, personal protective equipment, steps for giving safe injection, environmental cleaning, waste management, prevention of needle stick injuries and sterilization, disinfection.

Stage 3:

After one month of the end of the training program there was another evaluation of their knowledge and practices using the same questionnaire and the check observation list.

Statistical analysis:

Data were entered into Microsoft Access and data analysis was performed using SPSS software version 18 in windows 10.

Simple descriptive analysis in the form of numbers and percentages for qualitative data, and arithmetic means as central tendency measurement, standard deviations as measure of dispersion for quantitative parametric data, and inferential statistic test.

Ethical considerations:

This study was approved by the Faculty of Medicine Research Ethical Committee. A written permission was obtained from the director of the hospital. The study was conducted after explaining the study objectives and ensuring confidentiality to the participants. An oral consent was obtained from HCWs before distributing the questionnaire. Each one had the right not to participate in the study or withdraw at any time.

RESULTS

A total of 200 HCWs participated in the study with 395 opportunities (practices). Females were more than males 144 (72%) versus 56 (28%) respectively. Age of HCWs ranged from 18 to 37 years with a mean age of (24.74± 4.3) years. One hundred and thirty two (66%) of HCWs worked in Surgery Hospital versus 68 (34%) worked in Internal Medicine Hospital. Significant improvement was observed after conduction of training program regarding knowledge and practice score categories (p <0.008), (p <0.002) respectively (table 1).

Table 1: Assessment of knowledge and practice score categories pre and post training.

Variables	Pre training		Post training		p-value
	No	%	No	%	
Knowledge					
Bad	16	8%	10	5%	0.008*
Fair	138	69%	120	60%	
Good	46	23%	70	35%	
Practice					
Bad	94	23.8%	70	17.7%	0.002*
Fair	267	67.6%	225	64.6%	
Good	34	8.6%	70	17.7%	

Table 2 shows significant changes in knowledge of HCWs regarding safety injection practices, before and after training intervention ($p < 0.05$). For example, the knowledge of use new sterile syringe for each injection changed from 54% to 86%. And the knowledge of sharp

objects should be kept in a safety box changed from 93% to 98%, also HBV vaccination changed from 19% to 61%. And the inspection of multidose vial contamination and expiry date changed dramatically from 37% to 100%.

Table 2: Knowledge before and after intervention among HCWs by The questionnaire

Questions	Before	After	P value
	Yes	Yes	
	No. (%)	No. (%)	
1: Routinely washing the hands	116 (58%)	160 (80%)	<0.001*
2: Using hand drying material	0(0%)	0(0%)	-----
3: Using alcohol based hand rub	159 (79.5%)	190 (95%)	<0.001*
4: Using a new pair of latex gloves for every injection	101 (50.5%)	170 (85%)	<0.001*
5: Preparing skin before giving injection by alcohol and leave it to dry	167 (83.5%)	186 (93%)	0.003*
6: Avoiding giving injection if skin integrity is affected by dermatitis or local infection	200 (100%)	200(100%)	-----
7: Using one sterile syringe for one time for each injection	108 (54%)	172 (86%)	<0.001*
8: Taking measures to prevent sudden movement of patient during injection	154 (77%)	178 (89%)	0.001*
9: Wiping multidose vial stopper with alcohol before giving medication	49 (24.5%)	108 (54%)	<0.001*
10: Touching the needle or site of injection with the finger	105 (52.5%)	78 (39%)	0.007*
11: Recapping needles	154 (77%)	78(39%)	<0.001*
12: Discarding needle that has been touched or contaminated in a safety box	174 (87%)	183(91.5%)	0.004*
13: Putting the used syringes and needles at the point of use in safety box	176 (88%)	195(97.5%)	0.001*
14: Knowing that the safety box must sealed before becoming completely full just till three quarter	186(93%)	196(98%)	0.02*
15: Inspecting multidose vial contamination, expiry date	74(37%)	200(100%)	<0.001*
16: Taking HBV vaccine	38(19%)	122(61%)	<0.001*

Table 3: Practices before and after intervention among HCWs by observation checklist

Questions	Before	After	P value
	Yes	Yes	
	No.(%)	No.(%)	
1: Preparation of each injection in a clean area	157 (39.7%)	258 (65.2%)	<0.001*
2: Using sterile water for preparation of injection	169 (43.7%)	258 (65.2%)	<0.001*
3:Inspecting medication for visible contamination and safety of the product(expiry date)	144 (36.4%)	285 (72.1%)	<0.001*
4:Using of pieces of gauze to break ampule	62 (15.8%)	216 (54.7%)	<0.001*
5: Taking measurements to prevent of sudden movement of patients	284 (71.9%)	340 (86.1%)	<0.001*
6 : Using sterile syringe and needle in each injection	361 (91.4%)	372 (94.2%)	0.13
7: Routine hand washing before injection patient	185 (46.8%)	278 (70.4%)	<0.001*
8: Using alcohol hand rub if soap was not available for hand hygiene before injection	204 (51.6%)	352 (89.2%)	<0.001*
9: Using new glove for each patient	323 (81.8%)	348 (88.1%)	0.01*
10: Touching needle with finger	81 (20.5%)	48 (12.2 %)	0.001*
11: Disinfecting the rubber opening with cotton swab soaked with alcohol before administration of medication	94 (23.8%)	236 (59.7%)	<0.001*
12: Disinfecting skin before injection	313 (79.3%)	329 (83.2%)	0.001*
13:Touching skin after skin preparation	133 (33.7%)	119(30.1%)	0.008*
14: Using piece of cotton to compress the site of injection	325 (82.3%)	377 (95.4%)	<0.001*
15:Covering the site of injection with adhesive bandage	362 (91.7%)	386 (97.7%)	0.001*
16: Removing the needle from the stopper of vial	344 (87.2%)	387 (98.1%)	<0.001*
	312 (79%)	343 (86.8%)	0.003*
18:Discarding needle in safety box	356 (90.2%)	384 (97.2%)	<0.001*
19:Safty box not third quarter full	337 (85.3%)	377 (95.4%)	<0.001*
20:Discarding gloves in red bag container	334 (84.6%)	377 (95.4%)	<0.001*
21:Cannula dressing is clean	307 (77.6%)	324 (82.1%)	0.13
22: Cleaning the surface from spill of blood in correct manner	255 (64.6%)	354 (89.5%)	<0.001*
23: Closing and sealing Safety box for transfer to a secure area	314 (79.5%)	359 (90.9%)	<0.001*
24: Availability of Syringes	336 (85.1%)	395 (100%)	<0.001*
25: Availability of Cannulas	331 (83.8%)	395 (100%)	<0.001*
26: Availability of Detergents	308 (78.2%)	333 (84.3%)	<0.001*
27: Availability of Alcohol gel	265 (67.1%)	395 (100%)	<0.001*
28: Availability of Gloves	339 (85.7%)	359 (90.9%)	0.007*
29: Availability of Safety containers	307 (77.8%)	341 (86.4%)	0.002*
30: Availability of Red bag container	327 (82.8%)	352 (89.2%)	0.01*

Table 3 shows significant improvement nearly in all items of observation checklist ($p < 0.05$) regarding the practices,: recap needles were reduced from 21% to 13.2% , the percentage of using a new pair of gloves for each injection was changed from 81.8% to 88.8% and hand hygiene was changed from 46.9 to 70.4%.

We found a total incidence rate of NSI of 27/200 (13.5%). The rate was 15/27(55.6%) in Internal Medicine Hospital and 12/27(44.4%) in Surgical Hospital.

Regarding evaluation of knowledge and practice percentage pre and post training intervention between hospitals: There was no statistically significant difference ($p\text{-value} > 0.05$) in Knowledge and percentage of good practices regarding different sex.

Our results also revealed that there are significant improvement in knowledge in all age groups except those over 30 years ($p < 0.05$). While the only improvement in practices score was observed for age group

(20-25years) (p=0.01). No significant difference was observed in knowledge between all age groups while significant good practices was reported for age group between (26 to 30 years) before and after training (p<0.05)

There is significant difference (p-value <0.05) between the two hospitals in knowledge percentage of right answer (knowledge score) and percentage of good practices (practices score) with high mean among internal medicine hospital staff.

Significant improvement was observed after conduction of training program (p value <0.05) at all hospital departments. The best knowledge mean percentage was obtained from laboratory staff and the poor one from general surgery staff either pre or post training (p< 0.001). Regarding practices, the best mean percentage was reported from operative theater staff, while the least was from general surgery staff either pre or post training (p<0.001) (Table 4).

Table 4: Comparisons of knowledge and practice in different surgical hospital departments' pre training and post training

Surgical hospital departments	Knowledge score %			Practices score %		
	Pre	Post	p-value	Pre	Post	p-value
	Mean ±SD	Mean ±SD		Mean ±SD	Mean ±SD	
General surgery	27.1±6.1	30.5±6.2	0.01*	25.2±3.4	27.9±3.9	0.01*
Orthopedic	31.1±8.3	33.4±7.4	0.02*	29.1±5.4	32±4.9	0.01*
Urology	27.8±6.2	39±7.1	<0.001*	29.3±4.7	34.4±4.9	<0.001*
Cardiology	30.7±5.5	34.4±6.8	<0.001*	30 ±3.6	36.9±3.9	<0.001*
Laboratory	42.5±3.6	46.1±3.9	<0.001*	27.6±3.3	30.4±3.6	<0.001*
Cardiothocic ICU	29.3±8.2	33.9±8.8	<0.001*	28.2±3.03	32.1±3.6	<0.001*
ENT	30.9±9.6	32.6±8.8	0.01*	26.4±4.5	28.1±4.2	0.02*
Ophthalmology	31.1±6.7	36.9±8.6	<0.001*	28.9±4.5	31.7±4.2	0.01*
Surgical ICU	31±7.7	35.9±8.1	<0.001*	27.3±4.2	30±3.9	0.02*
Gynecology	29.6±5.8	33.9±6.3	<0.001*	25.3±2.9	29.9±3	<0.001*
Operative	39.5±4.1	45.4±4	<0.001*	37.9±3.4	40.7±3.6	<0.001*
p-value	<0.001*	<0.001*		<0.001*	<0.001*	

The best knowledge and practices mean percentage was obtained from neonatology staff (p< 0.001), and the poor knowledge (p< 0.04) and practices (p< 0.02) mean

percentage from internal medicine staff either pre or post training (Table 5).

Table 5: Comparisons of knowledge and practice in different internal medicine hospital department's pre and post training

Internal medicine hospital departments	Knowledge score %			Practices score %		
	Pre	Post	p-value	Pre	Post	p-value
	Mean ±SD	Mean ±SD		Mean ±SD	Mean ±SD	
Medical ICU	33.9±6.7	35.9±6.4	0.03*	29.1±6	33.4±6.8	<0.001*
Pediatric	28.6±6.2	30.5±5.8	0.04*	31.1±4.4	36.5±4	<0.001*
Internal medicine	25.5±8.9	27.9±8.3	0.02*	28±4.1	30.6±4	0.04*
Emergency	34.2±7.5	38.8±8.3	<0.001*	29.4±3.6	35.4±4	<0.001*
Pediatric ICU	30.9±7.3	35.5±8.3	<0.001*	32.4±3.1	36.3±3.9	<0.001*
Neonatology	38.3±6.8	41.8±7.1	<0.001	37.3±2.9	40±3	<0.001*
Outpatient clinics	32.4±6.2	35.4±7.1	0.04*	32.2±3.9	35.2±3.5	<0.001*
p-value	<0.001*	<0.001*		<0.001*	<0.001*	

DISCUSSION

Injections are one of the most common health care procedures. Every year at least 16 billion injections are administered worldwide ¹. Unsafe injection practices lead to the large-scale transmission of blood borne infections among patients, HCWs and the community. Healthcare is a high risk sector because of the high incidence of work related injuries and diseases due to inadequate or lack of compliance with safety measures against occupational hazards⁹.

So assess the injection practices is very important. The aim of our study was to assess the injection safety practices and waste disposal by: Evaluation of knowledge and practices of HCWs towards injection safety practices at Fayoum University Hospitals, before and after interventional training program, using self-administrated questionnaire and observation checklist and to determine the incidence of needle stick injuries among HCWs. Our results revealed highly significant improvement ($p < 0.05$) in knowledge of write answer among HCWs, post intervention training. This agreed with a previous study in India ¹⁰ which reported a highly significant ($P < 0.001$) improvement in the knowledge of HCWs after intervention with information education regarding safe injection practices. Also, coincided with an Egyptian study⁸ which reported high significant improvements of knowledge and practice after educational intervention ($P < 0.001$). In our study the knowledge of use new sterile syringe for each injection change from 54% to 86% after the training program. This is coincided with a study done in Pakistan which found that; there was a significant increase (from 15% to 29%) in awareness about the syringe used for previous injection ¹¹. Also, the knowledge that sharp objects should be kept in a safety box changed from 93% to 98%. The basal evaluation of knowledge in Saudi Arabia in which HCWs had a high level of knowledge; at least 95% of HCWs believed that sharp objects should be kept in a closed container agreed with our results ¹².

All healthcare workers should be adequately immunized for hepatitis B infection due to its immediate and long term sequel, however only 19% of the participants in this study had been fully vaccinated before training. This finding was lower than other reports: Chowdhury et al. ¹³ in Bangladesh (23%) and Mengal et al. ¹⁴ in Pakistan (37%), however our results were higher than reports in Mexico City (4%) ¹⁵, and previous report in Egypt ¹⁶ which was 16%. In our study the HCWs who having full doses of HBV vaccine changed to 61% after training course. This agreed with a study done in India that reported significant ($p < 0.001$) improvement in their immunization status which

reached 78.2% of HCWs who had completed the 3-dose HBV vaccination schedule after the intervention ¹⁰.

Regarding the safety injection practices which detected by chick list, our results found that: reuse of syringes was 8.5%. This finding was lower than finding of a study done by Ford ¹⁷. He found that, 18% have reused a needle on the same patient. Also, the countries of South-East Asian, Eastern Mediterranean, and Western of Pacific World Health Organization (WHO) regions showed higher percentages of syringe reuse without sterilization: 75%, 70%, and 30%, respectively¹².

In Cameroon, 44% of HCWs reused syringes ¹⁸ while our results differed from reports in other countries. In India the use of sterile syringe reached 34.5% ¹⁹.

The reuse of syringes for the same patient decreased to 5.2% after interventional training program in our study. This percentage of syringe reuse could be explained by the shortage of syringes supply in our hospitals. Recap needles in our study former to training intervention, were 21%. This figure lower than that reported by Adebimpe ²⁰ in Nigeria. He revealed that 36.5% occasionally recap needles. Also, it was lower than results of Martins et al. ²¹ in Portugal who found that (83.5%) of HCWs recapping needles. Recap needles in our study changed from 21% to 13.2% after training courses. In our work, the percentage of using a new pair of gloves for every injection changed from 81.8% to 88.8% and hand hygiene changed from 46.9 to 70.4%. These results differed from a study in Saudi Arabia which revealed that; at least 80% of HCWs do hand hygiene before giving injection and the percentage of using a new pair of gloves for every injection was 80.0%, and much higher than the percentage in Mexico (11%)¹². NSI have the potential to transmit many infectious agents ²².

In our study, we found a total incidence rate of NSI of 27/200 (13.5%). The rate was 15/27(55.6%) in Internal Medicine Hospital and 12/27(44.4%) in Surgical Hospital. Our results were lower than the report of Mahfouz et al. ²³ which found the incidence rate of NSI of 27.5% in Saudi Arabia. Prevalence of NSI was 58% in Mexico City ⁶. A study in Alexandria, Egypt reported, the rate of NSI was 76.9% ²⁴. Also, the rate in a Malaysian hospital, was 23.5%; and the rate in a tertiary care hospital in India was 34.8% ²⁵.

The high incidence of needle stick injuries among HCWs concluded that there are deficiencies in practice such as an excessive, unwarranted usage of injections, the short supply of injection equipment leading to a high incidence of needle stick injuries, a low proportion of hepatitis B virus immunization among providers. This is suggested that: education of prescribers to reduce the number of injections, provider protection with immunization for hepatitis B virus, an adequate supply

of injection equipment, and the provision of adequate sharps containers¹⁹.

Significant improvement was observed after conduction of training program (p value <0.05) at all hospital departments. This clarifies the effect of the training programs conducted and providing the infrastructure which helped in improving safe injection practices and reducing the NSIs, which is considered a big problem in different parts of the world. Comparing the Surgical and Internal Medicine Hospitals, statistically significant difference (p-value < 0.05) in knowledge and safe practice percentages with high mean among Internal Medicine Hospital staff. In Indonesia and Tanzania the safety injection-related knowledge and practice can be influenced by training measures²⁶. There was a significant difference (p-value <0.05) between different Internal Hospital departments in knowledge and safe practice percentage with high mean of knowledge and safe practice percentage among neonatology staff. The lowest knowledge and safe practice were among staff in Internal Medicine department. Kossover-Smith et al.²⁷ reported that, a higher proportion of oncologists reported unsafe practices occurring in their workplace.

CONCLUSION

A significant improvement in knowledge and practices after conduction of training program at all hospital departments was detected. The findings suggested better injection safety parameters. Training of safe injection, and comprehensive intervention model can significantly change the primary care practitioners' behaviors in unsafe injections and it is worth promoting. The rate of NSIs in the past year was low. But we need to design and implement more educational programs on safe injection to create a safe work, and increase the number of safe injection posters, especially for surgical hospital.

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