

# Safe injection practice among health-care workers in Gharbiya Governorate, Egypt

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ممارسة الحقن المأمون لدى العاملين في الرعاية الصحية بمحافظة الغربية في مصر  
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**الخلاصة:** قَيَّم الباحثون ممارسة الحقن المأمون لدى 1100 من العاملين في الرعاية الصحية في 25 مرفقاً من مرافق الرعاية الصحية في محافظة الغربية. وقد استخدم الباحثون استبياناً لجمع المعلومات وراقبوا 278 حقنة باستخدام قائمة تفقد معيارية. ولم تكن هناك سياسات لمكافحة العدوى في أي مرفق من هذه المرافق، كما لم تتوفر المعدات اللازمة للحقن المأمون، ولاحظ الباحثون أن التداول الملائم للإبر قبل نبذها لا يتجاوز 41٪ من حالات الحقن، وأن النبذ المأمون للإبرة لا يتجاوز 47.5، والنبذ المأمون للمحاقن لا يتجاوز 5٪. وقد أبلغ عن إعادة استعمال المحاقن والإبر لدى 13.2٪ من العاملين في الرعاية الصحية وعن أن 66.2٪ منهم أصيبوا بوخز الإبرة؛ وأن 11.3٪ فقط منهم قد استكمل جدول التطعيم ضد التهاب الكبد البائي.

**ABSTRACT** We assessed safe injection practices among 1100 health-care workers in 25 health-care facilities in Gharbiya Governorate. Questionnaires were used to collect information and 278 injections were observed using a standardized checklist. There was a lack of infection control policies in all the facilities and a lack of many supplies needed for safe injection. Proper needle manipulation before disposal was observed in only 41% of injections, safe needle disposal in 47.5% and safe syringe disposal in 0%. Reuse of used syringes and needles was reported by 13.2% of the health-care workers and 66.2% had experienced a needle-stick injury. Only 11.3% had received a full course of hepatitis B vaccination.

## Application des précautions universelles à la pratique des injections chez les personnels de santé dans le Gouvernorat de Gharbiya en Égypte

**RÉSUMÉ** Nous avons évalué l'application des précautions universelles à la pratique des injections chez 1100 personnels de santé répartis dans 25 établissements de soins dans le Gouvernorat de Gharbiya. Des questionnaires ont permis la collecte des données et 278 injections ont été observées et évaluées sur la base d'une *checklist* normalisée. Nous avons pu constater la carence des politiques de contrôle de l'infection dans tous les établissements, ainsi que le manque patent de nombreux dispositifs d'injection sécurisés indispensables. La manipulation adéquate des aiguilles avant élimination n'a été observée que dans 41 % des injections, l'élimination des aiguilles a été opérée dans le respect des règles dans 47,5 % des cas, ces règles n'étant jamais appliquées à l'élimination des seringues. La réutilisation des seringues et aiguilles a été rapportée par 13,2 % des personnels de santé et 66,2 % ont déclaré avoir déjà été victimes de blessures par piqûres d'aiguilles. Seuls 11,3 % des personnels de santé avaient reçu une vaccination complète contre l'hépatite B.

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Received: 11/04/05; accepted: 24/08/05

## Introduction

Injections are among the most frequently used medical procedures, with an estimated 12 billion injections administered each year worldwide [1]. Injections have been used effectively for many years in preventive and curative healthcare [2].

Unsafe injection practices throughout the world result in millions of infections, which may lead to serious disease and death. Scientists estimate that unsafe injections may cause about 8–16 million hepatitis B virus infections, 2.3–4.7 million hepatitis C virus infections, and 80 000–160 000 HIV infections each year worldwide [3].

The estimated risk of infection from bloodborne pathogens following a single needle stick from an infected source-patient is 30% for hepatitis B, 3% for hepatitis C and 0.3% for HIV [4]. The probability of the source of the blood being HBsAg positive (hepatitis B surface antigen) is 1–3 per 1000 in the general population and 5%–15% in high-risk groups. The Centers for Disease Control and Prevention have estimated that there are 12 000 health-care workers infected with hepatitis B virus [4]. They have also estimated that of 61 929 adults employed in health-care settings, 3182 had AIDS [5].

In Cairo University Hospital, Egypt the overall carrier rate for hepatitis B virus among health-care workers is about 28% [6]. Approximately 13% of the Egyptian population is infected with hepatitis C virus, leading to a high burden of chronic liver disease, cirrhosis and liver cancer, as well as mortality resulting from these diseases [7]. The proportion of new cases of hepatitis C that were attributable to unsafe injections exceeded 40% in 1996. This may have been related to the use of improperly sterilized needles that were used to treat

schistosomiasis [8]. As a consequence of these unsafe injections, a large reservoir of chronic infection was established that still drives hepatitis C transmission in Egypt today [7].

Although most injections given in the world are done following safe clinical practices, poor injection practices continue to transmit viral hepatitis and other infections on a large scale in many countries. Appropriate measures can and must be taken to avoid this route of transmission of disease [7]. This study was conducted from 2003 to 2004 to assess safe injection practice among health-care workers in an Egyptian governorate, and to identify the obstacles to and requirements for applying safe injection practices.

## Methods

A cross-sectional, observational study was conducted in Gharbiya Governorate, a governorate in the north of Egypt, which is divided into 8 districts and includes a total of 272 health-care facilities. Multi-stage random sampling was used to obtain a representative sample of these health-care facilities. First, 2 health districts, Tanta and Bassiun, were selected randomly. Within these, at least 25% of each type of health-care facility was selected randomly (hospital and primary health care centre). Thus the total sample included 25 health-care facilities; 7 hospitals and 18 primary health care centres.

Data were collected using a combination of interview and structured observations.

- A standardized questionnaire was used to interview the deputy director of the facility to obtain general information about the facility, administrative proce-

dures and availability of supplies needed for safe injection.

- An observational checklist was designed to evaluate injection practices and waste management, based on World Health Organization (WHO) definitions [9]. This included observations of the availability of supplies and equipment needed for safe injection practice and also of injections administered during the visit and of waste management activities. At least 10 injections were observed in different injection settings in each selected facility and were compared with the WHO definition of safe injections to verify their safety. All departments in the facility where injections were provided to patients were visited (e.g. emergency room, operating theatre, family planning unit, laboratories, dentistry facilities, renal dialysis room and vaccination room).
- A standardized questionnaire was used to interview all health-care workers available on the days of the visit about prescription of injections, giving injections, exposure to needle-stick injuries, hepatitis B vaccination status and safe injection training.

These data collection tools were pilot-tested to ensure that they were suitable for the local circumstances. This was conducted in a limited number of health-care facilities adjacent to the selected sites prior to the actual study fieldwork.

### Data management

Double data entry into a computerized database was used to ensure accuracy. *Epi-Info*, version 6.04b software was used for data entry, validation and analysis. The chi-squared test was used for statistical analysis. Suitable statistical tests were used and the significance level was set at  $P < 0.05$ .

## Results

The total number of health-care facilities studied was 25 (7 hospitals and 18 primary health care centres): 10 were in urban settings and 15 in rural settings.

### Interviews with deputy directors of the health-care facilities

Routine immunization for children was administered in 20 health-care facilities. The reported total number of the health-care workers in the facilities was 2776.

Table 1 shows that most of the health-care facilities studied lacked many procedures and policies important for safe injection practices. There was no statistically significant difference between different types of health-care facilities in this regard.

Table 2 shows that in most of the health-care facilities, there was a lack of most of the supplies needed for safe injection practices. Heavy-duty gloves were not available in any of the facilities. The shortage was greatest for plastic sharps containers, followed by disposable needles and syringes for therapeutic injections. There was no shortage of disposable needles and syringes for immunization injections. There was no statistically significant difference between the different health-care facilities.

### Observational checklist

#### *Assessment of injection practices*

A total of 278 injections were observed in all the health-care facilities. Figures 1–3 show that the safe injection practices most commonly carried out were the use of disposable syringes and needles, followed by the use of new injection syringes for each injection, the use of new reconstitution syringes for each reconstitution, avoidance of touching the needle before use and the use of recommended diluents. On the other hand, the safe injection practices that were

Table 1 Presence of some administrative issues related to safe injection practice by location and type of health-care facility

Presence of:	Urban (n = 10) %	Rural (n = 15) %	P. value	Hospital (n = 7) %	Outpatient clinic (n = 18) %	P. value	Immunization centre (n = 20) %	Not an immunization centre (n = 5) %	P. value	Total (n = 25) %
Infection control overseeing activities	0	13.3	> 0.05	0	11.1	> 0.05	10.0	0	> 0.05	8
Written policies and/or procedures for safe injection	0	0	-	0	0	-	0	0	-	0
Infection control committee	0	0	-	0	0	-	0	0	-	0
Safe injection training of health-care workers	20.0	13.3	> 0.05	42.9	5.6	> 0.05	15.0	20.0	> 0.05	16
Adequate waste management activities	20.0	20.0	> 0.05	28.6	16.7	> 0.05	20.0	20.0	> 0.05	20

least often carried out included safe disposal of syringes, proper needle manipulation before disposal, safe disposal of needles and the presence of a preparation area dedicated to giving injections away from contamination. Immunization injections and injections given by nurses were safer than therapeutic injections and injections given by physicians in most of the injection practices and the difference was statistically significant.

#### Assessment of injection areas

Table 3 shows that the areas (rooms) dedicated to injections often did not conform with safe injection practices. The areas where immunization injections were given were generally better than the areas for therapeutic injections. For example, in the latter, it was more likely to observe the presence of sharps in open containers and the presence of pierced, overflowing and/or open waste containers. Also, urban health-care facilities generally had more suitable areas for safe injections practice than rural facilities.

#### Waste management in the studied health-care facilities

Table 4 shows that there was a lack of many proper waste management activities and this varied with health-care facility. The commonest final waste disposal method was burning on the street near the facility. There was no statistically significant difference between urban and rural health-care facilities as regards waste management activities, but removal of waste by community refuse collectors was more likely to be used to dispose of waste in urban health-care facilities. There was no statistically significant difference between hospitals or primary health care centres as regards waste management activities.

Table 2 Reported availability of supplies needed for safe injection practices by location and type of health-care facility

Supplies	Urban (n = 10)	Rural (n = 15)	P. value	Hospital (n = 7)	Outpatient clinic (n = 18)	P. value	Immunization centre (n = 20)	Not an immunization centre (n = 5)	P. value	Total (n = 25)
	%	%		%	%		%	%		%
<i>Hand-washing materials</i>										
Soap	80.0	40.0	> 0.05	57.1	55.6	> 0.05	55.0	60.0	> 0.05	56
Hand-drying materials	60.0	13.3	< 0.05	28.6	33.3	> 0.05	35.0	20.0	> 0.05	32
Heavy-duty gloves	0	0	-	0	0	-	0	0	-	0
<i>Medical supplies</i>										
Intravenous fluid tubing	60.0	46.7	> 0.05	85.7	38.9	< 0.05	40.0	100.0	< 0.05	52
Disposable needles and syringes for immunization	60.0	93.3	> 0.05	28.6	100	< 0.001	100.0	0	< 0.001	100
Disposable needles and syringes for therapeutic injections	20.0	20.0	> 0.05	42.9	11.1	> 0.05	15.0	40.0	> 0.05	20
<i>Waste collection containers</i>										
Plastic bags	60.0	53.3	> 0.05	85.7	44.4	> 0.05	45.0	100.0	< 0.05	56
Safety boxes	100.0	86.7	> 0.05	85.7	94.4	> 0.05	95.0	80.0	> 0.05	92
Plastic sharps containers	20.0	6.7	> 0.05	28.6	5.6	> 0.05	5.0	40.0	> 0.05	12

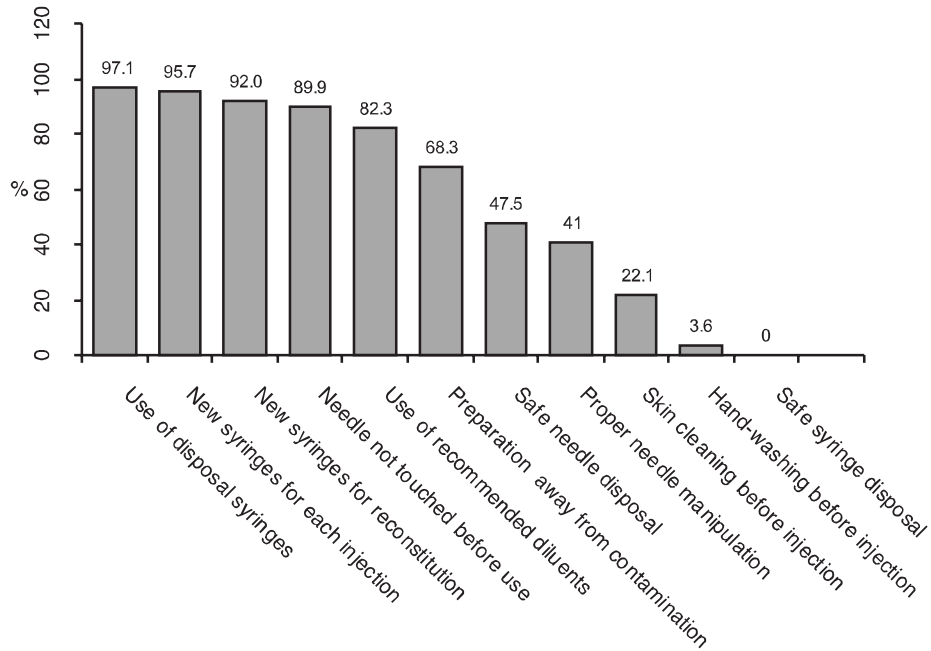


Figure 1 Safe injection practices observed in all the injections

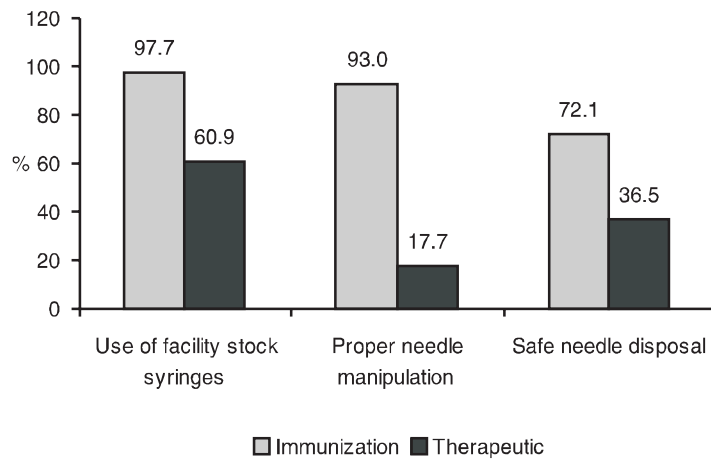


Figure 2 Injection practices in the studied injections according to type of injection

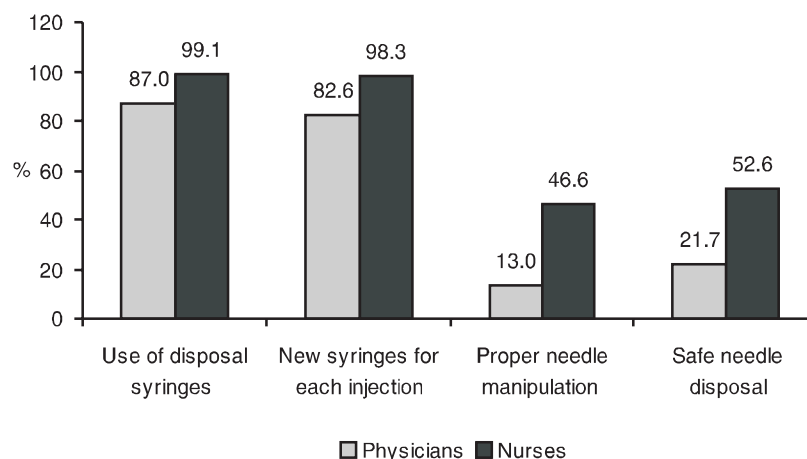


Figure 3 Injection practices in the studied injections according to provider

#### Interviews with health-care workers

We interviewed 1100 health-care workers representing about 40% of all health-care workers in the studied health-care facilities ( $n = 2776$ ).

Table 5 shows that females health-care workers were more likely to experience needle-stick injuries than males. Health-care workers who graduated from nursing school or who had lower levels of education were more likely to experience needle-stick injuries than those who had graduated from medical or nursing institutes or higher lev-

els of education. Health-care workers who give injections were more likely to experience needle-stick injuries than those who do not give injections. These differences were statistically significant.

Table 6 shows that the reuse of used syringes was reported by 13.2% of all health-care workers and there was no significant difference between those who had received training in injection control practices and those who had not. However, health-care workers who had received training were less likely to have had a needle-stick in-

Table 3 Practices observed in injection areas according to injection type and location

Practice	Immunization ( $n = 86$ ) %	Therapeutic ( $n = 192$ ) %	P- value	Urban ( $n = 118$ ) %	Rural ( $n = 160$ ) %	P- value	Total ( $n = 278$ ) %
Used sharps found outside sharps' containers	16.3	19.8	> 0.05	6.8	27.5	< 0.001	18.7
Used sharps found in open containers	48.8	64.6	< 0.05	49.2	67.5	< 0.05	59.4
Pierced, overflowing or open waste containers found	34.9	77.1	< 0.001	57.6	68.8	> 0.05	64

Table 4 Waste management activities in the health-care facilities according to location and type of the facility

Waste management	Urban (n = 10)		Rural (n = 15)		P. value		Hospital (n = 7)		Outpatient clinic (n = 18)		P. value		Immunization centre (n = 20)		Not an immunization centre (n = 5)		P. value		Total (n = 25)		
	%	%	%	%	> 0.05	> 0.05	%	%	%	%	> 0.05	> 0.05	%	%	%	%	> 0.05	> 0.05	%	%	
<i>Waste collection methods</i>																					
Assigned staff collect waste in the facility	20.0	13.3	> 0.05	14.3	16.7	> 0.05	15.0	20.0	> 0.05	16.0	20.0	> 0.05	15.0	20.0	> 0.05	16.0	20.0	> 0.05	16.0	16.0	
No systematic method for waste collection	70.0	73.3		57.1	77.8		80.0	40.0		72.0	40.0		80.0	40.0		72.0	40.0		72.0	72.0	
Use of heavy utility gloves during waste collection	0	0	-	0	0	-	0	0	-	0	-	-	0	0	-	0	0	-	0	0	
Presence of a designated central medical waste storage area	100.0	100.0	-	100.0	100.0	-	100.0	100.0	100.0	100.0	-	100.0	100.0	100.0	-	100.0	100.0	-	100.0	100.0	
Presence of improperly-disposed of medical waste and sharps in the storage area	80.0	100.0	> 0.05	85.7	94.4	> 0.05	95.0	80.0	94.4	> 0.05	92.0	80.0	95.0	> 0.05	92.0	80.0	> 0.05	92.0	92.0		
Secure storage (not accessible to lay persons)	0	0	-	0	0	-	0	0	0	-	0	-	0	0	-	0	0	-	0	0	
<i>Waste disposal methods</i>																					
Removed by community waste collector	70.0	20.0	< 0.05	71.4	27.8	> 0.05	30.0	80.0	27.8	> 0.05	40.0	80.0	30.0	> 0.05	40.0	80.0	> 0.05	40.0	40.0		
Incinerated on site in the facility	10.0	6.7	> 0.05	28.6	0	> 0.05	0	40.0	0	> 0.05	8.0	40.0	0	< 0.05	8.0	40.0	< 0.05	8.0	8.0		
Sent to another facility for incineration	20.0	0	> 0.05	14.3	5.6	> 0.05	5.0	20.0	5.6	> 0.05	8.0	20.0	5.0	> 0.05	8.0	20.0	> 0.05	8.0	8.0		
Burned in the street near the facility	60.0	80.0	> 0.05	42.9	83.3	> 0.05	80.0	40.0	83.3	> 0.05	72.0	40.0	80.0	> 0.05	72.0	40.0	> 0.05	72.0	72.0		
Buried on the facility ground	0	20.0	> 0.05	14.3	11.1	> 0.05	15.0	0	11.1	> 0.05	12.0	0	15.0	> 0.05	12.0	0	> 0.05	12.0	12.0		
Left outside proper waste containers	30.0	66.7	> 0.05	28.6	61.1	> 0.05	60.0	30.0	61.1	> 0.05	52.0	20.0	60.0	> 0.05	52.0	20.0	> 0.05	52.0	52.0		
Used sharps observed lying around outside the health-care facility	20.0	46.7	> 0.05	14.3	44.4	> 0.05	40.0	20.0	44.4	> 0.05	36.0	20.0	40.0	> 0.05	36.0	20.0	> 0.05	36.0	36.0		



Table 5 Characteristics of health-care workers who experienced a needle-stick injury and mean number of such injuries

Characteristic	Experienced needle-stick injury		P-value	Mean (SD) (needle-stick injury/health-care worker/3 months)
	No.	%		
<i>Age (years)</i>			> 0.05	
≤ 30	250/388	64.4		1.5 (1.8)
31–45	302/438	68.9		1.1 (1.6)
> 45	176/274	64.2		1.2 (1.7)
<i>Sex</i>			< 0.05	
Male	188/728	25.9		–
Female	540/728	74.2		–
<i>Educational level</i>			< 0.05	
Nursing school and lower	550/798	68.9		1.2 (1.8)
Health institute and higher	178/302	58.9		1.3 (1.5)
<i>Job</i>			> 0.05	
Physician/dentist	130/198	65.7		1.2 (1.5)
Assistant	598/902	66.3		1.3 (1.8)
<i>Job duration (years)</i>			> 0.05	
≤ 20	518/782	66.2		1.3 (1.7)
> 20	210/318	66.0		1.0 (1.7)
<i>Gives injections</i>			< 0.05	
Yes	620/910	68.1		1.2 (1.7)
No	108/190	56.8		1.3 (2.0)

SD = standard deviation.

jury than those who had not ( $P < 0.05$ ). Two-hand recapping of needles was the commonest cause of such injuries. Hand-washing was the commonest reported action taken by health-care workers who suffered a needle-stick injury while one-third reported that they did not do anything at all after exposure. Only a small proportion reported that they took a vaccination against hepatitis B virus infection as soon as possible after the injury.

Unsafe handling practices of needles prior to disposal (e.g. two-hand recapping, needle flexing and needle breaking) were

more frequent among all health-care workers than safe handling practices, e.g. nothing done to the needle at all prior to its final disposal and one-hand recapping (scoop technique), and there was no significant difference between those who had received training and those who had not. However, health-care workers who had received training on safe injection practices within training on infection control practices were more likely to have been vaccinated against hepatitis B virus infection whether by at least 1 dose or by the full course compared to those who had not attended any training.

Table 6 Injection practices reported by the health-care workers according to their training in infection control practices

Practice	Trained		Not trained		Total		P-value
	No.	%	No.	%	No.	%	
Use of used syringes/needles	4/32 <sup>a</sup>	12.5	116/878	13.2	120/910	13.2	> 0.05
Experienced needle-stick injury in the previous 3 months	18/36	50.0	710/1064	66.7	728/1100	66.2	< 0.05
Activity resulting in needle-stick injury							
Two-hand recapping of needles	12/18	66.7	403/710	56.8	415/728	57.0	> 0.05
Waste collection	0/18	0.0	120/710	16.9	120/728	16.5	
Needle flexing	2/18	11.1	49/710	6.9	51/728	7.0	
Other	4/18	22.2	138/710	19.4	142/728	19.5	
Action taken							
Hand-washing	10/18	55.6	450/710	63.4	460/728	63.2	> 0.05
Vaccination against hepatitis B	2/18	11.1	24/710	3.4	26/728	3.6	
Nothing	6/18	33.3	236/710	33.2	242/728	33.2	
Needle-handling method							
Two-hand recapping	26/36	72.2	624/1064	58.6	650/910	71.4	> 0.05
Nothing done	8/36	22.2	206/1064	19.4	214/910	23.5	
Needle-flexing	2/36	5.6	212/1064	19.9	214/910	23.5	
One-hand recapping (scoop technique)	0/36	0	4/1064	0.4	4/910	0.4	
Breaking	0/36	0	4/1064	0.4	4/910	0.4	
Other	0/36	0	14/1064	1.3	14/910	1.5	
Needle disposal method							
In the safety box	2/36	5.6	232/1064	21.8	234/1100	21.3	> 0.05
In the common garbage	34/36	94.4	814/1064	76.5	848/1100	77.1	
In a bottle	0/36	0	14/1064	1.3	14/1100	1.3	
Other	0/36	0	4/1064	0.4	4/1100	0.4	
Vaccination status							
At least 1 dose of hepatitis B vaccine	16/36	44.4	306/1064	28.8	322/1100	29.3	< 0.05
Full course of hepatitis B vaccine	8/36	22.2	116/1064	10.9	124/1100	11.3	< 0.05

<sup>a</sup>Total trained who give injections.

## Discussion

In this study, data were collected using a combination of interviews and structured

observations. In this way we attempted to minimize reporting bias and the Hawthorne effect (observer-induced changes in practices) [9].

### Availability of supplies

Ensuring availability of safe injection equipment and supplies is considered one of the main requirements for improvement of safe injection practices. The results of our study revealed that the Ministry of Health and Population distributes the supplies but some supplies are supported and funded by a specific health programme, e.g. disposable needles and syringes for routine immunization of children and women in the child-bearing period are provided through the Expanded Programme on Immunization and the family planning programme respectively. Therefore these supplies are more likely to be available all of the time in immunization centres compared to therapeutic centres.

### Safe injection practices

Most of the observed health-care workers used disposable needles and syringes for injection and used new syringes and needles for each injection. However, there were many cases where the recommended diluents were not used and a new needle for each reconstitution was not used. These findings are consistent with the results of Sophie et al., who reported that observation of injections conducted in Mongolia health-care facilities showed that needles were left in the septum of the multi-dose medication vials to be reused in the subsequent reconstitutions [10].

In our study, two-hand recapping of needles before disposal, which exposes the health-care worker to the risk of needlestick injury, was a common practice. This practice was also common among nurses in Mongolia [10].

Adherence to safe injection practices and the appropriateness of the injection areas were significantly better for immunization injections than therapeutic injections. Simonsen et al. also reported that childhood immunization injections were safer than

curative injections [11]. The immunization process constitutes a major priority for the Ministry of Health and Population and many national and international organizations and agencies, such as WHO and UNICEF, and as a result more training, funding, supervision and supplies are available for immunization.

Of concern, we found 13.2% of the health-care workers interviewed who give injections reported that they had used syringes and needles that had been used before for giving injections to others. This is a very hazardous practice for the injection provider, the recipient and the community. The reuse of syringes and needles for different patients was not reported at all by nurses in Romania, while 4% of them reported the reuse of syringes and needles on the same patient in an emergency [12]. In Indonesia, the observed reuse of syringes and needles in 5 health centres in several regions was reported to be more than 50% of the injections [13]. Also, in 2 countries in sub-Saharan Africa, it was reported that 15%–60% of health-care centres reused syringes and needles [11]. Reports from the Dominican Republic showed that disposable syringes and needles were used multiple times in more than 50% of injections [11]. However, Sophie et al. reported that the observed injection providers consistently used newly opened syringes and needles for all injections in Mongolia [10].

### Safe disposal of injection waste

Our study showed that syringes were not disposed of safely at all and most needles were not segregated before their final disposal, nor were proper waste containers used. Collection of used syringes and needles in safety boxes was also not reported in Kenya, Ethiopia, Zambia, Uganda and Tanzania [14].

We found that most waste management activities were unsafe as in most of the health-care facilities sharps were found lying around and not disposed of within proper containers in waste storage areas. These areas were also not secure enough to prevent the access of lay persons. The presence of used syringes and needles in health-care facilities in Senegal and Cote d'Ivoire was reported in 10% and 70% of these facilities [14]. However, in Mongolia, no dirty or used sharps were observed around any of the studied health-care facilities at all [10]. In our study, this may be due to the methods of final waste disposal. In Mongolia, all health-care facilities followed a national regulation recommending burning waste at an open site, in a drum or in a stove under supervision [10]. Waste incineration was reported in only a small proportion of the health-care facilities in our study. Incineration of used syringes was used for final waste disposal in many East African countries such as Kenya, Ethiopia, Rwanda and Zambia while it was not reported in Uganda and Tanzania [14].

There was no significant difference between immunization centres and non-immunization centres as regard waste management activities, but incineration of waste on-site in the facility was more likely to be used in non-immunization centres probably because all non-immunization centres were hospitals where incinerators are more commonly found.

### **Needle-stick injuries**

Health-care workers who use or may be exposed to needles are at increased risk of needle-stick injuries. Such injuries can lead to serious or fatal infections with blood-borne pathogens such as hepatitis B virus, hepatitis C virus, or human immunodeficiency virus [4].

In our study, 66.2% of the interviewed health-care workers reported that they had experienced at least 1 needle-stick injury during their working life. The mean reported number of needle-stick injuries per health-care worker in the 3 months prior to the study was 1.3. In Mongolia, 67.8% of health-care workers reported that they had experienced at least 1 needle-stick injury in the previous 12 months [10]. In Senegal and Cote d'Ivoire 70% of staff members of health-care facilities reported needle-stick injuries in the previous 6 months [14].

In developing countries, there is a lack of awareness and training of health-care workers regarding proper needle manipulation, prevention of needle-stick injuries and their harmful effects. Also, there is lack of supplies needed for protection of health-care workers and prevention of injury such as heavy utility gloves for waste collection, puncture- and liquid-proof sharps containers and safety boxes.

The commonest reported cause of needle-stick injuries among the health-care workers interviewed was during two-hand recapping of needles followed by during waste collection and then while needle flexing. Unsafe needle handling prior to disposal was also common. Past studies of needle-stick injuries revealed that 10% to 25% of injuries occurred during two hand recapping of needles [4]. Furthermore, after needle-stick injury, health-care workers who were injured did not deal properly with their injuries.

In our study, only 11.3% of the health-care workers and 11.6% of the health-care workers who give injections reported that they had completed the full course of hepatitis immunization. Sophie et al. reported that none of the health-care workers who give injections in their study in Mongolia was vaccinated against hepatitis B [10].

### Training in infection control practices

In our study, there was a lack of training of all interviewed health-care workers on different practices related to safe injection. In Romania, 91% of health-care workers had attended at least 1 training session on universal precautions for infection control, including safe injection practices [12].

Health-care workers who attended at least 1 training course on infection control practices or its related fields were less likely to experience needle-stick injuries and more likely to be vaccinated against hepatitis B, whether with 1 dose or with the full course, compared to those who had not attended any training course. At the same time there was no significant difference between these groups as regards the cause of needle-stick injuries, their action after injury, needle-handling methods before disposal and the needle disposal methods.

### Conclusions

The results of our study indicate that injection practices within all health-care facilities are not as good as they should be and as such can contribute to the spread of infection. All the health care facilities lacked adequate activities to promote and ensure safe injection practice, such as written policies and procedures, overseeing activities, etc. Clearly there is a need to address the situation and implement strategies to bring about improvement. The reasons for the inadequacy of safe injection practice may be a lack of supplies, such as disposable syringes and needles and safe disposal boxes, and/or a lack of awareness of the staff of

safe injection practices and their importance for control of infection, both to themselves, to the recipients of injections and also to waste disposal staff. Certainly only a very small proportion of the staff had received any training in infection control practices. Although the practices of the trained staff were better in certain areas, in others their practices were similar to those who had not received any training. This suggests that these training courses were not sufficient to increase the health-care workers' awareness and change their attitudes, behaviours and practices. This also suggests that the implementation of proper infection control practices needs not only specific training courses, but also strict regulations, supervision and even application of specific rewards and punishments schemes. It may additionally suggest that in some cases a lack of appropriate supplies made it difficult to apply safe injection practices.

### Recommendations

- Infection control policies and guidelines including safe injection practices and hospital waste management activities should be present in all health-care facilities.
- Training programmes on infection control, including safe injections practices, should be provided to all health-care workers.
- Hepatitis B vaccination coverage should be increased to cover all health-care workers.
- Adequate supplies for safe injection practices need to be made available.

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