
PUBLIC HEALTH RESEARCH

Assessment of Infection Control among Health Care Workers in Healthcare Centers Sana'a, Yemen : A cross-sectional study

Ameen Saleh Saleh Sherah and Mohd Hasni Jaafar

Department of Community Health, Faculty of Medicine, Universiti Kebangsaan Malaysia.

*For reprint and all correspondence: Ameen Saleh Saleh Sherah, Department of Community Health, Faculty of Medicine, UKM Medical Centre, Jalan Yaacob Latiff, Bandar Tun Razak, 56000 Cheras, Kuala Lumpur, Malaysia.

Email: ameensherah@gmail.com

ABSTRACT

Received	21 January 2015
Accepted	9 July 2015
Introduction	An Analysis of a Survey Questionnaire on health care workers' knowledge and practices regarding of infection control and complains them to apply universal precautions. Health care workers are at substantial risk of acquiring blood borne pathogen infections through exposure to blood or other products of patients. To assess of infection control among health care workers in Sana'a healthcare centers, Yemen.
Methods	A cross-sectional study was conducted in the health center to assess knowledge and practices regarding of infection control among 237 health workers in Sana,a city. A structured self-administered questionnaires were used and data was analyzed using SPSS version 20 and the associations were tested with chi-square, with p-value of < 0.05.
Results	The health care workers in public centers ware (51.1%) and (48.9%) of them works in private centers. One hundred and seventeen (49.4%) respondents had poor infection control knowledge, 113 (43.5%) had fair knowledge, and 17 (7.2%) had good knowledge. The knowledge was significantly associated with type of center ($P < 0.018$), such that the public center had the highest proportion with poor knowledge. And nurses and midwife having the highest proportion with fair knowledge of infection control. Eight (3.4%) respondents had a poor practice of universal precautions, 93 (39.2%) had fair practice, and 136 (57.4%) good practice. The practice was significantly associated with the profession, level of education and work experience ($P < 0.001$), ($P < 0.006$), ($P < 0.001$) respectively, and nurses and midwives as the profession with the highest proportion with good practice.
Conclusion	We conclude that the practices and knowledge of universal precautions were low and that's need for intensive programmes to educate health care workers on various aspects of standard precautions and infection control programmes and policies.
Keywords	Health care workers - Knowledge - Practice - Universal precaution - Health center.

INTRODUCTION

Infection is one of the most important problems in health care services worldwide¹. Health care facilities around the world employ over 59 million workers who are exposed to a complex variety of health and safety hazards every day.² Health care workers, are at increased risk of occupational exposure to human blood and body fluids.^{3,4}

The World Health Organization (WHO) reports that among 35 million health workers worldwide, about 3 million sustain percutaneous exposures to the blood borne pathogens each year, including, 2 million to hepatitis B virus (HBV), 0.9 million to hepatitis C virus (HCV) and 170,000 to the human immune deficiency virus (HIV).^{5,6} The World Health Organization has estimated that in developing regions, (40%–65%) of HBV and HCV infections in Health care Workers are attributable to percutaneous occupational exposure.⁷ The World Health Organization has estimated that exposure to sharps in the workplace accounts for (40 %) of infections with HBV and HCV and (2-3 %) of HIV infections among health care workers.⁶ A study by (Hadadi, A. et al., 2008) had shown that the annual incidence of occupational exposure is reported to be 3.5/100 Health care Workers. Overall, (37%) of HBV, (3%) of HCV and (4%) of HIV infections in Health care Workers were due to occupational exposures.⁸

Universal Precautions (UPs) as defined by the United States Centre for Disease Control and Prevention (CDC) is a set of precautions⁵ which designed to prevent health care staff being exposed to blood and body fluids by applying the basic principle of infection control through hand-washing, utilization of appropriate protective barriers, such as gloves, mask, gown and eyewear, and safe handling of needles.⁹ take care with devices, equipments and clothing used during care; environmental control (e.g., surface processing protocols, health service waste handling); adequate discarding of equipments including needles sharp objects in puncture resistant containers and patient's accommodation in accord to requirement levels as an infection transmission source.¹

A study of (Johnson OE.et al., 2013) in health institutions in Nigeria has reported poor knowledge of Universal precautions among health workers, while studies have documented knowledge of Universal precautions among doctors in different health institutions to be within the range of 26-44%⁵. The recommendations of universal precautions include; wearing gloves, gowns and aprons when collecting or handling blood and body fluids, wearing face shields when there is danger of blood splashing of mucous membranes.¹⁰

Generally, these recommendations are for doctors, nurses, patients, and health care support workers who are required to come into and contact

with patients or body fluids.¹⁰ However the level of practice of universal precautions by health care workers may differ from one type of health care worker to another.¹

In Yemen like many developing countries, few efforts have been undertaken to raise awareness about infection control precautions among Health care Workers and hospital managers. Additionally, there is a lack of regulations and policies to protect health care workers from exposure. To our knowledge this study is the first in Yemen, the purpose of this study was to assess of infection control among health workers in Yemeni health center and to identify the knowledge of health care workers regarding general aspect of infection control and practice of universal precautions. In addition, to determine the association between knowledge, practice with Sociodemographic factors.

MATERIAL AND METHODOLOGY

Study area

A cross sectional study took place in the Yemeni health centers (Public and private) in Sana'a city during the period from July to September 2014. The study population included health care providers working in the centers and the respondents include Nurses, Midwives, Physician, Dentist, Laboratory technician and others) as they are directly concerned with patients care. All participants have given their approval with written informed consent before enrollment into the study and it were aimed all the health care workers by convenience sampling. Data was collected using a structured self administered questionnaire, which had been designed after an extensive literature search, consultations with experts in the field and in according to standard precaution in health care report by WHO.¹¹ Only the questionnaires that completed were included and incomplete and missing data questionnaires were drop out from the study. The minimum sample size was calculated as 237 by using the formula of two proportions for a prevalence study by (Alice et al.,2013) with p set as <0.05 two-sided confidence level (1-alpha) and power (80% chance of detecting) as 14.5% of the proportion of doctors with good practice of standard precautions and (30.6 %) of the fair compliance. Reliability and validity questionnaire measured by using Cronbach,s Alpha of knowledge and practices 0.6 and 0.8 respectively in general the reliability and validity was good. Ethical approval was obtained from the University of Science and Technology ethical committee with approval number (2014 /07).

The survey questionnaire was divided into three main parts. Part I focused on sociodemographic characteristics, Part II contained 10 questions seeking to ascertain the level of

knowledge of the concept of infection control. Questions covered the basic concepts, content, and activity requirements of infection control with possible responses of 'yes' and 'no'. Part III comprised 30 questions on the level of adherence to universal precautions. Universal precaution measures of interest included hand washing (9 items), use of gloves (4 items), use of nose mask/face shield (5 items), use of protective eyewear (1 item), use of gown/apron (1 item), sharp practices (5 items), respiratory hygiene and cough etiquette (1 item) and Environmental cleaning /Waste disposal/Patient care equipment (1,2,1 items respectively). A practice that was deemed right when undertaken always was scored 2, sometimes was scored 1 and never scored 0 (Labrague et al., 2012).¹²

The knowledge of infection control was graded by assigning a score of "1" for a correct answer and "0" for an incorrect or 'do not know' answer. This scoring system has been used in an earlier study to investigate universal precautions among health workers in Borno state, Nigeria (Abdulraheem et al., 2012)¹³ and Edo state, Nigeria (Alice et al., 2013)¹⁴ Scores for each respondent were summed up and graded as good, fair or poor. Compliance with universal precautions was graded by assigning scores to Likert's scale responses on a scale of 0-2 points: 0 = never, 1 = sometimes, 2 =always. The maximum total score for practice was 60, respondents were graded for assessment of compliance as good, fair and poor if their summed scores fell <50%, between 50 and

74% and > 75% of the total score for practice. Since all the three parts were self administered, this study may susceptible to selection bias.

The data were coded and analyzed by SPSS version 20 (IBM Corp. Released 2011. Armonk, NY). Categorical data were displayed as frequencies, percentages, and continuous data as medians and interquartile range (IQR). Cross-tabulations of pairs of qualitative variables were produced and assessed using the Chi-square test of homogeneity. Spearman's rank correlation Coefficient was used for the measurement of association. In addition Kruskal-Wallis was used for comparison continuous data. Throughout, statistical significance was assessed at $P < 0.05$.

RESULTS

In this study, two hundred and thirty seven completely filled questionnaires were analyzed. The health care worker in public centers was (51.1%) and (48.9%) of them works in private centers (**Table 1**). The majority of them were in the age group of 20-29 (n =149; 62.9%) and followed by the age group of 30-39-year-old (n= 80; 33.8%). Most of them are females (n=155; 65.4%) and married respondents (n= 139; 58.6%). Respondents with diploma degree and nurses made up the highest proportions, (n=106; 44.7 %) and (n=119; 50.2%) respectively. Those with a short working experience group of <5 years were about 116 respondents (48.9%).

Table 1 Sociodemographic Characteristics of Respondents (n=237)

Variables	No.	%
Type of center		
Public	121	51.1
Private	116	48.9
Age Group (years)		
20-29	149	62.8
30-39	80	33.8
>40	8	3.4
Sex		
Male	82	34.6
Female	155	65.4
Marital Status		
Married	139	58.6
Not Married	98	41.4
Medical Profession		
Nurses and midwife	119	50.2
Physician	39	16.5
Dentist	25	10.5
Laboratory technician	45	19.0
Other	9	3.8
Work Experience (years)		
<5	116	48.9
6-10	73	30.8
>10	48	20.3

Knowledge and Practices of Health Care Workers Regarding Universal Precautions

Level of Education

Primary education	9	3.8
Secondary education	26	11.0
Diploma degree	106	44.7
Bachelor's degree	79	33.3
Postgraduate	17	7.2

The knowledge of health care worker regarding infection control were (n=168; 70.9%), they didn't receive any training program on the guidelines on infection control, training Program on the report of the event (n=204; 86.1%) were not received any, attending training program for infection control were (n=139; 58.6%).

Respondents hadn't received a vaccination against hepatitis B virus, Instructions after a needle stick accident (n=111; 46.8%) and (n=67; 28.3%) respectively. (n=109; 46.0%) and (n=82; 34.6%) they weren't dealing with patients and body fluids as a source of infection respectively (**Table 2**).

Table 2 Knowledge of Health Care Workers Regarding Infection Control (n=237)

Items	Yes		No	
	No.	%	No.	%
1 Program for training on infection control guidelines	69	29.1	168	70.9
2 Program for training on the report of the event	33	13.9	204	86.1
3 Attend a training program for infection control	98	41.4	139	58.6
4 Authorized personnel to monitor infection control	62	26.2	175	73.8
5 Follow-up program for workers	28	11.8	209	88.2
6 Vaccinated against hepatitis B	126	53.2	111	46.8
7 Instructions after a needle stick accident	170	71.7	67	28.3
8 Dealing with patients as a source of infection	128	54.0	109	46.0
9 Dealing with body fluids as a source of infection.	155	65.4	82	34.6
10 All health providers are at risk of occupational infections	194	81.9	43	18.1

The practice of universal precautions by respondents concerning the practice of hand hygiene was good, were (n=196.8; 83.1%) correctly knew hand hygiene to be the most important procedure for reducing transmission of germs. Stated as before and after any direct patient contact and between patients (n=224; 94.5%) and immediately after gloves are removed (n=225; 94.9%) respectively. Others included between tasks and procedures on the same patient to prevent cross contamination between different body sites (n=198;

83.8%), after touching blood, body fluids, secretions, excretions and contaminated items (n=230; 90.7%).

After contact with inanimate objects in the immediate (n=220; 92.8%) and vicinity of the patient, (n=228; 96.2%). While after touching with contaminated equipment or surfaces, before and after using the toilet (n=231; 97.5%). Before you leave work (n=231; 97.5%), before handling an invasive device, (n=209; 88.2%) (**Table 3**).

Table 3 Practice of Universal Precaution by Respondents (n=237)

Items	Always		Sometimes		Never	
	No.	%	No.	%	No.	%
Hand washing						
1 Before and after any direct patient contact and between patient	123	51.9	101	42.6	13	5.5
2 Immediately after gloves are removed.	186	78.5	39	16.5	12	5.1
3 Before handling an invasive device.	130	54.9	79	33.3	28	11.8
4 After contact with inanimate objects in the immediate Vicinity of the patient	150	63.3	70	29.5	17	7.2
5 After touching blood, body fluids, secretions, excretions and contaminated items.	218	92.0	10	4.2	9	3.8
6 After touching with contaminated equipment or surfaces	186	78.5	44	18.6	7	3.0
7 Before and after using the toilet	207	87.3	24	10.1	6	2.5
8 Before you leaving work	154	65.0	77	32.5	6	2.5

9	Between tasks and procedures on the same patient to prevent cross contamination between different body sites.	98	41.4	100	42.2	39	16.5
<i>Use of gloves</i>							
10	Wear when touching blood, body fluids, secretions, excretions, mucous membranes.	202	85.2	29	12.2	6	2.5
11	Change between tasks and procedures on the same patient after contact with potentially infectious material.	129	54.4	85	35.9	23	9.7
12	Remove after use, before touching non-contaminated items and surfaces	162	68.4	61	25.7	14	5.9
13	Remove before going to another patient.	179	75.5	34	14.3	24	10.1
<i>Use of Face mask</i>							
14	Wear facemask when undertaking procedures likely to generate splashes	105	44.3	77	32.5	55	23.2
15	Wear nose mask when handling with patients have expectoration	113	47.7	69	29.1	55	23.2
16	When handling with infectious microbes through the air	116	48.9	60	25.3	61	25.7
17	When exposed to the spray objects volatiles	117	49.4	64	27.0	56	23.6
18	Wear the masks before cleaning contaminated surgical instruments	92	38.8	69	29.1	76	32.1
<i>Protective eyewear</i>							
19	Wear protective eyewear to protect the mucous membranes of the eyes when conducting procedures that are likely to generate splashes of blood, body fluids, secretions or excretions	47	19.8	50	21.1	140	59.1
<i>Gown</i>							
20	Wear gown to protect skin and prevent soiling of clothing during activities that are likely to generate splashes or sprays of blood, body fluids, secretions, or excretions.	143	60.3	64	27.0	30	12.7
<i>Sharp management</i>							
21	Recapping after using	160	67.5	40	16.9	37	15.6
22	Detaching needle from syringe after using	152	64.1	53	22.4	32	13.5
23	Protect fingers when breaking glass ampoule/bottle	166	70.0	48	20.3	23	9.7
24	Disposing of used needles and other sharp instruments immediately in safety box	183	77.2	30	12.7	24	10.1
25	Dealing carefully with needles and scalpels and sharp instruments or other devices.	209	88.2	16	6.8	12	5.1
<i>Respiratory hygiene and cough etiquette</i>							
26	Cover your nose and mouth when coughing/sneezing patient by tissue or mask	153	64.6	71	30.0	13	5.5
<i>Environmental cleaning</i>							
27	Use adequate procedures for the routine cleaning and disinfection of environmental and other frequently touched surfaces and care with bed the patient.	156	65.8	72	30.4	9	3.8
<i>Waste disposal</i>							
28	Treat waste contaminated with blood, body fluids, secretions and excretions as clinical waste, by the safe way.	179	75.5	41	17.3	17	7.2
29	Discard single use items properly.	200	84.4	26	11.0	11	4.6
<i>Patient care equipment</i>							
30	Remove of contamination from equipment soiled with blood, body fluids, secretions, and devise prevent infection transmission to another patient.	188	79.3	44	18.6	5	2.1

Knowledge and Practices of Health Care Workers Regarding Universal Precautions

Gloves practices were stated as wear when touching blood, body fluids, secretions, excretions, mucous membranes were (n=231; 97.5%), change gloves between tasks and procedures on the same patient after contact with potentially infectious material (n=214; 90.3%), and remove it after use, before touching non-contaminated items and surfaces, and before going to another patient. (n=223; 94.1%) (Table 3).

The regular use of face mask when undertaking a procedure that could generate splashes of blood or other body fluid and when handling with patients have expectoration was reported by (n=182; 76.8%) respondents, (n=176; 74.3%) claimed to always use nose mask when handling with infectious microbes through the air, wear mask when exposed to the spray objects (n=181; 76.4%), and wear the masks before cleaning contaminated surgical instruments (n=161; 67.9%). Sharp management practice were stated as recapping after using (n=200; 84.4%), detaching needle from syringe after using (n=205; 86.5%), protect fingers when breaking glass ampoule/bottle (n=214; 90.3%), disposing of used needles and other sharp instruments immediately in safety box (n=213; 89.9%), dealing carefully with needles and scalpels and sharp instruments or other devices (n=225; 94.9%), and other items practice as (Table 3).

One hundred and seventeen (49.4%) respondents had poor knowledge of infection control, 113 (43.5%) had fair knowledge, and

(n=17; 7.2%) had good knowledge. The knowledge was significantly associated with type of center ($P < 0.018$), such that the public center had the highest proportion with poor knowledge. In addition, there was no association with sex ($P < 0.060$), age ($P < 0.387$), profession ($P < 0.492$), work experience ($P < 0.530$) and level of education ($P < 0.533$) (Table 4).

Regarding the practice of universal precautions, (n=8; 3.4%) respondents had a poor practice of universal precautions, (n=93; 39.2%) had fair practice, and (n=136; 57.4%) good practice. The practice was significantly associated with the profession, level of education and work experience ($P < 0.001$), ($P < 0.006$), ($P < 0.001$) respectively. such that Nurses and midwife, Bachelor's degree and less than five years of work experience had the highest proportion with good practice, and There was no association with sex ($P < 0.236$), age ($P < 0.134$), and type of center ($P < 0.273$) (Table 4).

The median scores for the selected items of universal precautions showed significantly different scores between the professions for hand washing practice, use of gloves, use of a face mask, and sharp management dentist having the highest median for the selected items, and then the physician (Table 5). The good practice of universal precautions was significantly associated with better knowledge of infection control show ($P < 0.001$).

Table 4 Association between Sociodemographic Factors of Respondents Knowledge and practice by (n=237)

Sociodemographic item	Level the Knowledge of infection control				Level the Practices of universal precautions			
	Good N (%)	Fair N (%)	Poor N (%)	P-value	Good N(%)	Fair N (%)	Poor N (%)	P-value
Type of center								
Public	4 (3.3)	49 (40.5)	68 (56.2)	0.018*	65 (53.7)	53 (43.8)	3 (2.5)	0.273
Private	13 (11.2)	54 (46.6)	49 (42.2)		71 (61.2)	40 (34.5)	5 (4.3)	
Age Group (years)								
20-29	9 (6.0)	64 (43.0)	76 (51.0)	0.387	90 (60.4)	55 (36.9)	4 (2.7)	0.134
30-39	8 (10.0)	33 (41.2)	39 (48.8)		40 (50.0)	37 (46.2)	3 (3.8)	
>40	0 (0.0)	6 (75.0)	2 (25.0)		6 (75.0)	1 (12.5)	1 (12.5)	
Sex								
Male	8 (9.8)	42 (51.2)	32 (39.0)	0.060	45 (54.9)	32 (39.0)	5 (6.1)	0.236
Female	9 (5.8)	61 (39.4)	85 (54.8)		91 (58.7)	61 (39.4)	3 (1.9)	
Marital Status								
Married	14 (10.1)	60 (43.2)	65 (46.8)	0.110	78 (56.1)	54 (38.8)	7 (5.0)	0.269
Not Married	3 (3.1)	43 (43.9)	52 (53.1)		58 (59.2)	39 (39.8)	1 (1.0)	
Medical Profession								
Nurses and midwife	6 (5.0)	49 (41.2)	64 (53.8)	0.492	59 (49.6)	55 (46.2)	5 (4.2)	0.001**
Physician	3 (7.7)	18 (46.2)	18 (46.2)		24 (61.5)	14 (35.9)	1 (2.6)	
Dentist	3 (12.0)	14 (56.0)	8 (32.0)		25 (100.0)	0 (0.0)	0 (0.0)	
Laboratory technician	5 (11.1)	19 (42.2)	21 (46.7)		23 (51.1)	21 (46.7)	1 (2.2)	

Other	0 (0.0)	3 (33.3)	6 (66.7)		5 (55.6)	3 (33.3)	1 (11.1)
Level of Education							
Primary education	1 (11.1)	2 (22.2)	6 (66.7)	0.533	4 (44.4)	5 (55.6)	0 (0.0) 0.006**
Secondary education	0 (0.0)	11 (42.3)	15 (57.7)		18 (69.2)	8 (30.8)	0 (0.0)
Diploma degree	9 (8.5)	44 (41.5)	53 (50.0)		47 (44.3)	52 (49.1)	7 (6.6)
Bachelor's degree	5 (6.3)	37 (46.8)	37 (46.8)		56 (70.9)	23 (29.1)	0 (0.0)
Postgraduate	2 (11.8)	9 (52.9)	6 (35.3)		11 (64.7)	5 (29.4)	1 (5.9)
Work Experience (years)							
<5	7 (6.0)	52 (44.8)	57 (49.1)	0.530	73 (62.9)	39 (33.6)	4 (3.4) 0.001**
5-10	6 (8.2)	35 (47.9)	32 (43.8)		48 (65.8)	24 (32.9)	1 (1.4)
>10	4 (8.3)	16 (33.3)	28 (58.3)		15 (31.2)	30 (62.5)	3 (6.2)

* $p < 0.05$, ** $p < 0.001$

Table 5 Median Score for Selected Universal Precautions by Medical Profession

	Hand washing Median Total =18	Gloves Median Total =8	Face mask Median Total =10	Sharp management Median Total =10
Medical profession				
Nurses and midwife	15.00	7.00	6.00	8.00
Physician	14.00	8.00	7.00	9.00
Dentist	16.00	8.00	9.00	10.00
Laboratory technician	15.00	5.00	6.00	9.00
Other	14.00	7.00	8.00	9.00
<i>P</i> -value*- KW	0.008	0.001	0.002	0.012

* The significance level is 0.05, KW = Kruskal-Wallis

Table 5.1 The Association between Knowledge of infection control and Universal Precautions Practice.

Correlations	(r)	Spearman's <i>P</i> -value
	.236*	0.001

*Correlation is significant at the 0.01 level (2-tailed), (r) Correlation Coefficient

DISCUSSION

This study to assess infection control among health workers in Yemeni health centers. In this study most of the health workers were in the age group of 20-29 years age similar to what was documented in some studies.^{3,9,14,15} Data from the study revealed the low awareness of knowledge about infection control, Unlike other studies who reported the highest good knowledge in regards to infection control.^{14,16} This may attributed to poor infection control programs and policies. Additionally insufficient information of knowledge and practice may still be deficient due to a lack of training and continuing education about infection control.

We found that the respondents a good practice (57.4%) wear higher than (46.8%) what was reported by¹⁴ in contrast to⁹ who reported lower (71.7%) good practices of universal precautions. The highest proportion of the nurses and midwife were found to have a more knowledge and practices than other health workers. While our study was revealed an equally observed in a study carried out by,¹⁴ and is not surprising as nurses and midwives which have more numerous than others in the health team.

In the present study, we have found a high proportion of compliance hand washing practice items. Whereas hand washing before and after any direct patient contact and wears gloves when

touching blood or other body fluid or mucus membrane were approximately similar to what was reported by¹⁴. This might be attributed to their often times the greater perception of risk, and the fact that their work often necessitates handling waste, and hand washing thereafter becomes needful.

Generally, Good Sharp management items in our study like re-capping after using, were practiced at a higher rate than what was reported by previous studies.^{14,17-20} Our study also found that the disposing of used needles and other sharp instruments immediately in safety box was similar to report by a recent study¹⁴ and that's may attributed to that the health care workers try to be a model subjects in filling questionnaire items. The low practices of universal precautions among workers are in agreement with other studies^{1,14,16,20} and contrary to what was observed in other.^{12,21}

The finding of better practice of universal precautions were among nurses and midwives compared to other professions which is in agreement with¹⁴ in contrast to previous studies.^{5,22} This discrepancy may attributed to low awareness of universal precautions among different health care workers.

The positive correlation between knowledge of infection control and practice of universal precautions ($P < 0.001$) is likely to that reported by.^{14,23-25} This reinforces the needs for training in universal precautions. Our study has a several limitation; first the data was collected during a military explosion in Sana'a the Capital of Yemen which was trammels for getting access to the subjects. Second, the tendency for health care workers to exaggerate their compliance with universal precautions may have produced a less unfavorable picture than it actually is.

CONCLUSION

The findings of this study showed low awareness of general aspect of infection control knowledge and also low universal precautions practices among health care workers and its emphasized the needs for intensive enlightenment programs to educate health care workers on various aspects of standard precautions and infection control programs and policies.

RECOMMENDATION

Employing and training health care workers (pre- and in-service) about bloodborne infections and universal blood precautions through regular scientific meetings and training courses. A protocol for universal blood precautions, needle-stick injuries and infection control should be used in both government and private units.

ACKNOWLEDGMENT

I would like to thank my friend Dr .Salah Adlat who provide me all advices that needed in all

stages in writing the proposal and final manuscript. I also immensely grateful to all the research assistants, the management of the centers and health workers who participated are also acknowledged. Last but not least, I would like to thank everybody who helped me in collecting the data and who was favored in the success of this work.

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