

**Universal precautions needed for preventing blood-borne infections: Knowledge, attitude, and practices of health care workers at King Abdulaziz University Hospital, Jeddah, Saudi Arabia**

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**Original Article**

**Universal precautions needed for preventing blood-borne infections: Knowledge, attitude, and practices of health care workers at King Abdulaziz University Hospital, Jeddah, Saudi Arabia**

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## ABSTRACT

**Objectives:** The study was done to assess knowledge, attitudes and practice (KAP) of physicians and nurses working at King Abdulaziz University Hospital (KAUH) towards the Universal Precautions (UP) needed for preventing blood-borne pathogens (BBP).

**Design:** A cross-sectional design was conducted.

**Setting:** KAUH, Jeddah, Saudi Arabia

**Subjects:** A total of 400 health care workers (HCWs) were selected from the inpatient and outpatient departments of KAUH.

**Intervention(s):** A validated, anonymous, interviewing questionnaire was used, during 2016/2017. Knowledge of HCWs was assessed through nine questions. Attitudes were determined through twelve statements answered on a three-point Likert scale. Self-reported practices were evaluated through twelve questions. Knowledge and practice scores were calculated. Descriptive and inferential statistics were done.

**Main outcome measure(s):** KAP of physicians and nurses towards UP needed for preventing BBP.

**Results:** Most participants correctly identified that UP are required for all body fluids, and for all patients. Younger participants, those with shorter working experience, physicians (especially residence), and those from non-surgical departments had significantly better knowledge scores compared to others ( $P < 0.05$ ). HCWs had generally good attitudes towards UP. Nurses, females, older participants, and those with longer working experience had significantly better UP practices than others.

**Conclusion:** Health care workers have relatively good attitudes and practices towards UP needed for preventing BBP. However, some areas of knowledge need improvement like knowledge about the infectivity of BBP, and the required post exposure prophylaxis. Conduction of more specific pre-service, on job training and educational programs on UP are required for all HCWs.

**KEY WORDS:** blood-borne pathogens, KAP, physicians, standard precautions, UP

## INTRODUCTION

Occupational exposures to blood-borne pathogens (BBP) have been documented as one of several occupational hazards that can affect health care workers (HCWs)<sup>[1-4]</sup>. Furthermore, patient safety represents an ultimate important discipline in the medical field<sup>[5]</sup>. There are many BBP which can be transmitted between patients and HCWs. The most important and frequent ones are Hepatitis B Virus (HBV), Hepatitis C Virus (HCV) and the Human Immunodeficiency Virus (HIV)<sup>[6]</sup>. Other BBP such as Hepatitis G, Herpes Simplex type 1, Group A Streptococcus and Human Parvovirus B19 may also be transmitted by needle stick injuries (NSI) but less frequently than the others<sup>[1]</sup>.

The risk of transmission of the main BBP after a NSI or cut exposure was estimated to be about 6 – 30% for HBV, 1.8% for HCV, and 0.3% for HIV/AIDS<sup>[7]</sup>. The global burden of diseases resulting from unsafe injection practices was estimated to be 21 million new cases of HBV, 2 million cases of HCV and 260,000 cases of HIV/AIDS annually<sup>[8]</sup>. These BBP can lead to serious complications including cancers<sup>[1]</sup>.

Exposure to infected blood and body fluids can be reduced in health care settings by proper applications of Universal Precautions (UP). These precautions need to be applied by HCWs for preventing transmission of BBP while providing patients' care<sup>[9,10]</sup>. Wearing latex gloves when dealing with patient's blood and different body fluids or mucous membranes is one of these precautions. The other personal protective equipment (PPE) include the use of gowns, masks, protective eye goggles, *etc.* Precautions are required when handling instruments or surfaces stained with blood or body fluids. Hands and other skin surfaces should be correctly washed after dealing with patients and following each glove change. HCWs should avoid recapping the used needles<sup>[1-4]</sup>. In addition, vaccination of HCWs against HBV has been included as an important precaution<sup>[11]</sup>. All these measures should be followed for all patients regardless the patients' blood-borne infection status<sup>[9]</sup>. A study reported from China in 2010, showed that nurses who were more compliant with the UP are less likely to be exposed to sharp injury contamination<sup>[12]</sup>.

Appropriate information and proper compliance with the standard infection control practices are the most important factors to confirm low rates of accidental injuries and low infection rates of HCWs and patients<sup>[13]</sup>. Improving infection control practices can be attained by identifying gaps of HCWs' knowledge and practice about such important issue<sup>[14]</sup>. However, inadequate studies were conducted about this topic in Jeddah. So, such study is needed.

The current cross-sectional study assessed the knowledge, attitudes & practice of physicians and nurses working at King Abdulaziz University Hospital (KAUH) towards the universal precautions needed for preventing BBPs.

## SUBJECTS AND METHODS

A cross-sectional design was conducted during 2016/2017. The study enrolled nurses and physicians from the wards and outpatient clinics of KAUH, Jeddah, Kingdom of Saudi Arabia (KSA). All HCWs who agreed to participate, and signed the written consent were included.

A convenience sample method was used and the sample size was calculated according to the formula<sup>[15]</sup>:

$$"n = \frac{z^2 \times p \times q}{d^2}"$$

Where Z= 1.96, p is the estimated prevalence of good knowledge about BBP. It was set as 0.5 due to lack of similar studies done in Jeddah. So, q = 0.5, and d was set at 0.05. The minimum calculated sample size was 384, which was rounded to 400 participants.

A validated, interviewing questionnaire was used. The face and content validity of the questionnaire was evaluated by 2 experts. The internal consistency reliability was assessed using Cronbach's alpha and found to be 80%.

The questionnaire consisted of four parts:

- Personal and socio-demographic data as age, sex, job, degree, *etc.*
- HCWs' Knowledge about BBP and the UP was assessed through nine multiple choice questions. These questions inquired about the correct applications of the UP. Another question asked about the Post Exposure Prophylaxis (PEP) needed for a non-immunized HCW (by HBV vaccine) who was exposed to infected blood by HBV. Questions were inquired also about the highest (HBeAg infected blood) and lowest (HIV/AIDS) possibility of catching infections by BBP through infected NSI. Information about HBV vaccine regarding the minimum number of doses, and the route of its administration were assessed.
- HCWs' attitudes towards UP were determined through responses of HCWs to 12 statements answered on three-point Likert scale.
- HCWs' self-reported practices were assessed through answers on questions about receiving at least 3 doses of HBV immunization, their exposure to NSI, the number of exposure to NSI (if any), and the measures taken by HCWs in response to such event. Compliance of HCWs with the UP was assessed through 12 questions which asked about their practices towards certain case scenarios related to BBP and how they can be prevented.

### **Ethical statement**

The study was approved by the Unit of Biomedical Ethics of KAUH (Reference Number: 91-16). Administrative approvals were taken from the Vice dean of University Hospital Director and from the Nursing Administrators. Confidentiality was maintained throughout the study.

### **Statistical methods**

Data was analyzed using Statistical Package of Social Sciences (SPSS) Version 21. For each knowledge question, a score of "1" was given for the correct answer and "zero" for the incorrect or don't know answers. A total knowledge score was calculated and ranged from zero to nine. It was then classified into three categories:

Poor score  $\leq 4$  ( $\leq 50\%$  of the correct answers), fair score: 5-6 ( $>50\%$ - 66.6% of the correct answers) and satisfactory score  $\geq 7$  ( $> 66.6\%$  of the correct answers).

For the 12 self-reported practice; a score of "1" was given for the correct practice and "zero" for the incorrect. A total practice score was calculated (ranging from 0 to 12).

Descriptive statistics was done. Inferential statistics including Chi-square test, Student's t-test and One-Way Analysis of Variance (ANOVA) tests were performed. Post-Hoc test for

ANOVA was done by the least significant difference (LSD). All p-values <0.05 were considered statistically significant.

## RESULTS

A total of 400 HCWs participated in the current study, and consisted of 227 physicians (56.7%) and 173 nurses (43.3%). Their age ranged from 21– 60 years, with a mean of 31.8 ± 9.2 years.

Table 1 reveals that physicians had significantly better knowledge than nurses regarding most of the questions about BBP. For example, 83.3% of physicians knew the correct number of doses of HBV vaccine compared to 69.4% of nurses ( $p < 0.001$ ). Similar trend was also seen regarding other questions about BBP. On the other hand, nurses had better knowledge than physicians regarding the route of administration of HBV vaccine and about the UP. The table also shows that 78.2% of all HCWs knew that UP should be applied while dealing with all body fluids, and a similar percentage (78.5%) identified that UP should be taken for all patients. However, only 46% of the participants knew the PEP required to prevent HBV among non-immunized HCWs exposed to infected blood with the virus. A similar percentage (43.8%) also identified the correct duration of survival of HBV outside the body. The table reveals that only 11% of the HCWs knew that the highest risk of acquiring infection with BBP is by accidental exposure to blood from individual with HBeAg positive status. On the other hand, 41.5% of health-care personnel identified that the lowest risk of infection by BBP occurred by exposure to HIV-infected blood.

Table 2 reveals that younger participants (<30 years), and those who had working experience less than two years obtained significantly better knowledge (higher levels of satisfactory knowledge scores) about BBP and UP compared to others. Similarly, physicians had significantly better level of knowledge compared to nurses ( $p < 0.01$ ), and residents obtained the best knowledge scores compared to other HCWs ( $p < 0.05$ ).

Regarding attitudes, Table 3 illustrates that most of the participants agreed that HCWs need to wash their hands after removing and disposing PPE (97%), and to change the used gloves after dealing with patients or touching the equipment (93%). About three-fourths (76.5%) of our HCWs agreed that they should refrain from direct patient care if they have exudative lesions or weeping dermatitis.

Concerning practice, 96% of our participants received three doses of HBV vaccine. On the other hand, 21.2% of HCWs reported their exposure to at least one accidental NSI during their work (ranged from 1-8 times). Regarding their responses to such NSI, 10.4% of the exposed participants reported that they didn't do anything in response to such occasion, and 20.8% reported that they only washed the injured area with water. The rest of HCWs (68.8%) said that they reported the responsible authorities about the event, and did multiple action including seeking treatment from the Hospital Infection Control Unit.

Regarding participants' self-reported practices and compliance with UP for prevention of BBP, 87.8% of HCWs reported that they always wash their hands after taking-off the PPE, and

79.3% always changed gloves after dealing with patients or touching instruments. Furthermore, 76.8% of HCWs reported that gloves are the last things of PPE they wear, and 82.5% of them reported washing their hands immediately after removing used gloves. In addition, 94% and 85.3% of HCWs reported changing gloves between patients, and removing gowns before leaving the patient's care area, respectively. However, only 58% of them notified that they remove gloves and wash their hands before taking off the rest of PPE. Furthermore, 70.8% of HCWs notified wearing eye goggles when they were exposed to bloody discharge.

Concerning injection safety, all HCWs reported usage of disposable needles and syringes, and 76% of them reported that they don't recap needles after usage. Concerning patients' safety, 80.8% and 71.5% of the HCWs reported that they cover their wound(s) with waterproof dressing before providing patient's care, and withholding all patients' care if they have exudative lesions, respectively.

Table 4 illustrates that females exhibited significantly better compliance with UP compared to males ( $t = 6.31$ ,  $P < 0.001$ ). Furthermore, nurses had better compliance with the standard precautions compared to physicians ( $F = 47.98$ ,  $p < 0.001$ ). Post-Hoc LSD test reveals that nurses' practice differs significantly from all other HCWs. The table also reveals that participants with the shortest duration of working experience had the lowest compliance with UP compared to others ( $F = 33.73$ ,  $p < 0.001$ ). The table also reveals absence of statistical association ( $t = 1.69$ ,  $p = 0.092$ ) between the compliance with the UP among HCWs from surgical and non-surgical departments. HCWs who obtained poor knowledge score reported slightly lower compliance with UP compared to those had fair & satisfactory scores ( $p > 0.05$ ).

## DISCUSSION

Infection with BBP represents an important public health challenge that face many nations' health care systems<sup>[5]</sup>. In the current study, physicians generally had better knowledge than nurses regarding most of the questions about BBP. This difference may be attributed to higher physicians' information gained from their medical education. However, nurses had better knowledge than physicians regarding UP and the route of administration of HBV vaccine, and this difference may be due to their on-job training programs related to work and UP.

In the present study, most of our HCWs (78.3%) correctly recognized that UP should be applied for all body fluids, which coincides with the findings from West Indies, Jamaica<sup>[4]</sup>. A similar percentage of our participants knew that UP should be applied for all patients, which agrees with findings from France<sup>[16]</sup> and Afghanistan<sup>[17]</sup>.

More than three-fourths of our HCWs knew the correct number of doses of HBV vaccination, which concurs with a study done among HCWs from Cameroon<sup>[18]</sup>.

Our results found that 35.3% of our nurses had sound knowledge about PEP after exposure of non-immunized HCW to HBV infected blood. This result is better than the percentage (12.1%) reported by nurses from Ghana, 2017<sup>[19]</sup>. This discrepancy may be attributed to the differences between both countries or due to training programs done in KAUH.

Presence of HBeAg reflects viral replications, and it is associated with the highest HBV infectivity rates after percutaneous exposure<sup>[20]</sup>. On the other hand, the risk of HIV transmission after a percutaneous exposure to the virus is considered the lowest compared to other BBP<sup>[2]</sup>. In the current study, only 11% and 41.5% of our HCWs correctly recognized these facts regarding HBeAg and HIV, respectively. The cause of such low knowledge regarding these two questions may be due to being specific questions that require a great amount of information about the infectivity rates resulted from different BBP. However, our rate regarding HIV infectivity is better than that reported by dental students and staff (32.1%) from India<sup>[21]</sup>. This inconsistency in results may be attributed to the differences between both target populations.

The present work revealed that younger HCWs obtained better knowledge score about BBP and UP compared to others, which is in line with the results from Afghanistan<sup>[17]</sup>. This finding may be because younger HCWs are usually newly graduated and they usually have more recent and updated medical information compared to others. This explanation can also elucidate our finding that residents obtained the highest level of knowledge compared to others, which may also due to their repeated examinations.

Our study found that gender didn't affect HCWs' knowledge. These two findings coincide with results of Vaz *et al.* from Jamaica<sup>[22]</sup>.

HCWs from non-surgical departments in our study had better knowledge regarding BBP compared to others. On the other hand, Askarian *et al.*<sup>[23]</sup> reported absence of significant association between knowledge scores among surgeons or physicians.

HBV vaccine is 95% effective in preventing HBV infection and its chronic consequences, and is the first anti-cancer vaccine<sup>[1]</sup>. Regarding practice, a very high percentage (96%) of our participants were fully immunized against HBV. This rate is greater than that reported by physicians (87.2%) from primary health care centres of Jazan, KSA<sup>[11]</sup>. The cause of this discrepancy may be due to differences between both settings. Our rate is also much better than that reported by nurses from Ghana (44.4%)<sup>[19]</sup>. This discrepancy may be due to differences between the economic status of both countries.

In the current study, most HCWs reported complying with the sound hand hygienic practices, which coincides with the results from Afghanistan<sup>[17]</sup>. In contrast, Ogoina, *et al.*<sup>[24]</sup> reported much lower rates of such good hand hygienic practices between HCWs from two Nigerian hospitals. This discrepancy may be attributed to the training programs in KAUH.

Our study found that 21.2% of HCWs reported exposure to NSI, and 68.8% of the exposed personnel reported the Infection Control Unit. On the other hand, about half of the dental students and staff from the Indian study reported exposure to NSIs, and more than half of them did not report their injuries to Infection Control Unit<sup>[21]</sup>. Similarly, another study from Ethiopia revealed that 34.8% of HCWs suffered from such injury and 58.7% of them didn't report their exposure<sup>[6]</sup>. These discrepancies may be attributed to the differences between the type of the target populations, or to the educational programs received by our staff.

All our healthcare personnel reported using disposable syringes and needles, which coincides with the results from Jazan<sup>[11]</sup>. However, a lower rate was notified from the study of Oyewusi, *et al*<sup>[25]</sup>. Furthermore, 94% of our participants reported changing gloves between patients, which is better than the rate reported from Afghanistan (68.2%)<sup>[17]</sup>. These discrepancies may be attributed to the more availability of resources in KAUH due to differences in the economic status, or due to more training available in the hospital.

A high percentage (76%) of our participants reported discarding needles without recapping. On the other hand, lower rates were reported from West Indies (31.7%)<sup>[4]</sup> and Afghanistan (42.2%)<sup>[17]</sup>. These inconsistencies may be also due to training courses done for our staff about “safe injection practices”.

In the current study, wearing eye goggles was notified by 70.8% of HCWs, which is better than the rate reported from Afghanistan (59.3%)<sup>[17]</sup>. On the other hand, a study from Georgia showed that 24% of their participants used eye shields<sup>[26]</sup>. These discrepancies may be explained by the deficiency of PPE in their settings.

Regarding patient safety, 80.8% of our HCWs reported covering their wounds with waterproof dressing before caring for patients, which agrees with the study from Afghanistan (82.6%)<sup>[17]</sup>.

Nurses and females in the present study displayed significantly better compliance with the UP compared to the physicians and males. This may be due to more training available for nurses at KAUH; as they are more exposed to NSIs. Furthermore, most nurses are females (generally and in our study) and this can explain better practice among females. Similar associations were reported from an older study done in Birmingham teaching hospitals, UK<sup>[27]</sup>. However, another Nigerian study reported absence of such associations<sup>[28]</sup>.

In the present study, increasing the age of HCWs and having longer working experience are associated with better compliance with UP, which agree with the results from Pakistan<sup>[3]</sup>. This may be due to the gained cumulative practice’s experience or the increasing number of received training overtime. However, a study from Malaysia found absence of association between the practice and the years of experience<sup>[10]</sup>.

We found absence of statistical association between practices of HCWs from medical or surgical departments, which may be attributed to the adequate training available for all hospital departments. In contrast, a study from Shiraz, Iran, reported significant association between compliance of HCWs from the two departments<sup>[23]</sup>.

HCWs in the present study exhibited good attitudes towards using the UP needed for prevention of BBP, which agree with the studies from Jazan<sup>[11]</sup> and Nigeria<sup>[24]</sup>.

## CONCLUSION

HCWs in the current study have relatively good attitudes and practices concerning standard UP needed for prevention of BBP. The occupational exposure to NSI was relatively low (21.2%) among our HCWs. About two-thirds of them reported the event and searched for suitable PEP. However, some areas of HCWs’ knowledge need more improvement like their

knowledge about the infectivity of BBP, and the required PEP after exposure to BBP. It is recommended that all elements of UP should be strictly utilized by HCWs for their own safety as well as for patients' safety. Intensifying the surveillance system about BBP and UP is recommended. Conduction of more comprehensive educational programs, wide-range pre-service and on job training programs are required. Intensifying educational programs such as sharps injury prevention programs is required to improve knowledge and practices of all HCWs regarding UP.

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**Table 1:** Comparisons between the knowledge of physicians and nurses about blood-borne pathogens and universal precautions, King Abdulaziz University Hospital

Sentence	Physicians		Nurses		Total		X <sup>2</sup> (P)
	No.	%	No.	%	No.	%	
<b>The minimum number of doses of Hepatitis B vaccine (3 doses)</b>							
Correct	189	83.3	120	35.3	69.4	77.3	10.78
Incorrect	38	16.7	53	30.6	91	22.7	(0.000)
<b>The route of administration of HBV vaccine (Intramuscular)</b>							
Correct	139	61.2	135	78.0	274	68.5	12.8
Incorrect	88	38.8	38	22.0	126	31.5	(0.000)
<b>PEP for non-immunized HCWs exposed to HBV infected blood (HBIG &amp; 3 doses of HBV vaccine)</b>							
Correct	123	54.2	61	35.3	184	46.0	14.16
Incorrect	104	45.8	112	64.7	216	54	(0.000)
<b>Duration of survival of HBV outside the body (at least 7 days)</b>							
Correct	116	51.1	59	34.1	175	43.8	11.52
Incorrect	111	48.9	114	65.9	225	56.2	(0.001)
<b>The highest infectivity from organism after exposure to BBP (Blood from persons who are positive for HBeAg +ve)</b>							
Correct	33	14.5	11	6.4	44	11.0	6.71
Incorrect	194	85.5	162	93.6	356	89.0	(0.01)
<b>The lowest infectivity of organism after exposure to BBP (HIV infected blood)</b>							
Correct	104	45.8	62	35.8	166	41.5	4.03
Incorrect	130	45.2	111	64.2	234	58.5	(0.04)
<b>The most resistant BBP to sterilization (HCV)</b>							
Correct	66	29.1	29	16.8	95	23.8	7.2
Incorrect	161	70.9	144	83.2	305	76.2	(0.000)
<b>UP should be applied while dealing with (all body fluids)</b>							
Correct	167	73.6	146	84.4	313	78.2	6.76
Incorrect	60	26.4	27	15.6	87	21.8	(0.009)
<b>UP should be applied when dealing with (all patients)</b>							
Correct	164	72.2	150	86.7	314	78.5	12.16
Incorrect	63	27.8	23	13.3		21.5	(0.000)
<b>Total</b>	227	100	173	100		100	

**Table 2:** Levels of knowledge of health-care workers about blood-borne pathogens and universal precautions, according to the study variables

Variables	Level of knowledge						$\chi^2$ (P)
	Poor		Fair		Satisfactory		
	No.	%	No.	%	No.	%	
<b>Gender</b>							
Male	68	48.9	54	38.8	17	12.2	0.74 (0.690)
Female	119	45.6	113	43.3	29	11.1	
<b>Age (years)</b>							
<30	95	42	96	42.5	35	15.5	9.72 (0.008)
≥ 30	92	52.9	71	40.8	11	6.3	
<b>Job</b>							
Physician	97	42.7	94	41.4	36	15.9	10.50 (0.005)
Nurse	90	52.0	73	42.2	10	5.8	
<b>Job title</b>							
Post graduate	17	45.9	16	43.2	4	10.8	13.92 (0.03)
Resident	33	35.9	43	46.7	16	17.4	
Nurse	84	52.2	68	42.2	9	5.6	
Interns	53	48.2	40	36.4	17	15.5	
<b>Department</b>							
Non-surgical	98	44.7	86	39.3	35	16	9.58 (0.008)
Surgical	89	49.2	81	44.8	11	6.1	
<b>Work experience (years)</b>							
< 2 years	65	43.9	56	37.8	27	18.2	13.09 (0.011)
2-10 years	62	44	67	47.5	12	8.5	
> 10 years	60	54.1	44	39.6	7	6.3	

**Table 3:** Attitudes of health-care workers towards universal precautions needed for preventing blood-borne infections, King Abdulaziz University Hospital

<b>Statement</b>	<b>Agree No. (%)</b>	<b>No Opinion No. (%)</b>	<b>Disagree No. (%)</b>
HCWs need to wash hands after removing and disposing PPE.	338 (97.0)	11 (2.8)	1 (0.2)
HCWs need to change gloves after patient interaction, touching portable computer keyboards or other mobile equipment	372 (93)	20 (5)	8 (2.0)
Gloves are the last thing that HCWs wear when using PPE.	271 (67.8)	26 (6.5)	103(25.7)
HCWs need to wash hands immediately after removing gloves.	367 (91.8)	23(5.8)	10(2.4)
HCWs need to remove gowns before leaving the patient's care area.	364 (91)	22 (5.5)	14(3.5)
HCWs need to take off the gloves and wash hands before removal of face shield, goggles and mask.	246 (61.5)	47 (11.8)	107(26.8)
HCWs need to use sterile, disposable needle for each injection.	386 (96.5)	11 (2.8)	3(.8)
HCWs need to change gloves between patients.	381 (95.3)	16 (4)	3(.8)
HCWs should not recap the used needles.	346 (86.5)	16 (4)	38(9.5)
HCWs need to cover their wound(s) or lesions with waterproof dressing before caring of patient.	341(85.3)	53 (13.3)	6(1.5)
HCWs need to wear eye shield/goggles when may be exposed to splashing of bloody discharge/fluid.	384 (96)	12 (3)	4(1)
HCWs need to refrain from patient's care or handling equipment if they have exudative lesions or weeping dermatitis.	306 (76.5)	57(14.3)	37(9.3)

**Table 4:** Health care workers' practice scores regarding their compliance with the universal precautions according to study variables

<b>Variables</b>	<b>Practice score Mean ± SD</b>	<b>Test of significance</b>	<b>P-value</b>
<b>Gender</b>			
Male	8.42 ± 3.01	t = -6.31	0.000
Female	10.12 ± 2.28		
<b>Age (years)</b>			
<30	8.69 ± 2.7		
≥ 30	10.62 ± 2.23	t = -7.64	0.000
<b>Job</b>			
Physician	8.43 ± 2.82	t = -10.63	0.000
Nurse	10.97 ± 1.58		
<b>Job title</b>			
Post graduate <sup>a</sup>	8.51 ± 3.25		
Resident <sup>b</sup>	8.65 ± 2.37	F = 47.98	0.000
Nurse <sup>c</sup>	11.20 ± 1.26		
intern <sup>d</sup>	8.16 ± 2.96		
Post-Hoc LSD test: <sup>c</sup> significantly differs from <sup>a,b,d</sup>			
<b>Department</b>			
Non-surgical	9.74 ± 2.51	t = 1.69	0.092
Surgical	9.28 ± 2.85		
<b>Work experience (in years)</b>			
< 2 years <sup>a</sup>	8.34 ± 2.86		
2-10 <sup>b</sup>	9.71 ± 2.40	F = 33.73	0.000
> 10 <sup>c</sup>	10.88 ± 1.98		
Post-Hoc LSD shows that <sup>a</sup> differs from <sup>b and c</sup> and <sup>b</sup> differs from <sup>a and c</sup>			
<b>Knowledge score</b>			
Poor	9.43 ± 2.87	t = - 0.64	0.5
Fair and satisfactory	9.61 ± 2.50		

LSD: Least statistical difference