Al-Azhar Med. J. *Vol. 46(2), April, 2017, 515-529*
DOI: 10.12816/0038274

INFECTION CONTROL AMONG HEALTHCARE PROVIDERS AT UMM AL QURA UNIVERSITY MEDICAL CENTER, MAKKAH, SAUDI ARABIA. A CROSS-SECTIONAL STUDY

By

Mohamed O. Nour[1,2*], Khalil Mohamed[3], Amel AL Bishi[3], and Maysa Amir[3]

[1] Department of Public Health & Community Medicine, Al-Azhar Faculty of Medicine, (Damietta), Egypt
[2] Faculty of Public Health and Health Informatics, Umm AL Qura University, Makkah, KSA
[3] University Medical Center, Umm AL Qura University, Makkah, KSA

ABSTRACT

Background: Healthcare associated infections (HCAI) are one of the most serious and complex worldwide health problems. Committment to standard precautions (SPs) and infection control (IC) measures are important to all healthcare providers (HCP) to prevent occupational exposure to hazardous materials.

Objectives: This study aimed at evaluating the knowledge, attitude and practices (KAP) towards IC measures amongst HCP at Umm AL Qura University Medical Center, Makkah, Saudi Arabia.

Subjects and methods: A cross-sectional descriptive study was conducted by using a pretested self-administered questionnaire. Convenience sampling was used, and the KAP scores of HCP towards IC measures were evaluated and correlated with their characteristics.

Results: The study included 54 HCP with mean age 32.4±7.8 years, half of them were female and 42.6 % of them received previous training/orientation on IC and SPs in different forms. Participants' good KAP scores concerning the various aspects of IC measures were slightly below average (46-48%). No significant differences between the overall mean KAP scores and different characteristics of participants, but significant correlations were observed between knowledge and both attitude and practices scores.

Conclusion: There was a gap between the actual and desired KAP of HCP regarding IC. Continuing education programs are needed to improve their KAP scores towards SPs and IC measures in order to reduce HCAI.

Key words: Knowledge, attitude, practices, standard precautions, infection control, healthcare providers.

INTRODUCTION

Healthcare providers (HCP) are constantly exposed to infectious organisms that can cause serious or even lethal infections **(Laheij et al., 2012)**. They have the greatest risk of causing cross-infection, because of their high visibility and their direct interaction with patients during the course of carrying out their activities particularly if infection control (IC) procedures are ineffectively implemented **(Mani et al., 2010)**.

Standard precautions (SPs) require the application of basic IC principles through hand hygiene, use of personal protective equipment (PPE), safe handling of needles and sharp instruments and proper waste disposal **(Mehta et al., 2014)**. Consistent

use of SPs is recommended on all patients regardless their infection status **(Mollaoglu et al., 2015)**. Despite advances in prevention and control of these infections, the problem continues to cause death and increase costs of the health care **(Horan et al., 2011)**. Regular updating and strengthening of IC practices should be one of the priority functions of any place where health services are rendered **(Fashafsheh et al., 2015)**.

Prevention of HCAI is the duty of all HCW **(Amoran and Onwube, 2013)**. Medical and paramedical staffs must know various measures for their own protection **(McHugh and Stimpfel, 2012)**. Many SPs and IC measures are designed to reduce the risk of acquiring occupational infection from both known and unexpected sources in HC settings **(Jayasinghe and Weerakoon, 2014)**. Most of these precautions are usually simple, of low-cost and utilization of these precautions depends largely on the human element that may increase or decrease the chances of catching HCAI **(Cole, 2007)**.

Compliance of HCP with SPs has been recognized as an effective method to prevent and control HCAI **(Dioso, 2014)**. This requires accountability and behavioral change of HCP in addition to improving reporting and surveillance systems **(Brewster et al., 2016)**. Health education sessions, monitoring, improved availability of resources and interdisciplinary measures for poor compliance are needed to improve IC practices in HC settings **(Flanagan et al., 2016)**.

We aimed to assess the level of KAP scores regarding IC amongst the HCP at the Umm AL Qura University Medical Center, Makkah, Saudi Arabia.

SUBJECTS AND METHODS

This was an institutional based cross-sectional study conducted at the Umm Al Qura University Medical Center, Makkah, Saudi Arabia during the period from January to July 2016. The Center is considered as a primary HC center containing 15 outpatient clinics (both general and specific), laboratory, pharmacy, radiological, dental and emergency departments that serve about 400-500 Saudi and non Saudi attendants with their families per day.

All HCP (No.=78) (physicians, dentists, pharmacists, technicians and nurses) in the University Medical Center participated in the study regardless of age, gender, nationality or type of their work. Other sanitarians, health officers, clerical workers, maintenance and laundry personnel were not included.

Convenience sampling was used in finding the respondents where all available HCP at the time of the visits and fulfilling the inclusion criteria were selected.

Data were collected through self-administered questionnaires that distributed during the visits. Each questionnaire was evaluated for missing data at the time of submission with a trial to be corrected in the presence of the respondent to ensure that each question would be answered. A total of 54 HCP (out of 78) completed the questionnaires with a response rate of about 69%.

A questionnaire was designed to be a self-administered one in both Arabic and English, using back translation technique to ensure content validity, after extensive search in the literature on SPs and IC

guidelines **(Michelin & Henderson, 2010; Dioso, 2014; Mehta et al., 2014 and Ogoina et al., 2015)**, and consultations with experts in the field. A pilot study was conducted (Data were removed from final analysis) on 15 HCP in nearby primary HC center to ensure practicability and validity in questions and interpretation of responses. Accordingly, some questions and responses had to be revised for clarity or deleted as appropriate, and questionnaire was finalized after a series of group discussion. A reliability analysis was done to determine internal consistency of items with each other. The questionnaire was divided into 4 parts:

- The 1st part focused on demographic and occupational characteristics of participants.
- The 2nd part measured their level of knowledge regarding general concepts about IC, hand hygiene, PPE, sharp disposal, HC environmental sanitation, sharp injuries and care of HCP. It included 40 items, some of which were negatively stated and containing 3 answers (yes, no, don't know). For each item, the correct response was given 1 point, and wrong answer or don't know was given 0 point with overall score of 40 that graded to good knowledge (score $\geq$ 30), fair (score 20-29) or poor (score < 20).
- The 3rd part determined their attitude (n= 10 items) that was measured by 3 point Likert scale of agreement (agree, uncertain or disagree). A score of 1 was given for 'Agree' to a positive attitude question, or 'Disagree' to a negative attitude question. A zero score was given for 'Uncertain', 'Disagree' to a positive attitude question, or 'Agree' to a negative attitude question. Consequently, overall score was 10 that graded to good attitude (score 8-10), fair (score 5-7) or poor (score <5).
- The 4th part assessed their self-reported practices (n= 15 items) using yes, no or sometimes options with overall score of 30 (2, 1 or 0 for correct, sometimes or incorrect responses respectively) that graded to good practice (score $\geq$ 23), fair (score 15-22) or poor (score <15). Overall KAP scores were graded as good (based on $\geq$ 75% of the summed scores), fair (50-74%) or poor (if < 50%).

Ethical approval was obtained from the committee of Bio-ethics at Umm Al Qura University and then from the directorate of University Medical Center. Furthermore, written consents were obtained from the participants with brief explanation on objectives and benefits of the study with emphasis that personal data would be confidential and used for scientific work only.

Statistical analysis was carried out using the SPSS computer package version 21.0 (SPSS Inc., Chicago, IL, USA). The mean ± SD were used for quantitative variables, while number and % were used for qualitative variables. Differences in means of quantitative variables were assessed by independent samples t-test and One-Way ANOVA test. Correlation was analyzed by Pearson correlation coefficient. A value of $P<$ 0.05 was considered statistically significant.

RESULTS

The study included 54 HCP working at Umm Al Qura University Medical Center with mean age 32.4±7.8 years ranged from 23–57 years. Half of them were females. Nursing constituted the main working power, and 42.6 % of them received previous training/orientation on IC and SPs in different forms (Table 1).

Table (1): General characteristics of participants.

Variables \ Participants (No. = 54)		No.	%
Age (years)	Mean ± SD	32.4± 7.8	
	Min – Max	23 – 57	
	≤ 30 years	29	53.7
	> 30 years	25	46.3
Gender	Male	27	50.0
	Female	27	50.0
Department	Nursing	23	42.6
	Medical	9	16.7
	Dental	8	14.8
	Radiology	5	9.3
	Lab	5	9.3
	Pharmacy	4	7.4
Years of experience	Mean ± SD	10.39 ± 7.84	
	Min – Max	1 – 35	
	<10 years	٣٠	55.6
	10 – 20 years	١٨	33.3
	> 20 years	٦	11.1
Previous training/orientation on IC and SPs		23	42.6

The main goal of IC was recognized correctly by 98.1% of the participants. The correct responses of participants' knowledge regarding IC measures revealed that less than half of them (48.1% and 38.9%) correctly identified that all patients, regardless diagnosis, and all body fluids except sweet were sources of infection respectively. The majority believed that the risk of occupational infection was not restricted to physicians. About 63% failed to recognize the duration recommended for routine hand washing, 57.4% did not know the correct place for discarding personal protective equipment (PPE) or the label of sharp

containers, 59.3% recognized the importance to change PPE between different procedures on the same patients and about two thirds failed to define methicilin-resistant staphylococcus aureus (MRSA). The misconception about the irrelevance of immunization history before recruitment was believed by 61.1%. About 55.6% recognized the value of immunization against hepatitis B, whereas only 29.6% were aware of the role of post-exposure prophylaxis following HIV exposure (Tables 2 & 3).

Table (2): Knowledge of participants regarding concept of infection control, hand hygiene, personal protective equipments and environmental sanitation.

Knowledge	Correct responses No. (%)
General concepts	
Main goal of IC to minimize risk of HCAI to patients & HCP*	53 (98.1)
All patients were sources of infection regardless diagnosis*	26 (48.1)
All body fluids except sweet considered as sources of infection*	21 (38.9)
Only physicians were at risk of occupational infection	49 (90.7)
Hand hygiene	
Hand washing reduced incidence of HCAI*	46 (85.2)
Should include washing of both hands and wrists*	52 (96.3)
Minimum duration should be 20 seconds	20 (37.0)
Should not be repeated between tasks on the same patients	34 (63.0)
Use of gloves replaced the need for hand washing	47 (87.0)
Indicated after removal of gloves*	45 (83.3)
Personal protective equipments (PPE)	
Provide protective barriers against infection*	53 (98.1)
Chosen according to type of exposure and procedures*	36 (66.7)
Used only when contact with blood	35 (64.8)
Can be re-used after proper cleaning	53 (98.1)
Discarded through regular municipal disposal system	23 (42.6)
Changed between different procedures on the same patients*	32 (59.3)
Removed in a designated area*	40 (74.1)
Healthcare environmental sanitation	
Disinfection means removal of microorganisms without sterilization*	19 (35.2)
Hot water (80°C) was a useful and effective environmental cleaner*	22 (40.7)
Dry sweeping was daily recommended for patients' waiting area	28 (51.9)
Blood-soiled objects disinfected by detergent and water	30 (55.6)

HCAI: Healthcare-associated infection, HCP: Healthcare providers.*: True.

Table (3): Knowledge of participants regarding safe disposal, sharp injuries and care of healthcare providers.

Knowledge	Correct responses No. (%)
Safe disposal	
Used needles should be recapped after use to prevent injuries	40 (74.1)
Used needles should be bent after use to prevent injuries	42 (77.8)
Transferring infection from instruments is procedure dependent*	33 (61.1)
Sharp containers are of a heavy-duty plastic and puncture-resistant lid*	50 (92.6)
Sharp containers should be placed upright and stable during use*	54 (100.0)
Sharp containers are labeled with cross	23 (42.6)
Sharp injuries and occupational infection	
Sharp injuries should be managed without reporting	41 (75.9)
Needle-stick injuries are common in general practices*	45 (83.3)
MRSA means methicilin-resistant staphylococcus aureus*	19 (35.2)
MRSA can't be transmitted on hands of HCP	23 (42.6)
Management includes immediate washing in running water and soap*	27 (50.0)
Care of healthcare providers (HCP)	
Immunization history before recruitment is irrelevant	21 (38.9)
Annual influenza vaccine is recommended*	49 (90.7)
Routine immunizations include HIV, rubella and rabies	50 (92.6)
Periodic tuberculin skin testing is recommended*	31 (57.4)
Post-exposure immunization following hepatitis B exposure*	30 (55.6)
Hepatitis B immunization recommended for all HCP*	48 (88.9)
Post-exposure prophylaxis immediately following HIV exposure*	16 (29.6)
Using antibiotic prophylaxis following exposure to a patient with flu	43 (79.6)

*: True.

Regarding attitude about IC (Table 4), it was revealed that about 61% had positive attitude towards the role of IC measures in preventing transmission of HCAI, and 70.4% agreed on availability of PPE. About one-fourth thought that the use of PPE makes them uncomfortable, while more than three-fourths ascertained the safety of hand hygiene agents. Around half of them did not think that the patients felt stigmatization when PPE were used, and excess workload challenged the use of SPs. More than half of them hesitated regarding the effective role of isolation in IC. The majority was worried about acquiring infection while at work and ensured the importance of continuous IC training to HCP (Table 4).

Table (4): Attitude of participants towards infection control measures.

Attitude	Agree No. (%)	Uncertain No. (%)	Disagree No. (%)
Implementation of effective IC measures can prevent transmission of HCAI	33 (61.1)	16 (29.6)	5 (9.3)
PPE were not always available	8 (14.8)	8 (14.8)	38 (70.4)
PPE were uncomfortable	13 (24.1)	18 (33.3)	23 (42.6)
Hand hygiene agents caused irritation and dryness	2 (3.7)	10 (18.5)	42 (77.8)
Patients felt stigmatized when PPE were used	12 (22.2)	14 (25.9	28 (51.9)
Excess workload challenged the use of SPs	10 (18.5)	17 (31.5)	27 (50.0)
Isolation was an effective strategy in IC	25 (46.3)	14 (25.9)	15 (27.8)
I worried about acquiring infection while at work	45 (83.3)	6 (11.1)	3 (5.6)
Observation by IC committee negatively affected proper practice of SPs	8 (14.8)	15 (27.8)	31 (57.4)
Continuous IC training was important to HCP	46 (85.2)	8 (14.8)	0 (0.0)

IC: Infection control, HCAI: Healthcare-associated infection, PPE: Personal protective equipments, SPs: Standard precautions, HCP: Healthcare providers.

Regarding their self-reported practices, about 70% experienced hand washing according to WHO guidelines. However, only 44-46% washed hands regularly before touching patient and after each task to the same patient. About 80-90% reported used gloves before dealing with patient, inspected and changed gloves when damaged. About 44.4%, 57.4% and 79.6% did not wear mask, gown or protective eyewear respectively. Still 18.5% were not vaccinated with HBV and 64.8% announced when penetrated by sharps (Table 5).

Table (5): Self-reported practices of participants about infection control measures.

Self-reported practices	Yes No. (%)	No No. (%)	Sometimes No. (%)
Washing hands according to WHO	38 (70.4)	1 (1.9)	15 (27.8)
Washing hands before touch patient	24 (44.4)	11 (20.4)	19 (35.2)
Washing hands after touch body liquids	54 (100.0)	0 (0.0)	0 (0.0)
Washing hands after each task in same patient	25 (46.3)	9 (16.7)	20 (37.0)
Using gloves before dealing with patient	46 (85.2)	5 (9.3)	3 (5.6)
Change gloves when damaged	49 (90.7)	4 (7.4)	1 (1.9)
Inspect gloves	43 (79.6)	4 (7.4)	7 (13.0)
Wearing mask	10 (18.5)	24 (44.4)	20 (37.0)
Cleaned and disinfected mask	45 (83.3)	1 (1.9)	8 (14.8)
Vaccinated with HBV	44 (81.5)	10 (18.5)	0 (0.0)
Wearing gown	16 (29.6)	31 (57.4)	7 (13.0)
Taking off gown correctly	24 (44.4)	28 (51.9)	2 (3.7)
Wearing protective eyewear	7 (13.0)	43 (79.6)	4 (7.4)
Announcing when penetration occurred	35 (64.8)	13 (24.1)	6 (11.1)
Advised patients with respiratory infection on SPs	33 (61.1)	8 (14.8)	13 (24.1)

WHO: World health organization, HBV: Hepatitis B virus, SPs: Standard precautions,

The results showed that the accepted level of good KAP among participants was slightly below average (46%-48% - Figure 1).

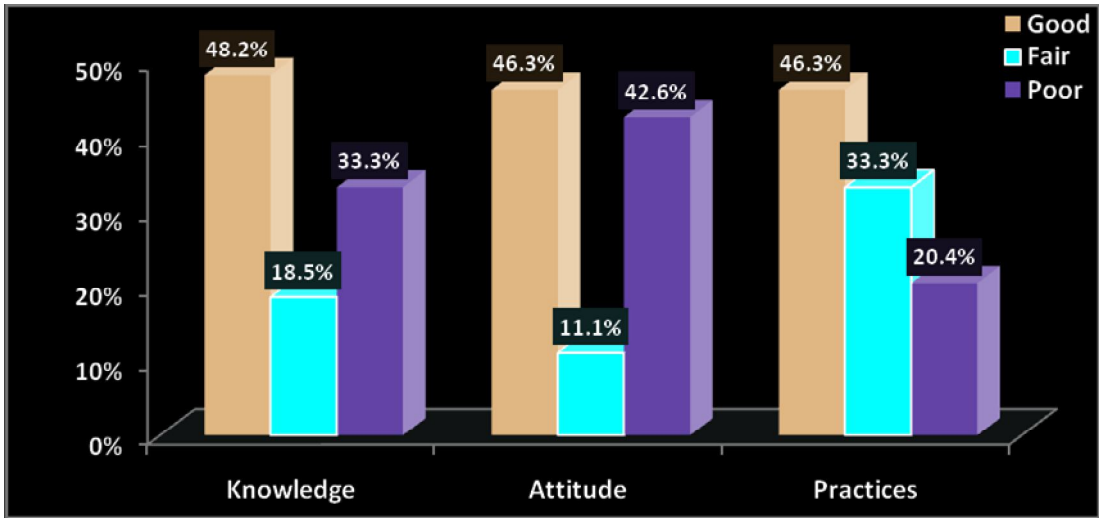

Figure (1): Overall KAP scores about infection control measures.

No statistical significant differences between the overall mean KAP scores and different characteristics of participants. Knowledge score was significantly higher among those previously attended training/orientation on IC and significant correlations were observed between knowledge score and both attitude and practices scores (Table 6).

Table (6): Relation between characteristics of participants and KAP score about infection control measures.

Characteristics		Knowledge score (Max.=40)	Attitude score (Max.=10)	Practice score (Max.=30)
Overall score		26.8±12.4	5.4±3.7	20.5±8.1
Age[1]	≤ 30 years	25.9 ±12.1	5.2±3.5	20.2±8.2
	> 30 years	27.8±13.0	5.8±3.9	20.9±8.2
	P-value	0.586	0.515	0.775
Gender[1]	Male	27.2±12.3	5.6±3.7	20.8±8.0
	Female	26.4±12.7	5.3±3.7	20.2±8.4
	P-value	0.821	0.828	0.805
Years of experience[2]	<10 years	25.6±12.2	5.0±3.5	20.1±8.3
	10 – 20 years	25.3±13.6	5.1±4.1	19.3±8.7
	> 20 years	35.5±5.6	8.4±2.0	25.8±2.9
	P-value	0.137	0.077	0.179
Previous training/ orientation	Yes	30.8±13.7	6.6±3.9	22.7±9.3
	No	23.9±10.7	4.7±3.4	18.9±6.9
	P-value	0.043*	0.072	0.093
Knowledge score	r		0.97	0.98
	P-value		<0.001*	<0.001*

[1]: Independent Samples t-test, [2]: One-Way ANOVA test, r: Pearson correlation coefficient, *: Significant.

DISCUSSION

The study investigated the level of participants' knowledge regarding concept of IC, hand hygiene, PPE, sharp disposal, environmental sanitation, sharp injuries and care of HCP with 48.2% had good knowledge. This finding was higher than that of a Saudi study conducted in 4 multispecialty hospitals at Al-Qassim, KSA where 39.1% of nurses had good knowledge regarding SPs **(Mersal and Keshk, 2016)**. The results reported by **Abu Salam et al. (2014)** where 32.5% of Egyptian HCP in family health settings in Shebin El-kom district, had good knowledge regarding IC. The results reported by **Ghadmgahi et al. (2011)** concluded that most Iranian nurses do not have a good knowledge of HCAI and the result of a Chinese study that assessed the knowledge of nurses about SPs as average **(Luo et al., 2010)**. However, better findings were reported in other studies as about 90% of ICU Indian nurses **(Sodhi et al., 2013)**, 63.3% of Indian doctors **(Mudedla et al., 2014)**, and 50.3% of HCW in Nigeria **(Alice et al., 2013)** were aware of SPs and IC guidelines.

Many factors may affect knowledge of HCP including individual characteristics, education, training courses and managerial and motivational factors that might explain the variability among different studies **(Sarani et al., 2015)**. In the same context, we should consider the diversity of nationalities represented in the University medical center, different background qualifications and training that might influence their overall KAP and compliance. Additionally, the relatively better KAP and compliance at the tertiary level of care might be related to strict hospital regulations and repeated education which are generally lacking at a primary level of care.

Among our participants, about 42% previously attended training/orientation on IC and SPs that significantly affected the knowledge score. Training and knowledge improvement were the most effective ways to fight HCAI. Many researchers emphasized the importance of developing a continuous training program on IC for all HCW **(Suchitra & Lakshmi, 2007; Tenna et al., 2013 and Brusaferro et al., 2015)**.

The main goal of IC was recognized correctly by 72.6% of HCW at the primary HC level in Al-Hassa region, KSA. The majority of them declared importance of hand washing (89.7%), and they recognized patients (87.8%) and body fluids (81.8%) as sources of infection that were relatively better than our findings **(Amin and Al Wehedy, 2009)**.

The majority of participants recognized the importance of PPE, and they could not be re-used. In contrast, there were wide areas where knowledge was lower, particularly regarding disposal of PPE and changing PPE between different procedures on the same patients. About 92.6% and 74.1% of participants were aware of disposing used needles in special sharp containers and that used needles should not be recapped after using respectively. Similar results were reported by HCW in a medical teaching hospital in India **(Sha, 2015**). In another Italian study **(Parmeggiani et al., 2010)**, similar results were reported regarding disposal in sharp containers but a lower rate regarding recapping of needles. Unsatisfactory

knowledge concerning HC waste disposal was reported in many other studies **(Oroei et al., 2014 and Shivalli & Sanklapur, 2014)**.

Ideally, needles should not be recapped. However, recapping should only be performed using a mechanical device or the one-handed technique **(Mehta et al., 2010)**. In a like manner, HC waste disposal should be categorized and disposed appropriately in color-coded plastic bags **(Ammakiw et al., 2013)**.

One aspect related to occupational infection was the lack of reporting of sharp injuries (24.1%) that was reported in other studies **(Janjua et al., 2007; Krishnan et al., 2007 and Amin & Al Wehedy, 2009)**.

This study found mixed results with positive and negative attitudes in some aspects of SPs and IC measures. About 39% and 22% of participants had negative attitude towards the role of effective IC measures in preventing transmission of HCAI and the effect of hand hygiene agents on their hands. These findings were relatively in congruence with the results reported by **Adly et al. (2014)** in their attempt to identify factors that affect nurses' compliance with SPs of IC. Better result with less negative attitude was reported among primary HCW in Kuwait regarding the role of effective IC measures **(Alnoumas et al., 2012)**.

In our study, availability of PPE was accepted by about 70% of participants which was higher than the results reported by nurses in other studies **(Adly et al., 2014 and Qalawa et al., 2014)**, while the majority of HCW in Nigeria considered non-availability of the equipments as the major reason for noncompliance **(Amoran and Onwube, 2013)**.

Another key finding in agreement with literature was that the attitude towards continuous IC training was encouraging since 85.2% of our participants ascertained its importance to HCP.

The overall self-reported good practices in our study were slightly lower than average. Similar findings were noticed among HCW in Nigeria **(Alice et al., 2013)**. The poor practice of SPs among HCW was reported by **Vaz et al. (2010)**. However, in contrary to our results, better practices were observed in other studies **(Allah-Bakhshian et al., 2010; Parmeggiani et al., 2010 and Flanagan et al., 2016)**. This might be ascribed to regular infection control training that helped to keep their skills and practices continually updated. In addition, good levels of knowledge and positive attitudes might be associated with proper infection control practices **(Engelbrecht et al., 2016)**.

Compliance with hand washing was reported by all participants after touching body liquids. However, it was below average before touching patient and after each task in same patient. This result corroborated the findings among HCWs in Riyadh, KSA **(Alsubaie et al., 2013)**, and better compliance was reported among HCW in India **(Sha, 2015)**. On the other hand, **Akyol (2007)** noted that hand hygiene compliance by HCW was less than the desirable levels of practice.

Using gloves was reported by 85.2% of participants that coincided with findings from India and Nigeria **(Amoran & Onwube, 2013 and Punia et al., 2014)**. A systematic review of 23 studies revealed

that adherence to glove utilization among HCW was suboptimal and often misused **(Picheansanthian and Chotibang, 2015)**.

More specifically, in a sample of US emergency medicine residents, 96% used gloves **(Ellison et al., 2007)**. A nationwide survey among orthopedic surgeons throughout England found that 99% routinely used gloves in a major trauma scenario, but only 18% and 21% used face mask and eye protection, respectively **(Sundaram and Parkinson, 2007)**. About 35% of HCW in emergency departments in Italy wearing protective eye goggles and mask when at direct contact with a patient **(Parmeggiani et al., 2010)**. Variable practices of primary HCW in Kuwait were noticed regarding hand washing, wearing gloves, changing gloves, wearing protective eyewear and mask **(Alnoumas et al., 2012)**.

Still 18.5% of our participants were not immunized against hepatitis B. This finding was better than a higher result reported among HCW in primary health center in Kuwait **(Habiba et al., 2012)**. Similar results were reported among Indian HCW **(Sha, 2015)**. A relatively better result was reported among dental HCW in Hail region, KSA, and self-reported compliance with SP guidelines among them was high suggesting institutional factors to have an important role in improving compliance **(Haridi et al., 2016)**.

The participants' good KAP concerning the various aspects of IC measures was slightly below average (46-48%). This result was higher than the findings obtained from Iranian nurses **(Sarani et al., 2015)**. However, this was not consistent with better findings among physicians in family health setting in Egypt **(Abu Salam et al., 2014)**.

There was no significant relationship between KAP score and gender in our results. This was inconsistent with the results of other studies **(Ghadmgahi et al., 2011 and Sarani et al., 2015)**. There was a significant correlation between knowledge and both attitude and practices scores in the present study. Similar studies reported also significant relationship between knowledge and practice **(Luo et al., 2010 and Sarani et al., 2015)**.

Years of experience did not affect the level of KAP of our participants regarding IC. In contrary to our results, **Adly et al. (2014)** reported that years of experience in emergency departments had a major effect on the nurses' knowledge and practices which consequently enhanced nurses' compliance to universal precautions.

We considered some potential limitations when interpreting the results. First, as a cross-sectional study, we could not prove direct relationship between variables and outcomes. Second, as a self-administered questionnaire was applied, there would be potential reporting bias with difficulty to determine whether the responses reflect the actual practices of HCP or their subjective views with possibility of over-reporting and social desirability bias. A more effective method would be direct observation of actual practice although the effect of being monitored may improve practice by itself. Third, other University medical centers especially for females were not included that may decrease the overall generalization of the results to all HCP in primary care of level. Therefore, future studies should include wider settings.

Despite limitations identified, we believed that the study addressed a major health problem that challenged HCP in primary care of level in Makkah, and findings may have important implications for the development of IC education and strategies suitable for improving KAP of HCP about this issue and optimizing prevention programs and future research.

CONCLUSION

There was a gap between the actual and desired KAP of HCP regarding IC. The relevant authorities should pay more attention and adopt interventions, training and continuing education programs, on regular basis to improve their KAP towards SPs and IC measures in order to reduce HCAI that reflected on the overall health of both HCP and patients.

ACKNOWLEDGEMENT

The authors would like to thank all participants in the Umm AL Qura University Medical Center for their help and cooperation.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

REFERENCES

1. **Abu Salam ME, El-Shazly HMA and Dewidar MA. (2014):** Infection control awareness among healthcare providers in family health settings in Shebin El-kom district, Menoufia Governorate, Egypt. Menoufia Med J., 27(4):840–6.
2. **Adly RM, Amin FM and Abd El Aziz MA. (2014):** Improving Nurses' Compliance with Standard Precautions of Infection Control in Pediatric Critical Care Units. World J. Nursing Sci., 3S:1–9.
3. **Akyol AD. (2007):** Hand hygiene among nurses in Turkey: opinions and practices. J Clin Nurs., 16(3):431–7.
4. **Alice TE, Akhere AD, Ikponwonsa O and Grace E. (2013):** Knowledge and practice of infection control among health workers in a tertiary hospital in Edo state, Nigeria. DRJHP, 1(2):20–7.
5. **Allah-Bakhshian A, Moghaddasian S, Zamanzadeh V, Parvan K and Allah-bakhshian M. (2010):** Knowledge, attitude, and practice of ICU nurses about nosocomial infections control in teaching hospitals of Tabriz. IJN, 23(64):17–28.
6. **Alnoumas SR, Enezi FA, Isaeed MM, Makboul G and El-Shazly MK. (2012):** Knowledge, attitude and behavior of primary healthcare workers regarding health care-associated infections in Kuwait. Greener J Med Sci., 2(4):92–8.
7. **Alsubaie S, Maither A, Alalmaei W, Al-Shammari A, Tashkandi M and Somily A.** https://www.ncbi.nlm.nih.gov/pubmed/?term=Alaska%20A%5BAuthor%5D&cauthor=tru & cauthor_uid=22863122 **(2013):** Determinants of hand hygiene noncompliance in intensive care units. Am J Infect Control, 41(2):131–5.
8. **Amin TT and Al Wehedy A. (2009):** Health-care providers' knowledge of standard precautions at the primary healthcare level in Saudi Arabia. Healthcare Infection, 14(2):65-72.
9. **Ammakiw CL, Balicag JS and Odiem MO. (2013):** Health Care Waste Management Practices in the Hospitals of Tabuk City. European Scientific Journal, 4:584–96.
10. **Amoran O and Onwube O. (2013):** Infection control and practice of standard precautions among healthcare workers in northern Nigeria. J Glob Infect Dis., 5(4):156-63.
11. **Brewster L, Tarrant C and Dixon-Woods M. (2016):** Qualitative study of views and experiences of performance management for healthcare-associated infections. J Hosp Infect., 94(1):41–7.
12. **Brusaferro S, Arnoldo L, Cattani G, Fabbro E, Cookson B, Gallagher R, Hartemann P, Holt J, Kalenic S, Popp W, Privitera G, Prikazsky V, Velasco C, Suetens C and Varela Santos C. (2015):** Harmonizing and supporting infection control training in Europe. J Hosp Infect., 89(4):351-6.

13. Cole M. (2007): Infection control: worlds apart primary and secondary care. Br J Community Nurs., 12(7):301–6.

14. Dioso RP. (2014): Factors Affecting Doctors' and Nurses' Compliance with Standard Precautions on All Areas of Hospital Settings Worldwide — A Meta-Analysis. ASM Sci J., 8(2):134–42.

15. Ellison AM, Kotelchuck M and Bauchner H. (2007): Standard precautions in the pediatric emergency department: knowledge, attitudes, and behaviors of pediatric and emergency medicine residents. Pediatr Emerg Care, 23(12):877–80.

16. Engelbrecht M, Janse van Rensburg A, Kigozi G and van Rensburg HD. (2016): Factors associated with good TB infection control practices among primary healthcare workers in the Free State Province, South Africa. BMC Infect Dis., 16(1):1–10.

17. Fashafsheh I, Ayed A, Eqtait F and Harazneh L. (2015): Knowledge and Practice of Nursing Staff towards Infection Control Measures in the Palestinian Hospitals. JEP, 6(4):79–90.

18. Flanagan E, Cassone M, Montoya A and Mody L. (2016): Infection Control in Alternative Health Care Settings: An Update. Infect Dis Clin North Am., 30(3):785-804.

19. Ghadmgahi F, Zighaimat F, Ebadi A and Houshmand A. (2011): Knowledge, attitude and self-efficacy of nursing staffs in hospital infections control. Iran Journal Mil Med., 13(3):167–72.

20. Habiba SA, Alrashidi GA, Al-otaibi AE, Almutairi GR, Makboul G and El-Shazly MK. (2012): Knowledge, attitude and behavior of health care workers regarding hepatitis B infection in primary health care, Kuwait. Greener J Med Sci., 2(4):77–83.

21. Haridi HK, Al-Ammar AS and Al-Mansour MI. (2016): Compliance with infection control standard precautions guidelines: a survey among dental healthcare workers in Hail Region, Saudi Arabia. J Infect Prev., 17(6):268–76.

22. Horan TC, Bridson KA and Morrell G. (2011): Surveillance of Healthcare-Associated infections. In: Hospital Epidemiology and Infection Control. Mayhall CG (ed), 4th edition, Pbl. Philadelphia, PA: Lippincott, Williams & Wilkins, Chapter 89, pp:1230–41.

23. Janjua N, Razaq M, Chandir S, Rozi S and Mahmood B. (2007): Poor knowledge-predictor of non adherence to universal precautions for blood borne pathogens at first level care facilities in Pakistan. BMC Infect Dis., 7(81):1–11.

24. Jayasinghe RD and Weerakoon BS. (2014): Prevention of nosocomial infections and standard precautions: knowledge and practice among radiographers in Sri Lanka. J Med Allied Sci., 4(1):9–16.

25. Krishnan P, Dick F and Murphy E. (2007): The impact of educational interventions on primary health care workers' knowledge of occupational exposure to blood or body fluids. Occup Med., 57(2):98–103.

26. **Laheij AM, Kistler JO, Belibasakis GN, V?limaa H and de Soet JJ. (2012):** Healthcare-associated viral and bacterial infections in dentistry. J Oral Microbiol., 4(1):1–10.

27. Luo Y, He GP, Zhou JW and Luo Y. (2010): Factors impacting compliance with standard precautions in nursing, China. Int J Infect Dis., 14(12):e1106–14.

28. Mani A, Shubangi AM and Saini R. (2010): Hand hygiene among health care workers. Indian J Dent Res., 21(1):115–8.

29. McHugh MD and Stimpfel AW. (2012): Nurse reported quality of care: a measure of hospital quality. Res Nurs Health, 35(6):566–75.

30. Mehta A, Rodrigues C, Singhal T, Lopes N, D'Souza N, Sathe K and Dastur FD. (2010): Interventions to reduce needle stick injuries at a tertiary care center. Indian J Med Microbiol., 28(1):17-20.

31. Mehta Y, Gupta A, Todi S, Myatra S, Samaddar DP, Patil V, Bhattacharya PK and Ramasubban S. (2014): Guidelines for prevention of hospital acquired infections. Indian J Crit Care Med., 18(3):149–63.

32. Mersal FA and Keshk LI. (2016): Compliance to standard precautions among

nurses working in Qassim hospitals in KSA. IJBAS, 5(4):210–4.

33. Michelin A and Henderson D. (2010): Infection control guidelines for prevention of health care-associated transmission of hepatitis B and C viruses. Clin Liver Dis., 14(1):119–36.

34. Mollaoglu M, Mollaoğlu M and Şanal L. (2015): Compliance with Standard Precautions of Students in Clinical Practice. J Family Med Community Health, 2(8):1–5.

35. Mudedla S, Tej WL, Reddy KT and Sowribala M. (2014): A study on knowledge and awareness of standard precautions among health care workers at Nizam's institute of medical sciences Hyderabad. J Nat Accred Board Hosp Healthcare Providers, 1(2):34–8.

36. Ogoina D, Pondei K, Adetunji B, Chima G, Isichei C and Gidado S. (2015): Knowledge, attitude and practice of standard precautions of infection control by hospital workers in two tertiary hospitals in Nigeria. J Infect Prev., 16(1):16–22.

37. Oroei M, Momeni M, Palenik CJ, Danaei M and Askarian M. (2014): A qualitative study of the causes of improper segregation of infectious waste at Nemazee Hospital, Shiraz, Iran. J Infect Public Health, 7(3):192–8.

38. Parmeggiani C, Abbate R, Marinelli P and Angelillo IF. (2010): Healthcare workers and health care-associated infections: knowledge, attitudes, and behavior in emergency departments in Italy. BMC Infect Dis., 10(1):1–9.

39. Picheansanthian W and Chotibang J. (2015): Glove utilization in the prevention of cross transmission: a systematic review. JBI Database System Rev Implement Rep., 13(4):188–230.

40. Punia S, Nair S and Shetty RS. (2014): Health Care Workers and Standard Precautions: Perceptions and Determinants of Compliance in the Emergency and Trauma Triage of a Tertiary Care Hospital in South India. Int Sch Res Notices, (2014):1–5.

41. Qalawa SA, Mahran SM and Alnagshabandi E. (2014): Investigation of factors influencing nurses' compliance with standard precaution in critical care areas. SSHJ, 1(21):177–200.

42. Sarani H, Balouchi A, Masinaeinezhad N and Ebrahimitabas E. (2015): Knowledge, Attitude and Practice of Nurses about Standard Precautions for Hospital-Acquired Infection in Teaching Hospitals Affiliated to Zabol University of Medical Sciences (2014). Glob J Health Sci., 8(3):193–8.

43. Sha A. (2015): Knowledge attitude and practice towards infection control measures amongst healthcare workers in a medical teaching hospital of Calicut District, Kerala, India. Antimicrob Resist Infect Control, 4(1):P270. Poster presentation.

44. Shivalli S and Sanklapur V. (2014): Healthcare waste management: qualitative and quantitative appraisal of nurses in a tertiary care hospital of India. SCI World J., 2014. Article ID: 935101.

45. Sodhi K, Shrivastava A, Arya M and Kumar M. (2013): Knowledge of infection control practices among intensive care nurses in a tertiary care hospital. J Infect Public Health, 6(4):269–75.

46. Suchitra JB and Lakshmi DN. (2007): Impact of education on knowledge, attitudes and practices among various categories of health care workers on nosocomial infections. Indian J Med Microbiol., 25(3):181–7.

47. Sundaram RO and Parkinson RW. (2007): Universal precaution compliance by orthopaedic trauma team members in a major trauma resuscitation scenario. Ann R Coll Surg Engl., 89(3):262–7.

48. Tenna A, Stenehjem EA, Margoles L, Kacha E, Blumberg HM and Kempker RR. (2013): Infection control knowledge, attitudes, and practices among healthcare workers in Addis Ababa, Ethiopia. Infect Control Hosp Epidemiol., 34(12):1289-96.

49. Vaz K, McGrowder D, Alexander-Linda R, Gordon L, Brown P and Irving R. (2010): Knowledge, attitude and compliance with universal precautions among health care workers at the university hospital of West Indies, Jamaica. Theijoem, 1(4):171–81.

مكافحة العدوى بين مقدمي الرعاية الصحية في المركز الطبي لجامعة أم القرى - مكة- المملكة العربية السعودية
دراسة مستعرضة

محمد أسامة نور[١،٢]، خليل محمد[٣]، أمل البيشي[٣]، مايسة أمير[٣]

[١] قسم الصحة العامة وطب المجتمع، كلية الطب، جامعة الأزهر (دمياط)، مصر
[٢] كلية الصحة العامة والمعلوماتية الصحية، جامعة أم القرى، مكة، المملكة العربية السعودية
[٣] المركز الطبي الجامعي، جامعة أم القرى، مكة، المملكة العربية السعودية

خلفية البحث: تعد العدوى المرتبطة بالرعاية الصحية واحدة من أخطر المشاكل الصحية تعقيدا على مستوى العالم. ومن المهم الإلتزام بالإحتياطات المعيارية وإجراءات مكافحة العدوى بين جميع مقدمي الرعاية الصحية لمنع تعرضهم للمواد الخطرة.

الهدف من البحث: تقييم معارف وإتجاهات وممارسات مقدمي الرعاية الصحية نحو إجراءات مكافحة العدوى في المركز الطبي لجامعة أم القرى بمكة المكرمة - المملكة العربية السعودية.

المرضى وطرق البحث: أجريت دراسة وصفية مستعرضة بإستخدام إستبانة ذاتية الإملاء ، وتم تقييم معارف وإتجاهات وممارسات مقدمي الرعاية الصحية تجاه إجراءات مكافحة العدوى وإرتباطها بخصائصهم المختلفة.

النتائج: وقد شملت الدراسة عدد ٥٤ مشاركاً وكان متوسط أعمارهم ٣٢،٤ سنوات، نصفهم من الإناث وسبق أن ٤٢،٦٪ منهم تلقي تدريب أو توجيه على الإحتياطات المعيارية وإجراءات مكافحة العدوى بصور مختلفة. وكانت نسبة معارفهم وإتجاهاتهم وممارساتهم الجيدة نحو مختلف جوانب إجراءات مكافحة العدوى أقل بقليل من المتوسط (٤٦-٤٨٪). ولم يلاحظ وجود فروق ذات دلالة إحصائية بين المتوسط العام لدرجات معارفهم وإتجاهاتهم وممارساتهم وبين خصائصهم المختلفة، إلا أن هناك إرتباطاً بين معارفهم وبين درجة إتجاهاتهم وممارساتهم.

الإستنتاج: توجد فجوة بين المعارف والإتجاهات والممارسات الفعلية لمقدمي الرعاية الصحية نحو إجراءات مكافحة العدوى وبين ما هو مطلوب. وبالتالي، فهناك حاجة إلى وجود برامج تعليمية مستمرة لتحسين المعارف والإتجاهات والممارسات نحو الإلتزام بالاحتياطات المعيارية وإجراءات مكافحة العدوى وذلك للحد من العدوى المرتبطة بالرعاية الصحية.