International Journal of Medical Toxicology & Legal Medicine **Volume 27, No. 4S, 2024**
e-ISSN: 0974-4614
p-ISSN: 0972-0448
https://doi.org/10.47059/ijmtlm/V27I4S/144

Knowledge and Practices of Healthcare Providers towards Infection Prevention and Its Associated Factors in Saudi Arabia

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Received: 13.09.2024 Revised: 15.10.2024 Accepted: 20.11.2024

ABSTRACT

Background: Adherence to infection prevention and control practices is essential to providing safe and high quality patient care across all settings where healthcare is delivered.Hospital-acquired infections (HAIs) contribute to increased length of hospital stay, higher mortality and higher health-care costs. Prevention and control of HAIs is a critical public health concern.Adequate knowledge and safe practice of infection prevention among healthcare providers are vital to prevent nosocomial infections.

This study aimed: To assess the level of knowledge and practices of healthcare providers (HCPs) towards infection prevention and its associated factors in hospitals at Jeddah, Saudi Arabia.

Materials and Methods: A cross-sectional study was conducted among 171 HCPs who were selected by a convenient technique. Data were collected using interviewer-administered questionnaire.Multivariable logistic regression was performed to identify factors associated with knowledge and practice of infection prevention.

Result: The percentage of HCPs with sufficient knowledge and safe infection prevention practices was around 70.8% and 55.0%, respectively. Adequate knowledge of infection prevention was positively correlated with having five years or more of work experience (AOR = 1.52: 95%CI; 1.13, 4.51), working in a maternity unit (AOR = 1.67:95%CI; 1.38–5.23), taking infection prevention training (AOR = 2.2, 95% CI; 1.01, 4.75), and having infection prevention guidelines (AOR = 3.65, 95% CI; 1.26, 10.54). The odds of safe practice were lower for HCPs working in a facility without a continuous water supply (AOR = 0.48:95% CI; 0.21, 0.83), but greater for those who received infection prevention training (AOR: 2.4; 95% CI; 1.01, 4.75).

Conclusion: A considerable percentage of health care professionals lacked sufficient knowledge and engaged in risky infection prevention practices. In order to enhance healthcare workers' understanding of infection prevention, sufficient pre - service and on-the-job training should be provided.

Keywords: Knowledge, Practice, Infection prevention

INTRODUCTION

The term "infection prevention" encompasses all practices, guidelines, and initiatives designed to reduce or eliminate the possibility of infectious disease transmission in medical facilities. A successful hospital infection prevention and control program lowers the negative economical and psychological effects of infectious illnesses on patients and health systems while also improving patient safety and care quality [1, 2].The term "healthcare-associated infection" (HAI) refers to infections that were not present at the time of the patient's admission but were obtained in medical facilities during clinical, diagnos tic, and therapeutic procedures [3]. It is a major issue in the provision of healthcare services around the globe and is one of the

leading causes of morbidity and death [3-5]. According to a systematic assessment of the literature, the combined prevalence of infections linked to healthcare was 10.1% in low- and middle-income countries and 7.6% in high-income countries [6].
In spite of improvements in medical treatment and technology, the burden of HAIs is increasing internationally [7]. The World Health Organization (WHO) reports that the prevalence of healthcare-associated infections (HAIs) in hospital settings varies from 5.7% to 19.1% worldwide [8, 9]. According to recent studies, the prevalence of HAIs is 3.2% in the USA [10] and 6.5% in Europe [9]. Compared to high-income nations, the burden of HAIs is noticeably greater in low-resource countries [11-13]. According to a systematic assessment headed by the WHO, the prevalence of HAIs varies from 7.6% in high -income nations to 15.5% in low- and middle-income countries [8]. High mortality, longer hospital stays, higher health care expenses, and a financial burden on families, communities, and nations as a whole are all caused by HAIs [8, 14]. Therefore, it seems that preventing and controlling HAIs is a crucial public health issue[15].
The main sources of HAIs have been shown to be healthcare equipment and contaminated hands of healthcare professionals [12, 16]. When healthcare professionals fail to properly wash their hands after caring for one patient and coming into touch with another, the bacteria that cause healthcare-associated infections (HAIs) are frequently transferred from one patient to another [17]. Different kinds of clinical departments have varying rates of HAIs. According to a study by Koch et al. (2015), the intensive care units had the highest infection rate, followed by the neonatal and burn units [18].According to the WHO, the main causes of HAIs include inadequate infrastructure, inadequate manpower and equipment, poor environmental hygiene and waste disposal practices, overcrowding, a lack of national guidelines, and a lack of understanding and poor application of basic infection control measures [19]. In order to avoid the spread of disease-causing agents and, consequently, HAIs, the Centers for Disease Control and Prevention (CDC) created Standard Precautions, which outline specific steps that must be taken [20].
Numerous factors, including the availability of infection prevention guidelines, infection prevention training, and personal protective equipment, have been demonstrated in studies to support safe infection prevention practices at the hospital level [21-25]. However, limited research has been done on the parameters related to hospital unit infection prevention knowledge and practice.Therefore, this study aimed to assess the knowledge and practices towards infection prevention and it sassociated factors among primary healthcare providers in hospitals at Jeddah, Saudi Arabia.

MATERIALS AND METHODS

A cross-sectional study design was conducted from January to June in hospitals at Jeddah, Saudi Arabia. All healthcare providers (Laboratory, Nurse, Health officer, and Midwifery) working in hospitals and providing care and have direct involvement in patient care were eligible to be included in the study. HCPs that were on annual leave for longer than 2 weeks, maternity leave and who were critically ill during the study period were excluded.The sample size was 171 HCPs who were selected by a convenient technique.The outcome of the study was knowledge (adequate/inad equate) and practice (safe/unsafe) towards infection prevention.Independent variables include socio-demographic characteristics, water supply, presence of infection prevention committee, presence of infection prevention guidelines in a health facility and training on infection prevention. Knowledge of infection prevention was computed from 11 questions. The mean value was used to classify HCPs infection prevention knowledge as having adequate knowledge if the score was equal or above the mean. Respondents who scored less than the mean value of correct answers were classified as having i nadequate knowledge on the infection prevention.
Infection prevention practices of healthcare provides were assessed for main components of infection prevention measures like hand hygiene practices, utilization of personal protective equipment (PPE), and post-exposure prophylaxes (PEP),healthcare waste management practices, and instrument disinfection practice. Respondents were asked to indicate the frequency of use (practice) for these 7 infection prevention measures. Practice assessment questions had either three or two possible alternative responses (“Always” or “Yes”, “Sometimes” and “Never” or “No”). One point was given for each acceptable or correct practice and zero point for all other responses. Practice scores were summed up to give a total practice score for each healthcare worker. Therefore, the total score of practice questions ranging from zero (all prevention measures not practiced safely) to seven (all infection prevention measures practiced safely) were classified into two categories of response: safe practice (equal or above the mean) and unsafe practice (below the mean) [26, 27].
The researchers collected the data through face to face interview using a structured and pre-tested questionnaire which was prepared in the Arabic language. The tool was developed after reviewing related kinds of literature [22, 23, 28, and 29]. To assure the data quality, data collection instruments were pre-tested on 10 % of the sample. For each component, a reliability test was done. The reliability coefficient for practice and knowledge items had a Cronbach’s Alpha value of 0.85 and 0.75 respectively. The data were examined for completeness and consistency during data collection on a daily base by the supervisor.Data were entered using Epi-data version 3.1 and analyzed by SPSS version 28. Before analysis, data were cleaned and checked for outliers and missing’s. Logistic regression was done and variables with a *P*-value of less than 0.2 at bi-variable logistic regression model were entered into the multi-variable logistic regression model. In all cases, *p*-values of less than 0.05 were considered as statistically significant.

RESULTS

Table (1) shows that total of 171 study participants were included and the mean age of the study participants was27.98 with SD ± 3.56 years. Of the total participants, 119 (69.6%) of them were males and the majority 110 (64.3%) were married.

About 83(48.5%) study participants were nurses regardless of their educational level. In terms of educationalstatus,102(59.6%)studyparticipants were diploma and nearly one-third of respondents were currently working at the outpatient clinics.

Table 1: Socio-demographic characteristic of study participants

Variables	Category	Frequency	Percentage(%)
Age	18–27	84	49.1
	28–37	82	48.0
	38–47	5	2.9
Sex	Male	119	69.6
	Female	52	30.4
Marital status	Married	110	64.3
	Single	61	35.7
Profession	Nurse	68	39.8
	Midwifery	33	19.3
	Health Officer	26	15.1
	Laboratory technologist/technician	29	17.0
	Pharmacist /pharmacy-technician	15	8.8
Educational status	Degree and above	69	40.3
	Diploma	102	59.7
Work experience in health facility	Lessthan 5years	114	66.7
	>=5years	57	33.3
Currently work ingunit	Outpatient department	51	29.8
	Emergency and Triage	22	12.9
	Maternity unit	33	19.3
	Inpatient clinic	13	7.5
	Laboratory	29	17.0
	Pharmacy	15	8.8
	Under-fiveclinic	8	4.7

Table (2) shows that,more than two-thirds of study participants had an infection prevention committee, and approximately 73% had infection prevention guidelines. About 19.3% of the study participants did not receive any instruction on universal precaution and infection prevention.

Table 2: Characteristic of study participants

Characteristics	Category	Frequency	Percentage(%)
Type of health facility	Rural Health center	98	57.3
	Urban health center	73	42.7
Members of infection prevention committee	Yes	119	69.5
	No	52	30.5
Access infection prevention guideline	Yes	124	72.5
	No	47	27.5
Infection prevention training	Yes	58	33.9
	No	113	66.1
Availability of continuous water supply	Yes	88	51.5
	No	83	48.5

Table (3) shows that70.8% of participants had adequate knowledge about infection prevention. 9.4% were believed that gloves cannot provide complete protection against acquiring infection. 95.3% of the study participants responded that washing hands with soap or alcohol-based antiseptic decreases the risk of transmission of hospital acquired pathogens.

Table 3: Knowledge questions for study participants

Knowledge Variables	Category	Frequency	Percentage(%)
Have you heard about infection prevention principle?	Yes	171	100

	No	0	0
Do you think that gloves cannot provide complete protection against acquiring/ transmitting infection?	Yes	155	90.6
	No	16	9.4
Do you think that healthcare-associated pathogens can be found on normal and intact patient skin?	Yes	163	95.3
	No	18	4.7
Do you think that washing your hands with soap oral cohol-based antiseptic decreases the risk of transmission of hospital acquired infection?	Yes	163	95.3
	No	8	4.7
Do you think that use of an alcohol-based antiseptic for hand hygiene is as effective as soap and water if hands are not visibly dirty?	Yes	168	98.2
	No	3	1.8
Do you think that gloves reduce the contamination of the hand but do not prevent it completely?	Yes	137	80.1
	No	34	19.9
Do you think that no need to wash hands before doing procedures that do not involve bodily fluids?	Yes	33	19.3
	No	138	80.7
Do you think that no need to wear the same pair of gloves for multiple patients as long as there is no visible contamination?	Yes	130	76.0
	No	41	24
Do you think TB is carried in airborne particles that are generated from patients with active pulmonary TB?	Yes	169	98.8
	No	2	1.2
Do you know to what level safety boxes should be filled before closing and sealing?	Full	16	9.4
	¾ full	155	90.6
Do you know specific waste disposal buckets according to the level of their contamination?	Yes	167	97.7
	No	4	2.3

Table (4) shows that, 55% of HCPs had safe infection prevention practice. From all participants, 68.4% wash their hands before patient care and 77.2% used soap to wash their hands. Around 50.3% of HCPs have used all personal protective equipment's and 90.6% participant changes chlorine solution every 24 h.

Table 4: Infection prevention practice questions for health care providers

Variables	Category	Frequency(N)	Percentage(%)
How often you wash your hands with proper detergent after contact with patient?	Always	68	39.8
	Sometimes	87	50.9
	Never	16	9.3
Do you use antiseptic hand rub to clean hands?	Yes	160	93.6
	No	11	6.4
How often do you use all personal protective equipment's as per standard to prevent infection?	Always	86	50.3
	Sometimes	85	49.7
When do you change chlorine solutions that used for instrumental processing?	Every24h	155	90.6
	After2days	16	9.4
How often do you use glove when you perform procedures that need wearing glove?	Always	142	83.0
	Sometimes	29	17.0
Have you ever exposed to blood or other body fluids of patients through contact or unprotected skin?	Yes	122	71.3
	No	49	28.7
What measure did you take if you are exposed to blood or fluids, needle stick injury?	Only taking Post exposure prophylaxis	19	11.1
	Only clean by alcohol	68	39.8
	Only washing with water	2	1.2
	TTaking Post exposure prophylaxis and clean by alcohol	32	18.7

	Taking post exposure prophylaxis and washing with water	7	4.1
	Clean by alcohol and washing with water	14	8.2
	All action taken	29	17.0
Did you practice high-level disinfection where sterilization is not applicable??	Yes	124	72.5
	No	47	27.5
What is your facility sterilization technique?	Boiling	19	11.1
	steam sterilization	152	88.9

Table (5) shows that all variables with a *P*-value of less than 0.2 atbivariate logistic regression model were included in the multivariable analysis. Thus age, sex, educational status, profession, work experience, presence of infection prevention guideline, getting of infection prevention training, availability of continuous water supply, type of health center and currently working unit were evaluated as possible factors associated with knowledge of infection prevention. But, we removed two variables; type of health center and member of infection prevention committee to avoid multi-collinearity (detected through chi-square test).

Also, **Table (5)** shows that multivariable analysis presence of IP guidelines, IP training, work experience and currently working unit were significantly associated with knowledge of infection prevention ($P < 0.05$). The odds of having adequate knowledge of infection prevention among health care providers who have IP guidelines in their health institutions were 3.7 times higher (AOR: 3.65, 95% CI;1.26, 10.54) than those who have not IP guideline.

The odds of having adequate knowledge towards infection prevention were higher in health worker who has trained about infection prevention (AOR = 2.19: 95% CI; 1.01, 4.75) than those who were not trained. Similarly, participants who had more than 5 years' workexperience had higher odds of having adequate infection prevention knowledge (AOR = 1.52: 95%CI; 1.13–4.51). Healthcare providers who were currently working in maternity and laboratory unit had higher odds of having adequate knowledge about IP ((AOR = 1.67:95%CI; 1.38– 5.23),(AOR = 2.56:95%CI;1.26–4.13)) respectively(**Table 5**).

Table 5: Bivariate and multivariate logistic regression of factors associated with knowledge of HCPs towards infection prevention

Characteristics		**Knowledge status**		**COR(95%CI)**	**AOR(95%CI)**
		Adequate	**Inadequate**		
Sex	Male	80(67.2)	39(32.8)	0.55(0.25–1.18)	1.03(0.34–3.09)
	Female	41(78.8)	11(21.2)	1	1
Educational status	Diploma	65(63.7)	37(37.3)	1	1
	Degree	53(80.3)	13(19.7)	2.47(1.17–5.20)	1.05(0.32–3.44)
Work experience	<5Years	75(65.7)	39(34.3)	1	1
	>=5years	46(80.7)	11(19.3)	0.46(0.21–0.98)	1.52(1.13–4.51)*
IPGuideline	Yes	100(80.6)	24(19.4)	5.16(2.49–10.68)	3.65(1.26–10.54)*
	No	21(44.7)	26(55.3)	1	1
IP Training	Yes	32(42.1)	26(24.8)	17.64(6.87–45.33)	2.19(1.01–4.75)*
	No	44(57.9)	79(75.2)	1	1
Currently working unit	Outpatient department	30(32.2)	21(26.9)	1	
	Emergency and Triage	6(6.5)	16(20.5)	1.25(0.53–2.04)	0.25(0.13–1.54)
	Maternity unit	23(24.7)	10(12.8)	1.31(1.08–3.38)	1.67(1.38–5.23)*
	Inpatient clinic	8(8.6)	5(6.4)	0.78(0.25–2.81)	1.38(0.48–2.51)
	Laboratory	15(16.1)	14(17.9)	1.46(1.13–3.43)	2.56(1.26–4.13)*
	Pharmacy	6(6.5)	9(11.5)	0.84(0.39–3.03)	0.54(0.17–1.57)
	Under-five clinic	5(5.4)	3(3.8)	0.91(0.32–1.84)	0.87(0.57–3.47)

IP infection prevention,*COR*crudeoddsratio,*AOR*adjustedoddsratio;*=significantlyassociatedat*P*<0.05

Table (6) shows that age, sex, educational status, profession, work experience, presence of infection prevention guideline, getting of infection prevention training, availability of continuous water supply, type of health center and currently workin g unit were evaluated as possible factors associated with safe infection prevention practices. But, getting infection prevention

training and the availability of continuous water supply in the health facility were significantly associated (P <0.05) with safe infection prevention practices in the multivariable analysis. HCPs who have trained on infection prevention were 2.2 times (AOR: 2.19, 95% CI; 1.01–4.75) more likely to have good practice than those who were not trained. The odds of safe infection prevention practices were 52% lower among healthcare providers who work in health facility which have not continuous water sup- ply (AOR = 0.48:95% CI;0.214–0.832)) than their counterparts.

Table 6: Bi-variable and multi-variable logistic regression of factors associated with infection prevention practice of HCP s

Characteristics		**Infection prevention practice status**		**COR 95% CI**	**AOR 95% CI**
		Safe	**Unsafe**		
Sex	Male	80(67.2)	39(32.8)	0.55(0.26–1.19)	1.21(0.52–2.80)
	Female	41(78.8)	11(21.2)	1	1
Educationalstatus	Degree	53(80.3)	13(19.7)	2.47(1.17–5.20)	0.78(0.32–1.91)
	Diploma	65(63.7)	37(37.3)	1	1
Workexperience	<5Years	75(65.7)	39(34.3)	0.46(0.21–0.99)	0.89(0.42–1.913)
	>=5years	46(80.7)	11(19.3)	1	1
Presence IP guideline	Yes	100(80.6)	24(19.4)	5.16(2.49–10.68)	0.95(0.83–4.55)
	No	21(44.7)	26(55.3)	1	1
Infection preventiontraining	Yes	114(82.6)	24(17.4)	17.64(6.87–45.33)	2.19(1.13–4.75)*
	No	7(21.2)	26(78.8)	1	1
Availability of continuouswatersupply	Yes	74(52.1)	14(48.3)	1	1
	No	68(47.9)	15(51.7)	0.86(0.34–0.95)	0.48(0.21–0.83)*
Currently working unit	Outpatient department	39(36.1)	12(22.6)	1	1
	Emergency and Triage	9(8.3)	13(24.5)	0.21(0.13–1.24)	0.25(0.13–1.54)
	Maternity unit	18(16.7)	5(9.4)	1.11(0.79–1.21)	1.67(0.89–3.61)
	Inpatient clinic	7(6.5)	6(11.3)	0.28(0.15–1.63)	0.68(0.34–1.97)
	Laboratory	22(20.4)	7(13.2)	0.97(0.53–2.76)	3.24(1.68–6.27)*
	Pharmacy	7(6.5)	8(15.1)	0.84(0.39–3.03)	0.54(0.17–1.57)
	Under-five clinic	6(5.6)	2(3.8)	0.47(0.21–1.35)	0.79(0.36–2.17)
*=significantly associatedat*P*-value<0.05					

DISCUSSION

In order to lower HAIs, adequate understanding on infection prevention is essential. According to the study's findings, almost one-third of hospital healthcare professionals showed a lack of understanding regarding infection prevention. Prior research supports this conclusion[21, 30, and 31]. But it was low when compared with studies done by Desta et al., (2018) [22] and Woldegioris et al., (2019) [32]. This discrepancy may be due to differences in the study settings. In hospitals HCPs might get the opportunities for various infection prevention training which could increase knowledge level about infection prevent ion [30, 33].

The current study showed that only 55% of HCPs had safe infection prevention practices. This finding was in line with a study doneby Woldegioris et al., (2019) [32] but lower when compared with studies done by Alemayehu et al., (2016) [28] and Sahiledengle et al.,(2018) [34]. The discrepancy might be due to a difference in the study setting an d composition of HCPs [28][24]. The composition of HCPs was different among hospitals unit. Majority of HCPs in hospitals were experienced and specialized which might improve their practice towards infection prevention.

This finding implies that improving safe infection prevention practices are vital in hospitals units where a high proportion of patients developed healthcare associated infection [35].Remarkably, in the current study, about 90% of HCPs believed that gloves can't provide complete protection against acquiring infection. This finding is higher than previous studies [22, 23, 36]. As similar to previous study doneby Yakob et al., (2015) [29], in this study, only one-third of healthcare providers had hand hygiene practice after patient care and 68.4% of HCPs wash their hands before patient care.

This study revealed that HCPs who had more than five years of work experience were 1.5 times more likely to have adequate knowledge than their counterparts. This finding is in line with findings by Desta et al., (2018) [22] Gulilat, (2014) [26]. This might be due to the fact that as the number of years of practice increases, HCPs are exposed to infection prevention

information and became more experienced through working with senior staff. Every healthcare facility should create its own standard operating procedures based on national infection prevention and control recommendations , as recommended by the WHO [37, 38]. One of the main elements of infection prevention and control programs at all healthcare facilities is the creation and application of infection prevention guidelines [37, 38].

The existence of infection prevention guidelines in healthcare facilities also raises the likelihood that people will know enough about infection prevention, according to this study and earlier research[23, 39]. HCPs with infection prevention guidelines were more likely to receive updated information, which may have improved their understanding of infection prevention.HCPs with present positions in the laboratory and maternity units were more likely to know enough about IP. This could be because the laboratory unit has standard operating procedures for infection prevention, which could increase their understanding. Additionally, this can be because different units receive different infection prevention instruction.

Compared to individuals who did not get infection prevention training, HCPs who had ever participated in any kind of infection prevention training program were more likely to practice. This is supported by a study done by Geberemariyam et al., (2018) [23]. Various worldwide standards state that the mainstay of infection prevention and con trol programs should be infection prevention education and training[37, 38]. Hospital-acquired infections can be decreased by following infection prevention and control protocols and educating and training healthcare professionals [38]. Prior research has confirmed that providing health care personnel with infection control training benefits them by increasing their adherence to basic precautions [40, 41].

However, according to the current study, only 33.9% of the HCPs had ever participated in an infection prevention training program. This suggests that infection prevention training is required for over two-thirds of HCPs. In a similar vein, HCPs with infection prevention guidelines were more likely than those without to follow safe infection prevention prac tices. The finding highlights the necessity of infection prevention guideline in the improvement of HCPs' practice.HCP s working in health facilities without continuous running water supply were 52% less likely to have safe infecti on prevention practices as compared with HCPs working in a facility with continuous water supply. This finding is supported by a study done by Sahiledengle et al., (2018) [34].

CONCLUSION

The results of this study demonstrated that 45% of HCPs executed infection prevention in a dan gerous manner, and a sizable portion lacked sufficient understanding about infection prevention. Work experience, obtaining infection prevention training, and the existence of infection prevention guidelines have all been strongly linked to knowledge of in fection prevention. As a result, HCPs should receive sufficient pre-service and on-the-job training to enhance their understanding of infection prevention. Additionally, infection prevention guidelines should be used to enhance infection prevention practic e and knowledge.

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