

Assessment of Knowledge and Practices of Staff Nurses towards Infectious Diseases Isolation Precautions in Tertiary Care Hospitals: A Multi-Center Study

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Abstract

Background: Compliance with the evidence-based isolation precaution guidelines is essential to prevent the spread of infectious diseases among hospitalized patients and its ensuing complications. **Objectives:** This study aimed to assess the nurses' knowledge towards the infectious diseases' isolation precautions in governmental tertiary care hospitals and to identify the relationship between nurse's characteristics concerning their knowledge and practices. **Method:** A cross-sectional study was conducted in ten tertiary care hospitals using a self-administrated questionnaire to collect nurses' characteristics and to assess their knowledge level. Nurses' practices were evaluated using an observation checklist. Univariate, bivariate, and logistic regression analysis were applied. **Results:** The study revealed that 35.8% of nurses had a good knowledge regarding isolation precautions and 41.6% had good practices score. Some demographic variables inclined Nurses' knowledge; age, gender, education, and experience. While their practice score was affected by; gender, work experience, and unit of work (ICU vs. non- ICU). A statistically significant positive correlation was revealed between the overall knowledge score and the overall practice score of nurses regarding adherence to the infectious diseases isolation precautions ($r=0.3$). Participants' education and duration of working experience were the significant predictors for higher knowledge scores ($p < 0.05$). **Conclusion:** The tailored multi-modal training approach can improve nurses' knowledge and promote their experiences towards isolation precautions.

Keywords: *Prevention, Isolation precaution, Infection control, Nurse training.*

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Introduction

The burden of infectious diseases fell dramatically during the last century, largely due to immunization and improvement in sanitation.¹ Despite this epidemiological transition, researchers believe in the resurgence of infectious diseases.² Thus infectious diseases continue to be a main public health concern and problem. They are responsible for an increase in hospital stay, extra services required during

hospitalization and account for about 12 million deaths globally.³⁻⁵

Healthcare workers (HCWs) compliance and mainly nurses by following the infection control precautions are known as effective means to prevent and control diseases transmission not only among patients but also among HCWs and to the environment.⁶⁻⁷

The nurses are the key members of providing continuous care for patients. Their knowledge and adherence to all

measures associated with disease transmission prevention and control are considered as a top priority.⁸ Several studies were conducted in the region to assess the level of HCWs' knowledge and practice focused on type-specific or disease-specific isolation precautions particularly against the emerging infectious diseases.⁹⁻¹¹ These researches concluded that in addition to regular education and training activities, monitoring practices comply with the evidence-based isolation guidelines is a crucial element for patients' safety and an important element to assess the need of HCWs for orientation and training regarding the isolation precautions.⁹⁻¹² No similar study was conducted in the state of Kuwait; therefore the authors would like to conduct this study with the purpose to assess the nurses level of knowledge and practices towards different types of infectious diseases isolation precautions in multiple governmental tertiary care centers and to identify the relationship between the nurses' characteristics in relation to their knowledge and practices.

Method

A cross-sectional study design conducted over six months from April to September 2019. The data were collected from 10 tertiary care governmental centers affiliated to the ministry of health in the state of Kuwait. These centers include the following non ICU departments; medical, orthopedics, cardiology, cardiothoracic, otolaryngology, ophthalmology, obstetrics and gynecology, pediatric surgery, neonatal, organ transplant, nephrology and burn units. In addition to these wards there are intensive care units for different specialties in each hospital. The total bed capacity in these hospitals is 1843 bed.

The nurses (males & females) employed at the Kuwait Ministry of Health tertiary care hospitals.

Currently working nurses in the study hospitals for more than one year with

full-time employment and providing direct patient care for in-patient departments (wards and ICUs) were eligible for this study. The number of those eligible nurses was approximately 1430.

The researchers obtained the number of nurses working in the ten tertiary care centers from the National Health Information and Statistics annual report.¹³ Then added up these numbers to get the total targeted population frame from which the sample was drawn. The sample size was calculated using Epi-Info program version number 7 using the sampling technique for cross-sectional study with power 80% and confidence interval 95%. The anticipated knowledge percentage used in the calculation is 50%, this procedure yielded a sample of 303 nurses.

The recruitment of nurses in each hospital was based upon the previous calculated representative percentage of the nurse's number from the total targeted population. Thereafter the sample from each hospital was drawn using a systematic random sample technique from the list of nurses working in the in-patients departments and providing direct care for patients with infectious diseases. Nurses were invited, explained the study objectives, assured the confidentiality of data and consented to participate in the study.

The following research tools used to collect data: A *self-administrated questionnaire used to describe the nurses' characteristic* including nurse's age, gender, marital status, hospital name, department of work (ICU or non-ICU), nursing degree of education, work experience in years. In addition to questions concerning receiving any training regarding infection control isolation precautions in the last year or not, and the availability of the isolation precautions guidelines in their departments.

The nurses' knowledge assessed covered the following domains: Patient placement, performing hand hygiene and the use of appropriate personal protective equipment (PPE), methods of care in regards to patient equipment, the process of waste management and precautions taken during patient transfer. The knowledge assessment was done using twenty four questions; each question has a group of answers and only one answer is correct. The researchers counted one point for each correct answer (when the respondent's answer to the question was in agreement with the Centers for Disease Control and Prevention (CDC) isolation precaution recommendations') [14]. The wrong answer or I don't know the answer was taking zero. All the scores for the correct answers were added up to obtain a total knowledge score for each participant. The knowledge scores were classified into three groups; the first one who had answered less than 50% of the questions correctly, the second group who had correct response to 50% of the questions but less than 80%, the last group who answered 80% or more of questions accurately.¹⁵

Observation checklist: Practices assessment was done using an observation checklist. The checklist domains were similar to the knowledge domains and agreed with CDC isolation precautions guidelines.¹⁴ The nurse practices evaluated using a total of twenty four statements with answers; yes, no or not observed. The not observed domain removed from the total elements during the analysis. The results of the practice score were classified into three groups; the first group had less of 50% of the observed practice done in the recommended way, the second group had 50% or more and less than 80% of the observed practice done in the proper manner, the last group had at least 80% of the observed practice done in the appropriate way.¹⁶

Validity and reliability of the study tools: The research tools were revised by professors of public health and community medicine experienced in the community and public health researches. The reliability of the questionnaire and checklist statements was assessed by calculating Cronbach's Alpha which was 0.72 and 0.81 for nurse's knowledge and practices respectively.

A pilot study was accomplished to test the study instruments and refine the methodology. It was applied on 20 staff nurses, working in the same settings, using the same data collection and analysis techniques to determine the clarity of questions, response, the time needed to complete the questionnaire and accomplishment of data collection technique. The nurses shared in the pilot were not part of the study sample and their data excluded from the analysis of the study.

Assigned infection control nurses in the studied hospitals distributed the questionnaires and completed the observation checklist. The researchers provided a training session for them before they started the collection of data. The training included a briefing of the research methods and an explanation of how to complete the observation checklist to ensure the accuracy and consistency of data.

Before the beginning of the study and after explaining the objectives of the research and ensuring confidentiality of the data, all participants in each hospital signed a consent form. Each consented nurse received a self-administered questionnaire, which was distributed to be filled out to collect their characteristics and knowledge towards infectious diseases isolation precautions. The questionnaires were collected after 30 minutes. Afterwards, nurses' practice were evaluated without prior notice and data collected by a concealed observation technique during their regular care. The

participating nurses were observed during giving direct care for patients under different isolation precautions.

Ethical consideration

The necessary official approval obtained from the Ministry of Health Joint Committee for the protection of human subjects in research under number (997/5 March 2019). Informed consent was obtained from all participating staff nurses. Participants were assured about the confidentiality of the given information. All data were coded, entered and analyzed anonymously.

Statistical analysis

Data was presented using frequency, percentage, and mean \pm SD. Binary logistic regression analysis and Spearman's correlation coefficient applied to examine the relationship between the participant's knowledge, practices, and different characteristics. A Chi-square test used to analyze paired qualitative data. Statistical significance was set at *p-value* (<0.05). Statistical analysis was done using SPSS version 19 statistical software package (IBM, Chicago, IL, USA).

Results

Out of the sample of 303 nurses a total of 243 of them completed both questionnaire and the checklists, with a response rate of 80.2%. The analysis of the participants' variables revealed that the majority of the nurses were females 72.4%, their mean age was 36.21 ± 6.76 years, 60.9% had bachelor's degree, 32.9% worked in the intensive care unit, and 76.9% had been working for 5 years and more, and 72.1% of the nurses participated in the study received training about isolation precautions in the last year. The isolation precautions guidelines were reported available by 94.7 % of respondents (Table 1).

Figure (1) shows the distribution of the participant's scores in the different knowledge domains, patient placement, hand hygiene and PPE, patient

equipment, waste management, and patient transfer.

Table (1): Characteristics of The Participant Nurses in The Studied Tertiary Care Hospitals

Nurses Characteristics	No. (243)	%
Age: (years)		
< 35	120	49.4
35 – 40	65	26.7
> 40	58	23.9
Mean \pm SD	36.2 \pm 6.7	
(Range)	23.0 – 65.0	
Gender:		
Male	67	27.6
Female	176	72.4
Education:		
Nursing diploma	96	39.5
Bachelor	147	60.5
Marital status:		
Single	24	9.9
Married	219	90.1
Area:		
ICU	80	32.9
Non-ICU	163	67.1
Duration of experience in the study hospital:		
< 5	59	24.3
5 - 10	100	41.1
> 10	84	34.6
Mean \pm SD	9.37 \pm 5.90	
(Range)	(1.0 – 40.0)	
Previous training on isolation precautions in the last year		
	187	77.0
Isolation precautions guidelines is available		
	230	94.7

Around two-thirds of the participants responded properly to at least 80% of knowledge questions concerning patients transfer, patient's equipment and hand hygiene & use of PPE. While the percentage of participants with knowledge score of 80% or more regarding waste management was only 10%.

Looking at the overall knowledge score; it was found that 35.8% of the participants fell in the third group (correct knowledge 80% or more).

Additionally, the analysis of the knowledge domain scores concerning participants' characteristics variables

indicates that there is a statistically significant difference

Table (2): The relationship between participant nurses' knowledge level and their characteristics

Characteristics	Knowledge level						X ²	P-value
	<50		50-<80		≥80			
	No.	%	No.	%	No.	%		
Age: (years)								
< 35	19	15.8	72	60.0	29	24.2	16.12	0.003*
35 - 40	5	7.7	29	44.6	31	47.7		
> 40	3	5.2	28	48.3	27	46.6		
Gender:								
Male	13	19.4	34	50.7	20	29.9	6.74	0.034*
Female	14	8.0	95	54.0	67	38.1		
Education:								
Nursing diploma	20	20.8	53	55.2	23	24.0	19.85	0.000*
Bachelor	7	4.8	76	51.7	64	43.5		
Marital status:								
Single	4	16.7	15	62.5	5	20.8	2.85	0.240
Married	23	10.5	114	52.1	82	37.4		
Area:								
ICU	5	6.3	42	52.5	33	41.3	3.53	0.171
Non-ICU	22	13.5	87	53.4	54	33.1		
Duration of experience in the current hospital:								
< 5	12	20.3	37	62.7	10	16.9	29.22	0.000*
5 - 10	12	12.0	58	58.0	30	30.0		
> 10	3	3.6	34	40.5	47	56.0		
Previous training on isolation precautions in the last year:								
Yes	24	12.8	99	52.9	64	34.2	2.74	0.255
No	3	5.4	30	53.6	23	41.1		

between their knowledge in terms of variables such as age, gender, education level, and duration of working experience ($p < 0.05$) (Table 2).

Figure (2) shows the distribution of the participant's scores in the different practice domains; patient placement, hand hygiene and PPE, patient equipment, waste management, and patient transfer. The majority of studied nurses showed a correct practice in at least of 80% of the observation regarding the patient equipment and patient transfer. On the other hand only less than one third had a proper practice in at least 80% of the observation concerning the patient placement. In the current research, the analysis identified that

41.6% of the participants were adherent to 80% or more of the observed practices. Moreover, the investigation of the participants' practice domain scores concerning their characteristics revealed a statistically significant difference between their practice scores about gender, duration of working experience, type of isolation and working in ICU vs. non-ICU settings ($p < 0.05$) (Table 3).

Spearman's correlation coefficient was applied to compute the relationship between knowledge score and participant characteristics variables. It revealed a statistically significant positive correlation between the knowledge score and both participants' age and duration of the experience $r=0.23$ & 0.33

respectively with *p-value* (<0001). Additionally, the relationship between practice score and participants characteristics variables showed a statistically significant positive

Table (3): The relationship between participant nurses' practice level and their characteristics

Characteristics	Practices level						X ²	P-value
	<50		50-<80		≥80			
	No.	%	No.	%	No.	%		
Age: (years)								
< 35	24	20.0	47	39.2	49	40.8	9.01	0.061
35 – 40	5	7.7	32	49.2	28	43.1		
> 40	4	6.9	30	51.7	24	41.4		
Gender:								
Male	18	26.9	21	31.3	28	41.8	15.79	0.000*
Female	15	8.5	88	50.0	73	41.5		
Education:								
Nursing diploma	13	13.5	44	45.8	39	40.6	0.07	0.967
Bachelor	20	13.6	65	44.2	62	42.2		
Marital status:								
Single	3	12.5	14	58.3	7	29.2	2.09	0.352
Married	30	13.7	95	43.4	94	42.9		
Area:								
ICU	4	5.0	39	48.8	37	46.3	7.50	0.024*
Non-ICU	29	17.8	70	42.9	64	39.3		
Duration of Work in the current hospital:								
< 5	17	28.8	26	44.1	16	27.1	17.35	0.002*
5 – 10	9	9.0	44	44.0	47	47.0		
> 10	7	8.3	39	46.4	38	45.2		
Previous training on isolation precautions in the last year:								
Yes	22	11.8	83	44.4	82	43.9	3.03	0.220
No	11	19.6	26	46.4	19	33.9		
Type of isolation precautions								
Standard	4	11.8	11	32.4	19	55.9	79.98	0.000*
Contact	1	0.9	57	53.3	49	45.8		
Droplet	7	10.8	28	43.1	30	46.2		
Airborne	21	56.8	13	35.1	3	8.1		

correlation between the practice score and duration of the experience $r= 0.020$ with *p-value* 0.002 (Table 4).

Binary multivariate logistic regression analysis was applied using the significant variables that affected the knowledge score of the participants which were identified in the univariate analysis; Age, gender, education, and duration of experience were recognized as dependent factors affecting the knowledge score.

However, participants' education and duration of experience were significant predictors for higher knowledge scores

($p < 0.05$). The overall percentage 71.2% and the prediction of the regression model was 23.3% ($p < 0.01$) (Table 5).

Furthermore, analyzing the relationship between the overall knowledge score and the overall practice score of the nurses regarding adherence to the infectious diseases isolation precautions using Spearman's correlation coefficient; it revealed a statistically significant positive correlation $r=0.31$ and ($p < 0.001$) (figure 3).

Discussion

The threat of infectious diseases continues to pose a risk not only in the community but also in healthcare settings. Understanding and

implementing isolation precautions are fundamental actions to prevent the spread of

Table (4): Correlation between participant nurses’ knowledge and practice level with nurses’ age and duration of experience

Variables		Age (years)	Duration of work in the current hospital	Knowledge level	Practice level
Age (years)	r _p	1	.685**	.231**	.090
	P value		.000	.000	.160
Duration of work in the current hospital	r _p	.685**	1	.337**	.197**
	P value	.000		.000	.002
Knowledge level	r _p	.231**	.337**	1	.302**
	P value	.000	.000		.000
Practice level	r _p	.090	.197**	.302**	1
	P value	.160	.002	.000	

** . Correlation is significant at the 0.01 level (2-tailed).

Table (5): Logistic Regression Analysis of Independent Factors Affecting Nurses Knowledge Score

Variables	P-value	OR	95% C.I.	
			Lower	Upper
Age (years)	0.820	0.991	0.918	1.070
Male gender	0.732	0.889	0.454	1.740
Previous training	0.838	0.932	0.473	1.837
Bachelor education	0.000*	5.487	2.641	11.401
Duration of experience	0.001*	1.185	1.073	1.308
Overall percentage				71.2%
Nagelkerke R square				0.233
Significance of the model				0.013*

microorganisms from one person to another, either patient, visitor, or healthcare worker. The current study evaluated the knowledge and practices of different types of infectious diseases towards isolation precautions among nurses at ten tertiary care governmental centers in Kuwait.

The present study identified that 35.8% of the participants had correct response to at least 80% of all knowledge domains. This overall knowledge level is better than what is reported from Palestinian governmental hospitals 18.08%¹⁵ and a cross sectional study in Yemen (4%).¹⁶ The discrepancy in the knowledge level recorded is not solely due to the proper answer percentage in the questionnaire, but it could be due to

other factors; as the clarity of the questions, number and elements asked, eager of the participants to proper answer, previous infection

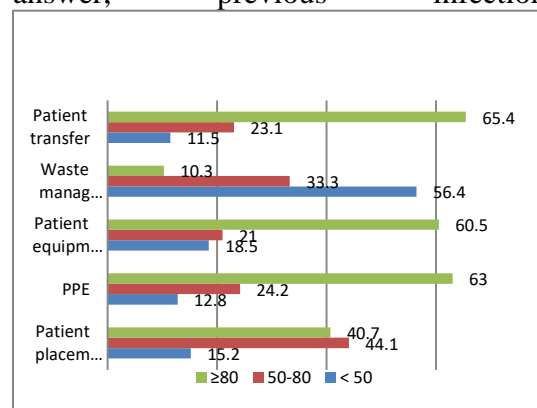


Figure (1): Distribution of The Participant Nurses’ Knowledge Domains Scores

control training received.^{10,16-18} Nevertheless to improve nurse's good knowledge score; additional training using different procedures and approaches is required concentrating on different types of isolation precautions as an alternative to the general training on infection control.¹⁰

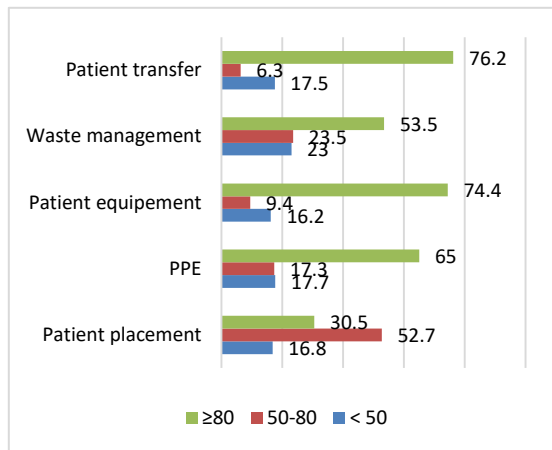


Figure (2): Distribution of The Participant Nurses' Different Practice Domains Scores

Bivariate analysis of the knowledge domains about participants' characteristics, showed a statistical significance difference between knowledge scores in different aspects concerning different age groups. These findings were comparable with those reported from various studies conducted in Iran and Turkey.^{17, 19-20}

The present study reported that the nurses' knowledge level towards isolation precautions influenced by their gender; females had better knowledge than males. This result was consistent with Motamed et al, who found that, there was a relationship between HCWs' gender and their knowledge.²¹ Unsurprising results of the existing study indicated that nurses' knowledge and their level of education were significantly associated. This finding is concurred with Al Jazairi who documented that, the level of knowledge increased when the level of education has improved too.²² Our study demonstrated that, 41.6% of the studied nurses had a correct practice

for at least 80% of the overall observed isolation precautions domains. This finding was higher than the outcomes found in other research studies; that documented nurses' compliance to appropriate isolation precautions ranged between (8-26%).^{10,16-17} The variation in the nurses practice towards isolation precautions in the research studies could be due to several factors; like healthcare worker attitude to apply isolation precautions, the infrastructure inclination specially for airborne and to a lesser extent for the droplet isolation precaution, and healthcare worker knowledge for all types and requirement in each isolation precaution.^{10,17,23-25} The inconsistency between the level of knowledge and practice points out the difference between theory in guidelines and real-life practice.¹⁶

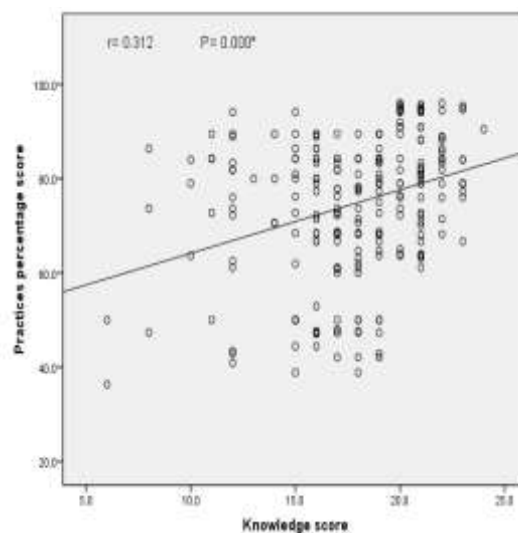


Figure (3): Correlation between Participating Nurses' Knowledge Score and Practice Score

The current investigation identified many factors that, influencing the participants practice score with statistical significance difference; nurses' gender, working unit (ICU vs non ICU), type of isolation and the working experience, these findings were similar to the results described by Arli et al, who concluded positive and significant relationship between the isolation precautions compliance and

nurses age, education, ICU working and duration of experience.¹⁹ It is anticipated to see that experience, knowledge that is gained all over the years, continuous training with an emphasis on the weak points will reflect positively on the nurses' practice.^{18, 22}

Our investigation displayed a positive correlation between the overall knowledge score and the overall practice compliance. This was in favor with the findings of multiple research studies in different countries.^{17-18, 26}

The majority of the research studies applied a self-administered questionnaire to assess the nurses' knowledge and practice towards isolation precautions and the greater part of them did not describe the significant difference between participants' knowledge and practice scores. In the present research, a self-administered questionnaire was used to evaluate nurses' knowledge in addition to using a direct observation method with a checklist to calculate participants' practice. This method ensures the realistic observation of the practice of the participants under investigation rather than depending on what they report in the questionnaires.²⁷

While the weakness of the study is that all study sites were tertiary cares so we cannot generalize the results obtained from this study.

Conclusion

The studied nurses showed a better practice of isolation precautions than knowledge, yet this level need to surge in order to provide better and safer patient care. The nurses knowledge level was inclined by some variables; age, gender, education, and experience. While their practice score was affected by; gender, work experience and unit of work (ICU vs. non ICU). A significant positive correlation between the overall knowledge score and the overall practice score was found. Customized training and education programs are

recommended focusing on different isolation precautions aspects to improve their knowledge and promote their practices.

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