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Major Article

Knowledge and practices of isolation precautions among nurses in Jordan



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Key Words:

Health care–associated infection
isolation precautions
personal protective equipment
compliance

Background: Implementation of isolation precautions from the Centers for Disease Control and Prevention (CDC) has been justified through research and clinical evidence. However, nurses' understanding and compliance with these precautions is still unknown. The aim of this study was to assess nurses' knowledge and practices in relation to isolation precautions in Jordan.

Methods: A cross-sectional, descriptive design was used. The study took place in 8 hospitals in Jordan. A self-reported questionnaire and an observational checklist were developed based on the CDC (2007) isolation precautions guidelines.

Results: A total of 247 questionnaires were returned out of 400, for a response rate of 61.7%. The results show that most nurses (90%) have good knowledge of isolation precautions. However, only 65% of nurses reported good compliance with isolation precautions. The results of a *t* test revealed that nurses with Bachelor's degrees perform better in knowledge examinations than nurses with 2-year diplomas ($P < .001$). However, there was no significant difference in knowledge and self-report practices scores based on nurses' previous training and existence of isolation guidelines in their units or wards ($P > .05$). The results of the checklists confirm that there is a low compliance with standard isolation practice. In addition, the checklist shows that a high percentage of units and wards do not use isolation signs (46.4%) and posters (34.5%).

Conclusions: This study revealed that educating nurses about isolation is not enough strategy to improve their compliance. It is important to adapt other strategies, such as supporting nurses by giving them a manageable workload, and providing more supplies and reminders of isolation precautions in the hospitals.

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Globally, health care–associated infections have become a medical challenge in health care settings.¹ It is estimated that >1.4 million people worldwide get infectious complications in hospitals.^{2,3} The World Health Organization reported a noteworthy incline in the rate of hospital-acquired infection in developing countries in comparison with developed countries. A recent study found that hospital-acquired infection is 5 times higher in developing countries.⁴ The rates of device-associated infection range from 8.2–16.1 per 1,000 device-exposed days in developing countries.⁵

In Jordan, infectious diseases are still one of the main causes of morbidity.⁶ Acute respiratory diseases and hepatitis are 2 of the leading causes of morbidity in the region.⁶ In recent years, several

infectious agents have emerged such as the Ebola virus, Middle East respiratory syndrome coronavirus, and Avian influenza in humans.⁷ Increased national efforts are required to control the spread of these infectious diseases. Medical isolation and infection control practices should be enforced by health care workers to prevent transmission of health care–associated infections.⁸

As health care workers, nurses in Jordan form part of the health care team responsible for implementing patient isolation and following standards and disease-specific isolation precautions.⁹ However, many previous studies have suggested that nurses do not strictly adhere to these precautions.^{5,10,11} Other studies claim that nurses' inadequate knowledge about standard isolation precautions could explain why infection control activities are often carried out with poor results in health care settings.^{12–14} However, other studies have claimed that education alone is not enough.^{10,11} The Centers for Disease Control and Prevention encourage the implementation of training programs for health care workers about isolation precautions to prevent the spread of infectious diseases.

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Conflicts of interest: None to report.

The recommendation also includes frequent assessment of knowledge and isolation precautions practices.⁸

Many studies across the world have measured nurses' knowledge, attitude, and practice of standard isolation precautions. Most have used descriptive cross-sectional designs and different self-report tools to measure knowledge, attitude, and practice. The results of the studies highlighted the health care workers' inadequate knowledge about common transmission mechanisms and their improper attitude and practices in relation to isolation standards for infection control practices. The main recommendations of these studies were to focus on infection control in nursing curricula, provide more continuous education programs at the hospitals, apply more monitoring and supervision of standards and isolation precautions, and provide isolation structures and supplies in hospitals.^{5,10,13,15,16}

Few studies have investigated infection control knowledge and practice in Jordan.^{17–19} Al-Rawajfah et al¹⁷ reported nurses' lack of adherence regarding principles of infection control. In addition, Al-Rawajfah and Tubaishat¹⁹ found that students demonstrated a lack of knowledge regarding different infection control practices. Similarly, many national studies found that nurses and nurse students have some lack of knowledge regarding different infection control topics, such as prevention of central venous line infection and ventilator-associated pneumonia. These studies concluded that there might be a lack of administration of these topics into nursing curricula and lack of clinical training in the Jordanian hospitals about infection control practices.^{20–22} However, no study was found that assessed nurses' knowledge of isolation precautions and its relationship with their practices. Therefore, the purposes of this study were to assess nurses' knowledge of and practices in relation to isolation precautions in Jordan.

Our research questions were as follows: (1) What do nurses know about isolation precautions?; (2) What are nurses' practices in relation to isolation precautions?; (3) Is there sufficient structure and supplies that support isolation practices?; and (4) What are the factors associated with nurses' knowledge and practice in relation to isolation precautions?

METHODS

This study used a cross-sectional and descriptive design by distributing 400 self-report questionnaires to nurses and asking trained data collectors to complete observational checklists from 33 units and 51 wards. The study was conducted in 7 governmental and 1 university hospitals in Jordan. The questionnaire and observation checklist were adapted and developed based on the Centers for Disease Control and Prevention 2007 isolation precautions guidelines and previous studies.^{5,8,9} Ethical approval was obtained from AL al-Bayt University and the selected hospitals.

The questionnaires include 5 questions regarding nurses' demographics and background, 12 true or false questions about nurses' knowledge, and 14 questions about nurses' practices in relation to isolation precautions. The knowledge questions have true, false, and I do not know responses; the practice questions have 3 Likert scale responses: never, sometimes, and always. The observation checklist included 8 yes or no questions about the availability of isolation rooms and supplies and 2 questions about nurses' compliance with standard- and transmission-based infection control practices. Knowledge questions were assigned a score of 1 for correct answers and 0 for false and I do not know answers. The answers to the practice part were scored as 0 for never and sometimes and 1 for always. The total knowledge and practices scores were calculated and converted to a percentage. For this study, knowledge and practice were defined as good (>75%), acceptable (50%–75%), and poor (<50%).¹⁶

The questionnaire and observation checklist were assessed for content validity by a group of PhD holders from Al al-Bayt University.

The doctors were asked to check the questionnaire and the checklist for clarity and comprehensiveness and modify them where necessary. In addition, to assess the questionnaire's reliability, a pilot study was conducted with 20 nurses. The questionnaire showed good internal consistency with a Cronbach α reliability of 0.77 for the practice part and 0.89 for the knowledge part.

The researcher used 3 trained data collectors from Al al-Bayt University with Master's degrees in nursing to distribute the questionnaires and to complete the observation checklist. The main researcher delivered a 2-hour training session to them beforehand. The training included looking at the content of the observation checklist and how to complete it. For the questionnaires, the data collectors were to ask nurses to participate in the study after describing the study's aim and content. During data collection, verbal consent was gained from each participant after they had read the covering letter, which included details about their rights in relation to their participation. For the observation checklist, the data collectors visited the units and wards 3 times for 1 hour each visit to complete the checklists. Later, all completed sheets were checked by the data collectors for accuracy and completeness.

Statistical analysis

All data were analyzed using SPSS version 17 (IBM, Chicago, IL). Descriptive statistics, such as frequencies, percentages, means, and SDs, and inferential statistics such as 2-group *t* tests were used. Results were considered statistically significant at $P = .05$.

RESULTS

A total of 247 questionnaires were returned out of 400, for a response rate of 61.7%. The mean age of the nurses was 34 ± 4.9 years. Approximately two-thirds were women (67.9%), and one-third were men (32.1%). The mean number of years of nurses' experiences was 11.5 ± 6.1 . Most nurses had Bachelor's degrees (65%); 60.1% of them had previous training on isolation precautions (Table 1).

According to Table 2, the results of the knowledge part show that of the 12 knowledge questions, the nurses had a mean score of 10.3 ± 1.5 . According to our knowledge definitions, the results show that most of the nurses (90%) have a good knowledge of isolation precautions, whereas only 10% demonstrated acceptable or poor knowledge. Nurses mainly demonstrated lack of knowledge about disease-specific isolation precautions. For example, there was a low percentage of correct answers for the precautions of contact isolation question (42.2%), airborne isolation question (40.7%), and when a negative-pressure room should be used question (40.7%).

Table 1
Nurse and unit characteristics (243 nurses)

Characteristic	n (%)
Nurses' age (y)	
20–30	60 (24.7)
31–40	161 (66.3)
41–50	22 (9.0)
Nurses' sex	
Male	78 (32.1)
Female	165 (67.9)
Nurses' education	
Associate	60 (24.7)
Register	183 (75.3)
Experience (y)	
≤ 10	60 (24.7)
> 10	183 (75.3)
Previous training on isolation	
No	97 (39.9)
Yes	146 (60.1)

Table 2
Nurses' knowledge and practice about isolation precautions

Nurses' knowledge about isolation precautions	Correct	Not correct or do not know
Nurses should wash their hand before and after patient care (T)	239 (98.4)	4 (1.6)
Nurses should wash their hands before and after using gloves (T)	227 (93.4)	16 (6.6)
It is necessary to wear gloves when touching mucous membranes and nonintact skin of patients (T)	223 (91.8)	20 (8.2)
Nurses should wash their hand after accidental contact with blood, body fluids, secretions, or contaminated items (T)	241 (99.2)	2 (0.8)
Nurses entering the isolation room for a patient on contact precautions should wear a mask, gloves, and gown (F)	103 (42.4)	140 (57.6)
Nurses caring for patients with suspected or confirmed meningitis infection should wear gown, gloves, and mask (T)	233 (95.9)	10 (4.1)
All waste resulting from the care of tuberculosis patients should be removed in red containers or bags or as hospital policies (T)	225 (92.6)	18 (7.4)
Nurses should only wear gown and gloves when implanting procedures and activities that are likely to generate splashes and sprays of blood or body fluids (F)	125 (51.4)	118 (48.6)
Nurses should wear goggles to protect mucous membranes of the eyes when procedures and activities are likely to generate splashes and sprays of blood or body fluids (T)	219 (90.1)	24 (9.9)
Nurses who have a respiratory infection are advised to avoid direct patient contact, especially with high-risk patients; if this is not possible, then a mask should be worn while providing patient care (T)	233 (95.9)	10 (4.1)
Patients on droplet precautions who must be transported outside of the room should wear a mask if tolerated and follow respiratory hygiene and cough etiquette (T)	231 (95.1)	12 (4.9)
Patients with airborne precautions are preferred to be in negative-pressure isolation rooms (T)	199 (40.7)	144 (59.3)
Self-report of nurses' practices	Always	Never and sometimes
In general, I follow standard infection control precautions with all patients in my unit and wards	115 (47.3)	128 (52.7)
If patient is isolated, I follow transmitted-based precautions (eg, contact or droplet isolation precautions)	40 (19.6)	195 (80.2)
I wash my hands before and after I conduct nursing care in my unit and floor	53 (21.8)	190 (78.2)
I wash my hands before and after using gloves	77 (31.7)	166 (68.3)
I wear gloves every time I touch mucous membranes and nonintact skin of patient	21 (8.6)	222 (91.4)
I wear mask, gown, goggles, and gloves when I care for droplet-isolated patients	73 (30)	170 (70)
I wear gown, gloves, and special mask (N95) when I work with patients on airborne isolation	103 (44.4)	140 (57.6)
I transfer patients who require airborne or droplet precautions to isolation room	55 (22.6)	188 (77.4)
I dispose of garbage of infected patients in selected trash according to hospital policy	35 (14.4)	208 (85.6)
I discard needles and other sharp objects to sharps container	21 (8.6)	222 (91.4)
I record patient isolation status on nursing note when I care for infected patients	47 (19.3)	196 (80.7)
I use isolation sign at my patient room if he or she is on isolation	65 (26.7)	178 (73.3)
I wear mask every time I have respiratory infection to protect my patients	97 (39.9)	146 (60.1)
I check patient isolation status before I start my work with him or her	75 (30.7)	168 (69.1)
Observation of isolation precautions in the units and wards	No	Yes
Is infection control manual available in the unit and wards?	82 (97.6)	2 (0.4)
Are infection control policies implemented in the unit and wards?	57 (67.9)	27 (32.1)
Is there an isolation room available in the unit and wards?	56 (66.7)	28 (33.3)
Are different isolation signs available?	45 (53.6)	39 (46.4)
Are infection control precautions posters available in the unit and wards?	55 (65.5)	29 (34.5)
Is isolation equipment sufficiently (eg, mask, gloves, gowns) available in the unit?	69 (82.1)	15 (17.9)
Are disinfectant solutions available in various places in the unit and wards?	70 (83.3)	14 (16.7)
Are sharp containers available in various places in the unit and wards?	75 (89.3)	9 (10.7)
Observation of isolation precautions in the units and wards	Never and sometimes	Always
In the unit or ward, nurses follow standards infection control precautions in the units or wards (eg, maintain frequent handwashing)?	67 (79.8)	17 (20.2)
In the unit or ward, nurses follow transmitted-based isolation precautions in the unit or wards (eg, following contact isolation protocol)?	74 (88.1)	10 (11.9)

NOTE. Correct answers for true or false questions are labeled in parenthesis after the statement. Values are presented as n (%). F, false; T, true.

In the isolation practices, the mean score was 10.36 ± 3.8 . Only 65% of nurses reported good compliance with isolation practices, 22% reported acceptable compliance, and 23% reported poor compliance. The lowest reported practices were for wearing a mask every time the nurse has a respiratory infection (60.1%) and for wearing personal protective equipment when caring for airborne isolation cases (57.6%) (Table 2).

Checking the isolation supplies and tools showed that 46.4% of units and wards had no isolation signs, 34.5% had no isolation posters, and isolation rooms were not available in 33.3% of units and wards. In addition, some lack of disinfectant solutions and needle disposal boxes were observed. The data collectors also observed that few nurses were usually following standard infection control precautions (20.2%) and few followed transmission-based isolation precautions (11.9%) (Table 2).

The results of this study revealed a statistically significant difference ($P < .001$) in nurses' knowledge based on nurses' academic degrees, where nurses with Bachelor's degrees performed better in

knowledge examinations than nurses with 2-year diplomas. However, regarding both nurses' previous training and the existence of isolation guidelines in the unit and ward, there was no significant difference in knowledge and self-reported practices scores (Table 3).

DISCUSSION

Congruent with previous studies, nurses in this study showed reasonably good knowledge about isolation precautions. However, some lack of knowledge was noted in the topics of precautions relating to contact isolation, airborne isolation, and when a negative-pressure room should be used. These findings might highlight a defect in curricula in nursing schools and continuous education programs in the participating hospitals. It is consistent with previous studies who revealed poor student nurses' knowledge regarding infection control practices.^{17,21} Several factors contributed to the nurses' lack of knowledge in some topics; one of these was dissatisfaction

Table 3
t test to compare knowledge and compliance of isolation precautions

Variables	Knowledge score	t (df)	P value	Compliance score	t (df)	P value
Availability of isolation guideline						
No	10.2 ± 1.6	-0.97 (243)	.34	9.9 ± 3.6	-1.5 (243)	.15
Yes	10.4 ± 1.5			10.7 ± 3.8		
Education level						
Associate nurse	9.5 ± 1.7	-4.4 (241)	<.001	9.6 ± 4.3	-1.7 (241)	.09
Register nurse	10.5 ± 1.4			10.0 ± 3.5		
Previous training						
No	10.4 ± 1.5	-3.1 (241)	.19	10.5 ± 3.9	0.09 (241)	.90
Yes	10.3 ± 1.2			10.45 ± 3.5		

NOTE. Values are mean ± SD or as otherwise indicated.

with the content of the infection control educational courses during their studies.²³ Other factors included a shortage of well-designed infection control programs that targeted health care workers during their clinical practices.²⁴

Although nurses in this study showed acceptable knowledge about isolation precaution, their compliance was poor. The results show that few nurses reported that they followed standard isolation precautions (52.7%). In addition, few nurses were observed following standard isolation precautions (20.2%) and transmission-based isolation precautions (11.9%). These findings confirmed that nurses in Jordan were not strictly complying with activities that protect them from the transmission of infectious diseases. Our finding is consistent with the Al-Rawajfah et al¹⁷ study that revealed nurses in Jordan have low compliance to infection control practices. The researchers revealed that the lack of resources is a major barrier for compliance with infection prevention guidelines among Jordanian nurses. Other barriers from the literature that could not be measured in our study include heavy workload¹¹ and lack of safety climate.²⁵ Also, the Nmadu et al study²⁶ reported that lack of supplies and organizational structure were significant barriers to nurses' compliance with isolation precautions.

In this study, and as expected, nurses with Bachelor's degrees score higher in the knowledge examination than nurses with 2-year diplomas. However, there was no significant difference in compliance between them. The results of this study support findings from a previous study by Aloush,¹¹ who reported no significant improvement in nurses' compliance with infection control guidelines after an educational program. Aloush found that nurse to patient ratio and lower unit capacity are significant predictors of nurses' compliance, and concluded that education would not improve nurses' compliance unless their workload was lowered. Barikani and Afaghi¹⁰ also stated that having good knowledge and a positive attitude are not enough to influence nurses' compliance to isolation precautions; providing appropriate supplies and a manageable workload were highly recommended in the study.

In this study, lack of compliance extended up through the institutional level: nearly half of the participating hospitals lacked isolation signs and a third had neither isolation posters nor isolation rooms. This study was conducted mainly in governmental hospitals that are characterized by high workload and high demand on equipment and supplies. Therefore, it is expected that shortages in these supplies are a major barrier for nurses in trying to follow isolation precautions. This finding highlights the urgent need for the Ministry of Health to support those hospitals with isolation supplies to protect both patients and health care workers. In addition, this finding highlights a significant defect in the policies that are supposed to organize and facilitate nurses' isolation practices, and supports the reports of previous studies that denoted the impact of policies on nurses' compliance. Giard et al²⁷ reported that organizational structure had a positive effect on nurses' isolation

practice, and McCoy et al²⁸ highlighted institutional healthy climate as a significant predictor for compliance among nurses.

To our knowledge, this study is the first in Jordan to investigate knowledge and practices relating to isolation precautions. The strength of this study is using self-report and observation in data collection to validate the results of the practices part. However, one limitation of the study is that because there is no well-established tool to measure knowledge and practice in relation to isolation precaution, our developed questionnaire needs to be further tested and developed. Another limitation that we have failed to measure other factors that could influence nurses' compliance with isolation precautions. Finally, this study included only Jordanian nurses, which might limit the generalizability of the findings to other settings and other populations. Future studies may benefit from collecting samples of nurses from different countries.

CONCLUSIONS

The nurses in this study had reasonably good knowledge about isolation precautions; however, this knowledge did not entail compliance. In addition, nurses' knowledge and previous training did not significantly predict their compliance. Lack of supplies, organizational factors, and heavy nursing workload could be barriers to compliance. The Jordanian Ministry of Health and other private and university hospitals should implement more health education programs on infection control and isolation as a part of its disaster plan in case of an infectious disease outbreak. Furthermore, they should consider other strategies, such as implementing more supervision and monitoring of infection control practices, adapting the guidelines into nurses' routine practices, and providing more isolation structures, supplies, and reminders about isolation precautions.

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