

Knowledge and Compliance of Pediatric Nurses Related to Hospital Isolation Precaution and Symbols

Abstract

Aim: Pediatric patients who are treated in pediatric clinics are particularly at risk for hospital infections. It is needed to have a standardized policy for reducing the risk of hospital-acquired infection and to inform all professionals, especially nurses, about isolation practices and to evaluate the studies relation to isolation measures at regular intervals. This study was conducted to evaluate the knowledge and compliance of nurses working in pediatric clinics related to hospital isolation precautions and symbols.

Methods: The descriptive study was conducted among 220 pediatric nurses working at two children's hospital in Ankara city center. Data was collected by using questionnaire form and Scale of Compliance with Isolation Precautions (SCIP). For data analysis; frequency, mean, percentage, Kruskal Wallis and Mann Whitney *U*-tests were used and the statistical significance level was accepted as $P < .05$.

Results: The majority of the pediatric nurses in the study received education relation to hospital infections by in-service education. Among precautions from hospital infections, contact isolation was known mostly. The meanings of the isolation symbols were almost unknown. More than one-fifth of nurses considered using of symbols which may be easy to memorize if it was possible to change. The mean score of SCIP was 78.34 ± 11.25 and compliance levels for the isolation precautions of the nurses were high. There was a statistically significant relationship between age, getting education about isolation methods, unit which is worked at and scale score ($p < .05$).

Conclusion: Pediatric nurses' training on hospital isolation methods, knowledge of isolation, and SCIP scores were high. The rate of knowing when the isolations disappear is not sufficient. The meanings of hospital isolation symbols were almost unknown. Education was effective on age and clinical SCIP scores. It may be recommended to repeat the trainings on the importance of isolation at certain intervals, to make arrangements for the isolation symbols or to focus more on the meanings of the symbols in the trainings, and to conduct research with a larger study group.

Keywords: Hospital, Isolation, Symbol, Isolation precautions compliance, Pediatric nurse

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Introduction

Hospital infections (HI) that are caused by inpatients, relatives, visitors, and healthcare workers, in other words, nosocomial infections (NO) are among the risky conditions that require various isolation practices.¹ HI,² which is not present during hospitalization or is in the incubation period, occurs usually 48-72 hours after hospitalization or within 10 days of discharge.^{3,4}

Children's clinics require more frequent nurse care and carry a higher risk in terms of HI, due to patient characteristics, differences in nutrition and care, frequency of complicated patients, frequent drug administration and vascular catheterization.⁵ Nosocomial infection rates in Turkey vary between 3.3 and 4.1% in adult and pediatric patients. NO are important causes of morbidity and mortality in newborns who are treated in neonatal intensive care units (NICU)⁶ and the mortality rate due to NO in neonatal units in our country is 8%.⁷⁻⁹

It is possible to reduce HI related to health care through some important strategies and practices. These measures consist of standard and transmission-based precautions. Standard precautions are the precautions that are applied to all patients regardless of the patient's diagnosis and whether they have an infection. The precautions related to the transmission route are always applied together with the standard precautions and are defined by considering the main transmission routes of the infectious agents and divided into three subgroups as respiratory isolation (Airborne precautions), droplet isolation (Droplet precautions) and contact isolation (Contact precautions).¹⁰

Knowing and applying isolation methods for prevention of NO are important in NICU and pediatric clinics as in other clinics. Patients should be isolated, hospital infection control strategies should be known, and hospital management should have a standard policy to reduce the risk of infection that may arise from the hospital. Patients should be isolated, hospital infection control strategies should be known, and hospital management should have a standard policy to reduce the risk of infection that may arise from the hospital.¹⁰ It is also important to know in which situations isolation is applied, what these applications include and when the isolation disappears, for all health professionals, especially nurses.

Aim of the Research

The research was conducted to evaluate the knowledge and compliance of nurses working in pediatric clinics regarding hospital isolation precautions and symbols.

Method

The Type of the Research

The research was conducted as descriptive type.

Place of Research

It was carried out in the Neonatal and Pediatric clinics of two children's hospitals located in the city center of Ankara.

Universe and Sample

A total of 540 nurses working in two children's hospitals constituted the universe of the research. In the sample calculation of the research, the sample size was determined with the Sampsiz program according to the sampling method whose universe is known (SourceForge, Philippe Glaziou, 2003-2005; <http://sampsiz.sourceforge.net/iface/index.html>). In the calculation, it was aimed to reach 220 nurses ($\alpha = 0.05$, prevalence = 50%, confidence interval = 95% (45%-55%)). The study was completed with 220 nurses who voluntarily participated in the study. In this context, 40% of the nurses working in the hospital were included in the research. Of the 220 nurses included in the study; 18 work in the emergency and polyclinic, 114 in the intensive care unit and 88 in the inpatient clinics. The power of the study was found to be 87% as a result of the retrospective power analysis, according to the mean scores of the Isolation Precautions Compliance Scale (IPCS) of the nurses who received training (78.93 ± 11.24) and who did not (74.74 ± 11.15) on isolation methods ($\alpha = 0.05$, $d = 0.60$). [G*Power 3.1.9.7 Programming]

Data Collection

The data were collected between May 2015 and January 2016 with the Questionnaire Form and the Scale of Compliance with Isolation Measures.

Questionnaire Form: The questionnaire form consists of two sub-sections. The first part consists of 5 closed-ended questions as the sociodemographic characteristics of the participants, such as age, gender, educational status, years of employment, and the clinic where they work.

The purpose of isolation, which is the main expectation of international accreditation organizations from the infection control program of hospitals; To prevent the transmission of microorganisms from infected or colonized patients to other patients, visitors and health-care personnel.¹⁰ For this purpose, Service Quality Standards for the evaluation and improvement of the quality of health services were prepared by the Ministry of Health, General Directorate of Treatment Services, Performance Management Quality Improvement Department, and isolation practices were standardized with different symbols for hospitals. In this context, the first standards were brought to patient descriptive figures and droplet, respiratory and contact isolations were symbolized as "blue flower", "yellow leaf" and "red star", respectively, and these symbols were used on patient room doors.¹¹ In the second part of the questionnaire, there were 1 open and 20 closed-ended questions about knowing the hospital isolations included in the above-mentioned international accreditation and service quality standards, receiving training on the subject, situations in which isolation should be applied, isolation practices and the duration of isolation, symbol suggestions for isolation symbols.

Scale of Compliance with Isolation Precautions (SCIP)

The scale developed by Tayran and Ulupınar¹² (2011) consists of a total of 18 positive and negative statements aiming to measure the compliance

of nurses and physicians with isolation measures. A 5-point Likert Rating (1 = Strongly disagree 2 = Disagree 3 = No idea 4 = Agree 5 = Absolutely) is used in the evaluation. Negative statements in the scale are the 1st, 8th, 11th, 13th and 18th items and are scored as 1 = 5, 2 = 4, 3 = 3, 4 = 2, 5 = 1. There are four sub-dimensions in the scale, these are transmission route (3rd, 8th, 9th, 10th, 11th items), employee and patient safety (2nd, 5th, 12th, 14th, 16th, 17th items), environmental control (1st, 13th, 15th, 18th items) and hand washing and use of gloves (4th, 6th, 7th items). The lowest score that can be obtained from the scale is 18, and the highest score is 90. Higher scores indicate increased compliance. The Cronbach alpha value of the scale is 0.85. The Cronbach alpha value for this study was determined as 0.93.

Data Analysis

The data were evaluated in the computer environment with the SPSS 21.0 package program (IBM Corp. Armonk, NY: USA. Released 2012). In the evaluation, number, mean, percentage, Mann Whitney U for two-group comparisons and Kruskal Wallis test analysis for more than two-group comparisons were used. Bonferroni-corrected post-hoc testing was performed where significant differences were detected in more than two groups. In the tables, similar groups are shown with similar letters, and the group that caused the difference with a different letter. Statistical significance level was accepted as $P < .05$.

Ethical Dimension

Before starting the research, necessary legal (Ankara 2nd Region Public Hospitals Union General Secretariat, 20.09.2015/85,346,189/605.01) and ethical permission (AYBU, 26.05.2015/69) and informed consent were obtained from the participants.

Results

The average age of the nurses participating in the study was 28.9 ± 5.6 (min = 19, max = 51), and the average working time was 5.9 ± 5.8 (min = 1, max = 30) years. The majority of pediatric nurses were in the 31-35 age group (44.8%), female (85.0%), had undergraduate education (68.6%), working time was between 0 and 10 years (84.5%), working in the intensive care unit (51.8%). It is determined that they received training on NO (85.8%) and in-service training (97.2%) (Table 1).

It is known that the infections that require contact isolation (97.3%) and contact isolation method (92.3%) the most. It was determined that their correct knowledge about as; the room door should be closed for contact isolation (86.4%), a special ventilation system should be available for droplet isolation (66.4%), and it was correctly known that the room door could remain open for respiratory isolation (10.9%). It is found that 71.8% of the nurses knew correctly the time of disappearance of isolation in Vancomycin-resistant enterococci (VRE), 13.6% Rotavirus, Parainfluenza, 28.6% Pneumonia, 4.1% Mumps, 38.6% Severe Acute Respiratory Syndrome (SARS) and 29.1% Chickenpox infections (Table 2).

The most commonly known isolation method by pediatric nurses was contact isolation (91.8%), only 0.9% answered the meaning of the droplet isolation symbol. It was determined that symbolizing the contact isolation with a hand/red hand/glove (25.5%), respiratory isolation with a lung (9.1%), droplet isolation with a water drop (20.4%) would increase the memorability (Table 3).

SCIP mean score was found as 78.34 ± 11.25 (Min:22; Max:90). Although the mean score for SCIP in the pediatric nurses who had undergraduate education and 10-20 years of working years and who took isolation methods training as a course at the university was higher than the other groups, the difference between them was not statistically significant ($P > .05$). It was determined that in the 31-35 age group, those

Features	n	%
Age (n = 203)*		
19-24 years	42	20.7
25-30 years	99	48.8
31-35 years	30	14.7
36 years and over	32	15.8
Gender (n = 220)		
Woman	187	85.0
Man	33	15.0
Educational status (n = 220)		
High school	27	12.3
Two-year degree	33	15.0
University	151	68.6
Master	9	4.1
Working year (n = 220)		
0-10 years	186	84.5
11-20 years	28	12.7
20 years and over	6	2.7
Unit (n = 220)		
Emergency and polyclinic	18	8.3
Intensive care unit	114	51.8
Clinic	88	39.9
Getting education about HI (n = 218)**		
Yes	187	85.8
No	31	14.2
Place that is taken education about HI (n = 141)***		
In- service education	137	97.2
As a course in university	4	2.8

*17 participants did not answer this question.
 **Two participants did not answer this question.
 ***46 participants did not answer this question.

who received training on isolation methods and working in inpatient clinics had higher mean scores than other groups. It was determined that there was a statistically significant relationship between age, being educated about isolation methods, and the unit of study with the SCIP score ($P < .05$) (Table 4).

Discussion

The majority of pediatric nurses participating in the study received training on NO. These trainings were mostly taken in in-service trainings (Table 1). Studies have reported that the rate of nurses receiving training on NO in Turkey ranges from 29% to 88.1%.¹³⁻¹⁵ The rate of receiving education is similar to other studies.

Nurses' knowledge of hospital isolation methods is high. Nurses knew the isolation methods applied in hospitals, especially contact isolation.

To know isolation methods and practices (n = 220)	n	%
Isolation methods*		
Contact	214	97.3
Droplet	203	92.3
Respiratory	209	95.0
No answer	1	0.5
Isolation methods according to infections*		
Infections requiring contact isolation **	203	92.3
Infections requiring droplet isolation ***	114	51.8
Infections requiring respiratory isolation ****	112	50.9
Protective precautions for contact isolation *		
The patient should be taken to a single room or patients with the same infection should be taken to the same room.	184	83.4
Gloves should be changed for procedures or gloves should be removed and hands should be washed before leaving the room.	190	86.4
In cases where there may be excessive contact with the patient and the surfaces in the patient's room, a gown should be worn and removed before leaving the room.	190	86.4
Protective precautions for droplet isolation *		
The patient should be taken to a single room or in the same room with patients with the same infection.	171	77.7
There should be special ventilation	146	66.4
Room door should be kept open	78	35.5
Persons approaching within one meter of the patient should wear a surgical mask.	191	86.8
If the patient is going out of the room, he should wear a surgical mask.	191	86.8
Protective precautions for respiratory isolation*		
The room should have a ventilation system	170	77.3
Room door should be kept closed	182	82.7
If the patient is going out of the room, he should wear a surgical mask.	194	88.2
Patient room should be entered with N95 mask.	192	87.3
Time for Isolation to Disappear		
<i>Vancomycin resistant enterococci (VRE)</i>		
When the perirectal culture taken 3 weeks in a row is negative	158	71.8
<i>Rotavirus, Parainfluenza infection</i>		
When the perirectal culture taken 3 weeks in a row is negative	30	13.6
<i>Pneumonia infection</i>		
During the illness	63	28.6
<i>Mumps infection</i>		

Table 2. Correct Answers of Nurses regarding Knowledge and Practices of Isolation Methods (Continued)

To know isolation methods and practices (n = 220)	n	%
From the start of antibiotic therapy to the second day	9	4.1
SARS infection		
At the end of 10 days following fever reduction and symptom relief	85	38.6
Chickenpox infection		
At the end of the fifth day from the onset of the lesions	64	29.1

*More than one answer were given to the question. Percentages are calculated over n numbers.

**Infection with resistant bacteria (MRSA, VRE), Enteric Infections (Escherichia coli O157:H7, Hepatitis A, Rotavirus), Infections of Infants or Children (Syncytial Virus, Rotavirus, Pediculosis, Scabies), Viral Hemorrhagic Conjunctivitis/Viral Hemorrhagic Fever (Ebola, Lassa), Crimea-Congo.

***Meningitis, Mumps, Parvovirus B19, Rubella Meningococcal Pneumonia, H. Influenzae Type B Diphtheria, Pertussis.

****Pulmonary or Laryngeal Tuberculosis, Measles, Chickenpox, Common Shingles, SARS, Ebola, Lassa.

However, the rate of knowledge as which isolation method to use in which infection is low. It was determined that the rate of knowing the diseases that should be applied droplet and respiratory isolation methods is lower than contact isolation (Table 2). It is found as significant that more than half of the nurses did not know isolation methods that should be applied in diseases Meningitis, Mumps, Parvovirus B19, Rubella Meningococcal Pneumonia, H. Influenzae type B Diphtheria, Pertussis, requiring droplet isolation and Pulmonary or Laryngeal Tuberculosis, Measles, Chickenpox, Common Shingles Infection, SARS, Ebola, Lassa, requiring respiratory isolation ($P < .05$). In a study, it is determined that 71.9% of nurses knew about contact isolation measures for Methicillin-Resistant Staphylococcus Aureus (MRSA), but only 28% applied isolation methods.¹⁶ The fact that the rate of knowing contact isolation is higher in this study may be related to frequent encounters with infections that require contact isolation and to include more in-hospital training.

It is recommended to have special ventilation systems in patient rooms, if possible, for droplet and respiratory isolation. While it is stated that the doors of the patient room where respiratory isolation is applied should be closed, it is reported that the door of the patient room may remain open for droplet isolation.¹⁷ It is possible for nurses to frequently encounter patient groups that need to take isolation precautions in the hospital environment. However, in this study, nurses' awareness of the presence of a special ventilation system, which is one of the droplet isolation measures, and that the room door may be open in droplet isolation was found to be low (Table 2). It was thought that this situation might be related to the fact that there is generally no ventilation system in the rooms where isolation is applied in the hospital.

For contact and droplet isolation, it is stated that the patient should be in a single room if possible, and if a single room cannot be provided, patients with the same disease can use the same room.¹⁷ It is determined that the knowledge level of the nurses about the room layout of the patients in diseases transmitted by contact and droplet in both isolation practices was high, although it was not sufficient (Table 2). It was noteworthy that the rate of knowing the use of patient rooms with contact isolation was higher.

Table 3. Nurses Knowing Isolation Symbols and Their Meanings and Symbol Suggestions for Isolation

Variables	n	%
Known isolation symbols (n = 220)*		
Contact isolation (Red star)	202	91.8
Droplet isolation (Blue flower)	140	63.6
Respiratory isolation (Yellow leaf)	192	87.3
To know meanings of isolation symbols (n = 220)		
Contact isolation **	1	0.5
Droplet isolation ***	2	0.9
Respiratory isolation ****	1	0.5
Suggestions relation to isolation symbols		
Contact isolation (n = 220)		
No idea	164	74.5
Hand/Red hand/Gloves	56	25.5
Respiratory Isolation (n = 215)		
No idea	171	77.8
Lungs	20	9.1
Mask	11	5.0
Nose	10	4.5
Cloud	3	1.4
Droplet Isolation (n = 219)		
No idea	170	77.2
Water drop	45	20.4
Mouth/Nose/Eyes/Tears	4	2.4

*More than one answer was given to the question. Percentages are calculated over n numbers.

**The five corners of the star represent the five fingers of the hand. The red color is used based on the connection between the disadvantages of contact with fire and the disadvantages of contact with the patient.

***The dot in the middle represents the droplets around the patient.

****Trees are nature's lungs, leaves are trees' lungs. A yellow leaf is used, which starts with the initial letter "y" for respiration.

The use of surgical and N95 masks is among the respiratory isolation measures.¹⁷ It is observed that the level of knowledge of the nurses about the use of masks was high, although it was not as much as desired (Table 2). Increasing the awareness of nurses about protecting themselves and the other hospital population can also increase the rate of mask use. The use of gloves and gowns are among the commonly used practices to prevent hospital infection transmission.^{18,19} The level of knowledge of nurses on the use of gowns and gloves in contact isolation is high, although not as desired (Table 2).

According to the type of infection, the rate of knowing when the isolation disappears was found to be higher for Vancomycin-Resistant Enterococcus (VRE) infection than for other infections (Table 2). However, in other infections (such as Rotavirus, Parainfluenza, Pneumonia, Mumps, SARS, and Chickenpox), the rate of knowing the disappearance of isolation is low. This may be related to the fact that hospitals especially focus on VRE infection, create protocols

Table 4. Comparison of SCIP Median Scores according to Nurses' Descriptive Characteristics

Variables	Scale of Compliance with Isolation Precautions (SCIP) Score		Test	
	Median	Min-Max	Z/X ²	P
Gender				
Woman	111.16	22-90	-0.318	.713
Man	106.74	22-90		
Age				
19-24 ^a	83.63	22-90	8.086	.044* a < b,c,d
25-30 ^b	102.00	22-90		
31-35 ^c	106.08	22-90		
36-51 ^d	122.28	22-90		
Educational status				
High School	101.20	22-90	1.211	.750
Two-years degree	107.38	22-90		
University	111.98	22-90		
Master	125.06	22-90		
Working year				
0-10	107.93	22-90	2.998	.223
11-20	129.68	22-90		
21 and over	100.58	22-90		
Getting education about HI				
Yes	113.54	22-90	-2.325	.020*
No	85.15	22-90		
Education place				
University	77.50	22-90	-0.0323	.726
In-service education	70.81	22-90		
Unit				
Emergency and polyclinic ^a	69.50	22-90	9.204	.010* a < c
Intensive care unit ^b	108.66	22-90		
Clinic ^c	118.87	22-90		

Z = Mann Whitney U-test, X² = Kruskal Wallis Test.
^aP < .05.

for VRE, and have high awareness as a result of doing it in line with the protocols.

The nurses' awareness of isolation symbols is also higher for contact isolation than other isolation types. Although nurses know the symbols they will use in isolation, they almost do not know the meaning and contents of these isolation symbols (Table 3). It is thought-provoking that while nurses know the isolation symbols that they routinely use, their meanings are unknown. Again, nurses declared that they had no idea about the subject in general. However, if they had the opportunity to change the isolation symbols, it was found meaningful for them to

consider using symbols and colors that would evoke the name of the isolation method for all three isolation methods. It was noteworthy that they asked to use symbols such as hand/red hand/glove for contact isolation, lung for respiratory isolation, mask, nose, cloud and droplet isolation, such as water drop, mouth, nose, eye, and tear. Although the isolation precautions symbols are standardized for Turkey,¹¹ it is thought that nurses' imagery and color choices are quite compatible in terms of connotation.

In different studies, SCIP mean scores range are between 66.75 and 83.10.^{13,20-22} In this study, the average scale scores of the nurses are similar to the literature. Özlem and Tiryaki²² (2017) suggested that although the scale scores of women were higher, there was no statistical significance between gender and scale scores. Similarly, in this study, women's average scale scores were higher. Although there was no statistically significant difference between the genders (Table 4), it is thought that women's compliance with isolation measures was higher.

SCIP score was higher in 36-51 years and there was a significant difference between age and scale score. SCIP scores were lower in 19-24 years than the other groups. The significant difference is the 19-24 age group (Table 4). Similarly, in similar studies, it is stated that increasing age increases the scale score and creates a significant difference with age.^{13,21} This difference may have been due to the increase in professional experience with age.

Zencir et al.¹³ (2013) determined that education level increased the scale scores and created a statistically significant difference, while Özlem and Tiryaki²² (2017) determined that there was no statistical difference between the scale scores of the education level. In this study, similar to Zencir et al. study, education level increases the scale scores, but does not create a statistically significant difference (Table 4). Although Özden and Özveren²¹ stated that the working year increased the scale score, it is determined in this study that the working year did not affect the scale score and the mean score of the nurses with professional experience between 11 and 20 years was higher (Table 4). While the increase in the level of education increased the compliance with the isolation measures, it is seen that the working year did not directly affect the compliance with the isolation measures.

Conclusion

In the studies, it is found that receiving education did not significantly affect the scale scores and did not create a significant difference.^{13,20} In this study, getting education about isolation increases the scale score and creates a statistically significant difference (Table 4). Getting education on the subject has increased knowledge and compliance.

Contrary to the literature,^{13,20} there is an important and significant difference between the scale scores of nurses working in emergency and polyclinics, and nurses working in inpatient units and intensive care units. SCIP scores of nurses working in emergency and intensive care units are considerably lower than nurses working in other units. The significant difference was due to the emergency and outpatient clinic groups (P < .05). (Table 4). It is observed that professionals in inpatient units and intensive care units have better compliance with infection prevention. It significantly affects the clinical scale score studied. It was thought that this result may have been caused by the frequent encountering and application of infections such as VRE, which require contact isolation, especially in neonatal and pediatric intensive care units.

Pediatric nurses generally have a high rate of training on hospital isolation methods. The most well-known isolation method is contact

isolation. While the rate of knowing the isolation methods is high, the rate of knowing the isolation method that should be applied according to the types of infection and the isolation period is low. The rate of knowing which isolation is belong to which isolation symbols is high. However, the meanings of the symbols are almost unknown. The nurses stated that symbols other than the standard symbols can be used for isolation methods, which can be more memorable and facilitate the association. Age, being educated about the isolation method and the unit worked significantly affect the SCIP score. It is suggested to repeat the trainings on the importance of isolation at certain intervals, to make arrangements for the isolation symbols or to focus more on the meanings of the symbols in the trainings, and to conduct research with a larger study group.

Ethics Committee Approval: This study was approved by Ethics committee of Ankara Yıldırım Beyazıt University, (Approval No: 26.05.2015/69)

Informed Consent: Legal permission from the Ankara 2nd Region Public Hospitals Union General Secretariat [20.09.2015/85,346,189/605.01], who participated in the study and verbal consent was obtained from the nurses.

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