

## Effect of Infection Control Guidelines on Pediatric Nurses' Knowledge and Practice at Operating Room

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**Abstract:** Infections are a leading cause of death. Infection prevention is a crucial component to provide quality care in any health care setting. Many infection control measures such as appropriate hand hygiene and the correct application of basic precautions during invasive procedures are simple and low cost, but require staff accountability and behavioral changes, in addition to improving staff education, reporting and surveillance system. To utilize these precautions, human element plays an important role in increasing or decreasing the chances of catching infection. The study aimed to evaluate the effect of infection control guidelines on nurses' knowledge and practice at operating room. One group pre-posttest quasi-experimental research design utilized to achieve the aim of the current study. The current study was conducted in the operating room in Cairo University Specialized Pediatric Hospital (CUSPH). Convenient sample of 30 nurses who was caring children in the operating room in CUSPH participated. Data collection tool was developed by the researchers, it included structured interview questionnaire to assess personal and professional data of the nurses, nurses' knowledge assessment questionnaire to assess nurses' knowledge about infection control measures and nurses' practice checklist sheet to assess nurses' practice when infection control measures guidelines were applied. The study results revealed that there were statistically significant differences between total mean score of nurses' knowledge before and after receiving the infection control guidelines as well as, nurses who received the environmental health and safety measures guidelines had higher mean score of practice. The results of the current study concluded that nurses who received the infection control guidelines had higher mean score of knowledge and higher mean score of practice than before. Raising the awareness of nurses about infection control measures guidelines through educational training sessions.

**Key words:** Pediatric Nurses • Infection Control Guidelines • Operating Room

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### INTRODUCTION

Healthcare-associated infection is a major problem among children in the operating room as it could result in significant morbidity, prolonged hospitalization and increase in medical care costs. The role of nurses is extremely important in preventing hazards and sequela of healthcare-associated infections. Infections are nosocomially acquired that are typically not present or incubating at the time of hospital admission, which are

monitored closely by agencies such as Center for Disease Control and Prevention (CDC) in efforts to prevent their occurrence and improve patient safety [1].

As documented by Mengesha *et al.* [2] children readily transmit and acquire nosocomial infections. Children are also vulnerable to endogenous infections as a result of the breakdown of their normal defenses by disease, invasive procedures or therapy. The increasing acuity of illness in hospitalized children and therapeutic advances have resulted in a patient population that is

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increasingly at higher risk for nosocomial infections. Antibiotic resistance has emerged as a problem in some pediatric hospitals, usually in intensive care and oncology units. Infection rates are the highest in neonatal and pediatric intensive care units (where bloodstream infections are the most frequent) and are usually associated with intravascular devices.

Transmission of infectious agents within a health care setting requires three agents; a reservoir, susceptible host and a mode of transmission. Patients' health care workers and visitors are susceptible host in the hospital environment. The mode of transmission may vary by type of organism as some types of organism may be transmitted by more than one route. The complex interrelationship between a potential host and an infectious agent produces infection. Compliance on the part of healthcare workers with standard precautions has been recognized as an efficient and effective means to prevent and control health care-associated infections in patients and health workers [3].

According to WHO [4], infection control measure in operating room is a core component of infection control programs since they were established and they remain a constant feature in the modern healthcare context. Healthcare workers should be equipped with the requisite knowledge, skill and attitude for good infection control practices. Education through various means imparts knowledge about the correct practices and also helps to update the existing knowledge according to the changing scenarios. It is also clear that few of the educational interventions have a measurable prolonged effect.

In Egypt, Eskander *et al.* [5] emphasized that, infection control standards become an integral part of the accreditation program for all medical settings in Egypt. Infection control standard precautions include certain measures such as hand hygiene, sharp safety, staff health, use of personal protective equipment (PPE), equipment safety, waste management and environmental cleaning and many infection control measures.

All the healthcare personnel are equally responsible to prevent HAIs, but nurses are the most important front-line staff. They play an essential role in controlling infection that begins with early detection and surveillance technique. Hereafter, nursing staff should be adequately educated in the basic principles of infection control and should undergo continuous trainings to acquire up-to-date knowledge and skills. As a part of ongoing infection control training of health care workers and periodic workshops are organized for them [6].

A burgeoning literature by Kourosch *et al.* [7] demonstrated that, control of infections at operating room in pediatric health care settings is an ongoing challenge. Hospitalized children today have an increasing severity of illness and an increasing degree of immunocompromisation. As certain infection risks have been reduced by immunizations, improved treatment and technological advances, new risks have emerged. Transmission of infection between patients is theoretically achievable with current procedures, but implementation may be hampered by inadequate facilities, insufficient personnel, a lack of an appreciation of the impact of nosocomial infections and issues of feasibility. Balancing the benefits and costs of prevention, preventing infections associated with invasive procedures and devices and protecting immunocompromised patients are major challenges [8].

The prevention of transmission of infection between children and to personnel requires that certain measures be taken with all children and that additional precautions be taken with some infections, based on the route of transmission. The prevention of transmission from personnel involves ensuring that personnel are appropriately immunized and counselled about working with infections. The prevention of nosocomial infection also involves control of visitors, appropriate management of invasive procedures and devices, sterilization and disinfection of equipment, provision of a clean environment and adequate staffing. Severely immunocompromised children require extra protection, including ventilation systems that reduce the risk of exposure to filamentous fungi. Infection control in pediatrics is an evolving field that must adapt to changes in the pediatric patient population and in health care technology [7].

Nurses are considered the heart and hands of the health team and they comprise the first line care providers to the patients, who apart from giving drugs or rendering routine care to patients. Nurses should be able to do the caring of patients after learning the principles of standard precaution, effective training is essential to ensure that these concepts about standard precautions are understood and put into practice wherever health care is provided. Nurse is expected to perform all functions necessary for the total care of the child. Other reported factors that contribute to non-compliance with the standard precautions include lack of understanding and knowledge among health care workers on how to properly use protective barriers, lack of time, lack of resources and lack of proper training [9].

As documented by Royal College of Nursing [10] the nurse should be knowledgeable about the types of infection seen most often, factors that predispose a patient to a nosocomial infection, how to recognize persons at risk of infection and the prevention and control measures necessary to decrease the incidence of infections. Despite the fact that such educational programs could enhance nurses' compliance with hand hygiene practices, compliance with infection prevention practices and knowledge of infection prevention, there is a lack of research studies focusing on educating nurses on infection prevention precautions. As a developing country, there was a limited resource, carrying implications for the control of nosocomial infections making infection prevention programs of the utmost importance. This is intended to serve as a platform for highlighting the importance of infection prevention [11].

**Significance of the Study:** In developing countries, the risk is two to twenty times higher and the proportion of infected patients frequently exceeds 25%. A growing awareness of this problem prompted the WHO to promote the creation of the World Alliance for Patient Safety [12].

According to the WHO estimates, out of every 100 hospitalized children at any given time, seven in the developed and 10 in the developing countries, acquire at least one healthcare-associated infection. The multipronged approach aiming to reduce hospital acquired includes implementing standard precautions, particularly hand hygiene at each level of patient care, ensuring that core components for infection control are in place, improving surveillance of hospital acquired pathogens in hospitals and finally improving staff education and accountability [4].

Empirical evidence by Raffle *et al.* [13] demonstrated that in an individual healthcare facility, staff practice, which is driven by their knowledge and attitudes, plays a decisive role in the success of infection control programs. The core problem is not the lack of effective precautions and evidence-informed guidelines, but that healthcare workers apply these measures inadequately and inconsistently.

Through empirical observations, literature review and clinical experience in the pediatric care units, it is noticed that children are exposed to varying degree of infections. Nurse should be strictly complying and adhere to the hospital's preventive measures against nosocomial infections and other infectious diseases. There is a great need to assess and evaluate their knowledge and practice regarding infection control on a periodic or timely basis.

Hence, the aim of the current study was to evaluate the infection control guidelines on nurses' knowledge and practice. Eventually, the results of the current study might generate an attention and motivation for further researches in the field of infection control in the operating room. As well as providing guidance and recommendations that should be reflected in pediatric nursing education and practice.

**Aim of the Study:** The aim of the current study was to evaluate the effect of infection control guidelines on pediatric nurses' knowledge and practice at operating room.

#### **Research Hypotheses:**

*H1:* Nurses who receive the infection control guidelines will have higher mean score of knowledge than before.

*H2:* Nurses who receive the infection control guidelines will have higher mean score of practice than before.

## **MATERIALS AND METHODS**

**Research Design:** One group pre-posttest quasi-experimental research design was utilized to achieve the aim of the current study. A quasi experimental design is one type of experimental design that is very similar to the true experimental design except there is lose one criterion as randomization.

**Setting:** The study was conducted in the operating room in Cairo University Specialized Pediatric Hospital (CUSPH).

**Subjects:** A Convenient sample of 30 nurses who were cared children in operating room in CUSPH was participated in the study. All nurse categories regardless their age, years of experience were included except the nurse supervisors.

**Data Collection Tools:** The required tools were developed by researchers after reviewing the related literature through the following tools:

- Structured interview questionnaire: It had five questions and included one part to assess personal data for the nurse as: age, level of education, occupation, experience in years and place of residence.

- Nurses' Knowledge Assessment Questionnaire: It had seven questions and included one part to assess nurses' knowledge about infection control measures regarding to definition, functions, types, complications, component, support and resources.
- Nurses' Practice Checklist Sheet: It had eleven items and included one part to assess nurses' practice when infection control measures applied.

**Scoring System:** Scoring systems for nurses' knowledge assessment questionnaire and nurses' practice checklist sheet were 100 scores. Fifty scores were for each nurse's knowledge about infection control measures and nurse's practice checklist when infection control measures applied. Each complete answer took two scores, incomplete one took one score and the wrong answer or no response took zero. The total score will be converted to 100% (100 score) and then categorized as following: the total score less than 60% (less than 60 score) was considered as unsatisfactory while score of 60% and more (60 score) was considered as satisfactory level.

**Data Collection Procedure:** An official permission from CUSPH was obtained. Nurses who met the inclusion criteria were invited to participate in the study. The purpose and the nature of study were explained to each nurse individually. An oral consent obtained from each nurse to get her acceptance as well as to gain her cooperation.

The interview was conducted for all nurses to fill structured interview questionnaire which was covered personal and professional data about nurse: age, level of education, occupation, experience in years and place of residence. At the same time, the researchers obtained nurses' knowledge about infection control measures regarding to definition, functions, types, complications, component, support and applications and filled the nurses' Knowledge Assessment questionnaire by nurses as pretest, before receiving knowledge about infection control measures regarding to definition, functions, types, complications, component, support and applications. This interview took place in the waiting area in the operating room as a first interview (20-30 mins). Then in the second time, the researchers observed the participated nurses in the operating room to fill the nurses' practice checklist sheet as a first time before receiving knowledge about infection control measures regarding to definition, functions, types, complications, component, support and applications. At the same time, the researchers gave one session about infection control

measures regarding to definition, functions, types, complications, component, support and applications for participated nurse (20-30mins).

At the third time, the researchers observed the participated nurses in operating room to fill the nurses' practice checklist sheet as a second time after receiving knowledge about infection control measures regarding to definition, functions, types, complications, component, support and applications. At the same time, the researchers filled the nurses' knowledge Assessment questionnaire as posttest from the participated nurse (30-45 mins).

Data collection started at December 2017 and finished December 2018. The researchers prepared Arabic teaching instructions in form of flayer and gave it to the nurses who participated in the study after finishing the data collection. It included simple information about infection control measures regarding to definition, functions, types, complications, component, support and applications.

**Validity and Reliability:** The tool was reviewed by 3 experts in pediatric nursing to test the content validity of tools. Reliability of the tools was performed to confirm its consistency tools. The reliability coefficients' alpha between questions was 0.72.

**Pilot Study:** Pilot study was conducted on 3 nurses who were cared children in operating room to ensure the clarity of content of tools and to assess the time needed to fill the tools. Minor modifications were done such as restate some words. Based on the results of the pilot study, nurses who participated in the pilot study was included in the total study sample.

**Ethical Considerations:** Oral consent was obtained from the nurses after complete description of the purpose and the nature of the study. Nurses were informed that participation in the study is voluntary. The researchers informed the nurses about their rights to withdraw from the study at any time without giving any reason and without any effect on their work. Confidentiality assured to each nurse.

**Statistical Analysis:** A compatible personal computer (PC) was used to store and analyze data. The Statistical Package for Social Studies (SPSS), version 21.0 was used. Data were coded and summarized using mean, standard deviation and crosstabs for quantitative variables and percent for qualitative variables. The collected data were

tabulated and summarized. Data was computerized and analyzed using appropriate descriptive and inferential statistical tests. Qualitative data were expressed as frequency and percentage. A comparison between qualitative variables was carried out by using parametric Chi square test. Comparison of means was performed using paired-sample t-test. Correlation among variables was done using Pearson correlation coefficient. Level of significance at  $p < 0.05$ , 0.001 were used as the cut of value for statistical significance.

## RESULTS

It was clear from Table (1) that less than two thirds (63.3%) of the studied nurses were from rural area, on other hand about (36.6) of them were from urban area.

Nurses' Knowledge regarding infection control were significantly improved after receiving infection control measures guidelines compared with before receiving infection control measures guidelines results ( $50.3 \pm 1.1$ ) versus  $58.3 \pm 2.9$ ) with  $X^2 0.29$  at  $P < 0.05$ .

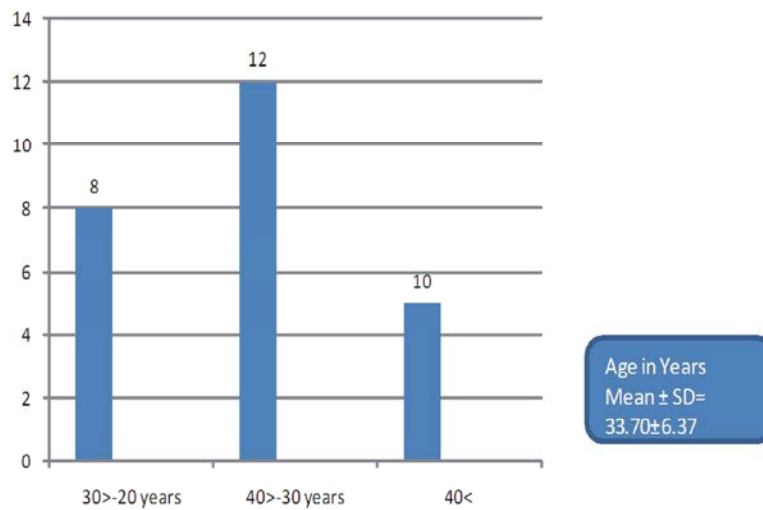


Fig. 1: Distribution of the nurses according to age (n=30)

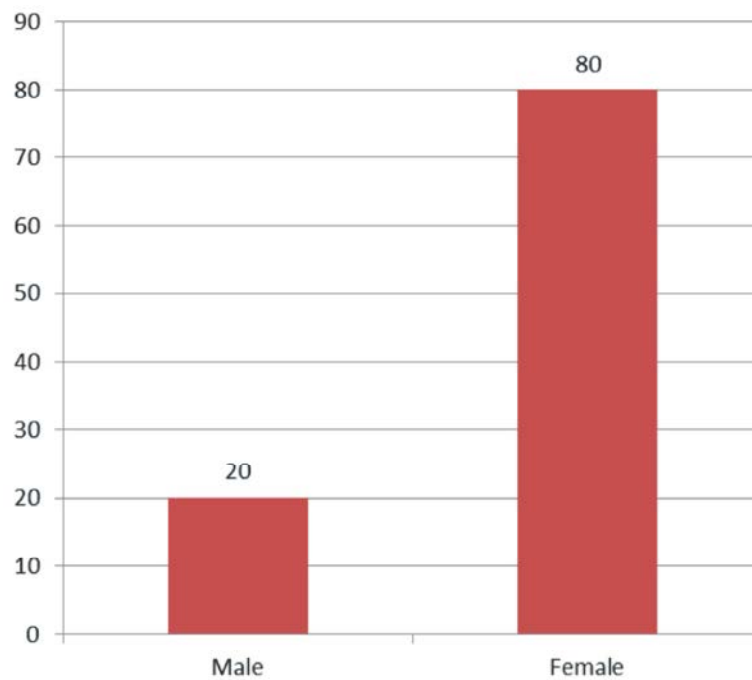


Fig. 2: Distribution of the nurses according to gender (n=30)

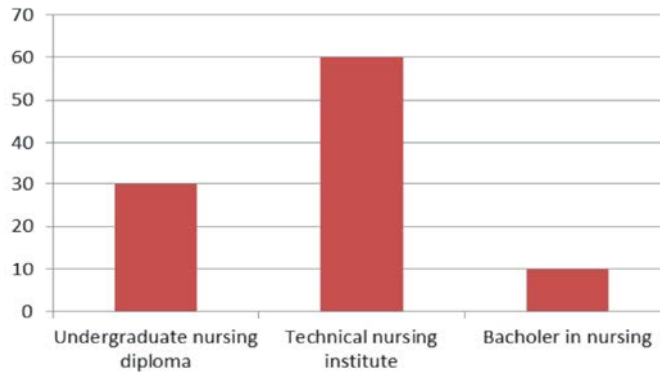


Fig. 3: Distribution of the nurses according to their educational qualification (n=30)

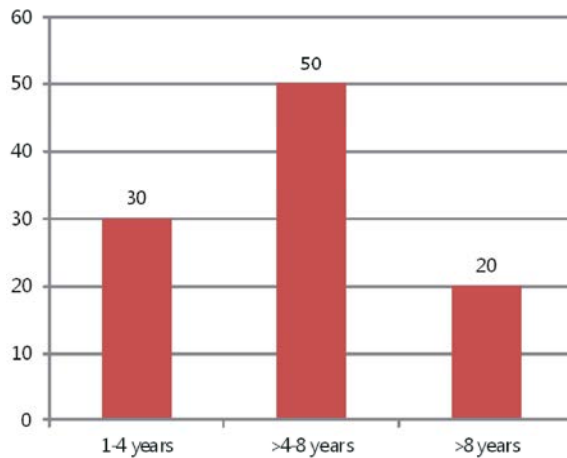


Fig. 4: Distribution of the nurses according to their years of experience (n=30)

Table 1: Distribution of the nurses according to their place of residence (n=30)

Place of residence:	Number	%
Rural	19	63.3
Urban	11	36.6

Table 2: Comparison between total mean score of nurses' knowledge before and after receiving infection control guidelines (n=30)

Items	Before infection control guidelines		After infection control guidelines		t-test	P value
	Mean ± SD		Mean ± SD			
Definition(20 marks)	11.4±2.1		14.3±3.2		0.73	0.01*
Functions (20 marks)	9.1±1.7		11.2±1.2		0.61	0.02*
types (10 marks)	6.3±2.5		7.3±3.6		0.55	0.062
Complications (20 marks)	11.3±1.4		14.2±1.2		0.88	0.02*
Component (10 marks)	6.3±1.1		7.3±3.2		0.9	0.07
Support (10 marks)	3.9±1.7		7.2±1.4		0.56	0.02*
Applications (10 marks)	5.3±2.1		7.3±3.2		0.93	0.01*

\* Statistically significant at  $P \leq 0.05$

Table 3: Comparison between nurses' level of knowledge before and after receiving infection control guidelines (n=30)

Level of knowledge	Before infection control guidelines		After infection control guidelines		X <sup>2</sup>	P value
	No	%	No	%		
Satisfactory	11	36.6	17	56.6	0.29	0.05*
	50.3±1.1		58.3±2.9			
Unsatisfactory	19	63.3	13	43.3	0.33	0.03*
	33.3±2.7		47.2±1.2			

\* Statistically significant at  $P \leq 0.05$

Table 4: Correlation between nurse's age and their total mean score of satisfactory knowledge

Items	Age (in years) Mean ± SD= 33.70±6.37	r	P
Mean ± SD Before infection control <i>guidelines</i>	50.3±1.1	0.170	0.905
Mean ± SD After infection control <i>guidelines</i>	58.3±2.9	0.036	0.801

Table 5: Comparison between nurses' practice before and after receiving infection control guidelines (n=30)

Score of Nurses' Practice	Before infection control guidelines		After infection control guidelines		X <sup>2</sup>	P value
	No	%	No	%		
Satisfactory	4 50.1±1.1	13.3	10 57.3±3.9	33.3	0.23	0.05*
Unsatisfactory	26 27.3±2.7	86.6	20 43.2±1.2	66.6	0.73	0.03*

\* Statistically significant at P ≤ 0.05

Table (4) reveals that there was positive correlation between nurses' level of knowledge and their age. There was statistically significant difference between nurses' total level of knowledge and their age at (r = 0.36; P < 0.801).

Nurses' practice regarding infection control measure was significantly improved after receiving infection control measures guidelines compared with before receiving infection control measures guidelines results (50.1±1.1) versus 57.3±3.9) with X<sup>2</sup> 0.23 at P < 0.05.

## DISCUSSION

Infection control is a key component of practice for all healthcare professionals including nursing, not only for their health but also to reduce infection transmission and thus improve the children safety, on other hand. Prevention of infection is one of the most important challenges in delivering optimum health care. In spite of advanced operative techniques, availability of higher antibiotics and modern sterilization techniques, higher rate of infection in government set up after major surgeries is quite worrisome, increases hospital stay [12].

Concerning nurses' personal and professional data, it was evident from the current study results that more than half of the studied nurses' age from 30 less than 40 years old. This finding is in concordance with that of Kourosh *et al.* [7] emphasizing the need to protect this group of workers in the prime of their life from hospital infections. The majority of study nurses was female and nearly to two thirds of them was graduated from technical nursing institute. The mean years of experience in caring for pediatric children in the operating room were 4-to less than 8 years. The highest percentage of them was from rural area.

Regarding to knowledge level about infection control measures as seen in Table (3), was significantly improved after receiving infection control guidelines compared with

before receiving it. This result indicating the effectiveness of the infection control guidelines and support the current study hypothesis number 1.

This result is in agreement with Abouelhamd [14] who found that higher level of knowledge was revealed in the post intervention phase as compared with the pre intervention phase. Also, higher total knowledge and practice scores were revealed in the post intervention phase as compared with the pre intervention. On the same line Stephanie [15] who studied the effectiveness of educational programs to improve the knowledge and compliance of healthcare workers towards standard precautions when measuring the knowledge levels of occupational exposures and universal precautions found the higher level of participants' knowledge after receiving the intervention.

Furthermore Al-Yousef [16] evaluated the effect of nursing guidelines regarding infection control measures on performance of internship students in applied medical science college and found that nursing students reported statistically significant post guidelines improvement in their knowledge about all infection control measures guidelines included hand hygiene and personal protective equipment. Also, he reported that the majority of the nursing students had significant improvement in total knowledge (general & specific) post guidelines from moderate level to good level. Adly *et al.* [17] found that there was a statistical significant difference before, immediately after the intervention and at follow up. Nurses had a satisfactory knowledge about the aim and the indications of standard precautions immediately after the intervention compared at follow-up respectively. The researchers explained that because of intervention refresh participants' knowledge that has a positive effect. The present study illustrated that significant positive correlation between knowledge regarding infection control guidelines and nurses age, at (r = 0.36; P < 0.801).

Richards and Russo [18] stated that to improve compliance, "one must make cultural changes which make it easier for health care workers to comply by improving hospitals and their materials and have health care workers to provide feedback on infection rates and areas that should be targeted. Adly *et al.* [17] Indicated that the nurses had a higher score of knowledge, practices and compliance with standard precautions of infection control immediately after the intervention while, this improvement reflected a highly statistically significant difference.

According to practice level about infection control measure as seen in Table (5), Nurses' practice regarding infection control measure were significantly improved after receiving infection control measures guidelines compared with before receiving infection control measures guidelines results ( $50.1 \pm 1.1$ ) versus  $57.3 \pm 3.9$ ) with  $X^2 0.23$  at  $P < 0.05$ . It may be the possible reason for lower findings in current study about level of knowledge which might be due to lack of in service refreshment trainings about infection control measure. So study results support the finding that application of nursing guidelines for infection control measures are effective for improving knowledge and practice of nurses in any health care settings. Therefore, hospital administrators should provide support and resources in the form of education and training opportunities designed to increase the health care personnel awareness and application of infection control procedures [11]. Nevertheless, the prevention of infection is a major concern of all health workers and health policy makers. Nursing is crucial to the success of any preventive program aimed at reducing the incidence of infections in our health care facilities. Nurses therefore, must possess adequate knowledge and demonstrate practices towards achieving the goal of prevention of infections [2].

### CONCLUSIONS

The results of the current study concluded that nurses who received the infection control guidelines had higher mean score of knowledge and higher mean score of practice than before. So, the infection control guidelines are crucial and essential for minimizing incidence of infection at operating room.

**Recommendations:** Based on the results of the current study, the following recommendations were suggested:

- Establishing infection control measures handouts to nurses is essential for care the child in operating room.
- Establishing a comprehensive infection control measures program for nurses starting from child's admission until discharge in operating room.
- Updating knowledge and practice of nurses through implementation of continuing educational programs about the importance of infection control measures at operating room.
- Further researches are mandatory to study factors contributing to nurses' knowledge and practice as regards utilization of infection control measures.
- Replication of this study is warranted, this would enhance opportunities to generalize the findings to other pediatric clinical settings.

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