

Nurses' Compliance of Safety Measures in Pediatric Surgical Intensive Care Unit

Dr. Nadia Medany Helaly

Assistant Professor of Pediatric Nursing, Faculty of Nursing, Alexandria University

Abstract: Patient safety is the cornerstone for better quality health care, prevention of errors and adverse effects to patients associated with health care. **Objective:** This study aimed to assess nurses' compliance safety measures in Pediatric Surgical Intensive Care Unit at University Children's Hospital in Alexandria. **Design:** A descriptive research design was used to accomplish this study. **Setting:** The study was conducted in the pediatric surgical intensive care unit of Alexandria University Children's Hospital at El –Shatby in Alexandria. **Subjects:** All nurses' working in Pediatric Surgical Intensive Care Unit who are responsible for providing direct care for children (approximately 35 nurses). **Tools:** One tool was used to collect the necessary data namely Nurses' Application of Safety Measures Observational Checklist. **Results:** More than two third of nurses had either good (56.2%) or satisfactory (39%) score and only 4.8% of them had unsatisfactory score in their application of safety measures in PSICU. **Conclusion:** The practices of majority of nurses were either good or satisfactory in their application of safety measures in PSICU.

Keywords: Safety Measures, Pediatric Surgical Intensive Care Unit; University Children's Hospital; Alexandria.

1. INTRODUCTION

The critical care setting is a highly complex environment (Tunlind, Granstrom & Engstrom, 2015). Critically ill patients are at a greater risk for poor prognosis and clinical outcomes when compared to other patients in the general ward context (Moreno, Jordan & Metnitz, 2009). Critical patients may be at risk for procedural injury or error due to their complex physiological problems, cognitive deficits, and complicated therapeutic regimens (Kendall-Gallagher & Blegen, 2009). Also, critically ill patients are more prone to adverse events than other hospitalized patients, whereas they had life threatening health problems with associated comorbidities which initiate the patient's stress response and interfere with the normal recovery process against the consequences of human errors (Killam et al., 2012). Thus, it is a challenge to maintain critically ill patients' safety while receiving high-quality care in the Pediatric Surgical Intensive Care Unit (PSICU) environment (Moffatt-Bruce, Hefner & Nguyen, 2015). In order to improve safety of critically ill patients in PSICU, the health care systems across differential managerial levels include; unit supervisors, administrators, and direct health care providers must highlight patient safety issues (Park, Lee & Choi, 2011).

Patient safety is the cornerstone for better quality health care and prevention of errors, adverse effects to patients associated with health care (Tregunno, Ginsburg, Clarke & Norton, 2014). Basically, patient safety means how hospitals and other health care organizations protect their patients from errors, injuries, accidents, and infections. It has become a major focus of attention by health care consumers, providers of care and administrators of health care institutions. Moreover, it is also the absence of preventable harm to a patient during the process of health care (Braun, Riehle & Donofrio, 2012).

Nowadays, Patient safety is a central concern of current health-care delivery systems and it is an important issue in health care quality (Arakawa, Kanoya & Sato, 2011). According to World Health Organization, patient safety has been created to facilitate the development of patient safety policy and practices and to act as a major force for patient safety improvement across the world. The discipline of patient safety is the coordinated efforts to prevent harm that caused by the process of health care itself from occurring to patients (World Health Organization WHO, 2012).

Children in medical emergency situations are at significant risk for medication errors. The observed rate of potentially dangerous prescribing errors in pediatric hospital was three times higher than the rate observed in adults. The American Institute of Medicine (2012) has estimated that 7000 child die every year in the USA as a result of medication errors (Institute of Medicine Committee on Quality of Health Care in, 2012). Furthermore, it was estimated that more than a million injuries and 44,000–98,000 deaths per year are related to suboptimal care or mistakes made by health care workers in USA (Kuitunen, Kuisma, & Hopppu, (2008)). Patients in the PSICU are exposed to 1.7 clinical errors daily. In addition, it was found that 11% to 39% of errors in PSICU are related to medical prescribing errors (Martinez-Anton, Sanchez & Casanueva, 2012). The incidence of Health care-associated infection (HCAIs) in PSICUs varies between 6.1 and 23.5% in developed and developing countries respectively.

Children in PSICU are the most critical children exposed to multiple hospital errors and malpractices which may occur by nurses or health care professional (Hodkinson et al., 2016). Initially, medication errors are one of the most common faults found in PSICU that hinder patient safety. In general, the number and severity of adverse medication reactions are directly related to the number of drugs administered to hospitalized patients. Medication errors may be due to failure in interpretation of the doctors' handwriting or verbal orders. These errors involve administering of the wrong medication to the wrong patient (Anthony, Wiencek, Bauer, Daly & Anthony, 2010). Additionally, the complex, high stress PSICU environment increase risk to patients. These environmental factors include nurses' workload, unpredictable workflow and quickly changing patient acuity, poor lighting, loud noise, frequent distractions and interruptions (Dabliz & Levine, 2012). Several researches demonstrated that distractions and interruptions during the medication administration process are a major contributing factor in medication errors (Beyea, 2019; Samra, McGrath & Rollins, 2011). So, developing and implementing ways to identify, support and improve the ability of the nurses with poor numeracy skills will help in improving their skills and thus reducing the medication errors which in turn lead to patient safety (Warburton, 2010).

HCAIs are one of the main issues that hinder patient safety that the patient gets it in the hospitals. It increases the days of hospitalization. In addition, Health care-related infections prolong patient's suffering, increase health care costs and have other direct and indirect economic implications, such as loss of productivity and disability. A major aspect to patient safety is the avoidance of healthcare-related infections (Deliverska, 2011).

There are several factors that hinder patient safety. Firstly, lack of communication leads to problems with management and making of mistakes between the team of health care. Communication with the other members of staff that are not professionals increases the potentiality of making errors. There is a strong relationship between providing patient safety in the PSICU and the working relationship of the PSICU care givers. Bad relationships lead to an increase in the errors and thus lead to bad outcome of the patients. Training of the teams using the resources available is a way to improve the relationships and thus enhancing patient safety (Despins, 2009). Secondly, overloading the nurses with work is another factor that leads to poor delivery of healthcare provided by the nurses. Hospitals must cut back workload and hours of nurses to maintain patient safety. In addition, nurses' emotional stability influences patient safety. Instability of their emotions is mostly caused by the work overload. Emotional instability can be minimize by adequate staffing thus lead to patient safety (Teng, Chang & Hsu, 2009).

All members in health care team especially nurses have a crucial role in ensuring patient safety. Nurses need to be aware of the potential hazards associated with the hospital environment to maintain safety measures with a high standard. Moreover, nurses should keep the patient free from injury or harm throughout their stay in the hospital. Also, nurses help in preventing and controlling infectious diseases that achieved through the practice of medical sepsis and standard precautions (Arakawa et al., 2011). To improve high quality of care which in turn maintain patient safety, all tasks performed by nurses should be monitored for clinical errors (Griffiths et al., 2014).

Aim of the Study:

The current study aimed to assess nurses' compliance of safety measures in pediatric surgical intensive care unit.

Research Question:

To what extent do nurses apply safety measures in Pediatric Surgical Intensive Care Unit?

2. MATERIALS AND METHOD

Materials

Research Design:

A descriptive research design was used to accomplish this study.

Setting:

The study was conducted at Pediatric Surgical Intensive Care Unit of Alexandria University Children's Hospital at El – Shatby.

Subjects:

All nurses working in Pediatric Surgical Intensive Care Unit who are responsible for providing direct care for children were included in the study and their number was 35 nurses.

Tool:

One tool was used to collect the necessary data:

Tool I: Nurses' compliance of Children's Safety Measures Observational Checklist:

This tool was developed by researcher after thorough review of related literature (Arakawa et al., 2011; Braun et al., 2012; Institute of Medicine Committee on Quality of Health Care in, 2000; World Health Organization (WHO), 2012) and guided by National Patient Safety Goals (2016) to assess nurses' implementation of safety measures in Pediatric Surgical Intensive Care Unit. It includes the following:

1-Universal Infection Control Measures:

It consists of hand washing technique, dressing, disinfection of equipment and temporary waste storage.

2-Medication Administration Safety Measures:

It includes safety measures during medication administration and blood transfusion procedure.

3- Suctioning Safety Measures:

It includes safety measures during oral, nasal and endotracheal suctioning.

4- Feeding Safety Measures:

It includes safety measures during formula feeding and nasogastric feeding.

Nurse's characteristics such as age, qualification and attending training programs about safety measure were attached to this tool.

Method

1- An official letter was sent from Faculty of Nursing to the director of the Alexandria University Children's Hospital to facilitate research implementation.

2- A written approval was obtained from hospital administrative personnel after explaining the aim of the study to collect the necessary data.

3- The tool was developed after thorough review of relevant literature.

4- The tool was tested for its content validity by five experts in Pediatric Nursing field. Based on their comments; necessary modification were done.

5- The reliability of the tool was done by measuring the internal consistency of its items using the Cronbach's alpha coefficient. The tool was reliable as $r = 0.899$.

6- A pilot study was conducted on 10% of nurses (4 nurses) to ascertain the feasibility, applicability and clarity of the tool. Accordingly, the necessary modifications were done. Those nurses were excluded from the final study sample.

7- Every nurse was observed three times during the morning and afternoon shifts for each procedure (two observations in the morning and one in the afternoon).

8- Data were collected over a period of six months starting from the beginning of September to the end of February 2017.

Ethical Considerations:

- Witness consent for participation was obtained from the head nurse after explanation of the aim of the study and confidentiality of data was guaranteed.

- Confidentiality of data was guaranteed.

Data Analysis

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY, IBM Corp) Qualitative data were described using number and percent. Quantitative data were described using mean and standard deviation. Significance of the obtained results was judged at the 5% level.

- Analysis and interpretation of data were conducted.
- Scoring system for nurses' performance was done as follow:
- Score one was given to each correct performance, and score zero was given for incomplete or not done.

The total score of nurses' performance was categorized as follow:

- Unsatisfactory (less than 60%).
- Satisfactory (60% to less than 75%).
- Good (75% and more).

3. RESULTS

Table (1) shows characteristics of nurses. It is clear from the table that 54.3% of the nurses were in the age from 25 to less than 30 years old. Moreover, 17.1% of them were in the age from 20 to less than 25 years old. Regarding level of education, the same table revealed that 54.3% of nurses had nursing diploma. While, 14.3% of nurses had technical diploma. It is also revealed from the same table that 28.6% of the nurses had 1 to less than 5 years of experience. In addition, 42.9% of them had 10 and more years of experience. Unfortunately, 100% of the nurses did not attend any training programs regarding safety measures in Pediatric Surgical Intensive Care Unit.

Table (1): Characteristics of Studied Nurses (n=35)

Nurses' characteristics	No.	%
Age (years)		
20 more	6	17.1
25 more	19	54.3
30 more	10	28.6
Mean ± SD.	27.87 ± 3.89	
Level of education		
Nursing diploma	19	54.3
Technical diploma in nursing	5	14.3
Bachelor of nursing	11	31.4
Years of experience		
<1 years	6	17.1
1 - <5	10	28.6
6 - <10	4	11.4
More 10 years	15	42.9
Mean ± SD.	7.31 ± 5.11	
Attendance of training program about safety measures		
No	35	100.0
Yes	0	0.0

Tables (2) portrays the total score of nurse's application of safety measures in pediatric surgical intensive care unit.

It was revealed from the table that about 39% of nurses had satisfactory total score of application of universal infection control measures. Meanwhile, 91.4% of nurses had good total score of application of overall medication. The table also revealed that 53.3% of nurses had unsatisfactory total score of performing suctioning safety measures. While, 56.2% of nurses had good total score of application of feeding.

Table (2): Total score of nurse's application of safety measures in pediatric surgical intensive care unit in each observation (n = 105)

	Total (n=105)					
	<60		60 - <75		≥75	
	Unsatisfactory		Satisfactory		Good	
	No.	%	No.	%	No.	%
1-Universal infection control measurers	15	14.3	41	39.0	49	46.7
2- Medication administration safety measures	0	0.0	3	2.9	102	97.1
Overall medication	0	0.0	9	8.6	96	91.4
3 - Performing suctioning safety measures	62	59.0	35	33.3	8	7.6
Overall Performing suctioning safety measures	56	53.3	49	46.7	0	0.0
A - Administration of formula feeding	13	12.4	17	16.2	75	71.4
B - Nasogastric or orogastric tube	16	15.2	35	33.3	54	51.4
Overall (n = 105)	5	4.8	41	39.0	59	56.2

Figure(3) illustrate total score of nurses' application of safety measures. It was found that more than half of nurses (56.2%) had good total score of application regarding safety measures and 39% of them had satisfactory application. Meanwhile, only 4.8% of nurses had unsatisfactory totalscore of application regarding safety measures in Pediatric Surgical Intensive Care Unit.

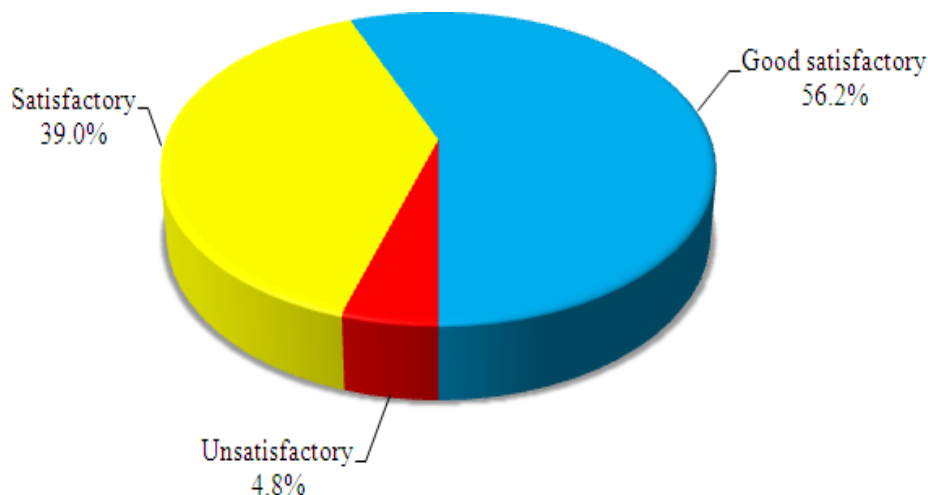


Figure (3): Total Score of Nurses' Application of Safety Measures.

Tables (3) represent relation between nurses' characteristics and total score of application. It is clear from the table that 80% of nurses who had unsatisfactory total score of application aged from 25 years and more. Meanwhile, 49.2% of them had good total score of application. The table also revealed that, 80% of nurses who had bachelor degree of nursing had unsatisfactory total score of application. Moreover, 60% of nurses who had from 1 to less than 5 years of experience had unsatisfactory total score of application. Meanwhile, 50.8% of nurses who had more than 10 years of experience had good total score of application.

Table 3: Relation between Nurses' characteristics and total score of application (n = 105)

Nurses' characteristics	Overall observation						χ^2	p
	<60 unsatisfactory (n = 5)		60 - <75 satisfactory (n = 41)		≥75 good (n = 59)			
	No.	%	No.	%	No.	%		
Age (years)								
20 more	1	20.0	8	19.5	9	15.3	4.241	MC p= 0.325
25 more	4	80.0	24	58.5	29	49.2		
30 more	0	0.0	9	22.0	21	35.6		
Level of education								
Nursing diploma	0	0.0	21	51.2	36	61.0	8.103	MC p= 0.065
Technical diploma in nursing	1	20.0	7	17.1	7	11.9		
Bachelor of nursing	4	80.0	13	31.7	16	27.1		
Years of experience								
<1 years	2	40.0	8	19.5	8	13.6	9.060	MC p= 0.121
1 - <5	3	60.0	11	26.8	16	27.1		
6 - <10	0	0.0	7	17.1	5	8.5		
More 10 years	0	0.0	15	36.6	30	50.8		
Attendance of training program about safety measures								
No	5	100.0	41	100.0	59	100.0	-	-
Yes	0	0.0	0	0.0	0	0.0		

4. DISCUSSION

Patient safety means reduce unnecessary risks to the minimum possible level while providing health care. It is also one of the main objectives for all health care systems and it is a key step in ensuring a good quality of care. There are many health care processes to be analyzed in order to improve patient safety (World Health Organization 2009). It is designed to avoid, prevent and minimize outcomes of adverse events resulting from health care practice. These include harm that occurring from care provided by health care providers. These events may prolong hospitalization or change the treatment initially proposed for the patient (Schatkoski, Wegner, Algeri & Pedro, 2009).The health care provider should give pediatric patients and their relatives opportunities to be involved in patient safety. All health care staff is obligated to report events and risks of Patient harm. Moreover, an annual patient safety report must also be written by the health care organizations. (Batalden, 2010).

Incorporating safeguards in the form of standards of nursing practice into daily practice is another avenue to protect patient. Nurses have the responsibility to report any errors, a crucial element in reducing the like hood of future errors. Nurses also are accountable for the development of nursing policies and ongoing quality improvement project to enhance patient safety and decrease errors (Hockenberry & Wilson, 2011).

Infection control is a necessary component of any health care system. It is useful in providing positive health outcomes for patients and healthcare workers. Controlling the spread of infection through the use of effective procedures and practices saves children lives (Amaran & Onwube, 2013).

Hand washing is the single most important intervention to prevent transmission of infection and should be a quality standard in all health institutions (Sultana, Mahumud, Sarker & Hossain, 2016). The findings of the present study showed that all of the studied nurses applied soap or detergent to the palms of hands. Moreover, about more than two thirds of them washed their hands using a firm circular motion and friction on back of hands, palms and wrists .This could be justified by nurses attending training programs about infection control and presence of posters about the process of hand washing in the unit. Moreover, availability of hand washing facilities in the unit. The findings of the current study are

congruent with (Sultana et al., 2016) who found that the majority of nurses washed their hands using soap and water. Moreover, Centers for Disease Control and Prevention (2016) recommended that hand washing with soap and water is always more efficient in removing and reducing the amount of microbes on the hands.

The results of the current study also revealed that all of the nurses rinsed wrists and hands completely and dried hands thoroughly with paper towels. These results could be attributed to nurses' accountability to infection control measures and the availability of supplies in the unit. The current study findings are incongruent with (Chitte, 2014) who mentioned that the minority of health care worker reported that there were lacks of towel to wipe their hands.

The current study findings revealed that about two thirds of nurses cleaned their hands between every procedure for the same child .The present study finding is congruent with an Egyptian study done by (Werdany, 2017) who found that the majority of nurses washed their hands between every procedure for the same child. Furthermore, the previous finding of the current study is supported with (Kandeel, 2012) who did a study about current nursing practice for prevention of ventilator associated pneumonia in intensive care unit.

Keeping the wound clean and sterile is one of the main responsibilities of nurses to ensure patient safety (Pickering & Marsden, 2015). The findings of the present study showed that about three quarters of nurses performed dressing from clean area and move out to unclean area with normal saline . This could be justified by presence of infection control team and nurses' awareness about principles of aseptic technique. The present finding is congruent with (Thatcher & Hemavathy, 2015)who reported that nurses cleaned the wound with normal saline and cleaned the dressing trolley with disinfectant solution.

Worcestershire Health and Care Trust organization recognized the importance of wound assessment (Stephen-Haynes & Callaghan, 2015). The finding of the present study revealed that half of the nurses performed complete wound assessment .This could be attributed to the fact that accurate wound assessment achieves appropriate goals to be set for the management of the wound in order to reduce morbidity and costs (Posnett, Gottrup, Lundgren & Saal, 2009). Moreover, the finding of the present study revealed that almost two thirds of the nurses documented the wound assessment. This could be justified by nurses' accountability about the importance of documentation of wound assessment. This result is incongruent with (Kinnunen, Saranto, Ensio, Iivanainen & Dykes, 2012) who reported that wound care documentation is frequently inadequate and inaccurate.

Safe and effective decontamination of all re-useable equipment between usages is an essential part of routine infection prevention and control practice. Achieving effective disinfection and sterilization is essential for ensuring that medical and surgical equipment do not transmit infectious pathogens to patients or staff (Wilson, 2019). The finding of the present study indicated that all nurses did not wear thick and house hold gloves . This could be justified by lack of knowledge about the importance of these gloves and also shortage of such supplies. The present study finding is supported by (Adnan, 2008) who found that all nurses never wear gloves before cleaning and disinfection of equipment after wound care.

The wastes which generated from medical activities represent a real problem of living nature and human world. Improper management of wastes generated in health care facilities causes a direct health impact. So, nurses should handle wastes in a manner which prevent infection and maintain patient safety (Mandal & Dutta, 2009). The finding of the present study reflected that all of nurses discarded infected wastes and body fluids in red isolation plastic bags, needles and sharps in safety box . This finding may be due to the availability of the safety boxes and red bags and nurses get used to discard the sharp instrument and infected wastes into these boxes in the PSICU. The present study finding is congruent with (Kamal, 2015) who found that the majority of nurses discard sharp instrument in safety boxes. On the contrary, (Adnan, 2008) who reported that collection of wastes and final disposal were not done in a sanitary correct ways.

Medicationadministration is one of the greatest responsibilities of nurses. Nurses' cognitive processes during medication administration are complex and require a high degree of critical thinking and vigilance to prevent patient harm (Edmonton, 2011). The finding of the present study reflected that the majority of the nurses washed their hands before administering the drugs. Moreover, all nurses checked the expired date of medication before administration . This findings could be justified by nurses' atomization regarding hand washing and nurses' awareness about the importance of checking expire date of medication. The previous findings are confirmed by (WHO, 2009) which emphasized on cleaning hand washing before touching a pediatric

patient. These findings are incongruent with (Ghamari Zare & Adib-Hajbaghery, 2016) who concluded that hand washing before the procedure and checking the expiry date of the drugs were the lowest intervention done by the nurse.

The finding of the present study reflected that the majority of nurses recorded name of medication, time, dose and child reactions in the medication chart. These could be justified by nurses' knowledge about the accountability of medication documentation that may lead to potential problems later. This finding is congruent with (McLeod, Barber & Franklin, 2013) who found that doses were correctly documented to indicate whether or not the dose had been administered or omitted. On the contrary, a study done by (Catherine, 2016) about medication, environmental, and patient factors that influence medication administration delivery times who found that the majority of medications were not accurately documented on the medication record.

The finding of the present study indicated that the majority of nurses checked rate and the amount of intravenous infusion. This could be justified by nurses' compliance with the doctor order. The present study finding is similar to (Vijayan, 2011) who found that the majority of nurses' observations revealed that nurses checked the amount, type of fluid against doctor's prescription. On the other hand, this finding is incongruent with (Han, Coombes & Green, 2005) who found that the most common errors of medication given intravenously were wrong rate.

Blood transfusion is a highly effective and potentially life-saving treatment for many patients. Red blood cell transfusions are the backbone of blood transfusion therapy as they account for the majority of components issued to patients (Taylor, et al., 2010). The finding of the present study revealed that all nurses checked the blood transfusion order with the written physician order (table 10). This could be explained by nurses' awareness about blood transfusion safety measures. This finding is incongruent with (Belal, 2012) who found that the majority of the nurses would act on incomplete medical order.

The World Health Organization (2013) recommended that blood bag should be labeled with ABO blood group, Rh blood type, date of collection and expire date. The result of current study revealed that all of nurses checked the special label of blood bag as blood group, expire date, amount. This could be justified by nurses' awareness about the major complication that can be resulted from improper checking of blood component. On the other hand, this finding is incongruent with (Mastoor, 2018) who found that less than half of nurses checked the special label of blood bag.

Airway suctioning plays a key role to keep the airway patent and help the patient to receive humidified air and oxygen. Correct suctioning technique help to reduce the risk of tracheal trauma and infections (Hooper, 2011). The finding of the present study revealed that the majority of nurses washed their hands before suctioning. This could be related to nurses' knowledge regarding aseptic practices of suctioning that prevent cross infection. This result is congruent with (Mwakanyanga, Masika & Tarimo, 2018) who found that nurses disinfect their hands before suctioning procedure. This finding is incongruent with (Haghighat & Yazdannik, 2015) who did a study about the practice of intensive care nurses using the closed suctioning system and found that small percentage of nurses washed their hands prior to suctioning.

The finding of the present study revealed that about three quarters of nurses inserted the catheter of suction 3 paths during every suction intervention. This could be justified by nurses' awareness with guidelines of suctioning. This result is congruent with Saudi study of (Tasnim 2017) who did a study about the gap between knowledge and practices of endotracheal suctioning in intensive care unit and found that nurses performed suction 3 times consecutively.

Documentation of suctioning is a vital aspect of nursing practice to maintain continuity of care and reflect current standard of nursing practice (Elkin, Perry & Potter, 2008). The current study finding revealed that about three quarters of nurses documented the child response to the suctioning type, amount and color of suctioned material. This finding could be attributed to nurses' accountability regarding documentation. The previous finding is congruent with (Wedani et al., 2017) who found that the majority of the nurses recorded endotracheal tube suctioning. The finding of the current study is somewhat congruent with (Gonçalves et al., 2012) who reported that only one third of the nurses in their study documented endotracheal suctioning procedure.

Bottle feeding is an alternative method for ensuring adequate nutritional intake. It is a means of providing nutrition to an infant in a safe and appropriate manner (Trigg & Mohammed, 2010). The World Health Organization (2007) recommended hand washing with soap and water before preparing formula feeding. The finding of the present study revealed that all nurses washed their hands before administration of formula feeding. This compliance with hand washing may be related to nurses' awareness about the importance of hand washing before bottle feeding and supervision of

infection control team. This is incongruent with (Labiner-Wolfe, Fein & Shealy, 2008) who found that half of the nurses did not always wash their hands with soap before preparing infant formula.

Nasogastric feeding is the most frequently used method of enteral nutrition in PSICU. Nasogastric tubes could be placed to administer enteral nutrition, medications and fluids to children who are unable to ingest enough proper nutrition by mouth to grow and develop normally (Ahamed, 2014). The finding of the present study illustrated that all of the nurses washed their hands before administration of nasogastric feeding. This could be justified by nurses' awareness of the benefit of hand washing as well as hazards resulting from contaminated hands. This result is congruent with an Egyptian study of (Gamal, 2018) who found that all nurses washed their hands using soap and water before nasogastric feeding. This result is incongruent with (Esmaeili, 2016) who found that small percentage of nurses washed their hands before nasogastric feeding.

The finding of the present study revealed that all of nurses lubricated the tube with child's saliva. This could be due to the importance of tube lubrication for ensuring smooth non traumatic introduction of nasogastric tube. This finding is congruent with (Stroud, 2003) who found that most nurses lubricate nasogastric tube with child saliva before insertion. In contrast (Ahmed, 2013) found that majority of nurses were not competent in nasogastric lubrication.

The finding of the current study revealed that more than half of the nurses had a good total score of application regarding safety measures. This could be justified by nurses' awareness about the nature of working in PSICU that requires application of safety measures that prevent harm and reduce the risk of adverse events. This finding is congruent with (Anwar 2018) who found that critical care nurses' implementation of safety measures was generally good.

5. CONCLUSION AND RECOMMENDATION

Conclusion

Based on the finding of the current study, it is concluded that the practices of nurses were either good or satisfactory in their application of safety measures in PSICU.

Based on the findings of the present study, the following recommendations are suggested:

1. Continuous in-service training programs for pediatric nurses in PSICU to update and raise their standard of care in the application of safety measures
2. The hospital administrative authority should develop updated policies related safety measures in PSICU.
3. Booklets of recent nurses' application of safety measures should be available in PSICU.
4. **Further studies:**
 - Effect of nurses' application of safety measures on reducing adverse events in PSICU.
 - Nurses' attitude toward application of safety measures in PSICU.
 - Study factors that hinder nurses' application of safety measures in pediatric surgical intensive care unit.

REFERENCES

- [1] Adnan, Y. (2008). Nurses' Practice regarding Implementation of Safety measuring in the critical care unit. [Unpublished Master Thesis]. Faculty of Nursing: Aexandria University.
- [2] Ahamed, N. (2014). Assessment of Knowledge and Practice of Staff Nurses regard Ryle's tube feeding in a selected hospital of Kolkata, west Bengal. *SM Medical Journal*, 1(2), 294-302.
- [3] Ahmed, F. (2013). Quality of nursing care for high risk neonate receiving nasogastric tube feeding. Un published master thesis. Faculty of Nursing, Benha University: Egypt.
- [4] Amoran, O., & Onwube, O. (2013). Infection control and practice of standard precautions among healthcare workers in northern Nigeria. *Journal of global infectious diseases*, 5(4), 156-163. doi:10.4103/0974-777x.122010.

International Journal of Novel Research in Healthcare and Nursing

 Vol. 7, Issue 1, pp: (865-877), Month: January - April 2020, Available at: www.noveltyjournals.com

- [5] Anthony, K., Wienczek, C., Bauer, C., Daly, B., & Anthony, M.K. (2010). No interruptions please: impact of a No Interruption Zone on medication safety in intensive care units. *Critical care nurse*, 30(3), 21-29. doi:10.4037/ccn2010473.
- [6] Arakawa, C., Kanoya, Y., & Sato, C. (2011). Factors contributing to medical errors and incidents among hospital nurses --nurses' health, quality of life, and workplace predict medical errors and incidents. *Industrial health*, 49(3), 381-388. doi:10.2486/indhealth.ms968.
- [7] Batalden, P. (2010). The leader's work in the improvement of healthcare. *Quality & safety in health care*, 19(5), 367-368. doi:10.1136/qshc.2010.043745.
- [8] Belal, M., (2012). Measuring Knowledge of Blood Transfusion: A Survey of Jordanian Nurses. *American International Journal of Contemporary Research*, 2(10), 13-23.
- [9] Beyea, S.C. (2019). Distractions, interruptions, and patient safety. *AORN journal*, 86(1), 109-112. doi:10.1016/j.aorn.2007.06.015.
- [10] Braun, B., Riehle, A., & Donofrio, K. (2012). Improving Patient and Worker Safety: Opportunities for Synergy, Collaboration and Innovation. USA: The Joint Commission. Available from: <https://www.jointcommission.org/assets/1/18/TJC-ImprovingPatientAndWorkerSafety-Monograph.pdf>.
- [11] Catherine, F.M. (2016). Medication, environmental, and patient factors that influence medication administration delivery times. *Electronic Theses and Dissertations*.
- [12] Centers for Disease Control and Prevention (CDC 2016). When & How to Use Hand Sanitizer. Atlanta, GA: CDC. Available:<https://www.cdc.gov/handwashing/show-me-the-science-handsanitizer.html> Accessed: 31 March 2017. Last Modified: 22 February 2016.
- [13] Children's Hospitals' Solutions for Patient Safety Network (SPS Network). (2017). Agency for Healthcare Research and Quality, Rockville, MD. <https://www.ahrq.gov/workingforquality/priorities-in-action/sps-network.html>.
- [14] Chitte, J. (2014). Hand hygiene practice among health care workers. *Pediatrics and Child Health*, University of Nairobi.
- [15] Dabliz, R., & Levine, S. (2012). Medication safety in neonates. *American journal of perinatology*, 29(1), 49-56. doi:10.1055/s-0031-1285831.
- [16] Deliverska, M.Y. (2011). The dynamics of antimicrobial resistance of salmonella typhimurium isolates. *Journal of IMAB*, 17(1), 111-115. doi:10.5272/jimab.2011171.111.
- [17] Despina, L.A. (2009). Patient safety and collaboration of the intensive care unit team. *Critical care nurse*, 29(2), 85-91. doi:10.4037/ccn2009281.
- [18] Edmonton, A. (2011). Complementary and/or alternative therapy and natural health products: Standards for registered nurses. Canada: College and Association of Registered Nurses of Alberta (CARNA).
- [19] Elkin, M., Perry, A., & Potter, P. (2008). *Nursing intervention and clinical skills* (7th ed p. 287-294). Philadelphia: Philadelphia.
- [20] Esmacili, R. (2016). Nurses' Practice about Performance of Nasogastric Tube Feeding in Intensive Care Unit. *International Journal of Advanced Biotechnology and Research*, 7(5), 1585-1594.
- [21] Gamal, N. (2018). Nurses' Application of Evidence Based Guidelines on Feeding Preterm Neonates via Orogastic Tube. *Master of Nursing Science*.
- [22] Ghamari Zare, Z., & Adib-Hajbaghery, M. (2016). Performance of Clinical Nurse Educators in Teaching Pharmacology and Medication Management: Nursing Students' Perceptions. *Nursing and midwifery studies*, 5(1), e29913. doi:10.17795/nmsjournal29913.

- [23] Gonçalves, F.A.F., Brasil, V.V., Ribeiro, L.C.M., & Tipple, A.F.V. (2012). Nursing actions for the prevention of ventilator-associated pneumonia. *Acta Paulista de Enfermagem*, 25, 101-107. Retrieved from http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-21002012000800016&nrm=iso.
- [24] Griffiths, P., Dall'Ora, C., Simon, M., Ball, J., Lindqvist, R., Rafferty, A.M., Aiken, L.H. (2014). Nurses' shift length and overtime working in 12 European countries: the association with perceived quality of care and patient safety. *Medical care*, 52(11), 975-981. doi:10.1097/mlr.0000000000000233.
- [25] Haghghat, S., & Yazdannik, A. (2015). The practice of intensive care nurses using the closed suctioning system: An observational study. *Iranian journal of nursing and midwifery research*, 20(5), 619-625. doi:10.4103/1735-9066.164509.
- [26] Han, P.Y., Coombes, I.D., & Green, B. (2005). Factors predictive of intravenous fluid administration errors in Australian surgical care wards. *Quality & safety in health care*, 14(3), 179-184. doi:10.1136/qshc.2004.010728.
- [27] Hockenberry, M.J., & Wilson, D. (2011). *Wong's nursing Care of Infants and Children - E-Book* (9th ed.). USA: El Sevier
- [28] Hooper, M. (2011). Normal and diseased airway. *Chest*, 3(14), 412-418.
- [29] Hodkinson, P., Argent, A., Wallis, L., Reid, S., Perera, R., Harrison, S., . . . Ward, A. (2016). Pathways to Care for Critically Ill or Injured Children: A Cohort Study from First Presentation to Healthcare Services through to Admission to Intensive Care or Death. *PloS one*, 11(1), e0145473. doi:10.1371/journal.pone.0145473.
- [30] Image Gallery Formula Preparation Similac Baby Milk. <http://www.litlestuff.com/view.asp>.
- [31] Institute of Medicine Committee on Quality of Health Care in, A. (2012). *To Err is Human*. In L. T. Kohn, J. M. Corrigan & M. S. Donaldson (Eds.), *Building a Safer Health System*. Washington (DC): National Academies Press (US).
- [32] Kamal, N. (2015). Pediatric nurses' knowledge about nosocomial infection control on neonatal intensive care unit. Un Published Master Thesis: Master of nursing Science.
- [33] Kandeel, T. (2012). Current Nursing Practice for Prevention of Ventilator Associated Pneumonia in ICUs. *Life Science Journal*, 9(3), 966-975.
- [34] Kendall-Gallagher, D., & Blegen, M.A. (2009). Competence and certification of registered nurses and safety of patients in intensive care units. *American journal of critical care : an official publication, American Association of Critical-Care Nurses*, 18(2), 106-113; quiz 114. doi:10.4037/ajcc2009487.
- [35] Killam, L.A., Montgomery, P., Raymond, J.M., Mossey, S., Timmermans, K.E., & Binette, J. (2012). Unsafe clinical practices as perceived by final year baccalaureate nursing students: Q methodology. *BMC nursing*, 11, 26. doi:10.1186/1472-6955-11-26.
- [36] Kinnunen, U.M., Saranto, K., Ensio, A., Iivanainen, A., & Dykes, P. (2012). Developing the standardized wound care documentation model: a Delphi study to improve the quality of patient care documentation. *Journal of wound, ostomy, and continence nursing : official publication of The Wound, Ostomy and Continence Nurses Society*, 39(4), 397-407; discussion 408. doi:10.1097/WON.0b013e318259c45b.
- [37] Kuitunen, T., Kuisma, P., & Hoppu, K. (2008). Medication errors made by health care professionals. Analysis of the Finnish Poison Information Centre data between 2000 and 2007. *European journal of clinical pharmacology*, 64(8), 769-774. doi:10.1007/s00228-008-0496-4.
- [38] Labiner-Wolfe, J., Fein, S.B., & Shealy, K.R. (2008). Infant formula-handling education and safety. *Pediatrics*, 122 Suppl 2, S85-90. doi:10.1542/peds.2008-1315k.
- [39] Lyman, B., & Rempel, G. (2018). Pediatric Nasogastric Tube Placement and Verification. *American Society for Parenteral and Enteral Nutrition* 33(2), 88-90. DOI: 10.1002/ncp.10189

- [40] Martinez-Anton, A., Sanchez, J.I., & Casanueva, L. (2012). Impact of an intervention to reduce prescribing errors in a pediatric intensive care unit. *Intensive care medicine*, 38(9), 1532-1538. doi:10.1007/s00134-012-2609-x.
- [41] Mandal, S.K., & Dutta, J. (2009). Integrated Bio-Medical Waste Management Plan for Patna City. *India Journal*, 6(2), 1-25.
- [42] Mastoor, A. (2018). Practice of Blood Transfusion among Nurses in Public Tertiary Care Hospitals. *Saudi Journal of Nursing and Health Care*, 1(3), 184-189.
- [43] McLeod, M.C., Barber, N., & Franklin, B.D. (2013). Methodological variations and their effects on reported medication administration error rates. *BMJ quality & safety*, 22(4), 278-289. doi:10.1136/bmjqs-2012-001330.
- [44] Moffatt-Bruce, S., Hefner, J.L., & Nguyen, M.C. (2015). What is new in critical illness and injury science? Patient safety amidst chaos: Are we on the same team during emergency and critical care interventions? *International journal of critical illness and injury science*, 5(3), 135-137. doi:10.4103/2229-5151.164909.
- [45] Moreno, R., Jordan, B., & Metnitz, P. (2009). The Changing Prognostic Determinants in the Critically Ill Patient. In J. Vincent (Ed.), *Intensive care medicine* (p. 899-907). Berlin: Springer-Verlag Berlin Heidelberg.
- [46] Mwakanyanga, E.T., Masika, G.M., & Tarimo, E.A.M. (2018). Intensive care nurses' knowledge and practice on endotracheal suctioning of the intubated patient: A quantitative cross-sectional observational study. *PloS one*, 13(8), e0201743. doi:10.1371/journal.pone.0201743.
- [47] Park, S.A., Lee, S.J., & Choi, G.U. (2011). Survey of factors associated with nurses' perception of patient safety. *Asian Pacific journal of cancer prevention : APJCP*, 12(8), 2129-2132.
- [48] Pickering, D., & Marsden, J. (2015). Techniques for aseptic dressing and procedures. *Community eye health*, 28(89), 17.
- [49] Posnett, J., Gottrup, F., Lundgren, H., & Saal, G. (2009). The resource impact of wounds on health-care providers in Europe. *Journal of wound care*, 18(4), 154-161. doi:10.12968/jowc.2009.18.4.41607.
- [50] Rungruedee, (2019). Patient on endotracheal tube with ventilator for help breathing system in ICU. Shutterstock, Inc.
- [51] Samra, H.A., McGrath, J.M., & Rollins, W. (2011). Patient safety in the NICU: a comprehensive review. *The Journal of perinatal & neonatal nursing*, 25(2), 123-132. doi:10.1097/JPN.0b013e31821693b2.
- [52] Schatkoski, A.M., Wegner, W., Algeri, S., & Pedro, E.N. (2009). Safety and protection for hospitalized children: literature review. *Revista latino-americana de enfermagem*, 17(3), 410-416. doi:10.1590/s0104-11692009000300020.
- [53] Stephen-Haynes, J., & Callaghan, R. (2015). Wound Assessment and Management Guideline. Worcestershire Health and Care Trust WHCT. Available from: file:///C:/Users/Downloads/CL-078_Wound_Assessment_Guideline_2015 [1]20(2).pdf
- [54] Stroud, J. (2003). Guideline for enteral feeding in adult hospital pts supply. US National Library of Medicine National Institute of Health Search Database. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/14612488>. retrived on 22 March 2018.
- [55] Sultana, M., Mahumud, R.A., Sarker, A.R., & Hossain, S.M. (2016). Hand hygiene knowledge and practice among university students: evidence from Private Universities of Bangladesh. *Risk management and healthcare policy*, 9, 13-20. doi:10.2147/rmhp.s98311.
- [56] Tasnim, Z. et al (2017). *Saudi Journal of Medical and Pharmaceutical Sciences*; Vol-3, Iss-6A:454-463
- [57] Taylor, C., Cohen, H., Mold, D., & Jones, H. (2010). On behalf of the Serious Hazards of Transfusion (SHOT) Steering Group. The 2009 Annual SHOT Report
- [58] Teng, C.I., Chang, S.S., & Hsu, K.H. (2009). Emotional stability of nurses: impact on patient safety. *Journal of advanced nursing*, 65(10), 2088-2096. doi:10.1111/j.1365-2648.2009.05072.x.

International Journal of Novel Research in Healthcare and NursingVol. 7, Issue 1, pp: (865-877), Month: January - April 2020, Available at: www.noveltyjournals.com

- [59] Thatcher, G.E., & Hemavathy, V. (2015). Aseptic Wound Dressing Practices among Nurses. *Journal of Nursing and Health Science*, 4(3), 31-33. doi:10.9790/1959-04313133.
- [60] The Joint Commission. (2011). Health care worker fatigue and patient safety. Sentinel Event Alert Retrieved from http://www.jointcommission.org/assets/1/18/sea_48.pdf.
- [61] The World Health Organization (WHO). (2010). *Waste Management at Medical Centers*. Geneva: WHO
- [62] Tregunno, D., Ginsburg, L., Clarke, B., & Norton, P. (2014). Integrating patient safety into health professionals' curricula: a qualitative study of medical, nursing and pharmacy faculty perspectives. *BMJ quality & safety*, 23(3), 257-264. doi:10.1136/bmjqs-2013-001900.
- [63] Trigg, E., & Mohammed, T.A. (2010). *Practices in Children's Nursing: Guidelines for Hospital and Community* (3rd ed.). Edinburgh: Churchill Livingstone.
- [64] Tunlind, A., Granstrom, J., & Engstrom, A. (2015). Nursing care in a high-technological environment: Experiences of critical care nurses. *Intensive & critical care nursing*, 31(2), 116-123. doi:10.1016/j.iccn.2014.07.005.
- [65] Veerabadran, S., & Parkinson, I.M. (2010). *Cleaning, disinfection and sterilization of equipment*. Philadelphia: Elsevier Ltd.
- [66] Vijayan, A. (2011). *A study to assess the knowledge and practices of staff nurses in fluid and electrolyte administration after cardiac surgery*. Trivandrum: University of Sree Chitra Tirunal Institute for Medical Sciences and Technology.
- [67] Warburton Paul 2010. Numeracy and patient safety: the need for regular staff assessment. *Nursing Standard*, Vol. 24 Issue 27, 42-44.
- [68] Werdany, E. (2017). *Nurses Application of evidence based guideline on prevention of Ventilator associated Pneumonia in neonates*. [Unpublished Master Thesis]. Faculty of Nursing, Alexandria University.
- [69] Wilson, J. (2019). *Infection Control in Clinical Practice Updated Edition E-Book* (3rd ed.). London: El Sevier.
- [70] World Health Organization (WHO). (2012). *World Alliance for Patient Safety 2004-2012*. Geneva: WHO.
- [71] World Health Organization (WHO) (2009). *A World Alliance for Safer Health Care. Conceptual Framework for the International Classification for Patient Safety. Version 1.1. Final Technical Report*. Geneva,Switzerland: WHO.
- [72] World Health Organization (WHO). (2012). *World Alliance for Patient Safety 2004-2012*. Geneva: WHO.
- [73] World Health Organization (WHO). (2013b). *WHO national standards for blood transfusion service*. Geneva: WHO.