

Assessment of Nurses' Adherence to The Centers for Disease Control and Prevention (CDC) Guidelines Regarding Central Line Care for Children with Cancer

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Abstract

Using Central Line Catheters (CLCs) is actually an essential element of modern healthcare throughout the world. Central Line Associated Bloodstream Infections (CLABSI) accounts for 11% of all health care association infection which increases the cost of health care and prolongs hospitalization. Nurses play an intrinsic role in preventing CLABSIs through following the CDC guidelines recommendations. This study aimed to assess Oncology nurses' adherence to CDC guidelines regarding CLC care for children with cancer at Pediatric Oncology Units, King Fahad Specialist Hospital in Dammam (KFSH-D). A descriptive research design was utilized and 25 pediatric oncology nurses who were providing Central Line Catheter care for children with cancer have participated in this study. Every nurse was observed for three different times while providing CLC care. **Results:** The participant nurses from pediatric oncology inpatient constituted 64% while outpatient nurses were 36% of the sample. The total adherence median percent score (IQR) for *inpatients nurses* was 79% (14%), while *outpatients nurses* adherence median percent score (IQR) was 76% (12%). No significant statistical different found between the two groups. **Conclusion;** although the strict adherence to CDC guidelines regarding CLC care is highly recommended the study illustrated that the adherence of the nurses was not efficient. **Recommendations:** Training sessions to improve nurses' skills regarding CLC care. Periodical competencies check off to assess the level of nurses' adherence to CDC guidelines are recommended. Further researches to assess CLC care practice are required with larger sample size.

Keywords: Central line catheter care, children with cancer

1. Introduction

A central Line catheter (CLCs) is actually an essential element of modern healthcare all over the world. Those devices permit immediate entry to the body circulation for hemodynamic monitoring, medication administration and Total Parental Nutrition (TPN) infusion for acute & critically ill patients. ⁽¹⁾ It is usually attained by cannulating one of the great veins or arteries such as jugular, ^(2&3) subclavian, iliac, femoral or umbilical artery or vein in neonate.

Using CLC are obviously increased in oncology & intensive care units in recent years, although they are an important tool, they still considered a foreign body that directly accessing the bloodstream and causing several complications. The most common complications are: thrombosis and Central Line Associated Bloodstream Infection (CLABSI). ⁽⁴⁾ Risk factors for CLABSI could be classified as intrinsic risk factors: such as age, gender and underlying diseases and extrinsic risk factors: including: prolonged hospitalization prior insertion of the central line catheter and duration of CLC staying. Moreover inappropriate adherence to infection control precautions and inadequate maintenance care for CLC. ⁽⁵⁾

CLABSI accounts for 11% of all health care association infection ^(6 & 7) the report of National Nosocomial Infections Surveillance System (NNISS) for the (CDC) showed that CLABSIs rate was 5.7 per 1,000 catheter days in 2012. ⁽⁸⁾ Some studies estimated that mortality rate associated with CLABSIs were about 35%, also it leads to increase the length of hospitalization up to three weeks. The hospital costs associated with each episode of CLABCISs has been estimated between 3700\$ to 56167\$. ^(9 to 17) Other studies showed that the incidence of (CLABSI) is higher in children with cancer than in adults. ⁽¹⁸⁾

Nurses play a vital role in preventing bloodstream infections. Strict adherence to CDC guidelines regarding CLC care especially for hand hygiene and the use of aseptic techniques during CLC insertion and maintenance remains the most critical measures for the prevention of CLABCISs. ^(4 & 19)

The 2012 CDC guidelines and the central line care bundles by the Institute for Healthcare Improvement (IHI) recommend auditing and monitoring of the staff practice to ensure and reinforce their adherence to guidelines in order to reduce the incidence CLABSIs. ⁽⁴⁾ Therefore; adherence to CDC guidelines recommendations regarding CLC insertion and maintenance care, should be the focus of quality assurance & performance improvement in all hospitals.

Research Objective:

To assess the nurses' adherence to CDC guidelines while providing Central Line Catheter care for children with cancer.

Research question:

Do the pediatric oncology nurses adhere to CDC guidelines while providing central line catheter care for children with cancer efficiently?

2. Methods and Procedures

Study Design: Descriptive research design was utilized in this study.

Setting: The study was conducted in the Pediatric Oncology Units (inpatient, outpatient) at King Fahad Specialist Hospital in Dammam (KFSH-D).

Subjects: A convenient sample of 25 pediatric oncology nurses (16 nurses from inpatient and 9 from outpatient department) who were providing Central Line Catheter care for children with cancer was included in this study

Inclusion criteria: All registered pediatric oncology nurses who had worked in the unit for at least six months prior to start the observations were eligible. All participants were currently registered with the Saudi Registered Nurses Association (Saudi counsel)

Exclusion Criteria: Pediatric oncology nurses who were not included directly with CLC care e.g. charge and triage nurses.

Ethical Considerations:

Prior to start the study, the research proposal including the observation checklist, and demographic data was reviewed and approved by the Institutional Review Board (IRB) in University of Dammam. Permission for conducting this study was obtained from the responsible authorities at KFSH-D

Research related risks were minimized by using procedures that are consistent with careful data security measures. The data entry and storage was done on a password-protected computer. Information was only known to the investigator and the supervisors. Any print copies of the information were kept in a locked file. Concerns about participants' privacy were addressed by using a de-identified process related to the checklist information.

There were no foreseen risks to the participation in this study and no risks were noted during the study. Respondents were instructed not to put their names on the demographic form.

Tool: *One tool was used in this study that is divided into two parts:*

- ❖ **1st part** is nurse's demographic data which included: nationality, gender, educational level, and years of experience in nursing as well as in oncology departments.
- ❖ The 2nd part is ***the Central Line Catheter Care Observation Checklist***: The intent of the checklist was to assess the adherence to CDC guidelines regarding central line catheter care. It is adopted from KFSH policy of prevention of CLC associated bloodstream infection based on CDC guidelines which include; hand hygiene, maintaining aseptic technique, CLC dressing change, administration set change, needless intravascular catheter system and scrub the hub.
- ❖ The scoring for the performance is ranging from 0-2 (done = 2, partially done =1 & zero if not done)

Data collection procedure:

1. Nurses' written consent was obtained after explanation of study aim.
2. Tool for data collection was developed and tested for its content validity and reliability by 5 experts in pediatric nursing.
3. Pilot study was carried out on five nurses who were involved with the care of CLC to test feasibility and applicability of the tool. Nurses in the pilot study were not involved in the study subjects.
4. The observation was focused on the nurse's adherence to CDC guidelines regarding central line care. Every nurse was observed while performing CLC care (during CLC dressing, hub scrubbing, and /or tubing and devices change) for three different times for each procedure to eliminate the subjectivity of nurse's practice. No attempt was made to mask the observations and staff members were aware of the presence of observer.

Data analysis:

After data collection, it is coded and entered to the computer. The data was checked for correction of any errors during data entry. SPSS program version 17 was used for data presentation (tables, graphs and mathematical presentations), statistical analysis and finally decision taking according to the significance depending on the P values. The 5% level of significance was used. Number and percent were used for presenting qualitative variables.

Tests of normality were carried out for the quantitative variables. Accordingly, if this test is significant ($P \leq 0.05$) the quantitative variables are abnormally distributed, otherwise it is normally distributed. Hence, median and inter quartile range were used for mathematical presentation and non-parametric test were used for

analysis. Chi Square test was used for comparisons of qualitative variables. The figures used were box plot. The tests used for comparisons of the median for the same groups during the period of follow up were Friedman's test (for more than two periods). Mann Whitney test and Kruskal–Wallis were used for comparison of the median according to the number of the groups.

3. Results

Figure 1: showed the distribution of the total sample in relation to work area. The participant nurses from pediatric oncology inpatient constituted 64% while outpatient nurses were 36% of the sample Figure1: Distribution of Participants in Relation to Area of Work.

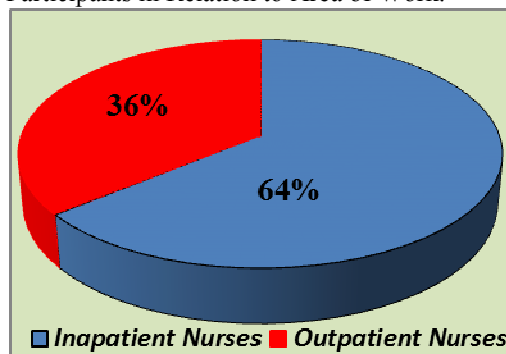


Figure1: Distribution of Participants in Relation to Area of Work

The demographic characteristics of the study population are shown in Table (1). Nearly half of participants' (48%) were middle aged group ranging from 30 to 40 years old. Filipino nurses constituted 40% of the sample, Indians 28% while 32% of nurses have other nationalities (Arab, Malaysian and South Africa). More than half of the participants (52%) have a diploma Degree in nursing while 48% have Bachelor.

Majority (76%) of participants' experience was more than 9 years as registered nurses (RN), while 60% of the study sample has 3 to 6 years experiences in oncology department. The demographic characteristics of the participants did not differ significantly for the variables of age, level of education, years of work experience as RN, but the median of work experience years as oncology nurse was significantly longer for inpatients nurses compared to outpatients ones [P= 0.048]. Majority of outpatient's nurses (77.8%) exposed to more educational courses regarding CLC care compared to inpatients nurses (18.8%), with statistical significant difference [P= 0.014].

Table 1 Demographic Characteristics of the Study Sample by Study Group

Demographic Characteristics (N, %)	Inpatient Nurses		Outpatient Nurses		Total Sample		P value
	16	64%	9	36%	25	100%	
Estimated Age (years)							
> 30	3	18.8	00	00	3	12	0.382
30 < 40	7	43.7	5	55.6	12	48	
> 40	6	37.5	4	44.4	10	40	
Nationality (n, %)							
Filipino	6	37.5	4	44.4	10	40	0.336
Indian	6	37.5	1	11.1	7	28	
Others	4	25	4	44.4	8	32	
Level of Education: (n, %)							
Bachelor	7	43.8	5	55.6	12	48	0.688
Diploma	9	56.2	4	44.4	13	52	
Years of experience as RN							
< 9 years	5	31.3	1	11.1	6	24	0.364
=>9 years	11	68.8	8	88.9	19	76	
Years of Oncology Experience							
1 < 3 years	2	12.5	2	22.2	4	16	0.048*
3 < 6 years	11	68.7	4	44.4	15	60	
6 < 9 years	3	18.8	0	0	3	12	
=>9 years	00	00	3	33.3	3	12	
Received Training							
No	2	12.5	00	00	2	8	0.014*
One Day	11	68.8	2	22.2	13	52	
> One Day	3	18.8	7	77.8	10	40	

***Statistically significant different**

Figure 2: present the distribution of oncology nurses total percent score regarding adherence to CDC guidelines for CLC Care. The total adherence median score for inpatients nurses ranged from (32 to 43 out of 48) with median percent score of (IQR) 79% (14%), while outpatients nurses total median score ranged from (27 to 36 out of 40)

with median percent score (IQR) 76% (12%). No significant statistical different found between the two groups. Figure2: Distribution of Oncology Nurses' Total Percent Score regarding Adherence to CDC Guidelines for CLC Care.

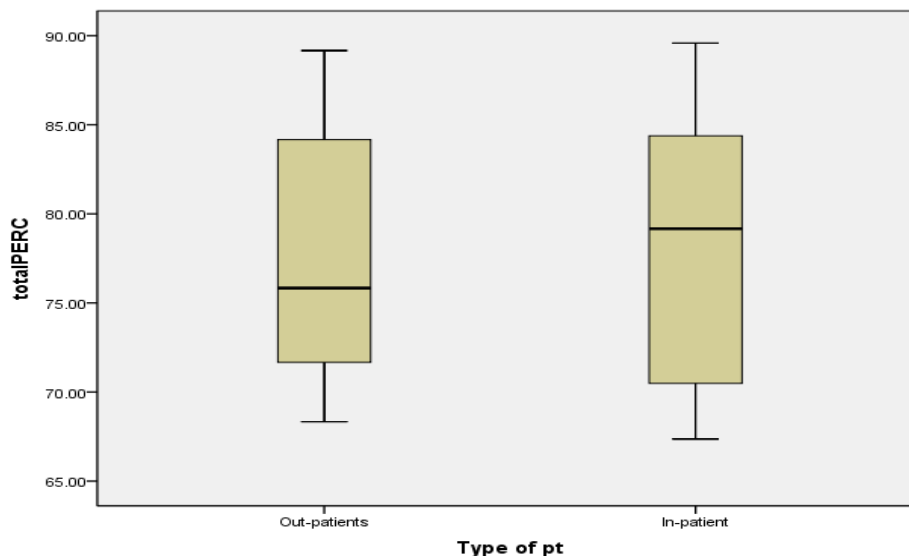


Figure2: Distribution of Oncology Nurses' Total Percent Score regarding Adherence to CDC Guidelines for CLC Care

Table 2: Present the distribution of oncology nurses' percent Scores regarding adherence to CDC guidelines for CLC Care. All nurses either inpatient or outpatient were changing administration set based on CDC guideline recommendations with 100% compliance, while their adherence to other critical element was not competent. Hand hygiene and hub scrubbing median percent scores (IQR) for inpatients nurses were higher than outpatient's nurses [92% (25) Vs 75% (0)] and [58% (33) Vs 50% (17)] respectively. Median percent scores (IQR) for outpatients nurse's adherences to CDC guidelines were higher than inpatient's nurses regarding maintaining aseptic technique [75% (44) Vs 58% (22)] and CLC dressing change[76% (7) Vs73% (13)].There is no statistical significant difference between inpatients and outpatients nurses in adherence to CDC guidelines regarding CLC care [P = 0.093].

Table (2) Distribution of Oncology Nurses adherence Sub Scores to CDC guidelines regarding CLC care.

CDC Guidelines Items	Maximum Marks	Inpatients Nurses		Maximum Marks	Outpatients Nurses		P Value
		Median (IQR)*	% (IQR)		Median (IQR)	% (IQR)	
Hand Hygiene	4	3.6 (1)	92 (25)	4	3 (0)	75 (0)	0.063
Marinating Aseptic Technique	8	4.6 (3)	58 (22)	8	6 (4)	75 (44)	0.320
CLC Dressing Change	20	15 (3)	73 (13)	18	14 (1.3)	76 (7)	0.496
Administration set Change	10	10 (0)	100(0)	8	8 (0)	100(0)	1
Needleless IV System Change	4	3 (0)	75(0)	0	NA**		NA
Hub scrubbing	2	1.2 (0.7)	58(33)	2	1(0.3)	50(17)	0.093

Table 3: illustrates the effect of demographic data on nurses' adherence to CDC guidelines regarding CLC care for children with cancer. No observed difference between diploma and bachelor degree nurses in adherence to CDC guidelines (median percent score was 76.6% for both).

Filipino and Indians' median percent score was 76.6% and 70.8% respectively, while the compliance of other nurses (Arab, Malaysian and South Africa) was higher with median percent score of 84%. Adherence to CDC guidelines was higher among nurses with shorter experience as RN, comparing to those with longer experience with median percent scores of [82% V.S 73%]. Nurse who received more educational courses regarding CLC care adhered to CDC guidelines comparing to those who received only one day course, with median percent scores of

[78% V.S 72%]. Generally there were no statistical significant differences were found between nurse's adherence to CDC guidelines and their demographic data (age, level of education, years of work experience in nursing, and years of experience in oncology as well as CLC care educational courses).

Table 3: The Effect of Demographic Characteristics on Oncology Nurses' Adherence to CDC Guidelines

Demographic characteristics	Median percent score	P value
Educational level :		
Diploma	76.6	0.870
Bachelor	76.6	
Nationality		
Filipino	76.6	0.151
Indian	70.8	
Others	84	
Years of experience as RN*		
< 9 years	82	0.192
=> 9 years	73	
Years of Oncology Experience		
1 < 3 years	75	0.191
3 < 6 years	77	
6 < 9 years	80	
=> 9 years	76	
Received Training		
No	72	0.839
One Day	72	
More than One Day	78	

4. Discussion

Minimizing the rate of CLABSI, length of hospitalizations, healthcare costs and improves the quality of care is considerable interest by healthcare providers, insurance companies, and patient advocates. This should be multidisciplinary effort, involving healthcare professionals mainly physicians who are responsible for insertion and removal of CLCs, and the nurses who are responsible for providing maintenance care for intravascular catheters. ^(4&20)

Once the nurse's practices regarding CLC care are determined to be effective and efficient, the next step is to implement these evidence-based practices so they become a part of routine oncology care. Although periodic auditing of CLC maintenance is essential in order to improve the quality care and prevent CLABCIS, very limited studies have been carried out regarding this issue. ^(4, 20, 21, 22, 23& 24)

Nurses' strict adherence to CDC guidelines regarding CLC care has critical impact in preventing CLABSIs. The present study showed that the nurses adherence was Substandard, with no significant different between inpatients and outpatients nurses' compliance. This is concurrent with the study that carried out by Warren et al in 2006 which revealed that, implementation of evidence based CLABCISs preventive practices in U.S. hospitals has been suboptimal. ⁽²⁵⁾

Proper hand hygiene before and after assessing catheter insertion sites as well as prior and after accessing or dressing the CLC, either by cleaning hands with alcohol-based hand rubs or through washing hands with conventional soap and water, remains the most important measure to prevent nosocomial infections. Proper hand hygiene must be performed for 15 seconds, with considering the fingernails and between fingers. A systemic review study carried out by Erasmus et al in 2010 to assess the health care workers adherence to hand hygiene confirmed that the compliance rates was universally low ranging from 4% to 100%, while the current study compliance was 92% for inpatients nurses and 75% for outpatients nurses. Many interventions have been provided over the years in order to improve hand hygiene compliance but the lasting improvement not achieved yet. ⁽²⁶⁾

Maintaining aseptic techniques is a mandatory in order to prevent CLABSIs specifically in dealing with immune-compromised patients. Unfortunately the present study revealed that, the nurse's compliance to aseptic techniques was not satisfactory.

Facial mask is highly recommended for procedures requiring less than 15 minutes. ⁽²⁷⁾ Majority of the participants in the current study were not instructing the patients to wear mask or turn their heads away from insertion site.

Maximum sterile barrier (MSB) precautions are defined as strict adherence to hand hygiene with wearing of sterile gloves, sterile gown, cap and using of full body drape during CLC care. Some studies found reduction in

the risk of skin colonization at the catheter insertion site when (MSB) precautions were used. A randomized controlled trial compared the sterile gloves and a small drape with using MSB, showed that MSB group had fewer episodes of catheter colonization. ^(28 & 29) Unfortunately nurses in this study were only using sterile gloves and a small sterile drape.

The use of a 2% chlorhexidine-based preparation for cutaneous antisepsis is strongly recommended by CDC guidelines and supported with well-designed experimental, clinical or epidemiologic studies. A meta-analysis study of 4143 catheters indicates that vigorous use of chlorhexidine reduced the risk of CLABCIS by 49 % (Chaiyakunapruk 2002). Cleaning the catheter insertion site with chlorhexidine vigorously for 30 seconds is necessary in order to prevent CLABCIS. ^(4&30) All participants in this study were using chlorhexidine agent for CLC dressing, but unfortunately whole participant did not clean the skin vigorously (using back and forth motion) while 20% of nurses were not cleaning the insertion site for 30 seconds as per recommended.

Disinfected site should be allowed to dry (approximately for 30 seconds) or it will not be aseptic anymore⁽⁴⁾, which is followed by majority of nurses in the present study. Transparent dressing permit visual inspection of the catheter site for continues assessment and requires less frequent changes (7days) than gauze dressing (48hours) which also plays a integral role in decreasing infection rates. All nurses in this study were using the transparent dressing. Lorente et al reported that there was no clinically substantial differences exist in the incidence of catheter site colonization between transparent & gauze dressing. ⁽³¹⁾ When dressing becomes damp, loose, or visibly soiled immediate change must be performed as per CDC guidelines recommendations. All nurses were completely adhering to recommended dressing change interval in the present study.

Several studies have being carried in examination of the optimal interval for routine replacement of intravenous administration sets. Some studies revealed that the frequently replacement of administration set not more than 3 – 4 days after initiation of use is safe and cost-effective while other studies found that delaying the replacement of administration set up to 7 days could be also safe, as well as cost-effective^(4, 32 & 33) Using new administration set with each re-accessing of porta-cath device is one of the infection control strategies. Although all participants in this study were totally compliance to administration set changing interval as per CDC guideline but unfortunately more than half of participants were re-using the previous intravascular tubes (that was contaminated with the old Huber needle set) with the new re-accessed porta cath.

Several attempts have been made in order to reduce the incidence of needleless injuries and the transmission of blood borne infections to healthcare personnel which finally lead to creating and mandating of needleless infusion systems one of these studies was by Cookson et al. ⁽³⁴⁾ As per CDC guidelines recommendations needleless intravascular catheter system must be change not longer than 72 hours, this conclusion was concurrent with McDonald et al findings, who stated that; replacing the needleless system every 6 days associated with increased blood stream infection (BSI) rate among ICU patient. ⁽³⁵⁾ The compliance of pediatric oncology nurses was in the present study regarding this recommendation was below the standard.

One of the most effective strategies that used to prevent CLABSIs is cleaning catheter hub, needleless, connectors and injection port before each accesses with alcoholic chlorhexidine preparation or 70% alcohol vigorously (with friction and twisting motion) to decrease contamination. In addition, the time spent for cleaning the luer-activated device could be important (Menyhay SZ etal2008). ⁽³⁶⁾ One study found that cleaning the luer-activated device with 70% alcohol for only 3 to 5 seconds did not sufficiently disinfects the septal surface. Some studies have shown that the increase in CLABSIs could be related to improper cleaning and infection control practices (Marschall et al 2008). ⁽³⁷⁾ Unfortunately adherence to proper disinfection of catheter hub was poor in the current study.

The employees who have longer experience feel that change threatens their interests and gains which they have acquired over the past years, (Dr. Alaaabdulhamid 2011). ⁽³⁸⁾ It's has been noted in the current study that's professional seniority showed lower adherence scores to CDC guidelines comparing with those with shorter experience period as RN or Oncology nurses. On the other hand (Labeau et al. 2009) revealed that "professional seniority showed to be independently associated with better test scores". ⁽³⁹⁾

A study carried out by Friedt 2011 revealed that implementation of a checklist & educational reinforcement can increase nurses' knowledge and may contribute to decreasing CLABSIs rates. Nurses who attended more CLC care courses have better adherence to CDC guidelines than those who were attended only one day course. ⁽⁸⁾ Ambulatory care pediatric oncology showed three times higher CLABSIs rate than inpatient setting. (Rinke, Michael L., et al 2013) Although inpatients nurses attended less educational courses related to CLC care their adherence to CDC guidelines was better than outpatients nurses who attended more educational courses. ⁽⁴⁰⁾

Conclusion

Although strict adherence to Center for Disease Control & prevention guidelines is highly recommended and it's also integrated within the hospital policies specifically for Oncology nurses, the study showed that the adherence of the nurses was not efficient.

Limitations

Although monitoring the staff behaviors through observation could be the most feasible option for majority of health care institutions for the time being. Knowing that there is observation focusing on staff performance may affect their behaviors in the clinical environment with greater attention to adherence to guidelines recommendations.

The result cannot be generalized due to short observational period & limited oncology settings in eastern region of KSA.

Recommendations

Education & training sessions annually using simulators regarding CLC care to refine and consolidate nurses' skills are highly recommended.

Periodical competencies check off must be carried out to assess the level of nurses adherence to CLC maintenance care guidelines with immediate feedback or reflective practice.

Empower nursing to enforce the use of central line maintenance checklist to make sure that all processes related to central line care are followed

Availability of pre prepared dressing kit specific for CLC care could improve adherence to maximal aseptic barriers.

Further researches to assess CLC care practice during and post insertion are required with a larger sample size.

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