

*“Infection prevention control strategies (IPCs)
to prevent central line bloodstream infection
(CLABSI) in neonatal intensive care unit
(NICU)”*

Authors

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Abstract:

Background:

- Babies in the neonatal intensive care unit are at high risk for infection.
- UVCs were the primary source of hospital acquired infections in the NICU

Aim of study:

Know the difference between the early planned removal of UVCs and the longer fixed duration in preventing infection of blood stream and other complications.

Methodology:

- Histogram
- Goal directed Checklists

Conclusion

- Implementation of infection prevention control strategies Can affect the health care associated infection in NICU

Keywords:

Neonatal intensive care unit (NICU) - Central line-associated bloodstream infections (CLASBI) - Infection prevention Control (IPC)-preventive bundles- UVC-ODDs ratio

INTRODUCTION

Hospital acquired infections “HAIs” refers to infection occurring during the presence of patient at health care facility (HCF), and not present at the time of admission, in emergency hospitals among every 100 patients an average of 15 in developing countries will have at least one acquired infection, Infection causes up to 65% of deaths among hospital – born babies.

Infections can lead to disabilities, antibiotic resistance, increase length of stay in hospitals and death.

A lot of neonates in intensive care units are preterm and their immunity are weak, so we take more care for them.

"HAIs" are transmitted to newborns, usually through the hands of Health care personals and equipment in comparison with other routes of infection, such as droplets or airborne transmission infections are relatively rare.

for example, it could occur from some of the support devices, such as central lines for administering medication or fluids.

Once a newborn acquires an infection, he became in high risk of developing a lot of health problems, some of them serious and even potentially death.

Effective (IPC) strategies reduce HAIs by at least 30%, improving hand hygiene practices may reduce pathogens transmission in (HCF) by 50%

In 2007, we discovered umbilical Venous catheter and umbilical arterial catheter were the primary source of most "HAIs" in the NICU. For that we strive as a team to improve insertion and care of central lines. This effort resulted in a reduction in (CLABSI) infections in the NICU by approximately 80% percent.

AIM OF WORK

- Taking all precautions of infection prevention and control to avoid infection related to umbilical venous catheters (UVCs).
- Compare the effectiveness of early planned removal of (UVCs) (up to two weeks after insertion) versus an expectant approach or a longer fixed duration in preventing bloodstream infection and other complications in newborn.
- Effect of hand hygiene in decreasing Blood stream infection related to the (UVCs).

METHODOLOGY

The methods of preventing infection transmission, how to apply and their effect in NICU

General Principles dealing with UVCs and contact with newborns should be minimized as much as possible. It is recommended to take the necessary measures to prevent the risk of transmission of disease-causing organisms' "pathogens" from the mother to the infant. Staff should wash their hands before and after handling each child and before moving to another, as well as when entering the nursery or intensive care unit for newborn.

Effective IPC in the nursery attempts to reduce the exposure of the neonate to harmful microorganisms for example, (CLBSI) is one of complications in the neonates. Babies can become at risk and stay for long period in the hospital. Our hospital team has put bundles in NICU to control such infections such as:

- Usage of central lines only when they are important.
- Early removing of UVCs as soon as possible.
- Training staff who deal with UVCs to use sterile steps.
- Use goal- directed Checklists to follow implementation of infection prevention bundles.
- Wearing personal protective equipment to keep the environment clean.
- Be careful with cleaning the skin when the UVC inserted.
- Staff member's applying hand hygiene before handling.
- Use Disinfectants before dealing with the line while taking medications.
- Active surveillance should implement and standardized process to see if UVCs can be removed.
- UVCs Surveillance must be doing by trained team to detect blood stream infections in the NICU

- Express data as the number of UVCs bloodstream infections per 1,000 catheter-days.
- Report blood stream infections rates for umbilical catheters separately. Monitor trends in blood stream infections rates to assist in identifying lapses in IPAC practices. Report blood stream infections rates back to staff in the NICU.
- Increase competency and knowledge to proper hand hygiene for health care team in a way decrease the rate of infection.

USING QUALITY TOOLS FOR ANALYSIS AND IMPROVEMENT

- **Histogram**

It can be analyzed to draw conclusions about the data set.

- **Goal- directed Checklists**

Goal-directed Checklist contains points that are measure a specific operation or situation. (8) Checklists are used to ensure that all vital steps must be doing.

- **FOCUS-PDCA**

Is a management method uses in improve processes

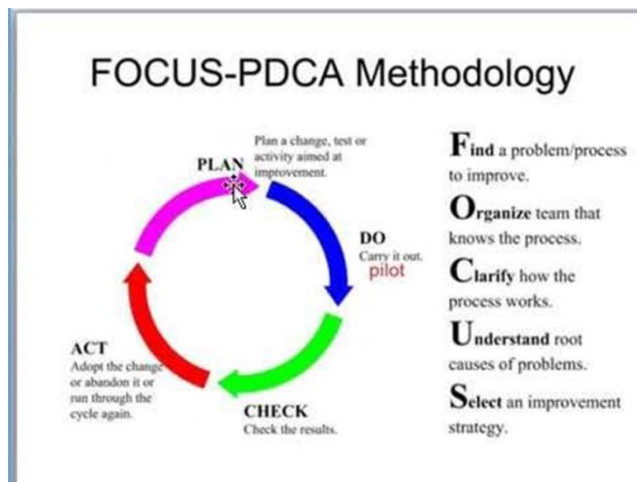


Table 1: Example of surveillance by Goal- directed Checklists

Standard	Generation	Newborn
Benchmark:		
	-Applying hand disinfectant	-Applying hand disinfectant
	-Applying preventive bundles	-Applying preventive bundles
	-Applying prenatal investigations	- Applying routine practices
	- Applying routine practices for health of mothers	
	for health of mothers	-Staff are vaccinated
	-Staff are vaccinated	-purpose of antibiotics usage
	- purpose of antibiotics usage	-Central line placement and removal

Table 2: -comparison between Early and latent removal of UVCs infections

Outcomes	Risk with Early removal	Risk with latent removal
Blood sepsis	131 per1000	202 per 1000
Number of mortalities	67 per 1000	75 per 1000

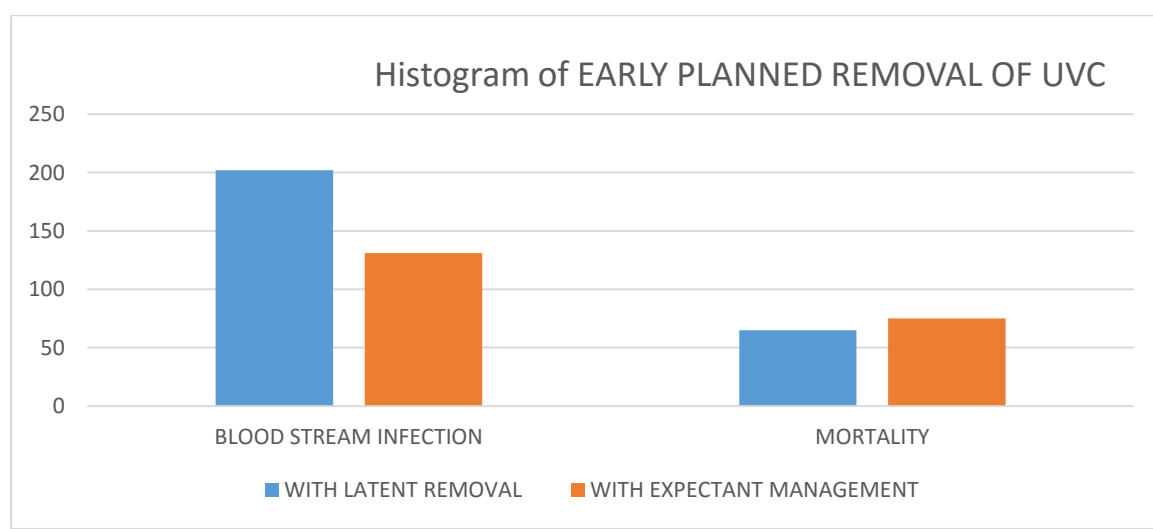
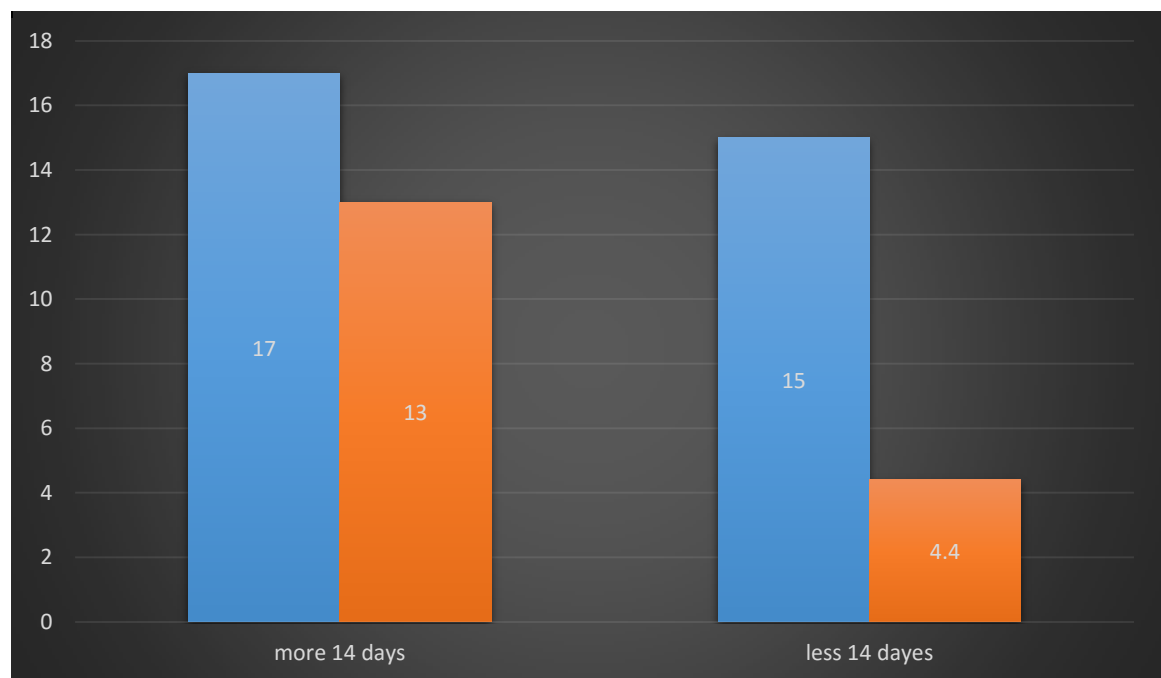


Diagram show comparison between risk with early and latent UVC removal

Table 3: UVC duration and high risk of sepsis in premature babies

Collecting 30 patient as a sample and collect data we found that percentage of blood sepsis increase by increasing numbers of days more than (14) of UVC and no significant change in percentage of blood sepsis by decreasing numbers of days than (14)

Days of UVC	Number of premature babies with sepsis (%)	Number of premature babies without sepsis (%)	Total (%)
more than 14 days	17 (53.6)	13 (46.4)	30 (100%)
less than 14 days	15 (50)	15 (50)	30 (100%)



■ With sepsis

■ Without sepsis

Diagram show UVC duration and the risk of sepsis.

Measuring Relative Risk (RR) and Odds Ratio (OR):

Days of UVC	Number of premature babies with sepsis (%)	Number of premature babies without sepsis (%)	Total (%)
more than 14 days	A 17 (53.6)	B 13 (46.4)	30 (100%)
less than 14 days	C 15 (50)	D 15 (50)	30 (100%)

Relative risk (RR) is an equation of the strength of association used in experimental studies. It is the probability of developing an infection if the risk factor is divided by the probability of developing infection if the risk factor is not present. It is sometimes called the risk ratio.

$$\text{Relative Risk (RR)} = \frac{a}{a + d} = \frac{17}{30} = 1.12$$

$$\frac{c}{c + d} = \frac{15}{30}$$

Odds Ratio (OR)

Is another equation closely related to relative risk .It is the probability of having a particular risk factor if a condition or infection is found divided by the probability of having the risk factor if the infection or condition is not found.

$$\text{Odds Ratio (OR)} = \frac{a*d}{c*b} = \frac{17*15}{13*15} = 1.30$$

$$\frac{c*b}{13*15}$$

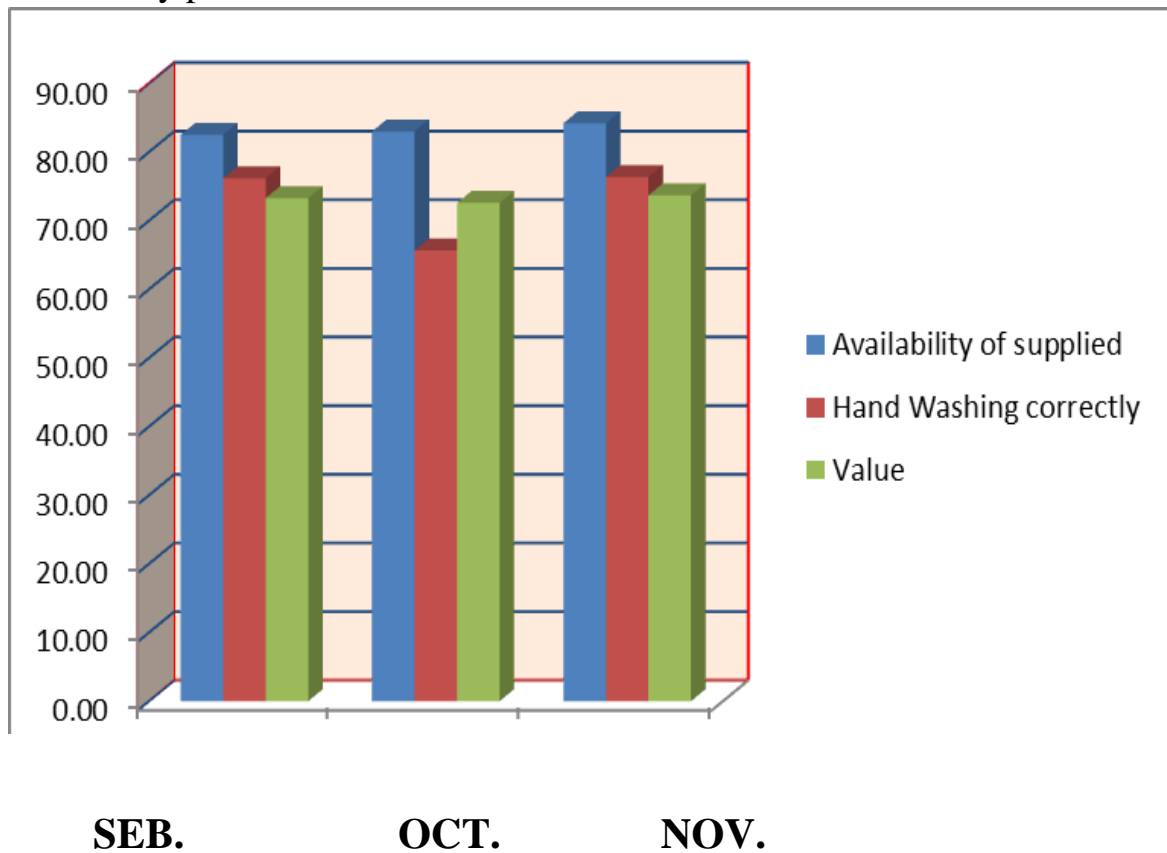
PERFORMANCE IMPROVEMENT PROJECT OF HAND HYGIENE

The model used in the development FOCUS-PDCA



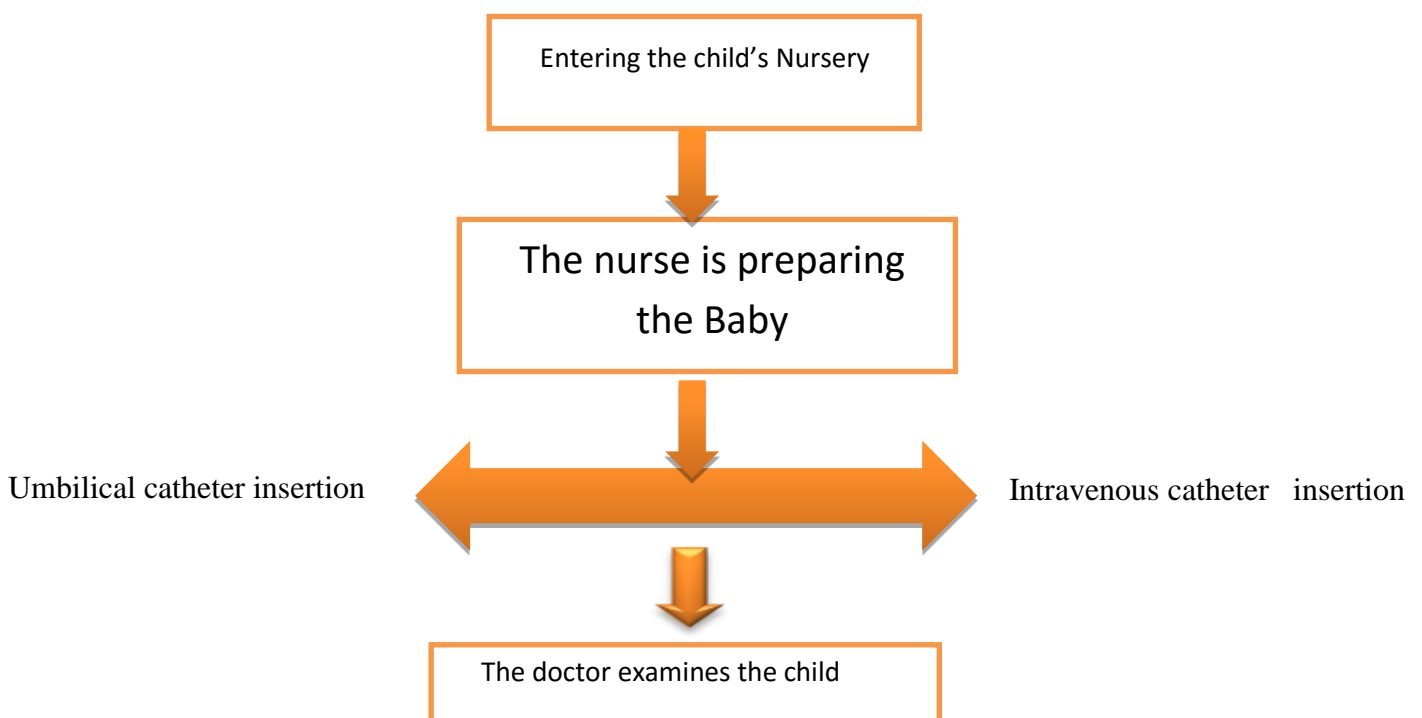
Frist: Find problem process to improve

- By analyzing performance indicator.
- Daily pas of infection control officer



Second: organize the team

- * By using High level flow chart



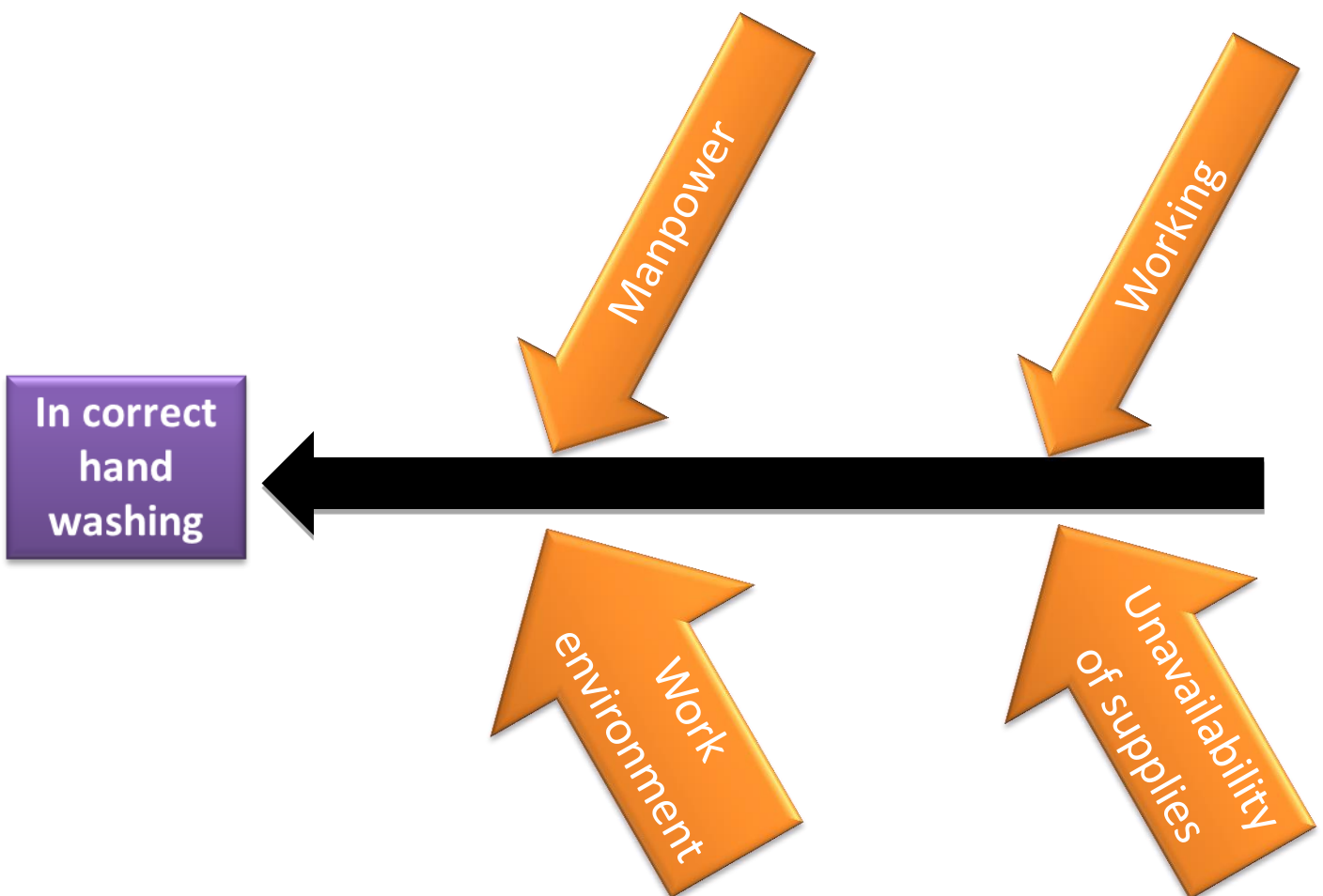
Third: Clarify the process.

*To determine the possible causes of the problem we need to explain the processes that the problem goes through using a detailed flowchart .

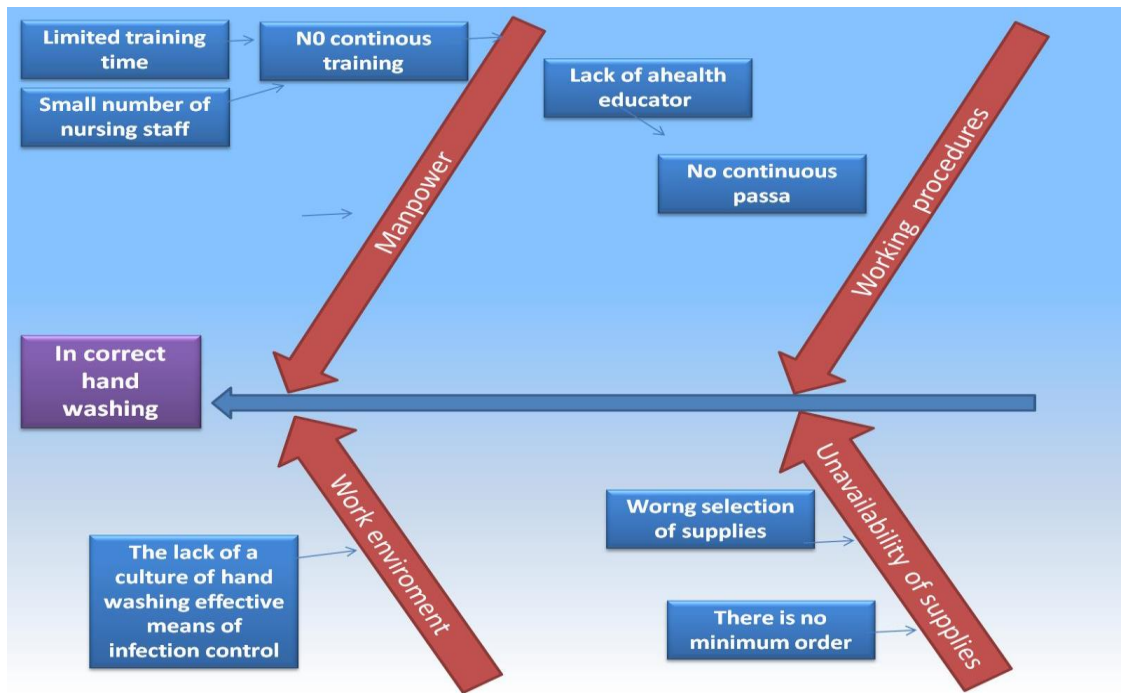
Fourth: Understand the root cause of the problem

- Done FISH BONE ANALYSIS to find out the main causes of the problem and the sub-causes as well.

1. Main reasons



2. Sub causes



Fifth: Strategy Select an improvement

1. Training intensified to choose appropriate type of hand washing.
2. Training is given on the timing of hand washing and how to perform it the right way.
3. A monthly minimum availability of supplies is made, provided that anew supply request as soon as h supplies available the submit facility reach the minimum.

Sixth: Plane a change, test or activity aimed at improvement

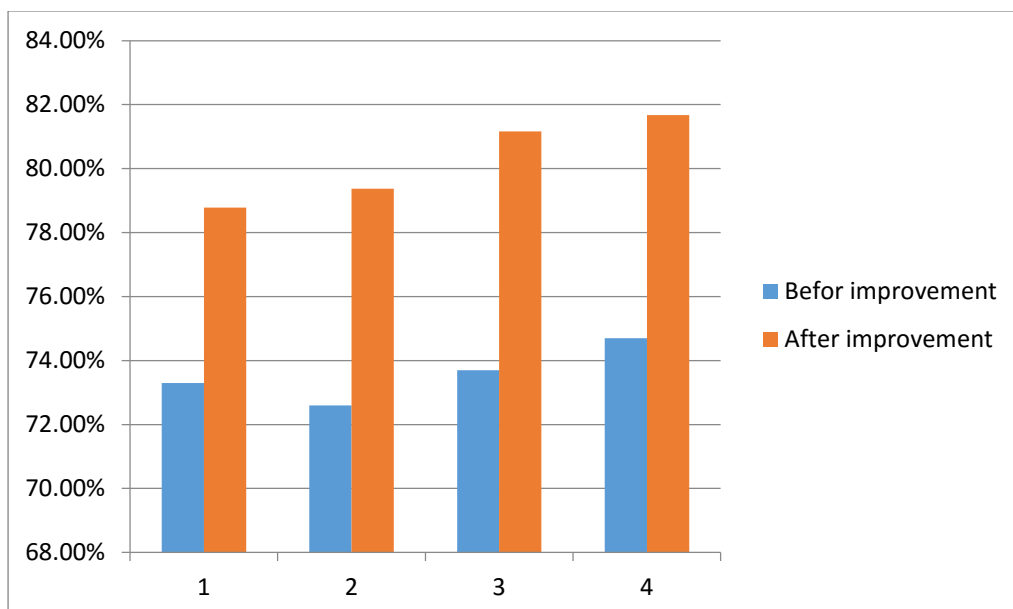
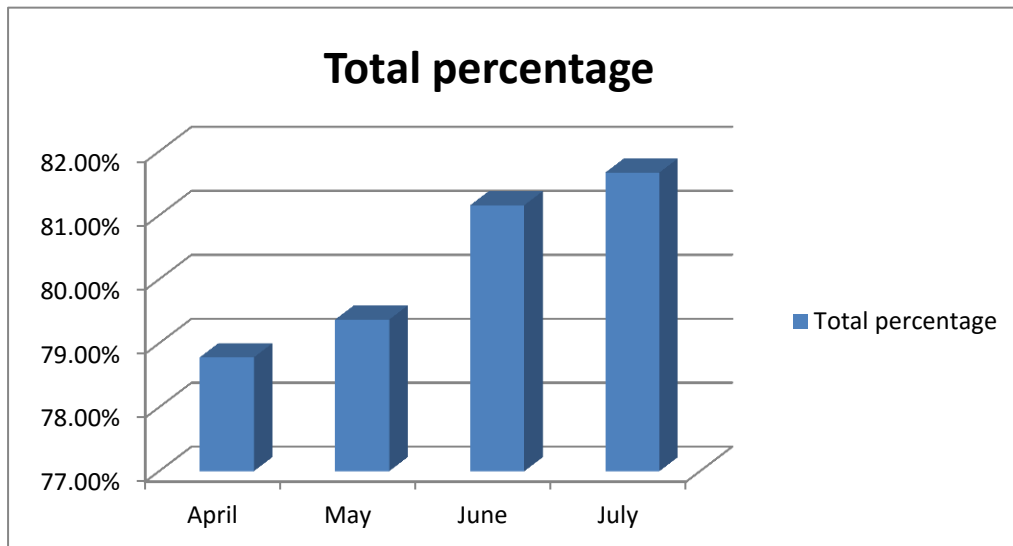
Measuring	Administrator	Time frame
Training is intensified to choose the right type of hand washing.	Infection control officer	4 days per month
Training is given on the timing of washing hands and how to perform it the right way.	Infection control officer	4 days per month
Make a minimum monthly availability of supplies.	Warehouse manager	First day of every month.

Seventh: Do carry it out

Attached are photos of the training records on the appropriate type of washing for each procedure and the appropriate moments of washing.

Eighth: CHECK the result

This is done by measuring the hand washing performance index. The performance indicators showed a high percentage of the performance of the hand washing indicators



Ninth: Act, Application and generalization:

- Continuing to train staff to wash hands properly.
- Continuing to measure performance indicators on a monthly basis to maintain the gains of the process of continuous improvement and development.

Results:

When considering the benefits and harms related to the timing of removing the (UVCs) from neonate, there is justification for conducting this randomized controlled trial to remove (UVCs) planned versus predictive measure.

Like this trial may include infants at high risk of catheter-associated bloodstream infection due to the anticipated need for a prolonged period of central vascular access for parenteral nutrition delivery (e.g. growth compromised and extremely preterm infants) and may address primarily

The effect of the planned early removal (e.g. from 7 until 14 days) on risk of catheter-associated bloodstream infection (It is determined by validated and established criteria). A pragmatic, large and simple trial will be needed to allow assessment of a humble but significant decrease in the incidence of bloodstream infection (example: more than 2000 participants to provide 90 % power to detect 25 % reduction of risk ratio (RR)), in addition to affecting other catheters and complications related to infection.

After improvement	Before improvement
78.78%	73.30%
79.37%	72.60%
81.16%	73.70%
81.67%	74.70%

NOTE: Prolonged present of UVC related to sepsis in premature babies.

- When we implemented this procedure Sepsis are reduced by 3.6%.

- Mortality rate is reduced.
- when we care for hand hygiene the performance becomes higher.
- Blood stream infections are decreased.

CONCLUSION:

It was noted that the acquired infection plays a very big role, as it is linked to the health care provided, which is considered one of the most important medical diseases that may face the infant section, and since the science of infection control And the strategies that we can use to reduce this infection within the

neonatal intensive care unit. Which requires focusing on all individuals who provide health care in this section. . Each care provider must understand his or her role in preventing health care–associated infections and have a willingness to modify behaviors such that they comply with recognized infection-control practices. All too frequently And because the health of the infant is subjected to some acts of neglect that are carried out by health care providers, such as the ineffectiveness of washing hands in a proper way, while the best 21st techniques in the century are used. Identifying the simplest wrong practices, or those that were not at a high level of efficiency, can be known to modify their behavior in line with the recommended infection control practices.

RECOMMENDATIONS

- 1- Infection and prevention team must Competence, certified, implies an expert level of knowledge and skills
- 2- Adherence to basic infection prevention and control practices are essential (Standard Precautions - Contact Precautions - Patient isolation - Environmental Interventions - Cleaning and disinfection - Dedicated equipment - reprocessing of medical instruments)
- 3- Education and training of Healthcare personnel about CVC preventive bundle during insertion and daily care is very important
- 4-Do active surveillance and makes reports by data
- 5- We should detect what apply and what does not apply by goal- directed Checklists
- 6- Adequate staffing ratio
- 7- Healthcare personnel must be competent, well trained and vaccinated.
- 8-Remove UVCs immediately if any infections are present.
- 9-UVCs should be early removal when no needed, we can use it up to 14 days if managed aseptically.

REFERENCES

Health care without avoidable infections: the critical role of infection prevention and control. Geneva: World Health Organization; 2016
(<https://apps.who.int/iris/handle/10665/246235>)

- Health care without avoidable infections: the critical role of infection prevention and control. Geneva: World Health Organization; 2016
(<https://apps.who.int/iris/handle/10665/246235>)
-
- Linares J, Sitges-Serra A, Garau J, Perez JL, Martin R. Pathogenesis of catheter sepsis: a prospective study with quantitative and semi quantitative cultures of catheter hub and segments. Clin Microbio,2016
- Early planned removal of umbilical venous catheters to prevent infection in newborn infants (Review)
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