IMPLEMENTATION OF COMPREHENSIVE UNIT-BASED SAFETY PROGRAM FOR THE PREVENTION OF CATHETER ASSOCIATED BLOODSTREAM INFECTIONS

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The growing use of peripherally inserted central catheters (PICC) has led to the recognition of the risk of central line-associated bloodstream infections (CLABSIs).

- Historical data (2019) – Incidence of CLABSI per 1000 central line days in a surgical ward at a teaching hospital was high (11.5%)

- CLABSIs can cause mortality, increase morbidity and length of stay, and result in higher health costs (Rosenthal et al., 2009).

- Comprehensive Unit-Based Safety Programs (CUSP) are sustainable models to reduce CLABSIs
  - developed by Johns Hopkins Quality and Safety Research Group and funded by Agency for Healthcare Research and Quality (AHRQ, 2017)

- CUSP can improve teamwork and safety culture and help clinical teams learn from mistakes through the integration of safety practices into daily work (AHRQ, 2017)

References:
OBJECTIVE

• To evaluate the implementation of CUSP for the reduction of PICC-associated bloodstream infections (BSI)

AIM

• <5 per 1000 catheter days
  (target of rate was determined by guidelines set by Ministry of Health, Malaysia)
PDSA PROCESS ANALYSIS

**PLAN**
- Problem identification
- Problem selection
- Identify root causes
- Find innovative solution

**DO**
- Gathering information
- Apply and verify
- Reengineer workflow

**ACT**
- Standardisation
- Staff empowerment
- Monitoring and sustainability

**STUDY**
- Monitor new workflow
- Ensure prevention control measures adhered
- Collect data and analyse
- Verify results of the action taken

CUSP dovetails with and supports a range of quality and safety improvement models such as Plan-Do-Study-Act (PDSA) Cycles (AHRQ 2017)
Fishbone / Ishikawa diagram for possible causes of PICC-associated BSI

**MAN**
- Lack of PICC insertion skills
- Fear of failure
- Lack of ownership
- Lack of emphasis on risk and safety awareness
  - Inadequate structured safety program
- Lack of proper monitoring system
- Lack of continuous medical education on science of safety
- Inadequate patient education
  - Lack of counseling and reinforcement
  - Lack of patient empowerment
  - Inadequate reference materials / leaflets
- Inadequate staff education
  - Lack of leadership directed decision process
- Inadequate target setting to reduce CLABSI
  - Lack of infection prevention items
  - Lack of use chlorhexidine (e.g., skin antisepsis / bath)
  - Lack of emphasis to patient (e.g., chlorhexidine surgibath) prior to procedure

**MATERIALS**
- Inadequate Policy & Procedures (P&P) for Hand Hygiene
- Inadequate P&P (with checklist) for PICC line insertion
- Inadequate P&P on risk and safety monitoring
- Processes not reviewed and amended
- Inadequate tracking and trending of CLABSI rates

**ENVIRONMENT**
- Inadequate comprehensive unit-based safety program
- Lack of leadership directed decision process
- Inadequate target setting to reduce CLABSI
- Lack of infection prevention items
- Inadequate reference materials / leaflets
- Lack of opportunity to explore new dressing materials

**EQUIPMENT**
- Lack of equipment
- Lack of medical imaging equipment to support line insertion process
- Lack of funding to explore new technology to reduce infection
- Inadequate monitoring system
- Inadequate CLABSI rates
- Inadequate comprehensive unit-based safety program
- Inadequate target setting to reduce CLABSI
- Lack of emphasis on safety culture / improvement activities

**METHOD**
- Inadequate processes and documentation
- Inadequate staff education
- Inadequate patient education
- Inadequate policies & procedures (P&P) for Hand Hygiene
- Inadequate P&P (with checklist) for PICC line insertion
- Inadequate P&P on risk and safety monitoring
- Processes not reviewed and amended
- Inadequate tracking and trending of CLABSI rates
- Inadequate reference materials / leaflets

**TIME CONSTRAINTS AND LACK OF POSTING (E.G., ON CALL DUTIES)**
- Inadequate personnel training / competency / regular assessments

**LACK OF FUNDING TO EXPLOR Vyte NEW TECHNOLOGY TO REDUCE INFECTION**
- Inadequate equipment
- Inadequate monitoring system
- Inadequate CLABSI rates
- Inadequate comprehensive unit-based safety program
- Inadequate target setting to reduce CLABSI
Goals of reducing hospital acquired infections (HAI) announced
- Target set <5 per 1000 catheter days (adopted from MOH, Malaysia)
- Performance data was transparently shared during CQA-HAI meetings

- Analyzed cause and effects using Ishikawa (Fishbone) diagram
- A series of interventions implemented:
  - Reengineer PICC workflow
    - Patient Education (PICC Patient Information Leaflet)
    - Chlorhexidine bath prior to PICC procedure
    - Chlorhexidine skin antisepsis (monitoring checklist)
    - Hand hygiene and maximal sterile barrier precautions (monitoring checklist)
  - Standardized dressing
  - Safety rounds established by Interventional Radiology team (24 hours and 48 hours) post insertion
  - Daily assessment of line at ward (monitoring checklist)
  - Explore new technology / medical imaging units for central line insertion
  - Process and progress evaluation (e.g., analyses and improvement activities)

- Staff training and awareness of CUSP model
- Education and awareness using Science of Safety

- Organizational level, clinical quality assurance (CQA) committee formed.
- Unit level, the CUSP model applied using an implementation science framework (Science of Safety)
- Concerted efforts initiated to drive culture change through CUSP model - awareness program
- Infrastructure initiated to support quality improvement efforts
- Obtain leadership commitment

- CUSP implemented with team-based approach – collaboration effort of medical imaging department with infection control department and a surgical ward
- CUSP team formed - created coordinating team and engaging clinical department staff, including
  - radiologists
  - infection control physician
  - radiographers
  - medical doctors
  - nurses (from medical imaging, infection control team and surgical ward)
CUSP TEAM - HOW FINAL SOLUTION WAS DETERMINED?

**Root Cause(s)**

- Inadequate processes and documentation
- Inadequate patient education
- Inadequate staff education

- Lack of PICC insertion skills
- Lack of daily monitoring line
- Lack of ownership

- Lack of funding to explore new technology
- Lack of equipment to guide the central line insertion process *(existing unit is shared with other clinical areas)*

- Lack of emphasis on safety culture / improvement activities
- Inadequate safety programme
- Inadequate target setting to reduce CLABSI

- Lack of infection prevention items
- Lack of use of antisepsis solutions items
- Lack of opportunity to explore new dressing materials

**Solutions / Interventions**

1. Prepare new Standard Operating Procedures
2. Prepare checklist for monitoring and documentation
3. Staff education and awareness on science of safety
4. Patient education – use Patient Information Leaflet (PIL) to aid explanation and understanding

1. More opportunity for personnel to learn skills (more clinical postings)
2. A proper daily monitoring system in Electronic Medical Record (EMR) for documentation and data analysis
3. Staff empowerment initiatives (dedicated team with appointed team leader)

1. Procure a new ultrasound unit
2. To secure grants / fundings **Rejected due to lack of funding**

1. To apply Comprehensive Unit-Based Safety Program (CUSP)
2. To map and conduct improvement activities following the CUSP model
3. Leadership buy in – set target rate based on guidelines
4. Goals of reducing Hospital Acquired Infections (HAI) announced

1. Reengineer workflow
2. Apply chlorhexidine skin antisepsis and bath before procedure
3. Compliance to hand hygiene and maximal sterile barrier precautions
**INTERVENTION - REENGINEER PICC WORKFLOW**

### PRE-INTERVENTION

1. No Patient Information Leaflet (PIL) on PICC procedure
2. No emphasis on surgibath pre-procedure
3. Interventional Radiology (IR) checklist not in place
4. Patient Information Leaflet (PIL) not used to educate patient
5. Inadequate patient education (post procedure care)
6. Patient assessment and monitoring done by ward staff

### POST INTERVENTION

1. Patient education on PICC procedure - PIL [Medical Officer (MO)]
2. Emphasis on surgibath pre-procedure during appointment (Radiographer)
3. Reinforcement on surgibath during pre-procedure ward round (MO / Ward nurse)
4. Fill IR checklist (e.g., surgibath, chlorhexidine skin antisepsis, hand hygiene & maximal sterile barrier, precautions, standardized dressing etc.) (MO / Nurse / Radiographer)
5. Patient education using PICC-PIL (MO / Radiographer)
6. Reinforcement of patient education and understanding on PICC procedure and consent (MO)
7. Reinforcement on PICC post care using PIL (MO / Nurse)
8. Reinforcement on patient education (e.g., counseling and understanding of the risks & costs for reinsertion) during safety rounds (MO / Radiographer)
9. Patient assessment and daily monitoring documentation (Ward nurse)
PERIPHERALLY INSERTED CENTRAL CATHETERS (PICC) ASSOCIATED BLOODSTREAM INFECTIONS

RESULTS

Following CUSP intervention:

• PICC-associated BSI rates had reduced from **3.4 per 1,000 central line days** pre intervention to **2.7 per 1,000 central line days** post intervention.

• Correspondingly, **BSI rate** had reduced from **8.8%** to **5.9%**.
• CUSP intervention was effectively implemented, and **reduced BSI associated with PICC-lines** inserted at a medical imaging department of a teaching hospital.

• Such interventions should be considered in other medical imaging departments, as it involves **minimal cost** with potentially **large impact** on PICC-associated BSI which are potentially **life-threatening**.

• It is believed that the results of this quality improvement study will **improve healthcare and safety practices**, which will be manifested in measurably **better outcomes** for patients.

**CONCLUSION**

**NEXT STEP**

• Expand the CUSP model to include **other wards** in this hospital
• Culture of **continuous improvement** to **reduce CLABSIs**
• Aim for **ZERO** PICC-associated BSIs