

TOPIC FOR DISSERTATION

QUALITY IMPROVEMENT IN CRITICAL CARE AREAS USING THE LEAN SIX SIGMA APPROACH

A study on compliance with quality indicators, at a tertiary care hospital in Durgapur

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P R E S E N T E R



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INTRODUCTION

- An intensive care unit (ICU) provides critical lifesaving care to patients who are severely sick or in a life-threatening situation.
- Patients in critical care units require 24 hours medical care and attention, in order to sustain their body functions in normal condition.
- As such, quality control is crucial in these areas and for this, quality indicators are used to track the performance.
- The quality of service in any ward in the hospital including the CCUs, largely depend upon the nursing staffs working there.
- Hence, this study aims to study the compliance of the nursing staffs with the quality indicators in the critical care areas of the hospital using the Lean Six Sigma approach.
- Lean Six Sigma approach is being used to increase the overall efficiency of the ICU by the detection of causes of deviations from the optimal process, their removal, and, as a result, providing a complete process performance improvement.

Scope of the department

Critical Respiratory Support

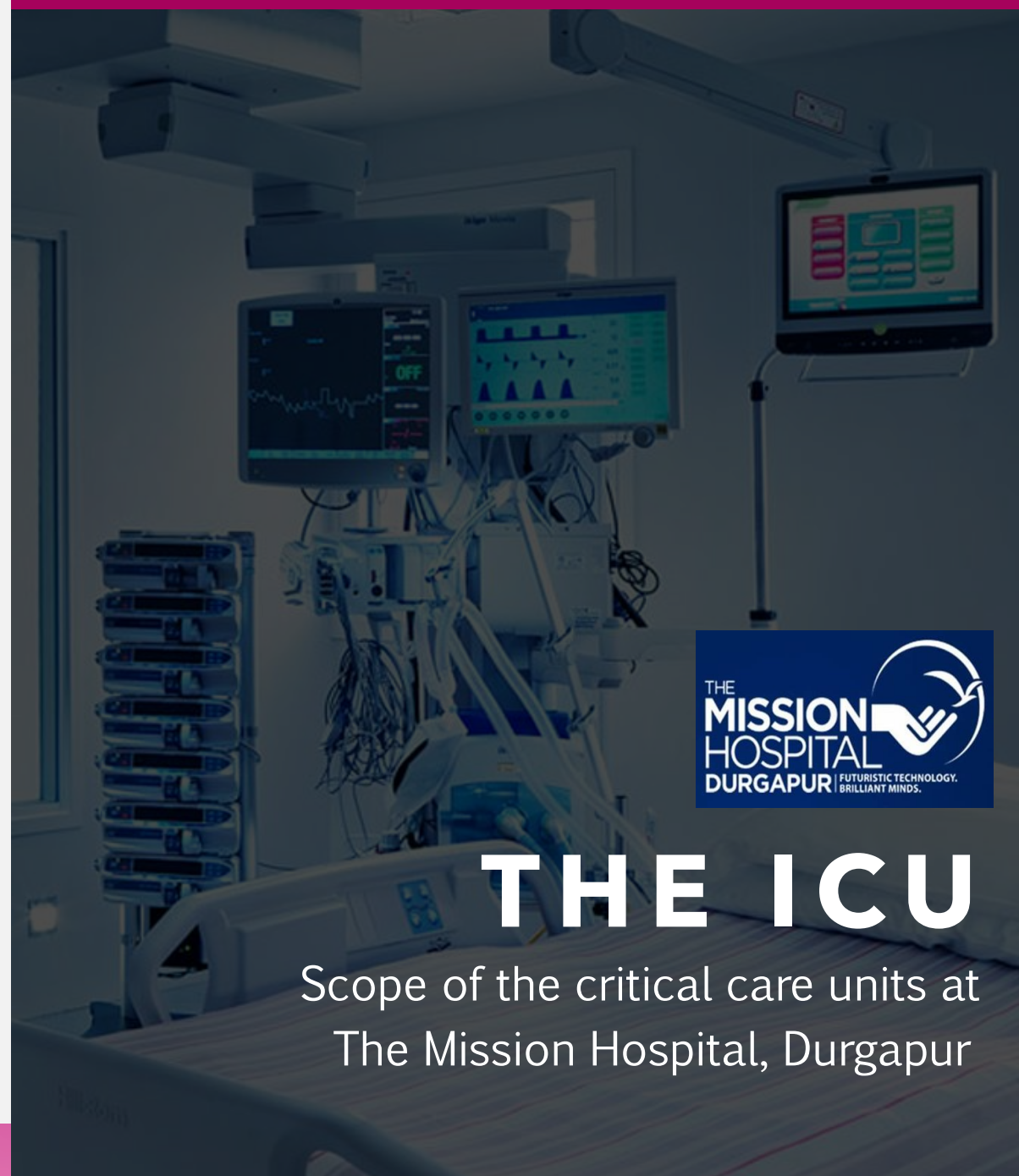
Recognition and treatment of life threatening conditions

Fluid and electrolyte therapy

Recognition and treatment of hemodynamic instability

Management of ethical issues involved in patient autopsy, consent, end of life care, and withdrawal of care

Psychological aspects of intensive care and critical illness



THE ICU

Scope of the critical care units at
The Mission Hospital, Durgapur



RESEARCH AGENDAS

Research Questions

- What is the compliance of various quality indicators being measured for the quality assessment in the critical care areas of The Mission Hospital, Durgapur, and the main reasons for the outliers?
- What is the difference in knowledge and practice towards various quality indicators in the critical care areas of the hospital, among the nursing staffs, according to various background characteristics?

The Objectives

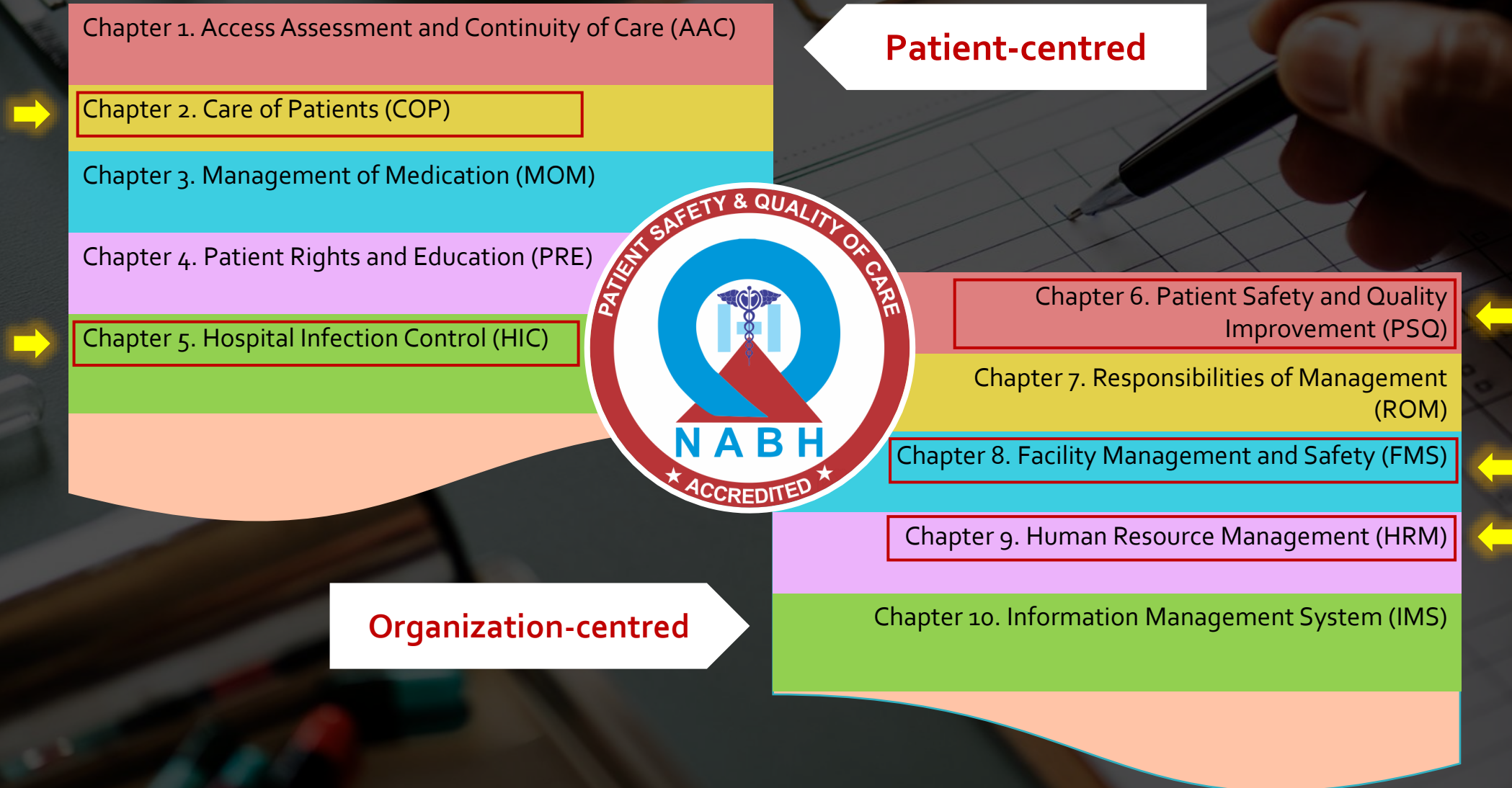
1. To determine the compliance level to different quality indicators of the ICUs in the hospital. – **General Objective**
2. To study the gap between knowledge and practice among the nursing staffs of ICUs regarding compliance to the quality indicators. – **General Objective**
3. To study the secondary data obtained from the HMIS and analyze the trend shown for various quality indicators for the last 6 months. – **Specific Objective**
4. To identify reasons for non-compliance to quality indicators in the ICUs of the hospital. – **Specific Objective**
5. To identify key improvement areas for increasing the compliance level towards quality indicators in the ICUs of the hospital. – **Specific Objective**

Research Hypothesis

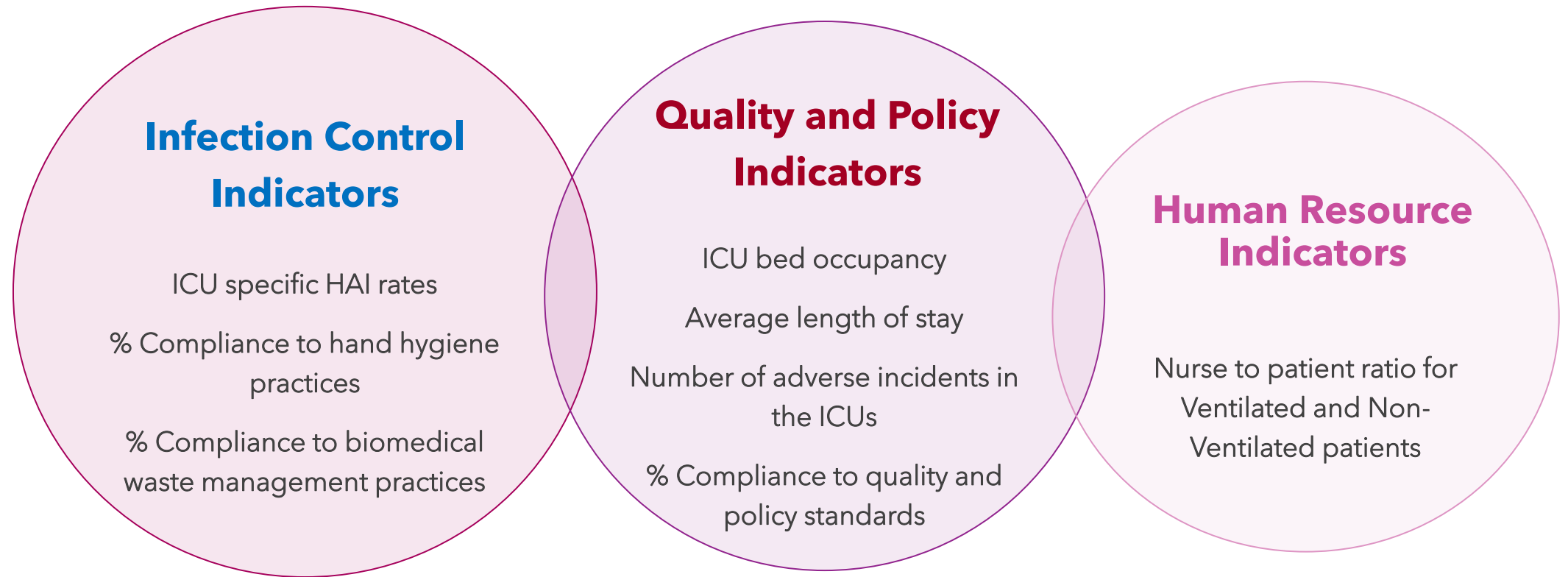
- ❑ **Null Hypotheses (H0):** There is no difference in knowledge and practice towards various quality indicators in the critical care areas of the hospital, among the nursing staffs, according to various background characteristics.
- ❑ **Alternate Hypotheses (H1):** There is a difference in knowledge and practice towards various quality indicators in the critical care areas of the hospital, among the nursing staffs, according to various background characteristics



NABH 5th Edition Standards



KEY PERFORMANCE INDICATORS CONSIDERED FOR THE RESEARCH



LITERATURE REVIEWS

A summary of the key findings



In a study conducted by Peter Pronovost et al., interventions like hand washing, using full-barrier precautions during the insertion of catheters, cleaning the skin with chlorhexidine etc. resulted in reduced incidence of catheter-related bloodstream infections



Didier Pipet et. al. conducted a study to observe the average compliance with hand hygiene during regular patient care in a teaching hospital in Geneva. The campaign resulted in a sustained increase in hand hygiene compliance, as well as a decrease in nosocomial infections and MRSA transmission.



A research conducted by Todd Dorman et. al. used daily goal forms as an intervention among the residents and nursing staffs working in the ICUs. After the study period, the average length of stay in the intensive care unit was observed to have reduced from 2.2 to 1.1 days.



WHO Clean Care is Safer Care programme - In its 3 years of existence, the First Global Patient Safety Challenge has gained great traction, due to the mobilization of countries, healthcare executives, patients, and technical specialists to support the initiative through effective action. There is a widespread growth of an improved hand hygiene.

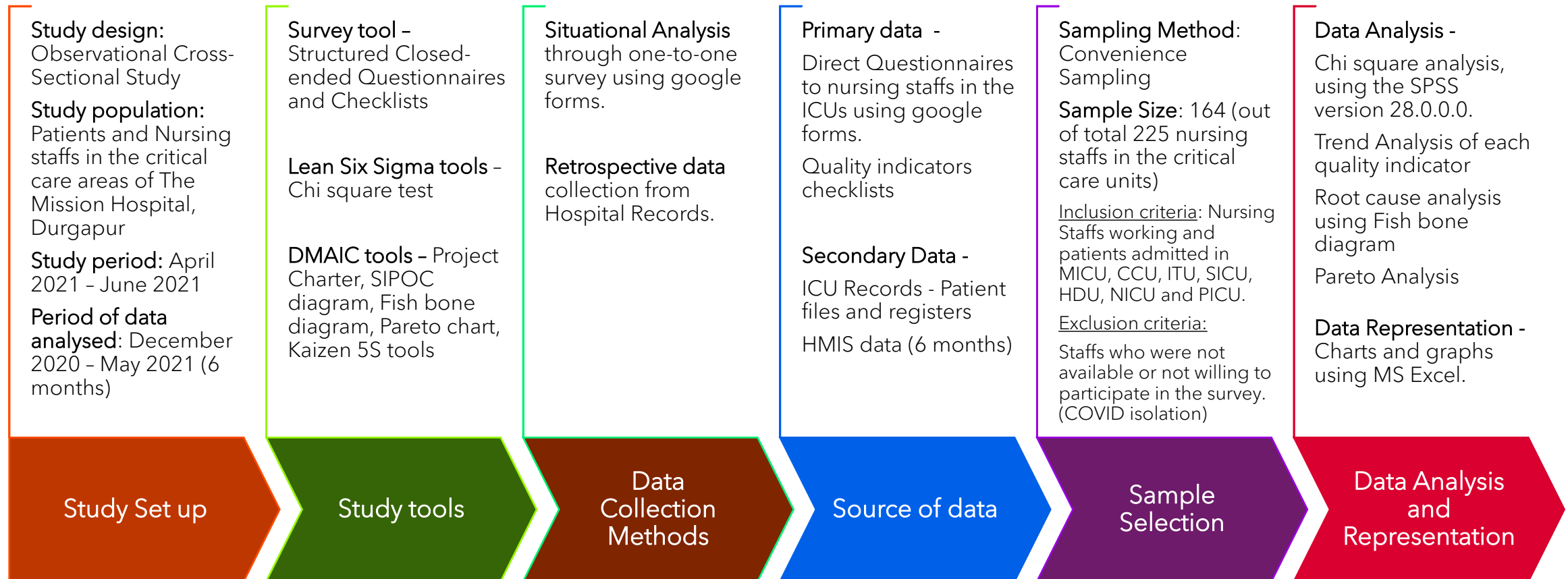


The relation of NNPR (Night time Nurse to Patient Ratio) with patient mortality, ALOS, hospital expenditure, and specific surgical problems was determined by R K Amaravadi et. al. A NNPR of more than 1:2 increases the likelihood of various postoperative respiratory and infectious problems, as well as higher resource consumption.



In a randomized clinical trial conducted by Derek Angus et. al., it was observed that high-intensity vs. low-intensity ICU physician staffing is linked to lower hospital and ICU mortality, as well as shorter hospital and ICU lengths of stay.

MATERIALS AND METHODS

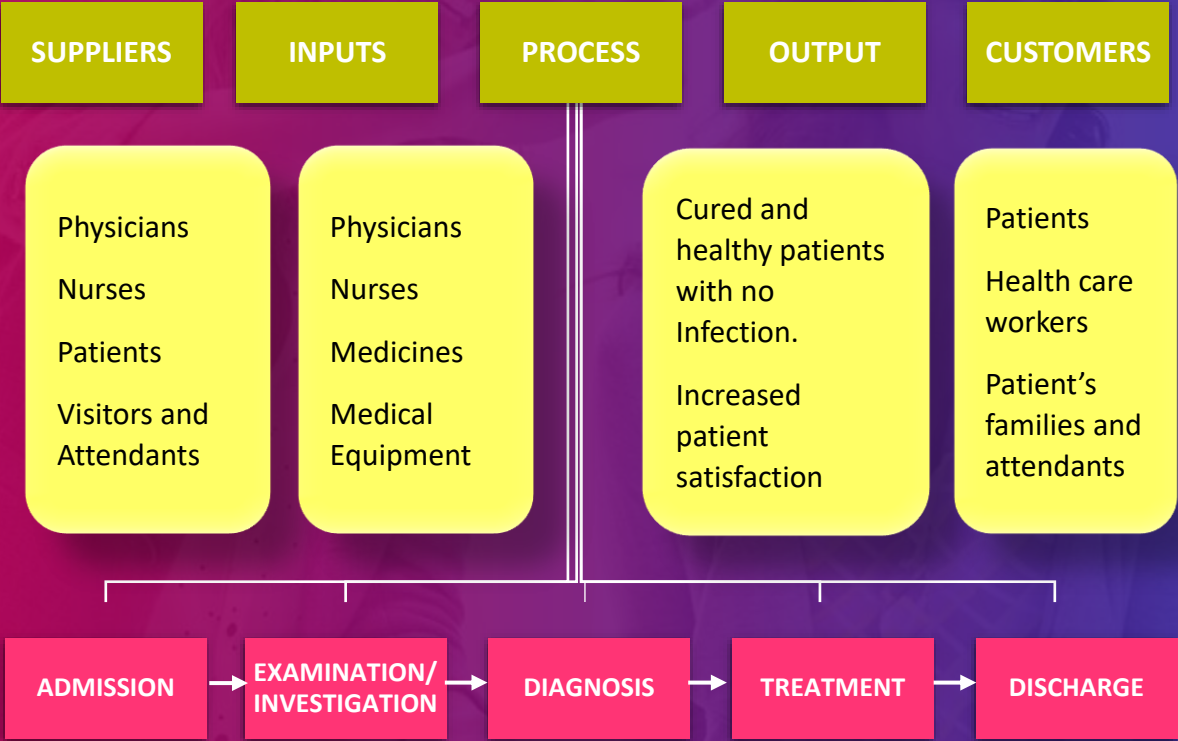


Results

Divided into Define, Measure, Analyse, Improve and Analyse Phases

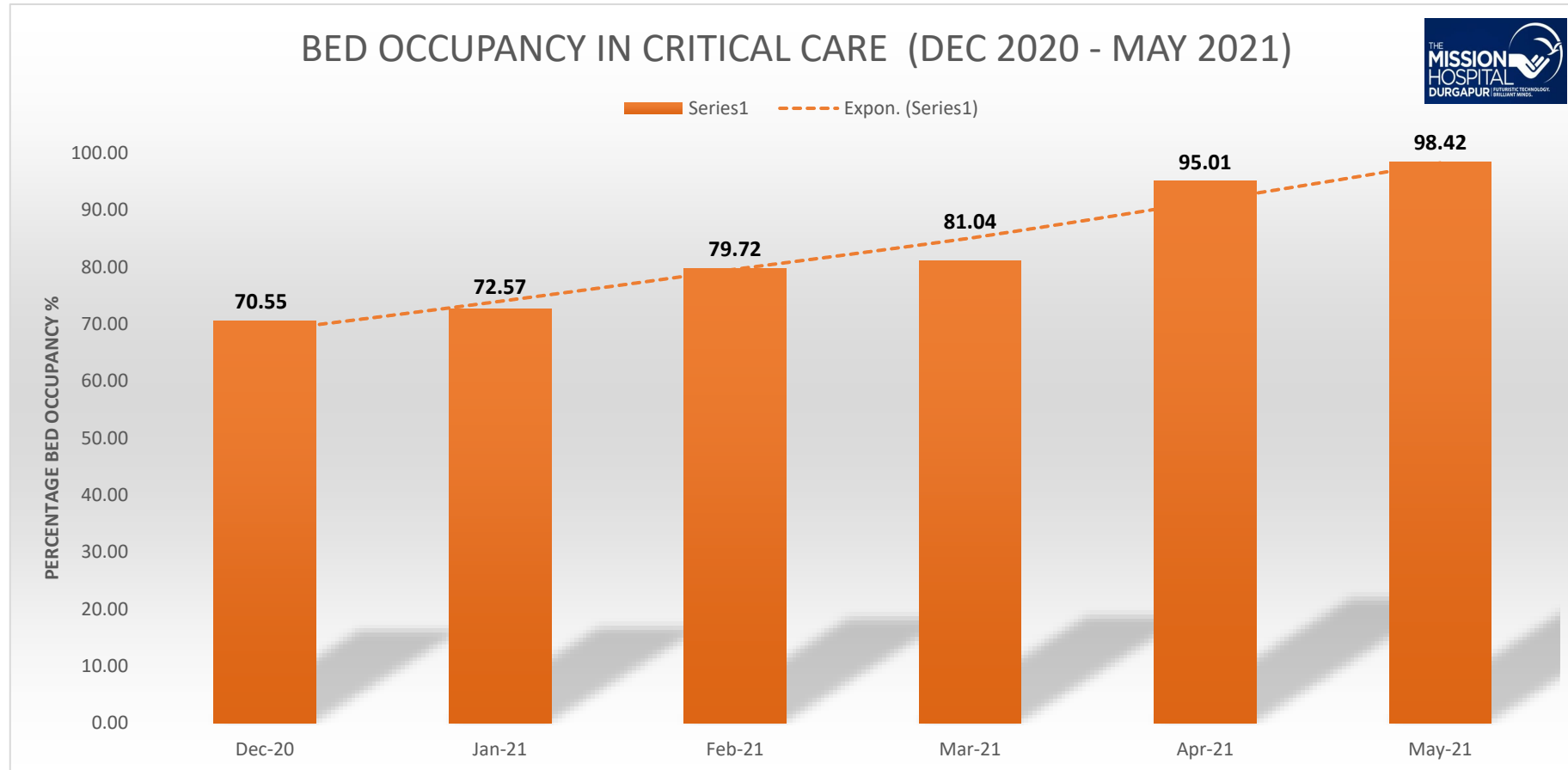


Problem Statement There is a decreased compliance to quality indicators among the medical staffs of the critical care areas in The Mission Hospital, Durgapur.		Stakeholder Needs Increase in the hospital revenue. Availability of hospital resources and its optimum utilization.
Project Title Analysing the compliance to quality indicators among the medical staffs of the critical care areas in a tertiary care hospital in Durgapur - a DMAIC approach		Project Goals Increased Revenue and availability of hospital resources. Decreased incidences of HAIs Decreased Average length of stay for the patients admitted in ICUs Increased compliance to NABH quality guidelines.
Estimated Cost Saving To increase the bed availability by 20% and increase hospital revenue by 35%. To increase patient footfalls by increasing the patient satisfaction by reducing their average length of stay.	Key Actions Develop a fish bone (Ishikawa) diagram Develop data collection plan Do pareto analysis Identify KPIs Define standards and indicators (NABH)	Barriers Non-compliance by the medical staffs in ICUs. Improper record keeping. Inadequate knowledge about NABH quality guidelines.
Scope of the project Identifying the key improvement areas for increasing the compliance level of the medical staffs towards quality indicators in the ICUs of the hospital, in order to increase the quality of services being delivered to the patients.		
Project Timeline		
Define	Identification of the problem area in the ICUs Developing tools for data collection	1 week
Measure	Collection of data through patient checklist Conducting ICU staff questionnaire Conducting Document Audit Collection of data from registers and patient files Collection of data in the ICU matrix Collection of data from Infection Control Department	8 weeks
Analyse	Analysis of data from all the ICUs of the hospital Analysis of data from patient files and registers of the ICUs for the past 6 months	2 weeks
Improve	Data Interpretation and Representation Designing solutions and proposals	1 week
Control	Approval of Proposed Solutions	1 week



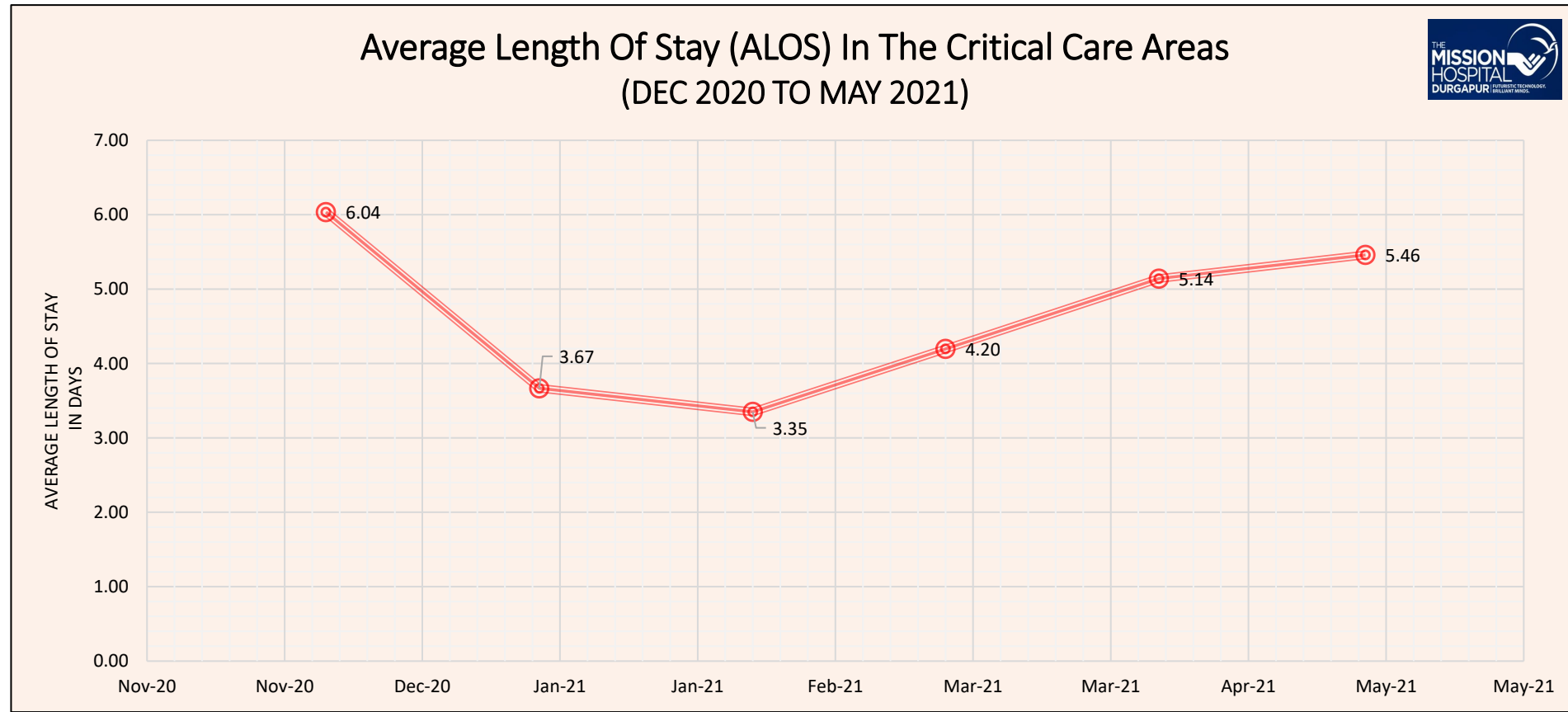
Trend Analysis

Bed Occupancy in the critical care areas for last 6 months



Trend Analysis

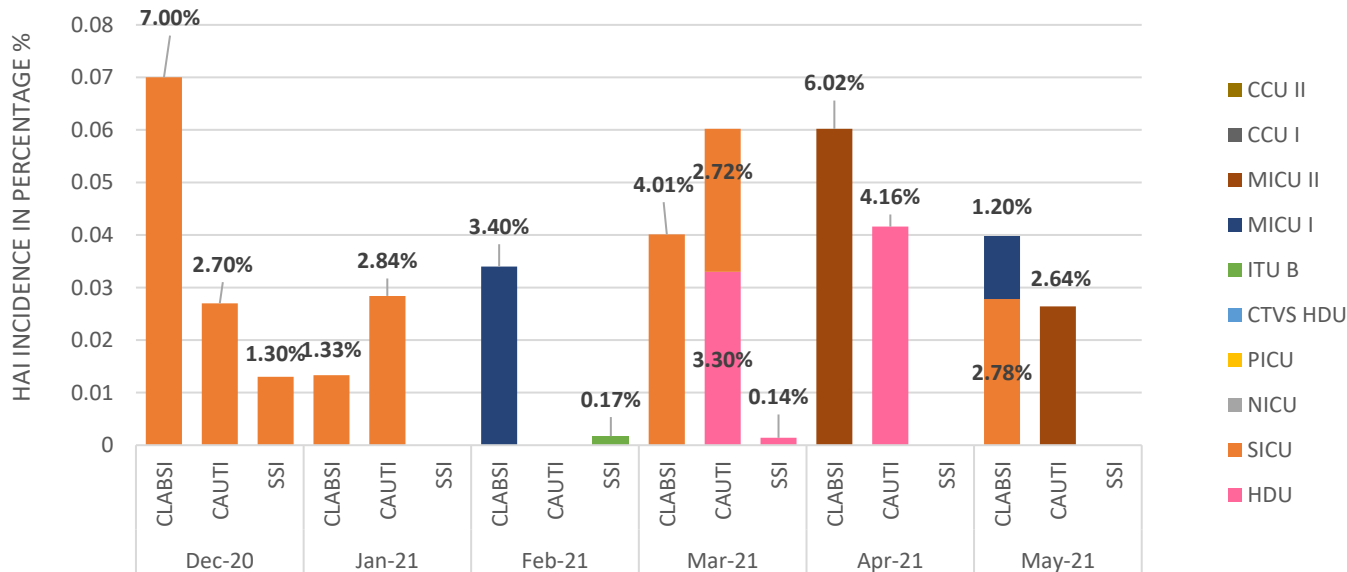
Average Length of Stay for patients in the critical care areas for the last 6 months



Trend Analysis

Hospital Acquired Infection Rates in the Critical care areas for the last 6 months

HAI INCIDENCE PERCENTAGE IN THE CRITICAL CARE AREAS
(DEC 2020 TO MAY 2021)

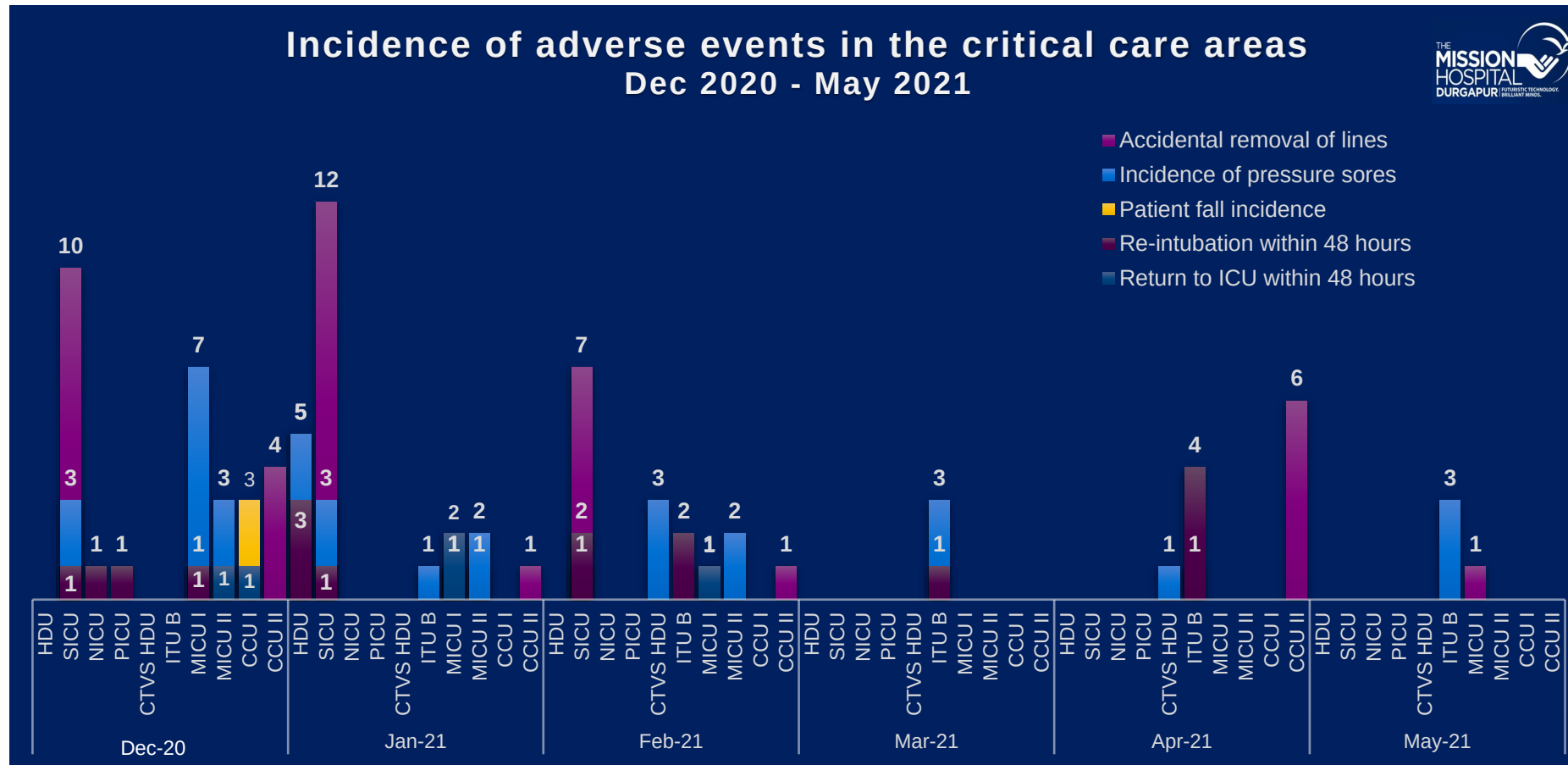


Hospital Acquired Infection	Actual Frequency	Benchmark
Central Line Associated Blood Stream Infections (CLABSI)	4.5%	1%
Catheter Associated Urinary Tract Infections (CAUTI)	5.5%	3%
Surgical Site Infection (SSI)	0.9%	0%
Respiratory Tract Infection	0%	2%
Ventilator Associated Pneumonia (VAP)	0%	0%
Skin Infections	0%	0%

Benchmark as per NABH standards (5th edition)

Trend Analysis

Incidence of Adverse events in the Critical Care Areas for the last 6 months



Nurse to Patient Ratio in the critical care areas for the last 6 months

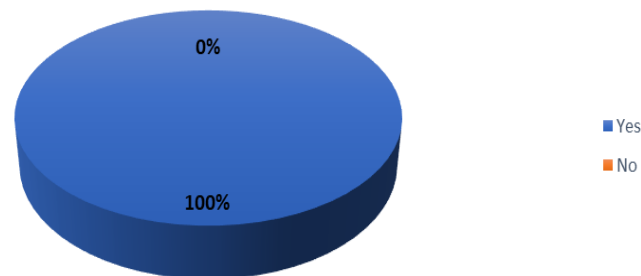
The nurse-to-patient ratios maintained in the critical care areas is as per NABH standards, i.e., 1:1 for ventilated patients and 1:2 or 1:3 for non-ventilated patients.

A typical shift wise nursing staff distribution in the ICUs of the hospital is shown in the given table.

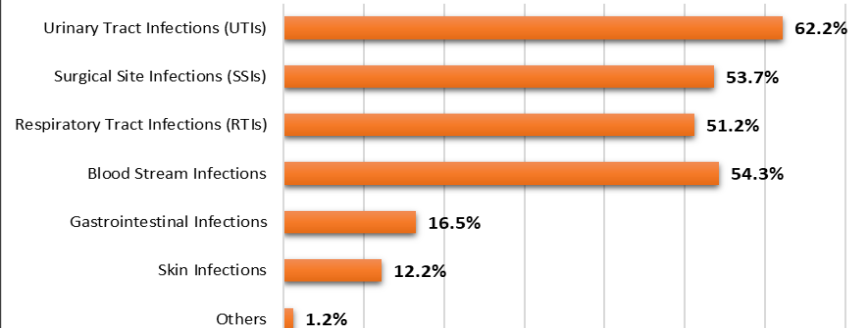
WARDS	MORNING SHIFT			EVENING SHIFT					NIGHT SHIFT			STAFF ABSEN T	DAY OFF	LEAVE	TOTAL STAFF
	T PT		TOTAL STAFF	T PT		ACTUA LSTAFF	EXTRA SHIFT	TOTAL STAFF	T PT		TOTAL STAFF				
	VENT+ BIPAP	NON- VENT		VENT+ BIPAP	NON- VENT				VENT+ BIPAP	NON- VENT					
MICU-I			12			8	4	12			12				49
MICU-2			6			5	1	6			6				25
CCU-I			6			4	1	5			5				23
CCU-II			6			3	3	6			5				23
C/S HDU			4			2	1	3			5				15
CTVS ITU-B			6			5	2	7			6				22
NICU			2			2	2	4			2				22
PICU			3			3	0	3			3				11
HDU			5			3	2	5			4				20
SICU			7			3	3	6			6				23
TOTAL			57			38	19	57			54				225

Distribution of Nurses according to their shifts in the critical care areas of the Hospital

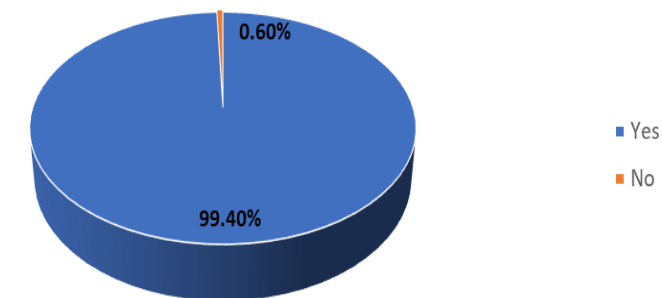
Are you aware of the Hospital Acquired Infections (HAIs) in your hospital?



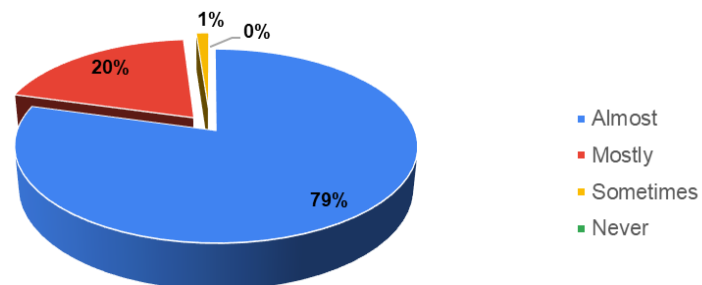
Which of the following HAIs are commonly seen in the critical care areas of the hospital?
(You can select multiple options)



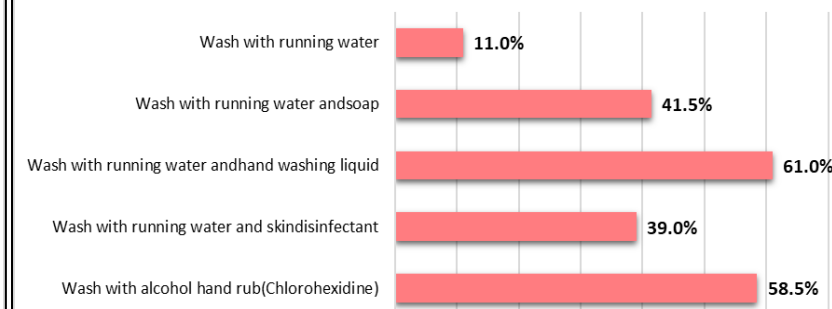
Do you know about the "5 moments of Hand Hygiene"?



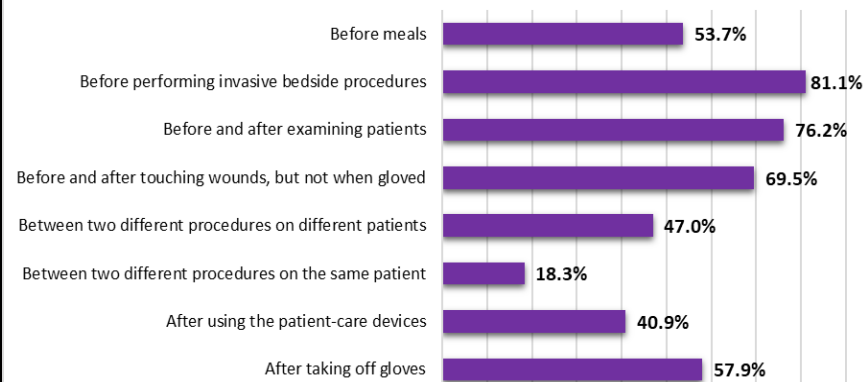
Do you follow the "5 moments of hand hygiene"?



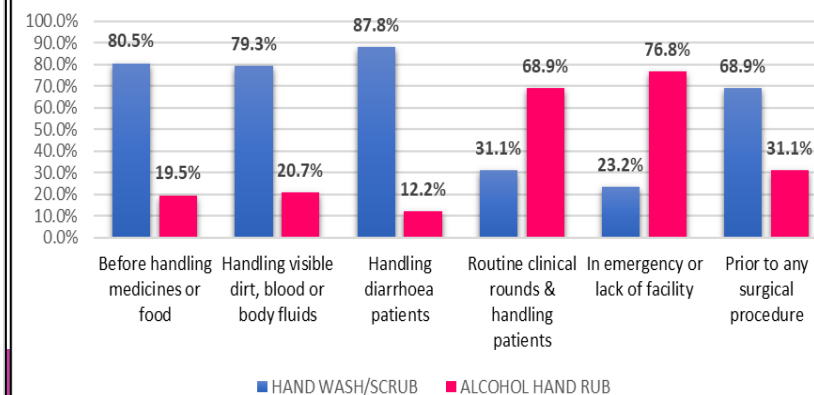
How do you usually wash your hands while ON DUTY?
(You can select multiple options)



When do you wash your hands in the hospital?
(You can select multiple options)



Choose the option that fits right for your hand washing practice.



SURVEY RESULTS

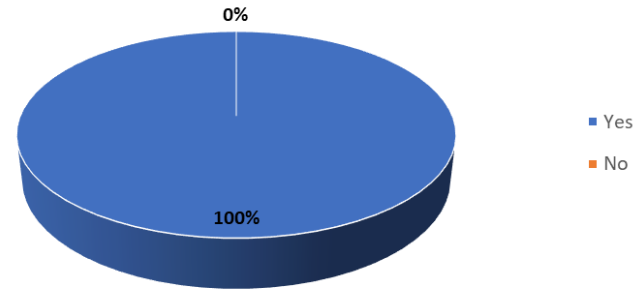
Questions on Infection Control



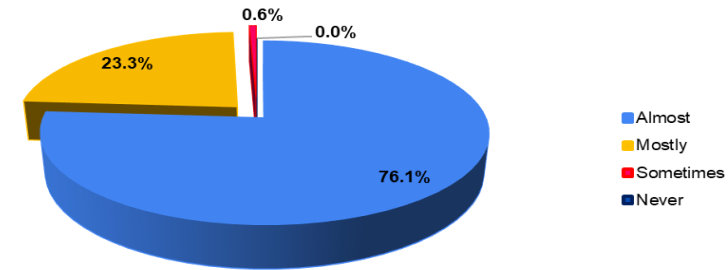
SURVEY RESULTS

Questions on Biomedical Waste Management

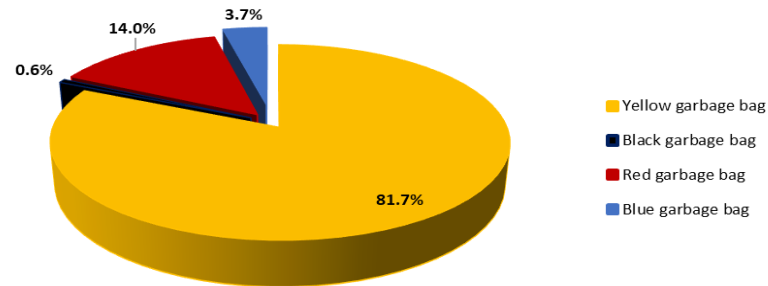
Do you know about the color coding of Bio medical Waste management?



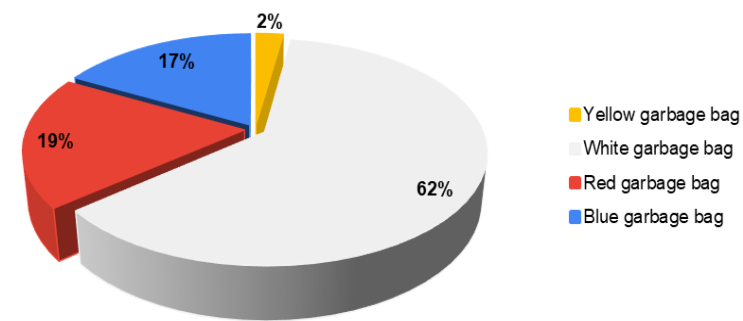
Do you follow the prescribed color coding protocol while disposing waste at the hospital?



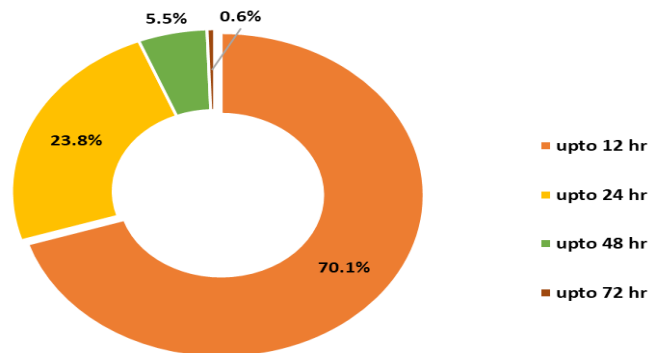
Where do you dispose infectious waste from patients? (pus, body fluids etc.)



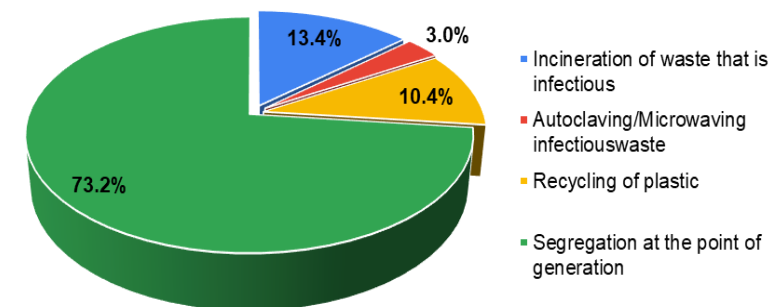
Where do you dispose sharp items and syringes (without needles)?



Infectious waste can be stored in the health care unit



The "key step" to "waste minimization" and management of waste is



SURVEY RESULTS

Questions on Quality and Policy Indicators

Choose the options that describe the policy protocols you follow in the Critical Care areas.				
	Always	Sometimes	Rarely	Never
Daily assessment of patient condition	77.4%	18.3%	4.3%	0%
Follow end of life care guidelines	65.9%	24.4%	9.1%	0%
Report needle stick injuries	65.9%	27.4%	6.7%	0%
Report any adverse events	57.9%	33.5%	7.9%	0%
Regular fall monitoring	74.4%	18.9%	6.7%	0%
Regular pressure ulcer monitoring	68.3%	25.6%	6.1%	0%
Isolation of Infected Patients	54.3%	26.2%	11.6%	0%
Following a daily structured handover	70.7%	25.0%	4.3%	0%
Reporting medication errors	65.9%	28.7%	5.5%	0%



Chi- Square Analysis

Chi square analysis and p-value for the distribution of nursing staffs with respect to their knowledge and practice was performed. The score above 60% in both knowledge and practice were grouped as Good and rest were grouped as Poor.

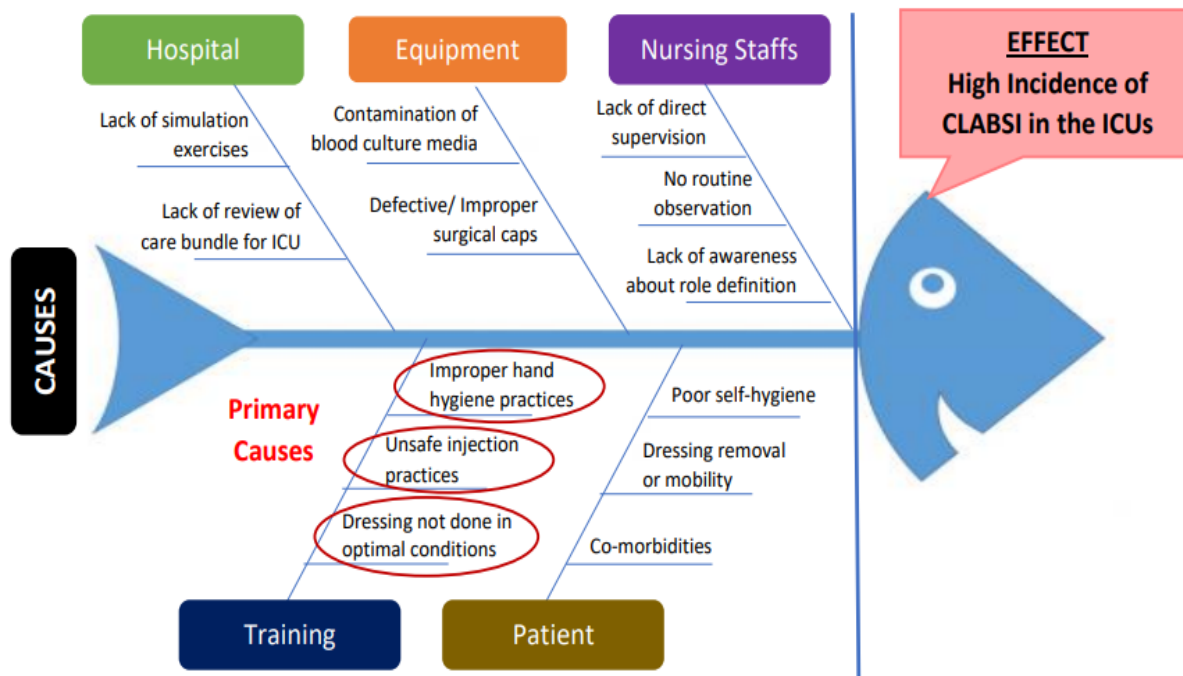
A P-value < 0.05 was considered to indicate asymptomatic significance.

The p-values marked yellow showed a highly significant difference i.e. practice of the nursing staffs w.r.t. seniority level and number of trainings attended by them. As such, the practice behavior was seen to be better with increasing seniority and with increased number of trainings attended by the nursing staffs.

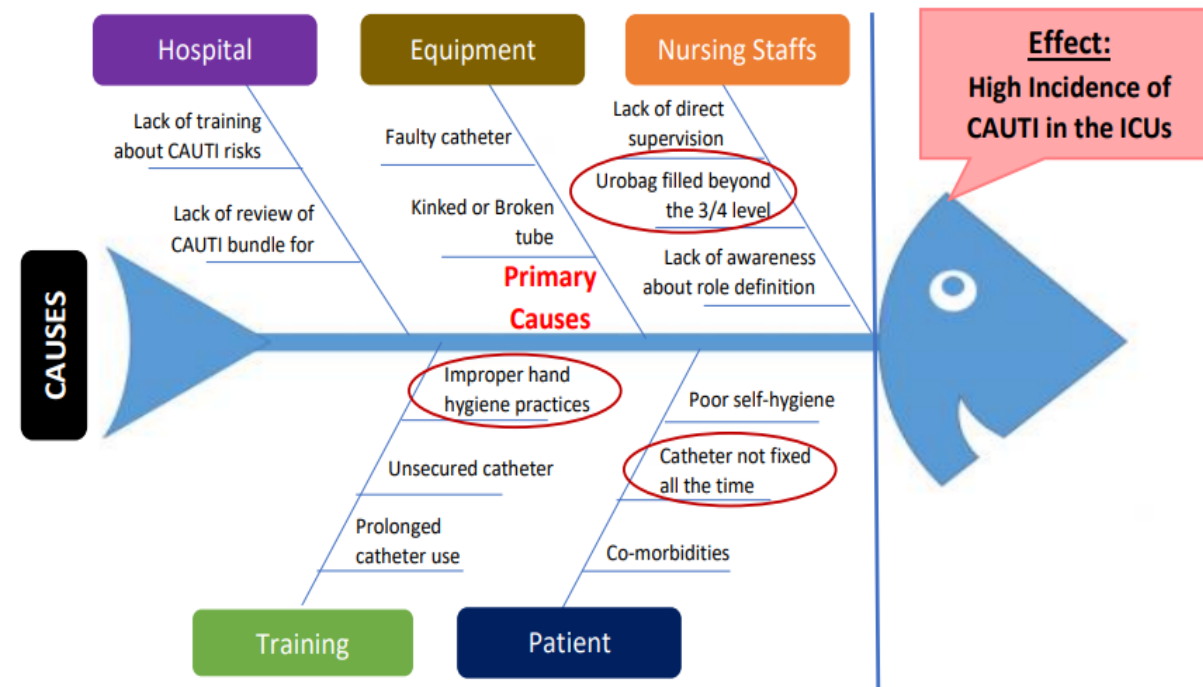
Variables		Knowledge				Practice			
	Total	Good	Poor	Pearson's Chi Square	Asymp. Sig. (2 sided)	Good	Poor	Pearson's Chi Square	Asymp. Sig. (2 sided)
Wards	164	χ^2				χ^2			
HDU	29	21	8	2.762	0.838	12	17	8.514	0.203
SICU	16	12	4			10	6		
NICU	12	7	5			3	9		
PICU	7	6	1			4	3		
ITU	15	12	3			9	6		
MICU	52	39	13			19	32		
CCU	33	26	7			18	15		
Experience									
0-1 years	71	51	20	0.053	0.997	31	40	5.409	0.144
1-3 years	54	42	12			25	29		
3-5 years	29	22	7			16	13		
> 5 years	10	8	2			7	1		
Trainings attended									
1	63	47	16	3.082	0.214	26	37	18.023	0.00012
2-3	86	62	24			61	25		
4 or more	15	14	1			12	2		
Position held									
Senior Level	39	33	6	5.937	0.0514	31	8	11.48	0.00322
Assistant	107	83	24			69	38		
Trainee/Intern	18	10	8			6	12		

ROOT CAUSE ANALYSIS

Problem 1 – Fish bone diagram – High incidence of CLABSI



Problem 2 – Fish bone diagram – High incidence of CAUTI



ROOT CAUSE ANALYSIS

Problem 3 – Primary Reasons for Increased Incidence of Pressure Sores

- Prolonged bed ridden patients having a longer length of stay
- Patients having increased albumin in their blood due to any disease condition.
- Under supervision of patient positioning - 2 hourly position change not done.
- Inadequate monitoring of HAPUs - Irregular monitoring in Braden pressure ulcer scale.
- Prolonged wearing of diapers by patients or non-supervision by the GDA while cleaning excreta.

Problem 4 – Primary Reasons for Increased Incidence of Accidental removal of lines

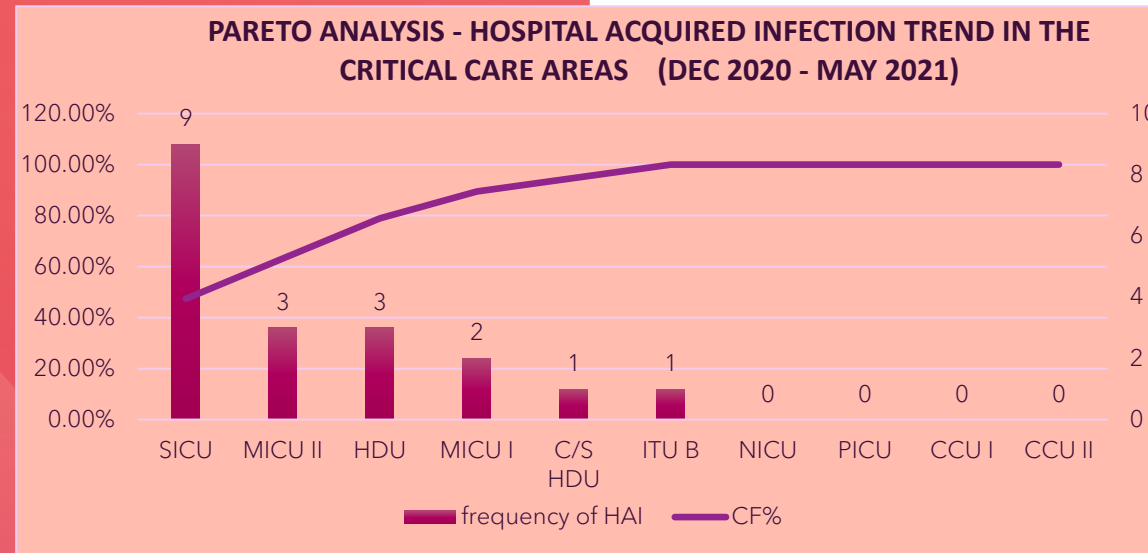
- In case of a restless or irritable patient
- Lack of awareness during shifting of patients
- Self-removal by patients

Accidental removal of Catheter Line is linked to issues from both the removal and the reinsertion of the catheter. As a result, determining the incidence is critical in order to put preventative measures in place.



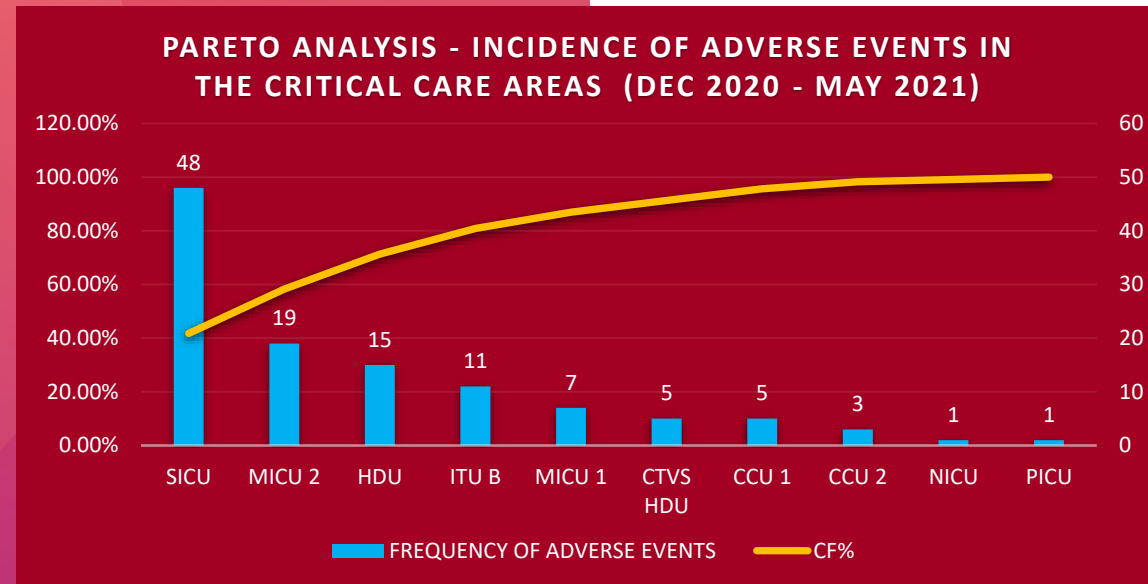
ANALYSE PHASE

PARETO ANALYSIS



70-80% of the Hospital Acquired Infections are reported from the three ICUs i.e., SICU, MICU II and HDU.

So, focusing on reducing the HAI rates in these 3 ICUs can significantly reduce the majority of HAI rates in the critical care areas of the hospital.



70-80% of the incidents are reported from the SICU, MICU II and HDU.

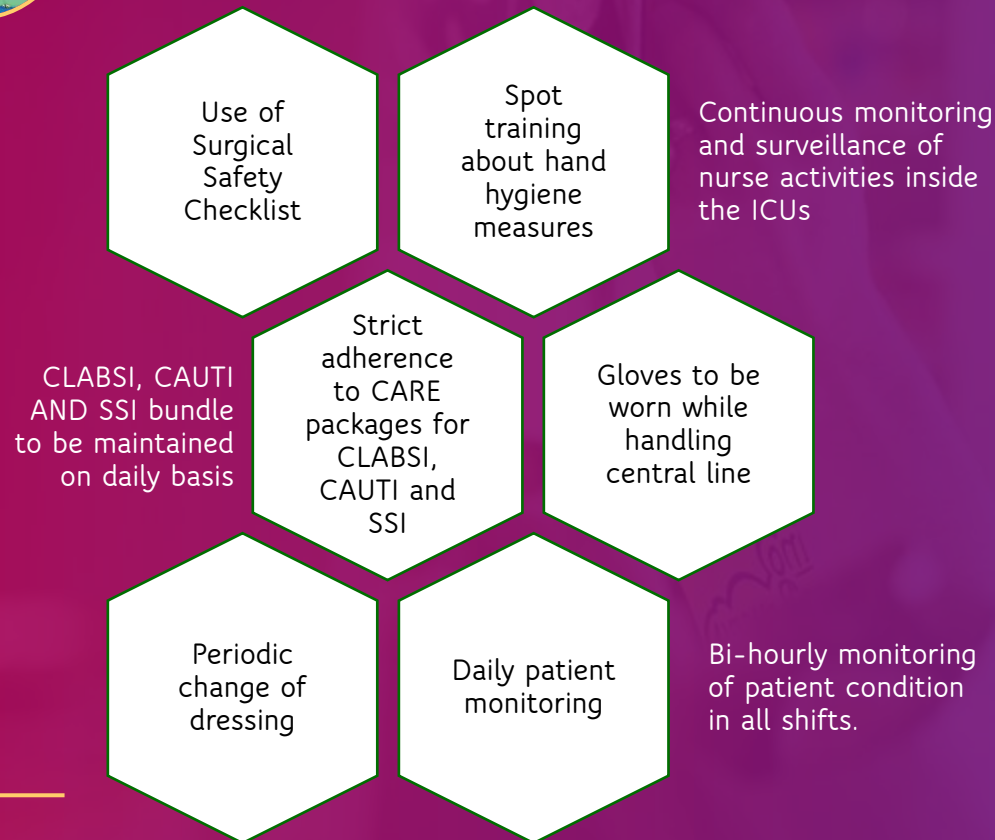
So, careful monitoring strategies in these 3 ICUs can significantly reduce the rate of adverse events in the critical care areas of the hospital.

CA/PA – Corrective Actions & Preventive Actions

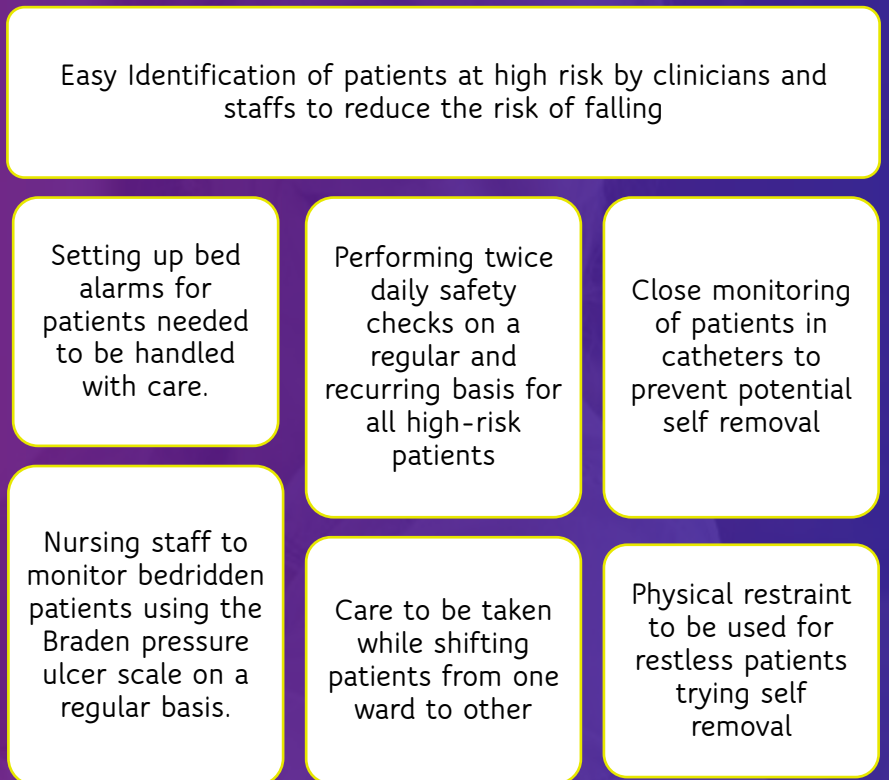
IMPROVE PHASE



Increase in nosocomial infection rate



Increase in incidence of few adverse events in the ICU



CA/PA – Corrective Actions & Preventive Actions

IMPROVE PHASE



Decreased compliance with infection control guidelines

Medical waste must be handled and disposed of properly.

Safety, hygiene, and infection control procedures to be strictly followed. PPE to be worn as and when required.

In critical care areas, a proper temperature of up to 60 degrees Celsius should be maintained.

Hand washing should be emphasized following any contact with the patient.



Gaps in the knowledge and practice regarding quality and policy guidelines

Monthly Training of the staffs in the critical care areas, regarding the NABH guidelines & standards

Regular monitoring with open and closed file audits in the ICUs to check the compliance.

Continuous surveillance of the nursing staff's activities, for on-spot identification of gaps and corrective action training.

Multidisciplinary rounds to enhance patient care.

Nurse Trainees, Interns and Nursing assistants should be kept in focus for the training programmes.

Kaizen 5S Technique

Sort

The “Reduce, Reuse, Recycle Concept” could be included with the sorting activities. This may include:

- Segregation and separation of medical waste
- Disposal of waste items in the specific color coded bins.
- Separation of items that can be reused by the hospital, at the point of generation.

Set (Set in order)

- The tools that could be used for the “set” activity are;
Red Tag, Numbering, Alphabetical order, color coding, zones, safety signs, checklists etc.
- The ICU could be divided into zones for isolation of patients with communicable disease (like COVID-19).
- Color coding of patient bands who have a high score in the Morse Fall Scale

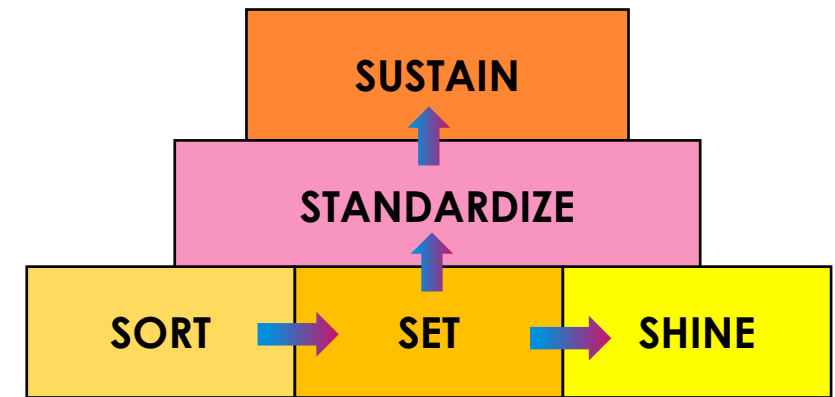
Shine - “Shine” Activity is done to maintain cleanliness in the work area especially in the critical care areas

Standardize

- This activity is a continuous process that involves:
- Making Kaizen 5S a part of daily activity for the nursing and other healthcare staffs.
- Displaying and Pasting IEC material with slogans/pictures of “Sort”, “Set” and “Shine” in the working area of the ICU wards.

Sustain - Regular audits and inspection with close monitoring, to impart 5S in the habit of the nursing staffs and healthcare workers

Steps of Kaizen 5S



CONTROL PHASE

A tentative timeline for execution of the proposed solution

Activities	Tentative duration
Meeting with the operation and quality heads of the critical care areas	1 week
Meeting with the Infection Control Team	1 week
Making a training plan for the ICU nurses	1 week
Deciding training goals and objectives	2 days
Approval of the training plan by the Hospital authorities	3 days
Continuous surveillance monitoring of the nursing activities in the ICUs	4 weeks
Listing out gaps and spot training	1 week
Conducting weekly once training program	12 weeks
Assessing pre and post training knowledge and Practice of the nurses	1 week
Focussing on areas that needs re-evaluation	Continuous





DISCUSSION & CONCLUSION



Recommendations for Infection Control in ICU

Gloves should be used while drawing blood, giving IV/IM injections.

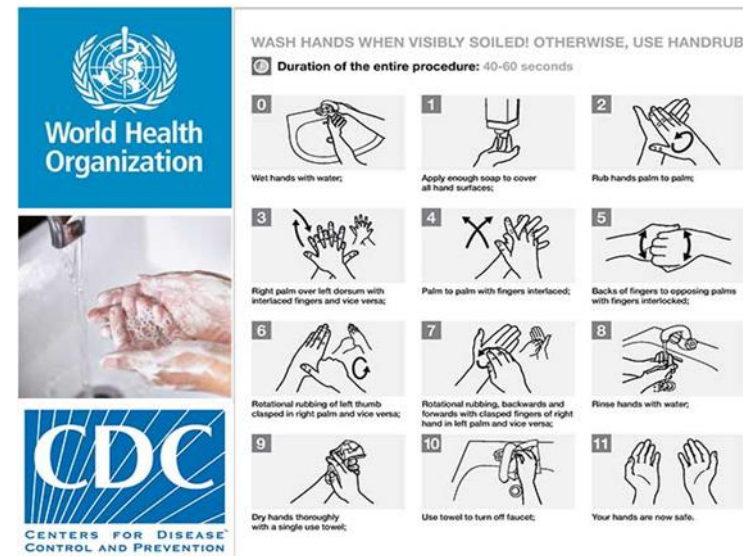
Wash gloves with soap and water after every procedure.

Follow the 5 moments of hand hygiene following all the steps of handwashing.

Destroy needle and syringe hub in needle and syringe destroyer.

Place non sharps e.g., gauze, cotton, clothing, contaminated with blood/ body fluids in polythene bags (Marked yellow).

Any form of accidental spills and/or any exposures to the infectious materials should be reported on immediate basis

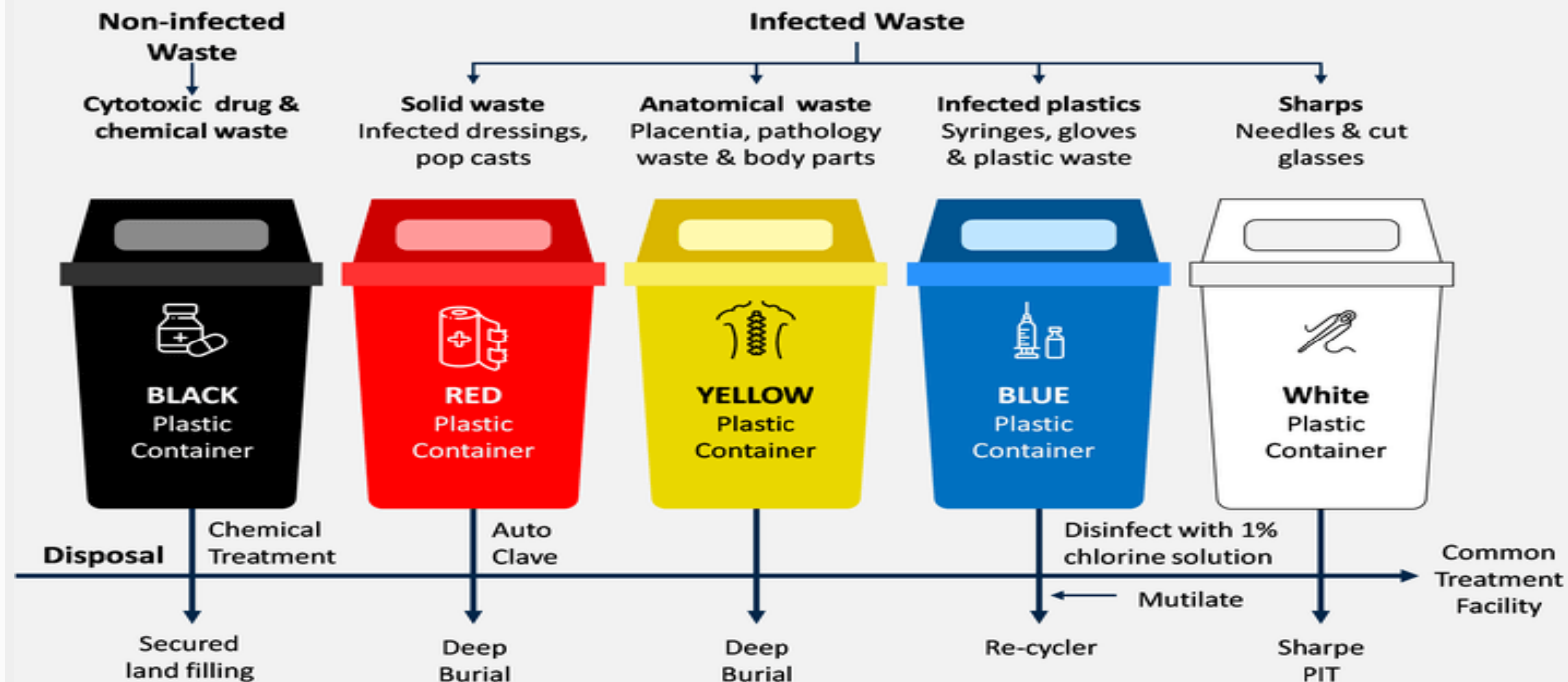


Waste Management in ICUs

Following the appropriate color coding for disposal of medical waste and segregating them at the point of generation.

WASTE SEGREGATION

Segregation of Solid Bio-Medical Waste



Recommendations for adherence to quality and policy guidelines in the ICU

Adequate supervision of critically ill patients

Prevent incidences of pressure sores by regular patient monitoring and evaluation with Braden Pressure Ulcer score

Enforce infection control protocols, including sterilization of equipment and machines;

Report incidences of adverse events like needle stick injuries, patient falls etc to the nursing in charge.

Participate in the trainings and mock drills conducted in the critical care areas.

Follow proper admission and discharge criteria as framed according to the Hospital policies

Follow the EOL care pathways as and when needed.



References



1. DelliFraine JL, Langabeer JR, Nembhard IM. Assessing the Evidence of Six Sigma and Lean in the Health Care Industry. *Quality Management in Health Care*. 2010Sep7;19(3):211–25. [Pubmed]
2. Improta G, Cesarelli M, Montuori P, Santillo LC, Triassi M. Reducing the risk of healthcare-associated infections through Lean Six Sigma: The case of the medicine areas at the Federico II University Hospital in Naples (Italy). *Journal of Evaluation in Clinical Practice*. 2017;24(2):338–46. [Pubmed]
3. Pronovost P, Needham D, Berenholtz S, Sinopoli D, Chu H, Cosgrove S, et al. An Intervention to Decrease Catheter-Related Bloodstream Infections in the ICU. *New England Journal of Medicine*. 2006;355(26):2725–32. [Pubmed]
4. Kim MM, Angus DC, Barnato AE. The Effect of Multidisciplinary Care Teams on Intensive Care Unit Mortality. *Archives of Internal Medicine*. 2010;170(4):369. [Pubmed]
5. Tarnow-Mordi WO, Hau C, Warden A, Shearer AJ. Hospital mortality in relation to staff workload: a 4-year study in an adult intensive-care unit. *The Lancet*. 2000Jul15;356(9225):185–9.[Pubmed]
6. Pittet D, Hugonnet S, Harbarth S, Mourouga P, Sauvan V. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. *The Lancet*. 2000Oct14;356(9238):1307–12. [Pubmed]
7. Pronovost P, Berenholtz S, Dorman T, Lipsett PA, Simmonds T. Improving communication in the ICU using daily goals. *Journal of Critical Care*. 2003Jun18;18(2):71–5. [Pubmed]
8. Pittet D, Allegranzi B, Storr J. The WHO Clean Care is Safer Care programme: Field-testing to enhance sustainability and spread of hand hygiene improvements. *Journal of Infection and Public Health*. 2008Oct27;1(1):4–10. [Pubmed]





THANK YOU!

