

**Fasten The Loops To Loosen The Clasp :
Strategic Reduction Of Central Line Associated Bloodstream Infections**



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INTRODUCTION

Central-line associated bloodstream infection (CLABSI) is a recognized healthcare-associated infection claiming a heavy toll of morbidity, mortality, resources and reputation. An obnoxiously high rising trend of CLABSI got focussed in the hospital infection control committee (HIC) meeting.

Project Priority Index



Project	Department	Potential Savings	Cost to Complete	Probability of Success	Time to Complete	PPI	Rank
	Critical Care					132	5
	Nursing					211	3
CLABSI	Infection Control	\$120270	\$1000	70%	3 months	336	1
	Operations					232	2
	Maintenance					186	4

INTRODUCTION

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Who is the Customer?	What Customer said?	What the Customer meant				
		What is the need?	When is the need felt?	Where is the need felt?	Why is the need felt?	How is the situation handled now?
ICU doctors	High mortality in ICU due to CLABSI	Prevent CLABSI	Critical patients on central line support	ICU	Patient mortality	Excessive broad-spectrum antibiotic usage
Hospital Administration	High patient bill, complaints	Prevent loss of revenue	During discharge/death	Billing & Accounts	TPA and medicolegal issues	Negotiation

INTRODUCTION

CTQ Tree			Project Name: CLABSI	Author (Date): Dr Sourav (06/07/2021)
1) Customer Needs	2) Quality Drivers	3) Quality Requirements (CTQ)		
"What do our customers most expect?"	"How can we satisfy this need?"	"How can we measure each quality driver?"		
Improved patient survival	Redcing CLABSI Events	CLABSI case count (monthly) <2 CLABSI Event Rate (monthly) <2.5		
	Preventing Patient Deaths	CLABSI death count (monthly) <2 CLABSI mortality rate (monthly) <50%		

PROBLEM DEFINITION

Business Case This project is taken up to prevent patient's death and associated costs due to bloodstream infections acquired in the hospital aligning with the organization's quality policy.	Problem Statement Based on the last two months data, five patients per month are getting CLABSI with 60% deaths. It impacts patient safety, clinician confidence and hospital reputation (AHRQ estimated cost \$240540/month).																																																																																											
Goal Statement The goal is to reduce the CLABSI rate by 50% by September-21 and save three lives per month.	Project Scope The project will focus on identifying and rectifying the failure modes in the present system and improve the associated processes.																																																																																											
Project Plan <table><tr><td></td><td colspan="4">Jul-21</td><td colspan="4">Aug-21</td><td colspan="4">Sep-21</td></tr><tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>1</td><td>2</td><td>3</td><td>4</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>Define</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Measure</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Analysis</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Improve</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Control</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>		Jul-21				Aug-21				Sep-21					1	2	3	4	1	2	3	4	1	2	3	4	Define													Measure													Analysis													Improve													Control													Team Selection Team Leader: Dr Sourav Team Members: Sr. Dwipta Sr. Jessy Sr. Krishna Administration: Dr S.R. Deb Quality: Mr. Anupam ICU: Dr Rimita
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Project Charter

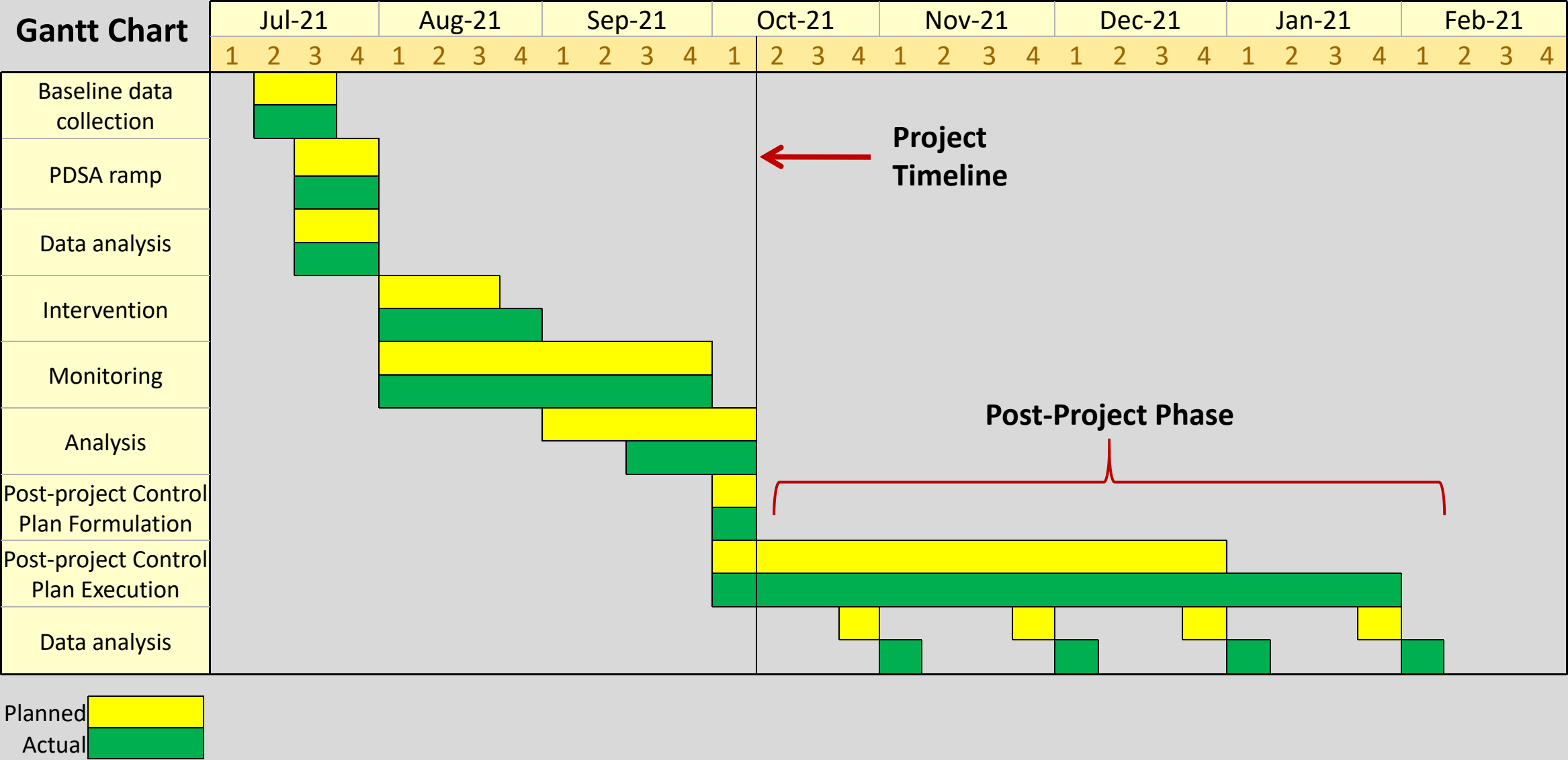
PROBLEM DIAGNOSIS

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- Project Timeline
- Baseline Assessment
- Process Flow Map
- Brainstorming
- HFMEA

Sl. No.	Name	Role	Function
1	Dr SR Deb	Sponsor	Approval, Advice
2	Dr Sourav	Team Leader	Execution, Data Analysis, Meeting
3	Sr Dwipta	Team Member	Data Collection, Data Analysis
4	Sr Jessy	Team Member	Data Collection, Audit, Reporting
5	Sr Krishna	Team Member	Data Collection, Coordination
6	Mr Anupam	Support	Coordination
7	Dr Rimita	Support	Clinical inputs

PROBLEM DIAGNOSIS



PROBLEM DIAGNOSIS

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SIPOC diagram

Company name	Project #	CLABSI	Revision #	4
RGHL	Mapped by	IC Team	Date	12/07/2021
Process Central Line (CL) insertion and maintenance				
Suppliers	Inputs	Process Steps	Outputs	Customers
Housekeeping	Soap, water, basin, handrub, towel	Surgical Handwash	Clean & dry hands	Doctor, Technician
CSSD, Pharmacy, Store	Instruments, sterile drape	Sterile Supply	Sterile items	ICU Nurse In-Charge, Doctor, Patient
Pharmacy, ICU Nurse In-Charge	Chlorhexidine solution	Skin Disinfection	Skin antiseptis	Doctor, Patient
HR and Training, Biomedical Engineer	Knowledge & skill, USG probe	CL Insertion	Central Line Placement	Doctor
Pharmacy, ICU Nurse In-Charge	Sterile dressing, CHG-impregnated dressing	Dressing	Secured CL	Patient
Pharmacy, ICU Nurse In-Charge	Handrub, Posiflush, Injections, Alcohol swab	CL Access	Medication, flushing, hub scrubbing, blood sampling	Allocation Nurse, Phlebotomist, Technician
Doctor	Need assessment	CL Removal	CL removed	Allocation Nurse, Patient

PROBLEM DIAGNOSIS

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HIGH LEVEL PROCESS STEP	PROCESS	SUB PROCESS	FAILURE MODE	SEVERITY	OCCURRENCE	DETECTION	RPN/HAZARD SCORE
INSERTION	Indication mentioned	Not indicated	Overuse	3	1	1	3
INSERTION	Hand hygiene (surgical hand wash)	Unavailability of soap & water	Contamination	3	3	3	27
INSERTION	Hand hygiene (surgical hand wash)	Hand hygiene duration & step not maintained	Contamination	3	5	4	60
INSERTION	Hand hygiene (surgical hand wash)	Unavailability of sterile drape/tissue	Contamination	3	4	3	36
INSERTION	Hand hygiene (surgical hand wash)	Alcohol based hand sanitizer not utilized	Contamination	3	3	2	18
INSERTION	Maximal barrier precautions with long drape/PPE	Incomplete drape	Contamination	1	2	1	2
INSERTION	Maximal barrier precautions with long drape/PPE	Full PPE not used	Contamination	1	2	1	2
MAINTANANCE	Scrubbing hub with 70% alcohol	Not available	Contamination	3	3	3	27
MAINTANANCE	Scrubbing hub with 70% alcohol	Technique not followed	Contamination	3	3	4	36
MAINTANANCE	Presence of date	Date not mentioned	Overuse	3	2	1	6
MAINTANANCE	Presence of date	Correct date not mentioned	Overuse	3	2	1	6
MAINTANANCE	Presence of CHG impregnated dressing	Change to non CHG dressing	Colonization	2	2	1	4
MAINTANANCE	Dressing in optimal condition	Dressing not changed	Contamination	2	2	1	4
MAINTANANCE	Dressing in optimal condition	Dressing is soiled	Contamination	2	2	1	4
MAINTANANCE	Daily bath with 2 % Chlorhexidine	Daily bath not given	Colonization	1	3	4	12
MAINTANANCE	Daily bath with 2 % Chlorhexidine	2% CHG not available	Colonization	1	2	4	8
MAINTANANCE	Securement	Dislodgement	Contamination	3	3	1	9
							688

HFMEA

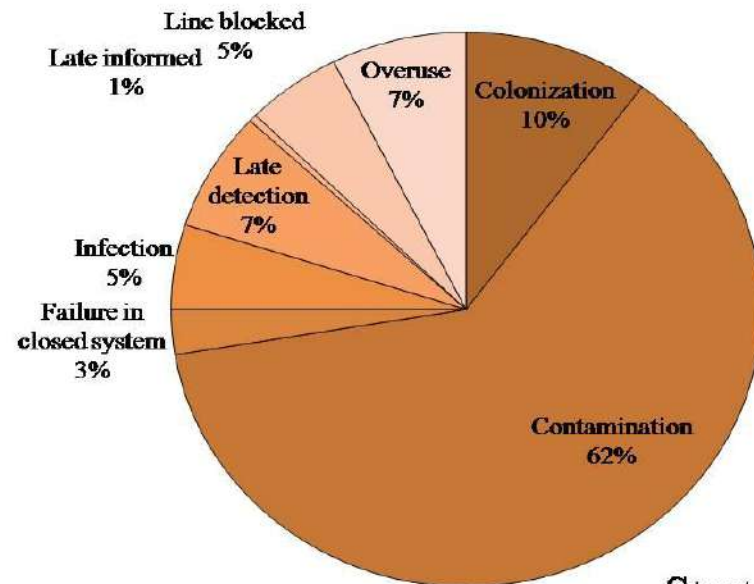
➤ 43 sub-
processes

➤ 8 failure
modes

PROBLEM DIAGNOSIS

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Failure Modes

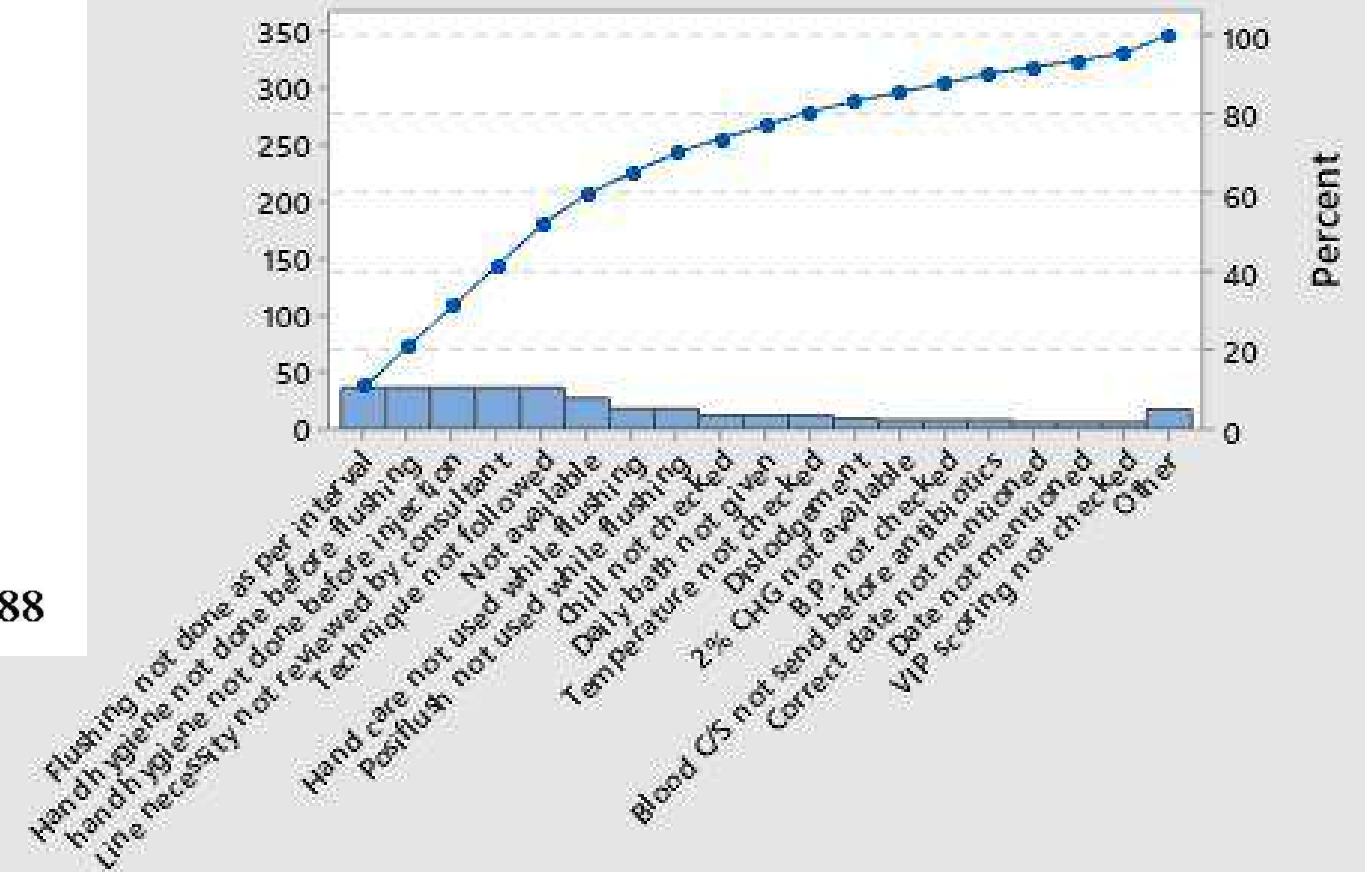


Start RPN=688

Tender Points:

- Poor Surgical Handwash before CL insertion
- Unregulated skin antiseptis time
- Lack of HH before medication delivery
- Improper flushing
- Delayed CL removal

Pareto Chart of SUB PROCESS



RPN/HAZARD SCORE	36	36	36	36	36	27	18	18	12	12	12	9	8	8	8	6	6	6	17
Percent	10	10	10	10	10	8	5	5	3	3	3	3	2	2	2	2	2	2	5

PROBLEM REMEDY

Hand wash before CL insertion was monitored by local nursing leaders in each case. PDSA cycles helped to adapt by introducing a compact set of consumables including sterile gloves, cut-sheet, long drape sheet, ultrasound probe cover and a sterile hand towel to dry the wet hands quickly after the surgical hand wash.

The skin-chlorhexidine contact time was regulated to 40 seconds $\pm$ 10 seconds to ensure at least 30 seconds of contact in each case. The necessity of the lines was judged from record review by the team to prevent overuse.



Possible aim	Important to patient outcomes	Affordable in terms of time and resources	Easy to measure	Under control of team members	Total score
	(1-5)	(1-5)	(1-5)	(1-5)	
Surgical hand wash at insertion	5	4	4	4	17
Skin CHG >30 sec	5	5	5	5	20
Flushing at least once in each shift	5	2	2	2	11
Hand hygiene before each access	5	3	2	4	14
Scrubbing the hub at least once in each shift	5	3	2	3	13
Need review	5	4	4	3	16

Prioritization Matrix

CTP (critical test parameter)		
surgical hand wash at insertion	control	
Skin CHG >30 sec	control	
Flushing at least once in each shift	inspection & enquiry	
Hand hygiene before each access	inspection & enquiry	
Scrubbing the hub at least once in each shift	inspection & enquiry	
Daily need review (ward)	checklist & enquiry	
Compliance	Grade	
<=25%	0	
26-40%	1	
41-55%	2	
56-70%	3	
71-85%	4	
86-100%	5	

PROBLEM REMEDY

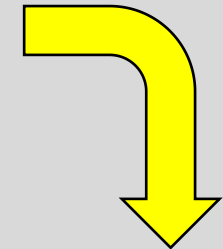
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Solution Selection Matrix

Problem/Situation: Which solution can improve hand hygiene compliance at CL insertion?

1 2 3 4 5

		Options				
Assessment criteria	Weight	No handwash; sterile gloves	Handwash + Hand dryer	Handwash + Common Towel	Handwash + Sterile Towel	Handrub only
Impact on CTQ	9	3	9	3	9	6
Quick to implement	6	9	3	6	6	9
Cost-effectiveness	6	6	3	3	6	6
User compliance	9	9	3	3	9	6
Prevent contamination	6	3	6	3	9	6
Less time consuming	6	9	3	6	6	9
Totals		270	198	162	324	288
Rank		3	4	5	1	2



Sterile Towel



PROBLEM REMEDY

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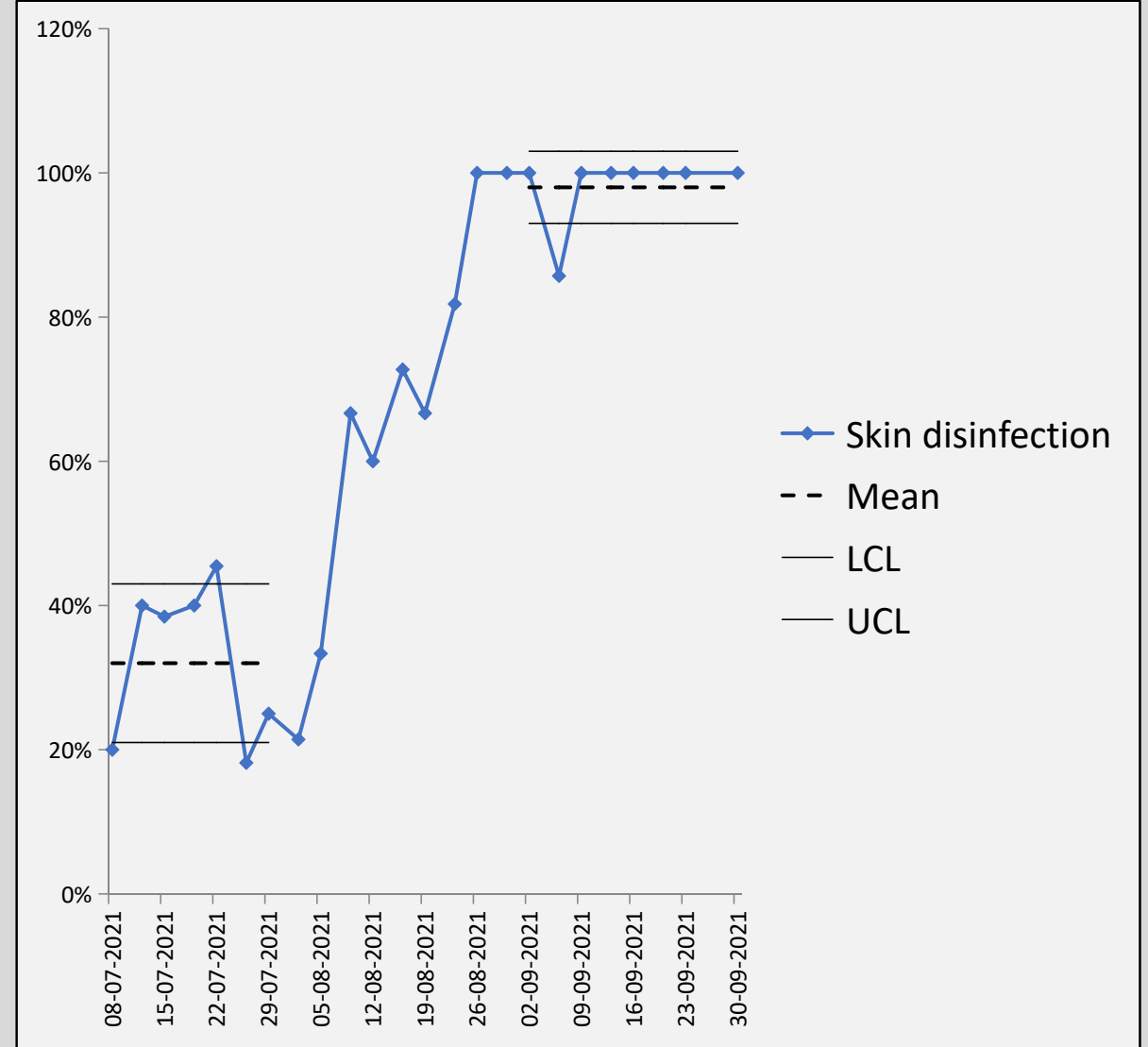
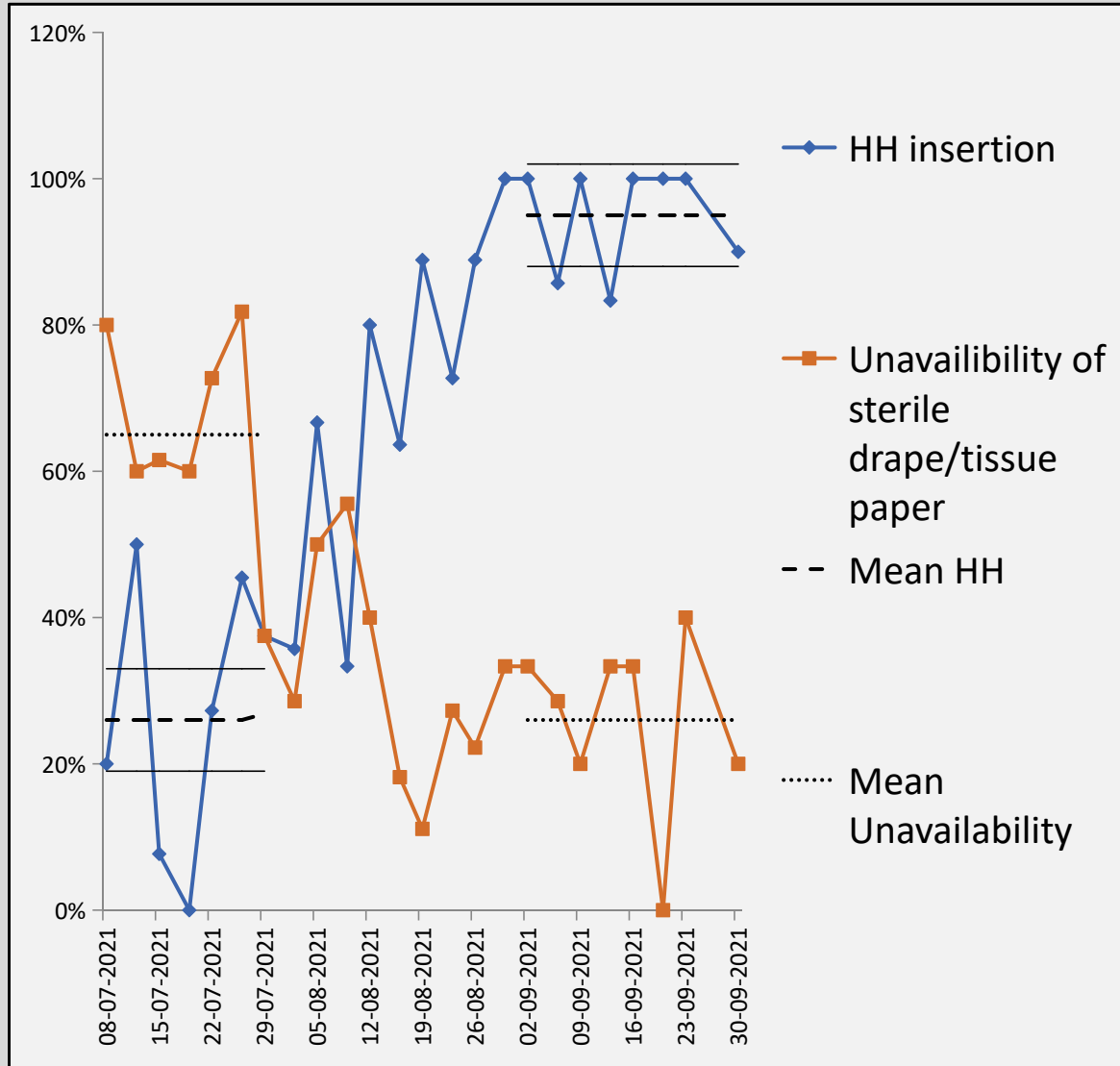
High Level Process Stage	Step	What will we measure	Processes/ Outcome	Numerator	Denominator	Data Source	Who collects	How often	How will it help	Initial Performance Grade	Current Performance Grade	Improvement	% Improvement	Starting RPN	Current RPN	% Reduction
Insertion	HH steps and duration during CL insertion	HH compliance before CL insertion	Processes	Number of CL insertions with the persons performing HH more than 2 minutes	Number of Central Line insertions	SI+DO	ICN	Each case	Clean insertion	1	5	4	80%	60	9	85%
Insertion	Sterile drape/tissue paper available for drying hands	Sterile drape/tissue paper non-availability for hand drying after surgical handwash	Processes	Episodes of non-availability	Number of Central Line insertions	SI+DO	ICN	Twice weekly	Less contamination	3	1	2	40%	36	12	67%
Insertion	Skin disinfection appropriateness	Appropriate skin disinfection rate	Processes	Number of CL insertions with skin-CHG contact time ≥ 30 seconds	Number of Central Line insertions	SI+ DO+ RR(Bundle forms)	ICN	Each case	Skin disinfection	1	5	4	80%	24	6	75%

PROBLEM REMEDY

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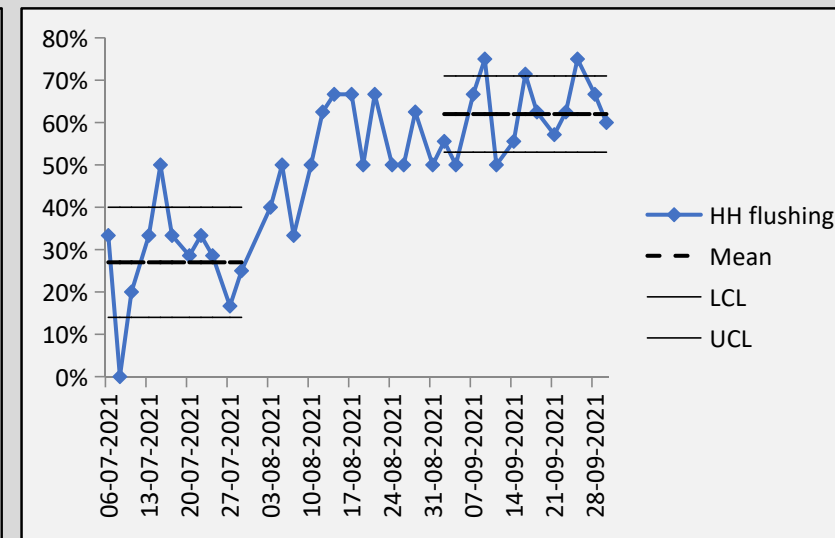
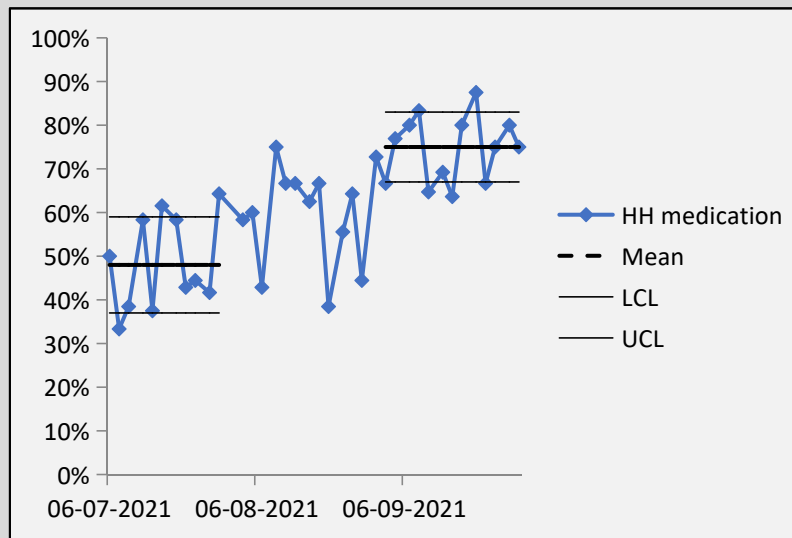
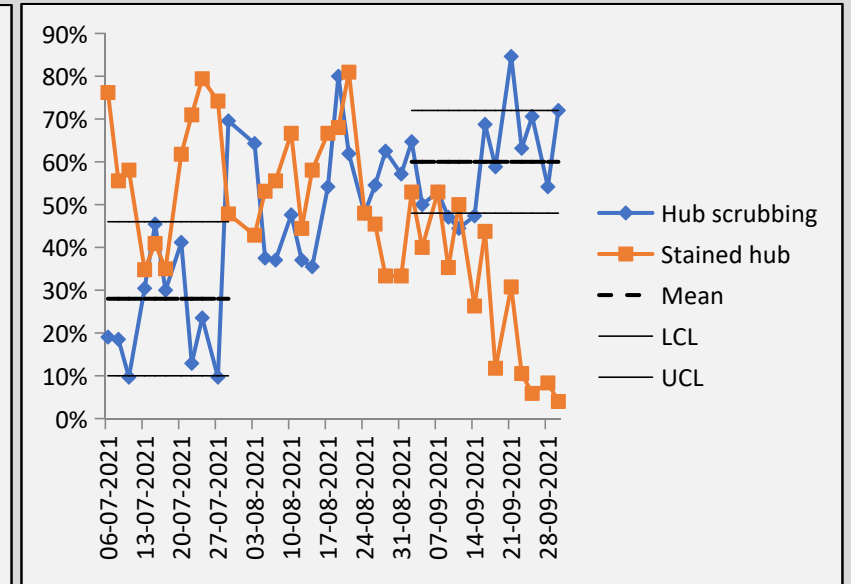
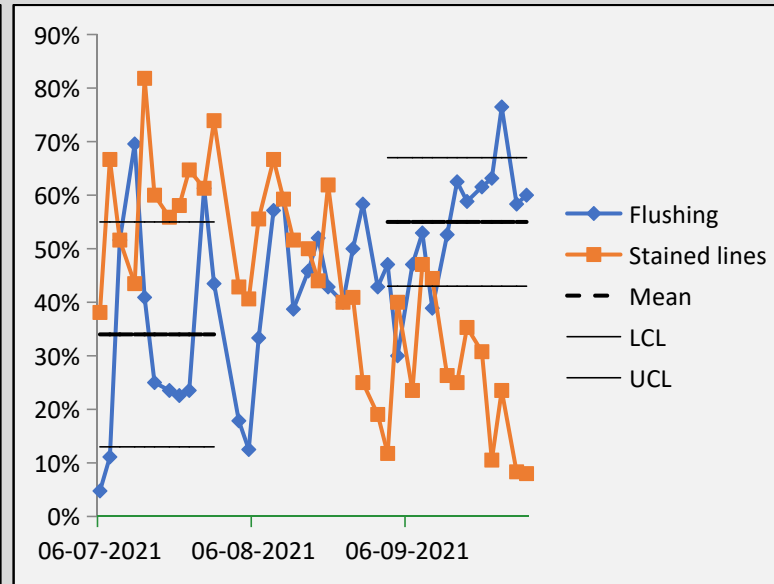
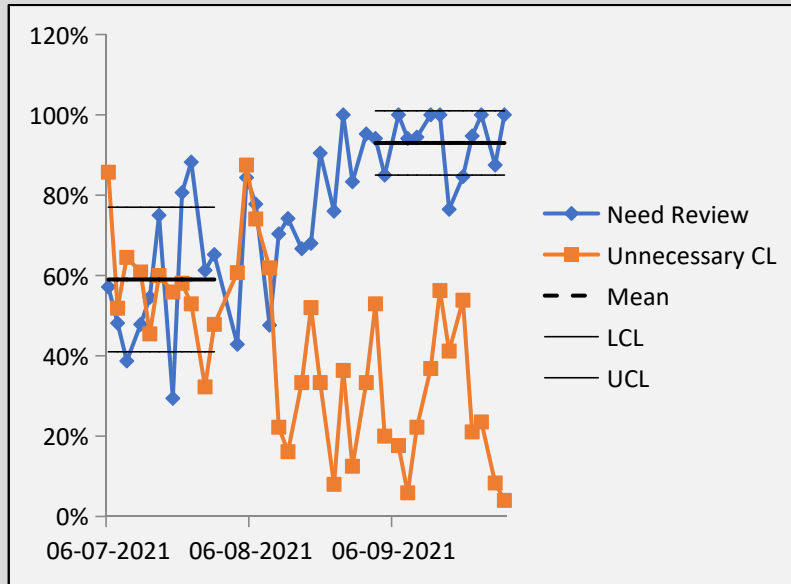
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Maintenance	Need review	Proportions of CLs with need reviewed	Process	Number of CLs with documented need review	Number of CLs examined	RR(Bundle forms)	ICN	Thrice weekly	Prevent overuse	3	5	2	40%	36	12	67%
		Unnecessary CLs	Outcome	Number of CLs without documented need review	Number of CLs examined	RR(Bundle forms + Patient file)	ICN	Thrice weekly	Prevent overuse	3	1	2	40%			
Maintenance	HH before injection	HH compliance before CL access for medicines	Process	Episodes of HH performed before any injection in CL	Number of opportunities	Feedback+DO	ICN	Thrice weekly	Less contamination	2	4	2	40%	36	27	67%
Maintenance	HH before flushing	HH compliance before CL flushing	Process	Episodes of HH performed before flushing the CL	Number of opportunities	Feedback+DO	ICN	Thrice weekly	Less contamination	1	3	2	40%	36	27	67%
Maintenance	Flushing	Compliance to flushing	Process	Number of CLs with at least 1 flush in each shift	Number of CLs examined	SI	ICN	Thrice weekly	Line patency	1	2	1	20%	36	18	50%
		Blood-stained lines	Outcome	Number of CLs with blood-stained lines	Number of CLs examined	DO	ICN	Thrice weekly	Line patency	4	1	3	60%			
Maintenance	Scrubbing the hub	Compliance to hub scrubbing	Process	Number of CLs with at least 1 scrubbing of hub in the last 24 hours	Number of CLs examined	SI	ICN	Thrice weekly	Less contamination	1	3	2	40%	36	27	25%
		Blood-stained hubs of CLs	Outcome	Number of CLs with blood-stained hub	Number of CLs examined	DO	ICN	Thrice weekly	Less contamination	3	1	2	40%			

PROBLEM REMEDY



PROBLEM REMEDY

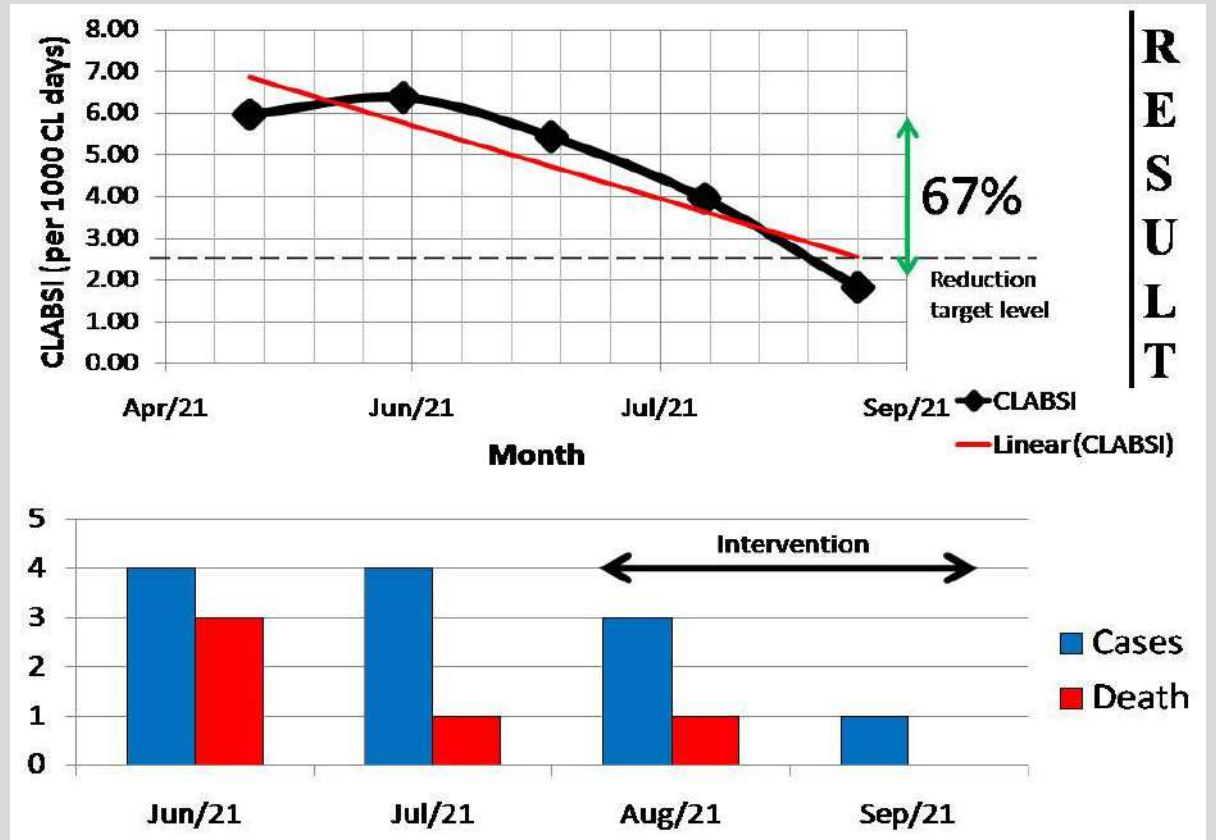
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PROBLEM REMEDY

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	Insertion	Maintenance
Step-wise Risk Reduction	Hand hygiene (85%)  Skin disinfection time (75%) 	Hand hygiene (25%)  Flushing practice (50%)  Scrubbing the hub (25%)  Need review (67%) 
Failure Mode Risk Reduction	Colonization (39%)  Contamination (29%) 	Contamination (16%)  Overuse (50%)  Line blocked (50%) 
Total Risk Reduction	27%	20%



LOCKING THE IMPROVEMENT

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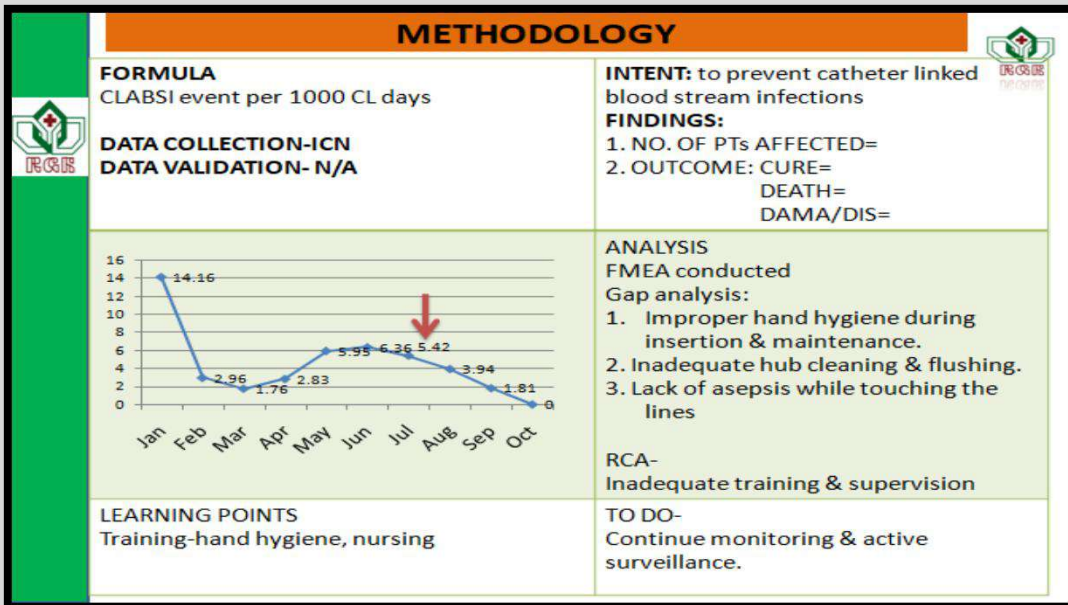
CONTROL PLAN

Process	Measurement method	Responsible	Sample size	Frequency	Barrier to success	Andon cord	Rectification plan	Follow ups	Responsible for follow up
Handwash at CL insertion	Observation	Nurse In-Charge, ICU	All cases	During case	Unavailability of soap and hand towel	Liquid soap container less than 1/3 full	Inform Housekeeping	Supply and housekeeping, patient condition	ICN, ICU In-Charge
Handwash at CL insertion	Observation	Nurse In-Charge, ICU	All cases	During case	Missing towel in sterile set	Reporting of missing item	Supply of tissue papers	CSSD packing, tissue paper availability	ICN, ICU In-Charge
Handwash at CL insertion	Observation	Nurse In-Charge, ICU	All cases	During case	Failed attempt of insertion	Failed first attempt	Ask help from senior doctor	patient condition	ICN, ICU In-Charge
Daily review of CL necessity	Audit	ICN	All cases	Twice weekly	Patient shifted to ward with CL	CL count of wards	Inform RMO for review	Line necessity, Discussion with Doctor	ICN, Allocation nurse
Daily flushing	Observation	ICN	All cases	Twice weekly	Unavailability of posiflush	Pharmacy stock out	Periodic communication between pharmacy and IC team	Supply and availability	ICN, Pharmacy In-Charge, ICU Nurse In-Charge

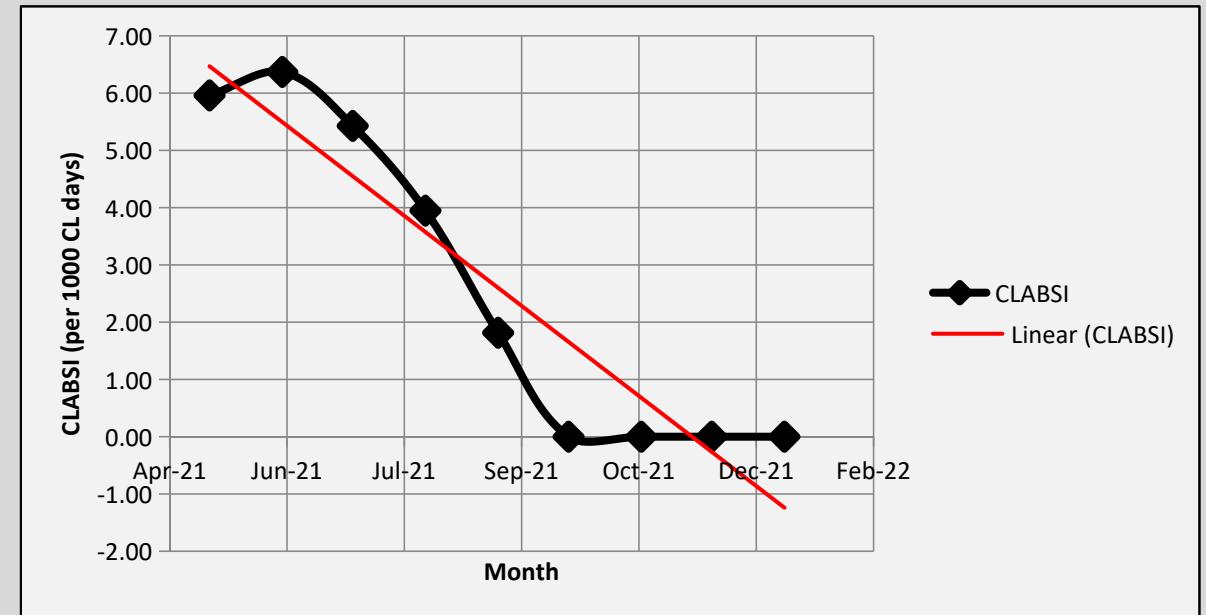
LOCKING THE IMPROVEMENT

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Roles and responsibilities were clarified with defined clear processes and communication guides. The storyboarding format of data presentation was implemented. Control measures involving the performance indicators, documented audit plan and deviation remedies streamlined the process to bring down the CLABSI rate below 2 within the project timeframe and subsequently ZERO over next 4 months.



Stakeholder	Communication method						
	Email	Phone calls	Text	1-on-1 meeting	Group meeting	Announcement	Other
ICU doctors	No	Weekly	Daily	Weekly	Monthly	No	No
Administration	End of each phase	No	No	Weekly	Monthly	No	No
Nursing	Daily	No	Daily	No	Monthly	No	No
Pharmacy	No	SOS	No	No	Monthly	No	No

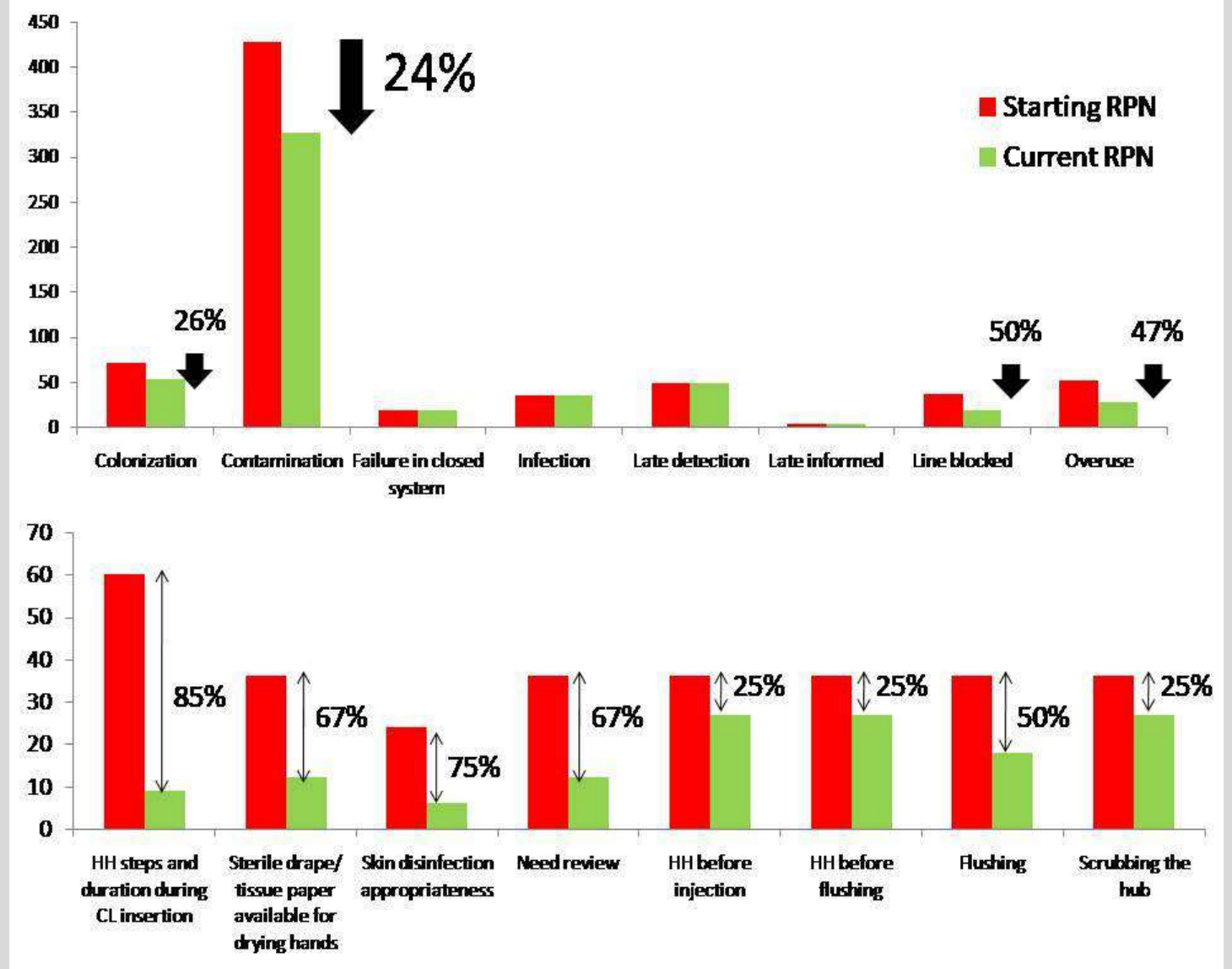


CLONING THE IMPROVEMENT

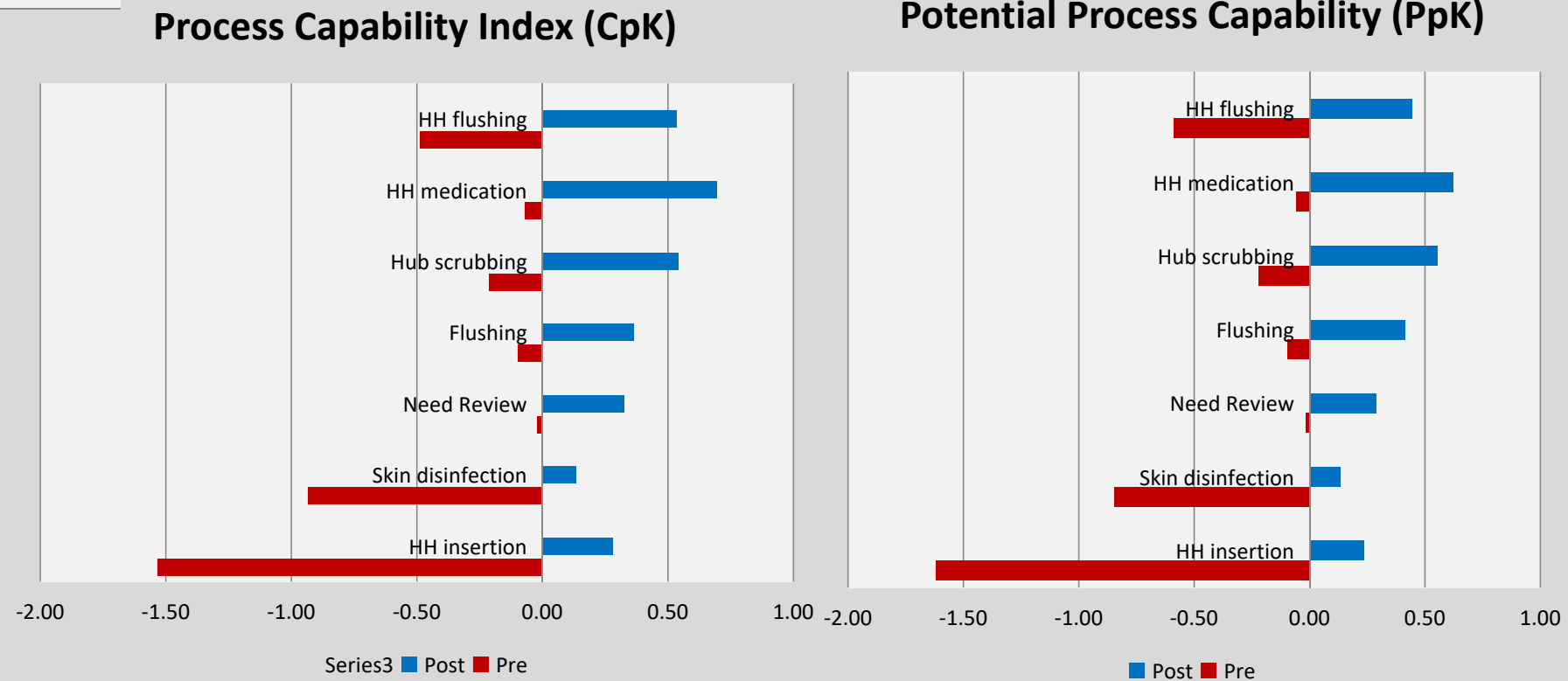
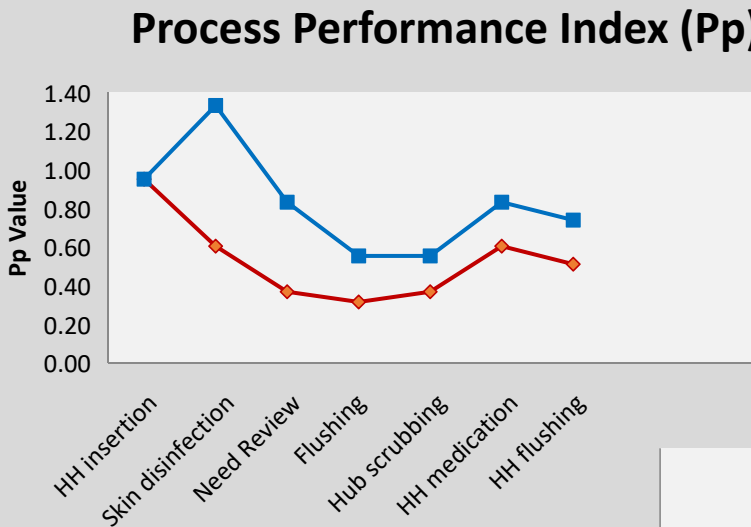
The improvement enhanced aseptic non-touch technique compliance in the non-critical areas as well as paediatric intensive care units by applicable cloning. Active management support, enhanced stakeholder confidence and visible improvement ensured uniform compliance throughout the organization maximizing the impact.

TANGIBLE RESULTS

- Reduction of CLABSI with savings of \$16162 attributable cost (AHRQ estimate)
- Attributable mortality reduction to 0%
- 24% reduction of the total risk of developing CLABSI
- Process improvement (0.5 sigma) leading to CLABSI-related DPMO reduction (3.42 versus 2.93; assuming 1.5 σ shift)
- External failure cost reduction (COPQ)



TANGIBLE RESULTS



INTANGIBLE RESULTS

- Improved patient safety
- Enhanced clinician satisfaction
- Impeccable cross-functional communication
- Greater regulatory compliance (NABH, ISO)
- Brand equity
- Organizational strategy support

