Identifying the Incidence and Causes of Large Volume Contrast Extravasation during CT Exams

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PURPOSE

A single institution quality improvement (QI) workgroup was formed in an effort to…

Decrease rates of large-volume IV infiltration (>50 mL) occurring during outpatient CT examinations

…using DMAIC methodology without reducing imaging quality or decreasing employee satisfaction

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Background

Problem Statement

- Safety reporting data indicated that 51 extravasation events out of 28,730 CT exams at MCA occurred between 4th quarter, 2017 through the 3rd quarter, 2019.
- 45% of these events (n=23) were considered large volume IV infiltrates with contrast (>50mL).
- According to the American College of Radiology Contrast & Medication Manual, IV infiltrates with contrast related to power injections occur between 0.1% and 1.7%/1000 patients, regardless of volume.
- However, for infiltrates greater than 50ml the patient safety expectation is 0% occurrence. For the large volume IV Infiltrates with contrast within the data sample, the occurrence was 0.08% or 0.8 events/1000 CT exams.

Goal

- Reduce the incidence of large volume IV contrast extravasations (>50mL) in the CT outpatient practice from 0.8 events/1000 CT exams (baseline) to less than or equal to 0.6 events/1000 CT exams (25% reduction) by May 2021, without reducing imaging quality or decreasing employee satisfaction.

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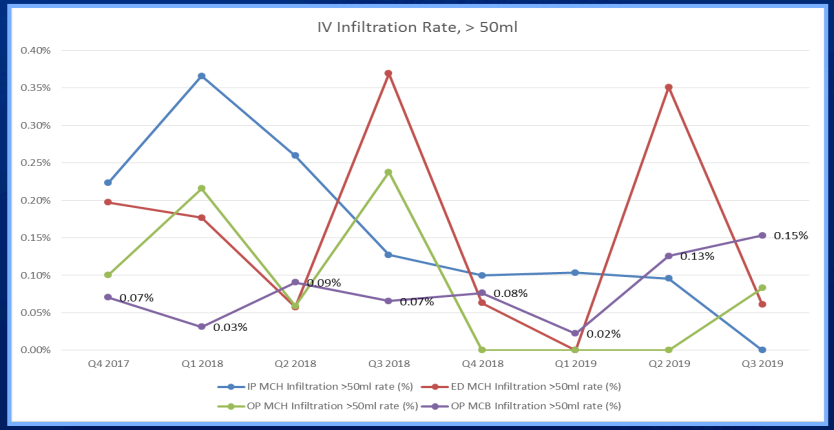
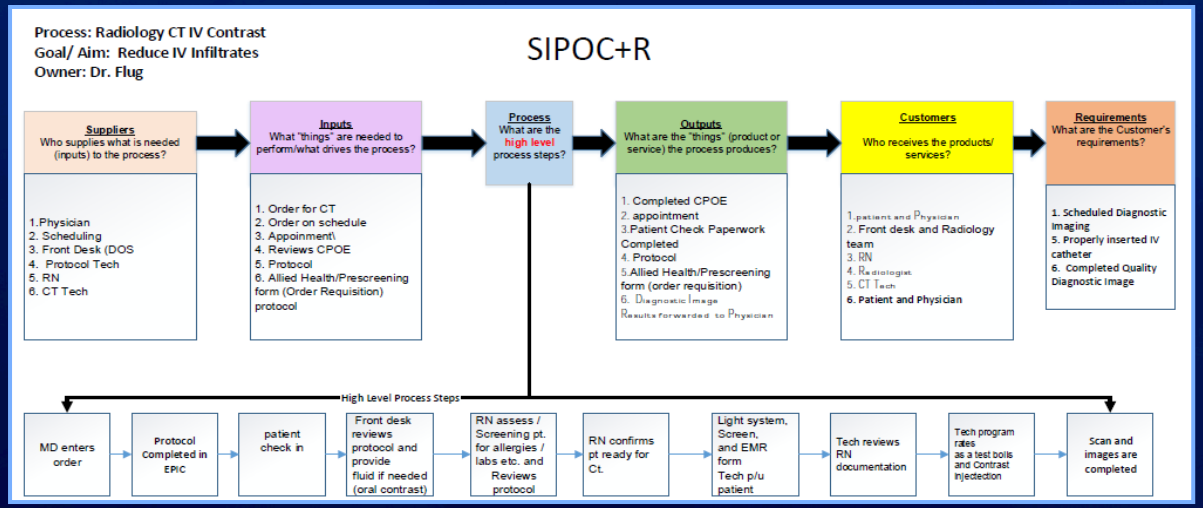
DMAIC Define Phase- Identify the Gap





- Baseline data indicated large volume IV Infiltrates occurred throughout the hospital system
- Focused on outpatient to consider process changes due to more consistent workflows and a more controlled environment
- Utilized SIPOC to identify the key inputs and outputs of the overall processes related to patients receiving IV contrast

DMAIC Define Phase- Identify the Gap

- Completed Stakeholder Analysis to identify concerns and level of support from key stakeholders
- Qualitative feedback from leadership and frontline staff is needed to determine sustainability of any recommended process changes

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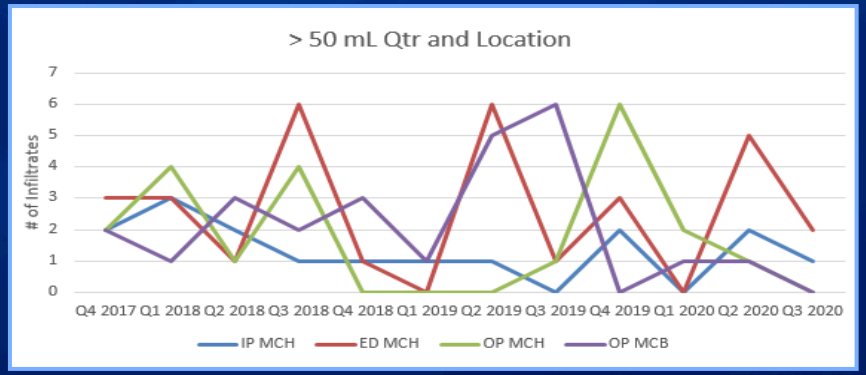
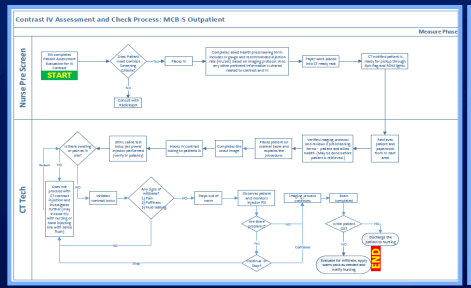
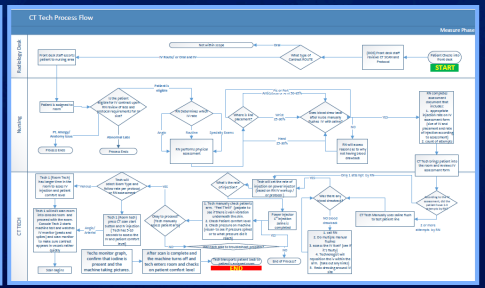
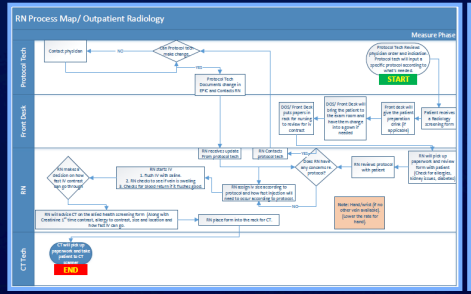
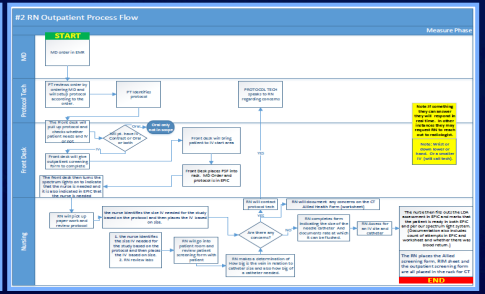
DMAIC Measure Phase - Develop a strategy for data collection and measure current process or performance





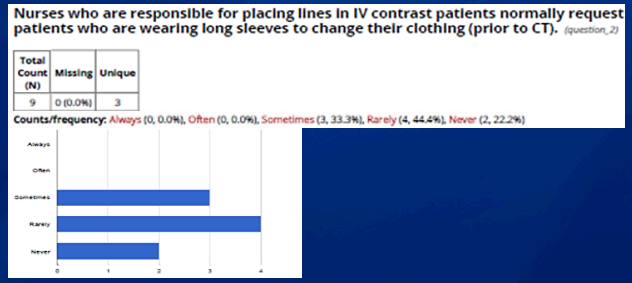


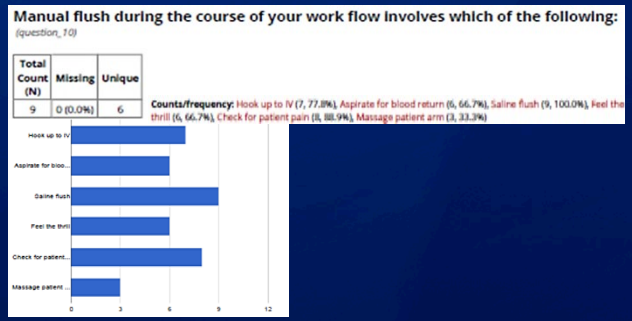


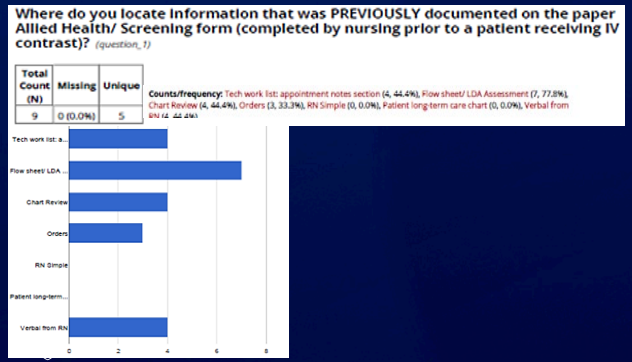


- Continued monitoring of large volume IV Infiltrates during COVID-19/ furlough. Favorable trend but uncertain if it's due to recent educational interventions or significantly decreased patient volume
- Developed process map to count steps and identify existing gaps in workflows using data from 15 hours of observation and discussions with staff
- Key Opportunities:
  - Handoff Communication Between CT Nursing
  - Standardizing manual flushing steps
  - Develop process for CT follow-up if protocol modifications need clarification

DMAIC Measure Phase - Develop a strategy for data collection and measure current process or performance



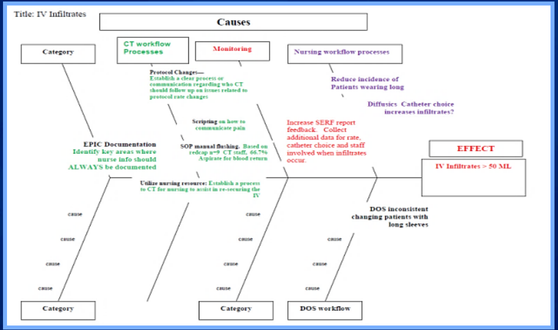


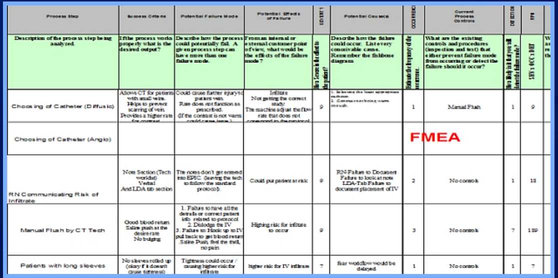


- Used Redcap survey tool to measure staff comprehension of existing procedures given post Kaizen education

- Key Opportunities:
  - Handoff Communication Between CT Nursing
  - Streamlining documentation practices
  - Incorporate communication plan for post Kaizen educational interventions
  - Standardize manual flushing practices
  - Develop staff scripting for giving patient instructions ‘If you experience pain/ discomfort”

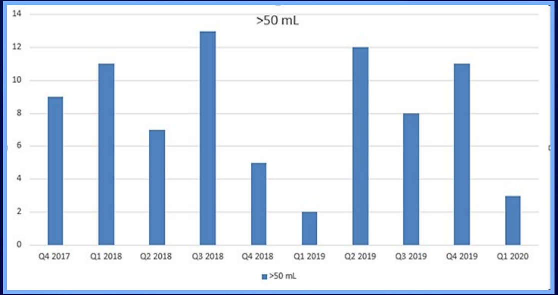
DMAIC Analyze Phase - Identify Root Causes and Determine sources of variation





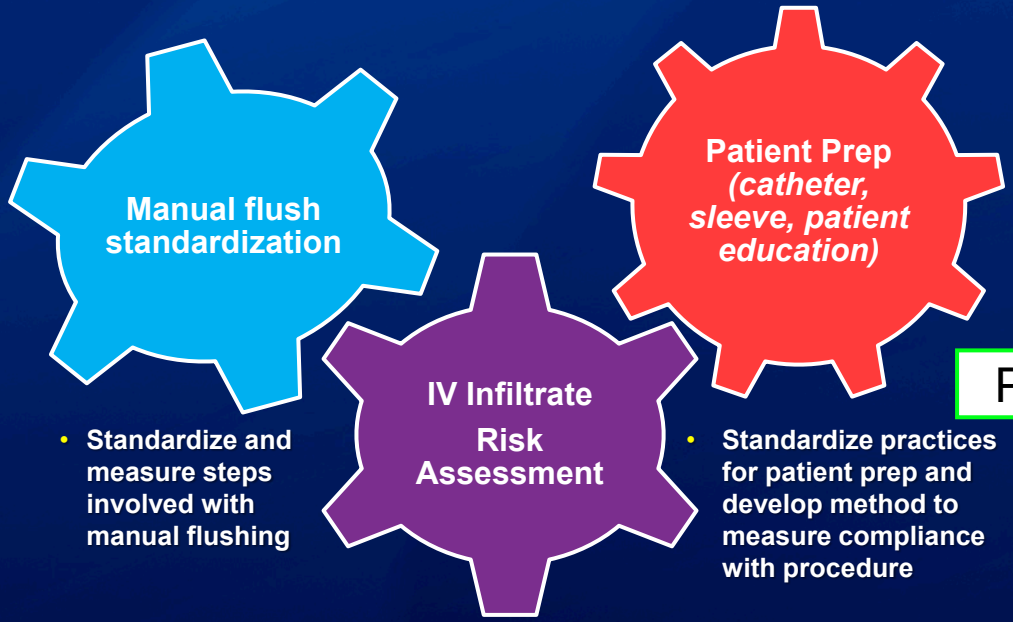
Process Step	Success Criteria	Potential Failure Mode	Potential Effects of Failure	SEVERITY	Potential Cause(s)	OCCURRENCE	Current Process Controls	DETECTION	RPN
Description of the process step being analyzed	If the process works properly what is the desired output?	Describe how the process could potentially fail. A given process step can have more than one failure mode.	From an internal or external customer point of view, what would be the effects of the failure mode?	How Severe is the effect to the patient?	Describe how the failure could occur. List every conceivable cause. Remember the fishbone diagram	Estimate the frequency of the occurrence.	What are the existing controls and procedures (inspection and test) that either prevent failure mode from occurring or detect the failure should it occur?	How likely is it that you will detect the failure mode?	SEV x OCC x DET
Choosing of Catheter (Diffusic)	Allows CT for patients with small veins. Helps to prevent scarring of vein. Provides a higher rate for contrast	Could cause further injury to patient vein. Rate does not function as prescribed. (If the contrast is not warm could cause issue.)	Infiltrate. Not getting the correct study. The machine adjust the flow rate that does not correspond to the protocol	9	[illegible]	1	Manual Flush	1	9
Choosing of Catheter (Angio)									
RN Communicating Risk of Infiltrate	Note Section (Tech worklist) Verbal And LDA tab section	The notes don't get entered into EPIC (leaving the tech to follow the standard protocol).	Could put patient at risk	9	RN-Failure to Document Failure to look at note LDA-Tab Failure to document placement of IV	2	No controls	1	18
Manual Flush by CT Tech	Good blood return Saline push at the desire rate No bulging	1. Failure to have all the details or correct patient info related to protocol 2. Dislodge the IV 3. Failure to Hook up to IV pull back to get blood return Saline Push, feel the thrill, no pain	Highing risk for infiltrate to occur	9		3	No controls	7	189
Patients with long sleeves	No sleeves rolled up (okay if it doesn't cause tightness)	Tightness could occur / causing higher risk for infiltrate	higher risk for IV infiltrate	7	fear workflow would be delayed	1	No controls	1	7

FMEA



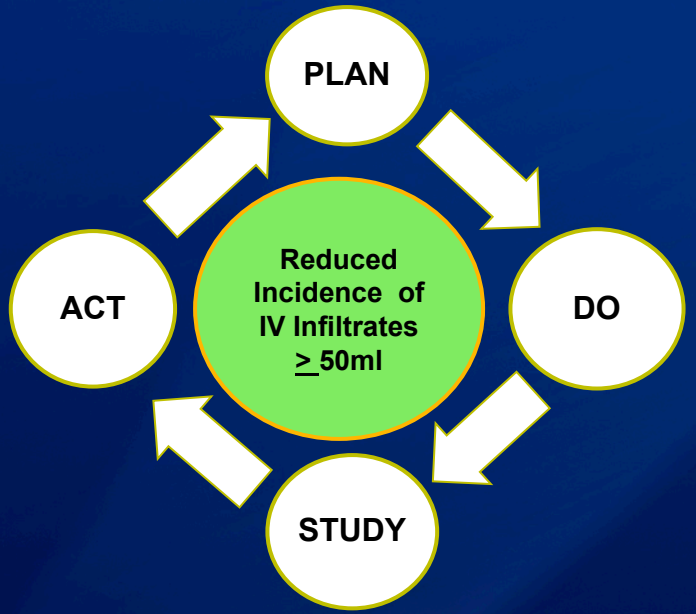
- Fishbone Diagram- graphical demonstration of possible causes grouped together
  - Protocol Changes prior to nursing handoff to CT
  - SOP vary for Manual Flushing
  - EPIC documentation locations regarding pertinent patient risk factors
  - Catheter Choice
  - Inconsistent changing practices (long sleeves)
  - Limited SERF report data elements
  - No standard scripting on instructing patients how to communicate pain or discomfort
- Failure Mode Effects Analysis tool used to prioritize process gaps identified during previous phase and estimate the impact of each defect on the patient
- FMEA: Process gaps related to Manual Flushing processes were identified as the greatest risk to patients
- Trending data doesn't clearly indicate the root cause

DMAIC: Improve Phase - Implementing the process changes/improvements



- Standardize and measure steps involved with manual flushing
- Standardize practices for patient prep and develop method to measure compliance with procedure
- Develop risk assessment tool that can be used by frontline staff to identify patients who are most vulnerable to develop IV Infiltrates and include the appropriate follow-up process

PDSA



After completing PDSA cycle(s) for the proposed change -decide on the following:

- Adopt Intervention (Complete process change) or
- Adapt (Modify proposed intervention) or
- Abandon proposed intervention?

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Conclusion

- DMAIC aided in determining factors which contribute to IV contrast media infiltration rates.
- Continued meetings regarding:
  - Monitoring IV extravasation events going forward
  - Standardizing workflows for IV assessment prior to contrast administration.
  - Creating protocols for reporting of IV infiltration events.
  - Testing proposed improvements using PDSA Cycle
  - Establishing communication plan for Control Phase of DMAIC

For any questions, please email Dr. Clint Jokerst at jokerst.clinton@mayo.edu

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