

# Contrast Cost Reduction for CT Pulmonary Angiography and Abdomen and Pelvis

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# Define – Project Charter

|   |  |   |  |
|---|--|---|--|
| <b>Project Name:</b> CT Contrast Cost Reduction   |  | <b>Project Start Date:</b> January 1, 2024  |  |
| <b>Sponsor:</b> Carson Kepler, Imaging Services Regional Administrator - AGH/WPH<br><b>Champion:</b> Tom Schmude, Radiology Operations Manager - AGH<br><b>Yellow Belt:</b> Maureen Gregory, CT Chief Technologist - AGH<br><b>Team:</b> Shonda Butler(Bayer Pharmaceuticals), Dr. Timothy Mickus & Dr. Ted Schroeder(Radiologists), Amber Cromerdie, All AHN Staff CT Technologists, All Agency CT Technologists |  |   |  |
| <b>Problem Statement</b><br>From May 2023 to October 2023 the average cost for contrast used on PE and standard Abdominal CT scans has been calculated to be \$41,445 or \$6,907/month. This results in increased cost to the patient and the department.   |  | <b>Goal Statement</b><br>The goal of this project is to decrease the average cost of contrast from \$41,445 to \$37,301 or to \$6216.83/month by August 31, 2024. |  |
| <b>Business Benefit</b><br><ul style="list-style-type: none"> <li>• Monetary benefit</li> <li>• Waste Reduction</li> <li>• Standardized Process</li> </ul>  |  | <b>Areas of Impact</b><br><ul style="list-style-type: none"> <li>• Patients</li> <li>• CT Staff</li> <li>• Radiologists</li> </ul>                                | <b>Project Scope</b><br><ul style="list-style-type: none"> <li>• Injection Process</li> <li>• AGH CT Scan, Radiology</li> <li>• By August 31,2024</li> </ul> |



1. Regarding PE studies and using the standard injection protocol, do you feel that more contrast is used than necessary to provide quality imaging?

Yes

No

Sometimes

2. Regarding standard Abdomen/Pelvis studies and using the standard injection protocol, do you feel that more contrast is used than necessary to provide appropriate portal venous enhancement?

Yes

No

Sometimes

## Waste

Cardiac & Stroke Filling

Using standard injections

Using too much contrast on small patients

Using syringe that was pre-loaded for something else

Syringe overfill for selected study

## Failure

Repeat injections

Saline infiltrate and no other access available

Contrast Extravasations

Loop not connected tight creating spray

Order change after contrast connected to patient

## People

Spiking 2 rooms in the a.m.

Expires b/c we spike contrast too early

Techs pitch contrast at end of day instead of moving to ED

Par level too high

Prefilling syringes then patient is no show

Drawing up 100ml out of habit

Contrast studies ordered at different times



Loop not connected,  
tights – contrast  
sprays

Using too much contrast  
on small patients

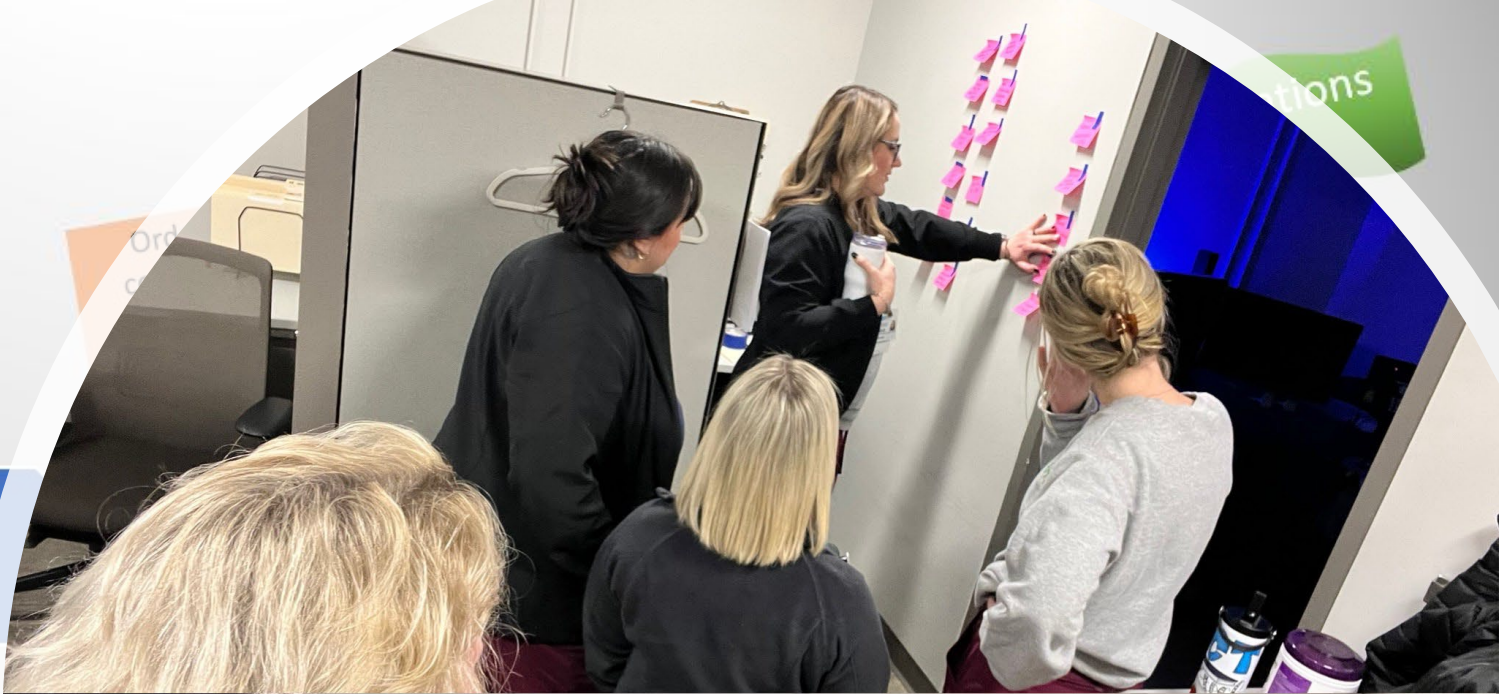
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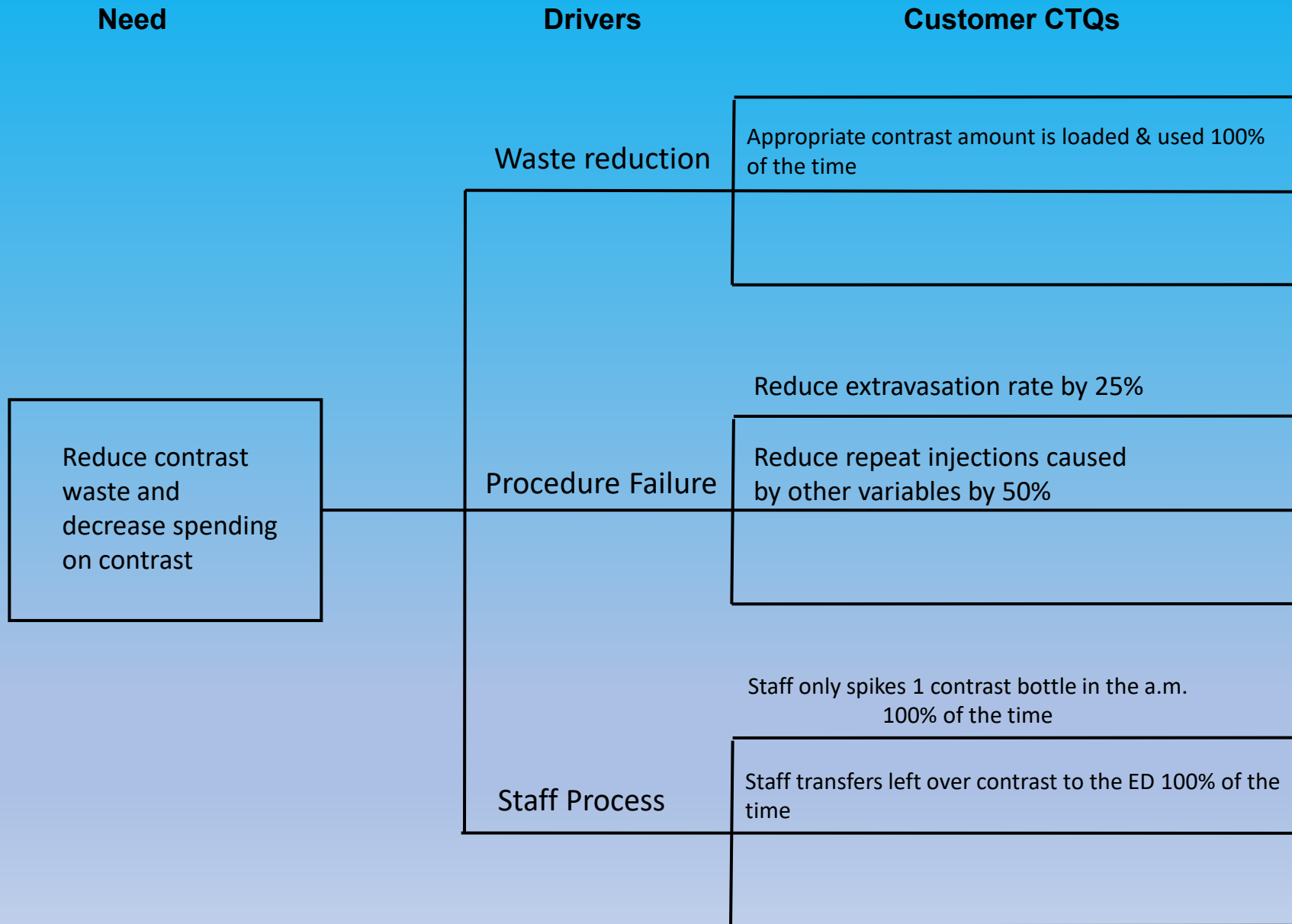
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injections

Prefilling syringes then  
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# Define - Lean Six Sigma Critical to Quality Tree





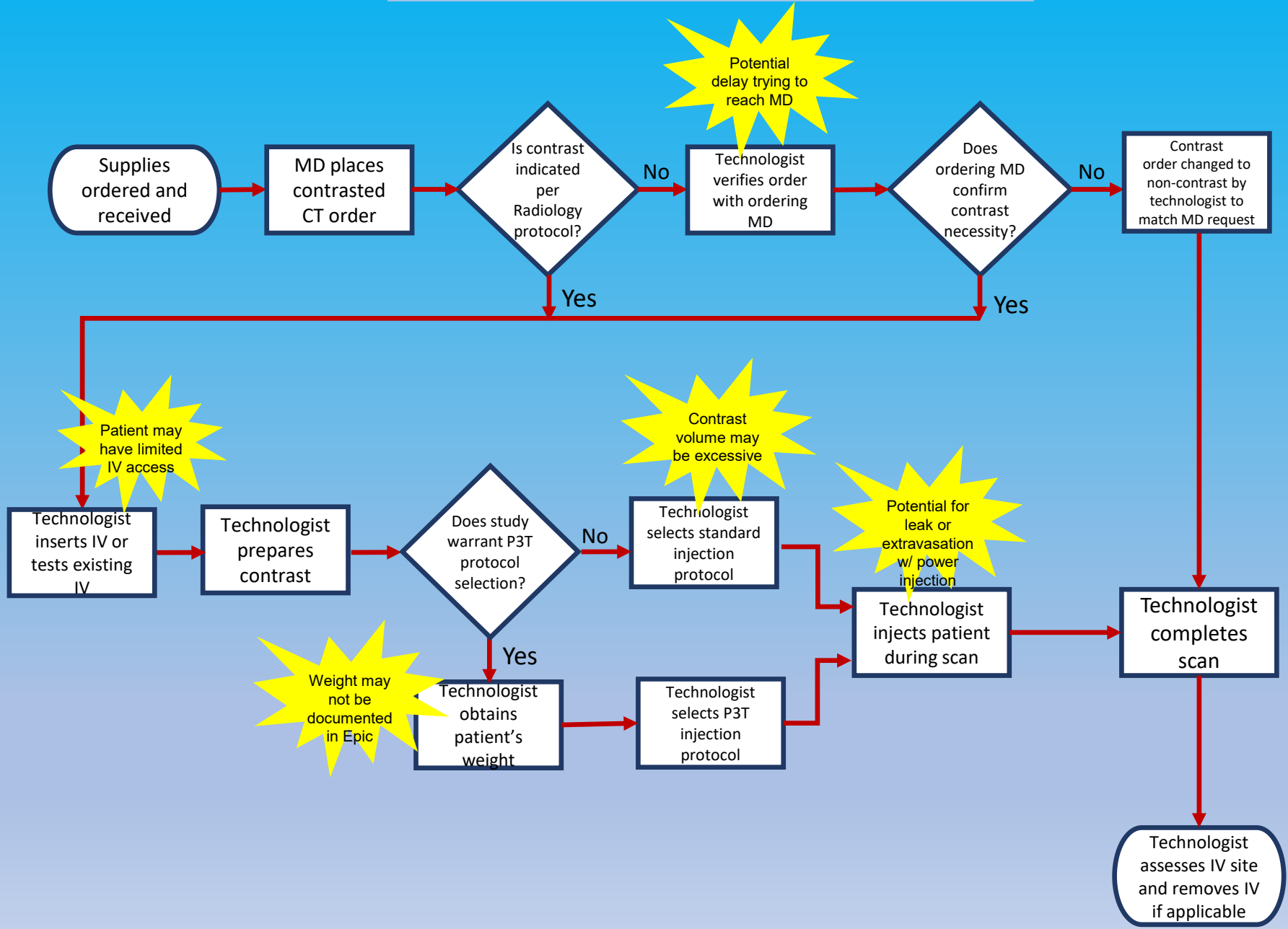
# Define - Lean Six Sigma SIPOC

Project Name:

CT Contrast Cost Reduction

| SUPPLIERS    | INPUTS                        | PROCESS                                     | OUTPUTS                        | CUSTOMERS    |
|--------------|-------------------------------|---|--------------------------------|--------------|
| Bayer        | IV supplies                   | Supply purchase                             | Potential order change         | Patients     |
| BD Insyte    | IV access                     | Contrasted CT orders placed by MD           | Potential contrast waste       | Clinicians   |
| Ordering MDs | Epic orders                   | Technologist may verify order               | Contrast volume adjustment     | Radiologists |
| Radiologists | Injection protocols           | Technologists prepare contrast              | Successful injection           | CT Staff     |
| CT Staff     | Scan protocols                | Technologist places IV or tests existing IV | Extravasation                  | RNs          |
| RNs          | Contrast Supply               | Obtain patient's weight                     | Diagnostic or suboptimal study | IV Team      |
| IV Team      | Technologist Experience Level | Technologist selects injection protocol     | Contrast billing               |              |
| Baxter       |                               | Technologist injects patient during scan    | Radiologist Report             |              |
| Medline      |                               | Scan is completed                           |                                |              |
| 3M           |                               | Technologist assesses IV site               |                                |              |

# Measure - CT Injection Process Mapping





# Measure – Data Collection



Data Collection Plan Template

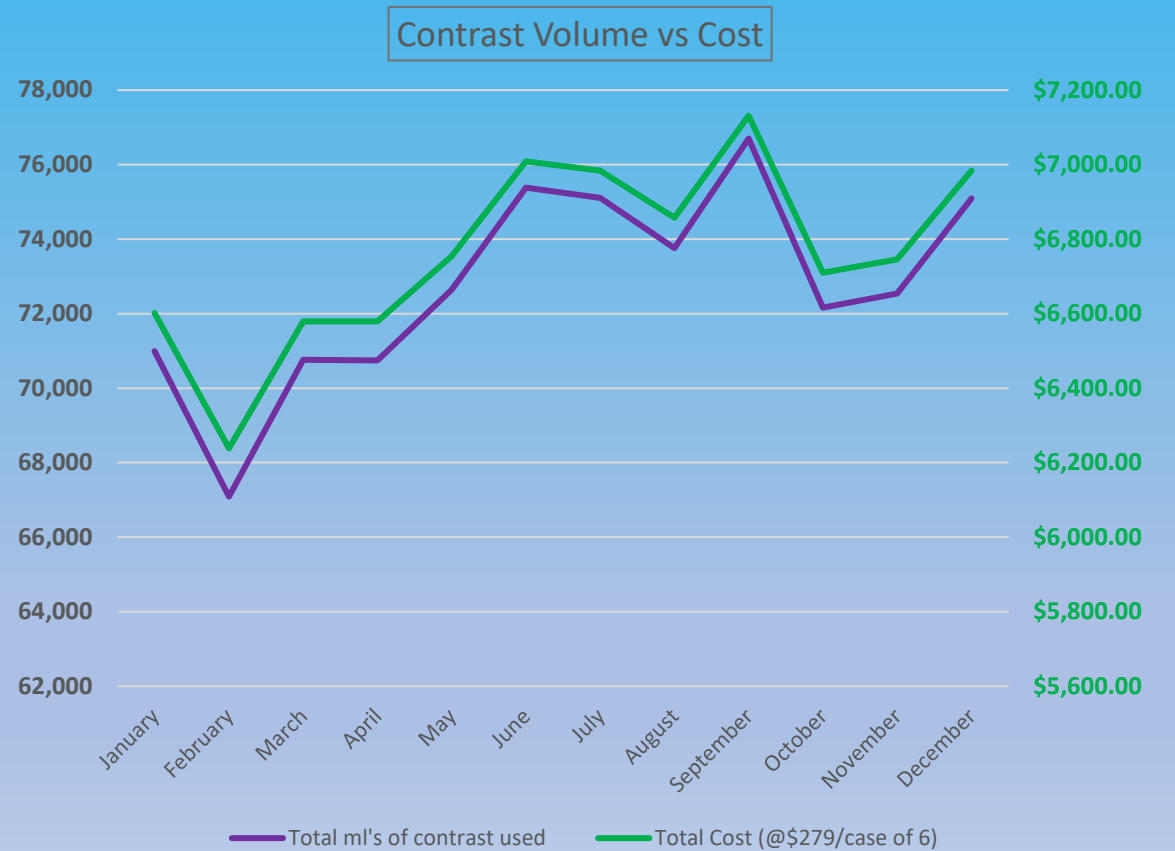
| # | Potential KPIVs | What Metric Will Measure It?          | Type of Chart or Graph Used | What are You Trying to Prove?  | Was Your Assumption Correct? |
|---|-----------------|---------------------------------------|-----------------------------|--|------------------------------|
| 1 | Contrast Volume | Bayer Certegra manager in milliliters | Run Chart Table             | As the contrast volume used for PE & Abdominal studies is decreased, cost to the patient and the department decreases while maintaining image quality. | Yes                          |

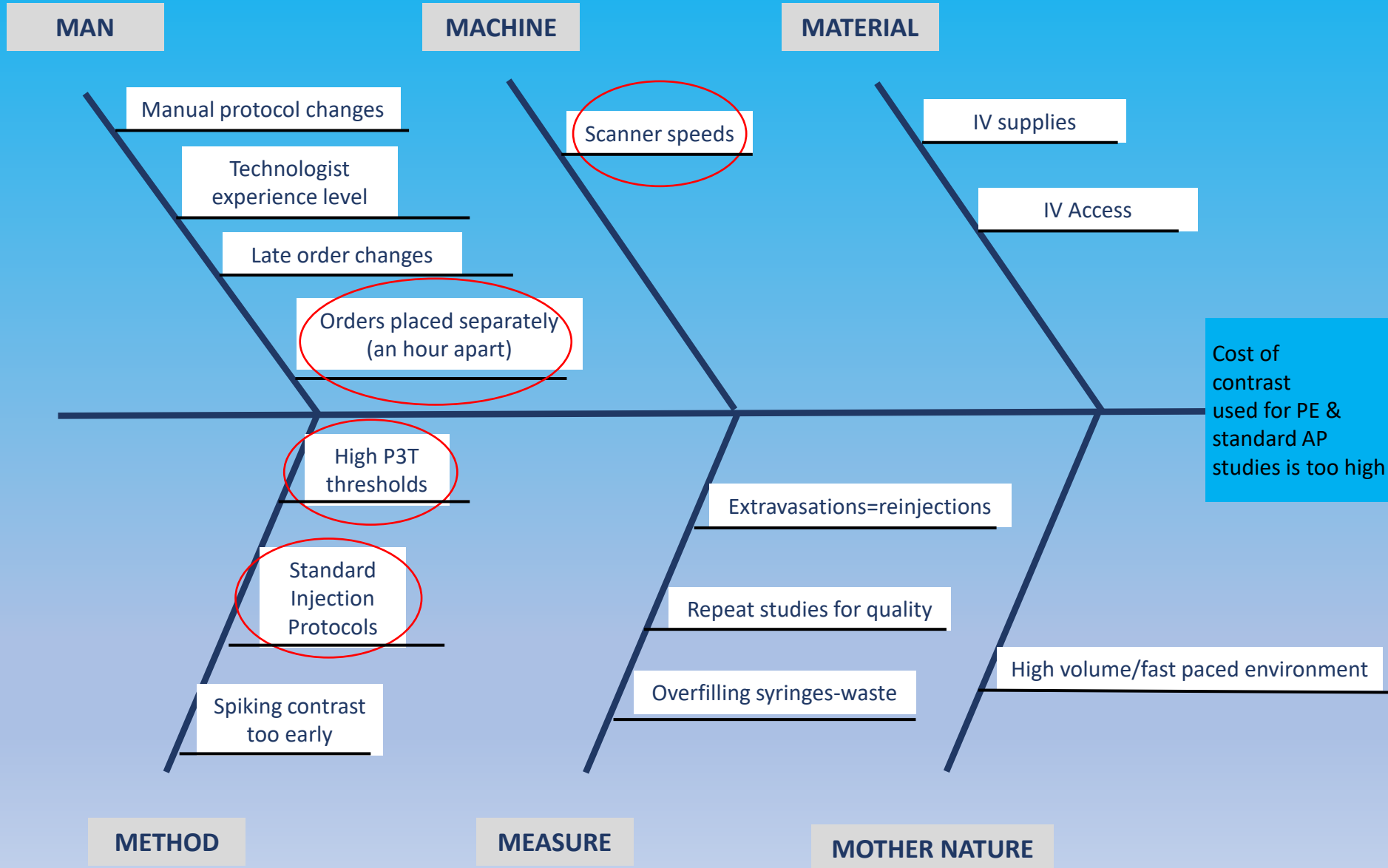
# Measure – Data Collection



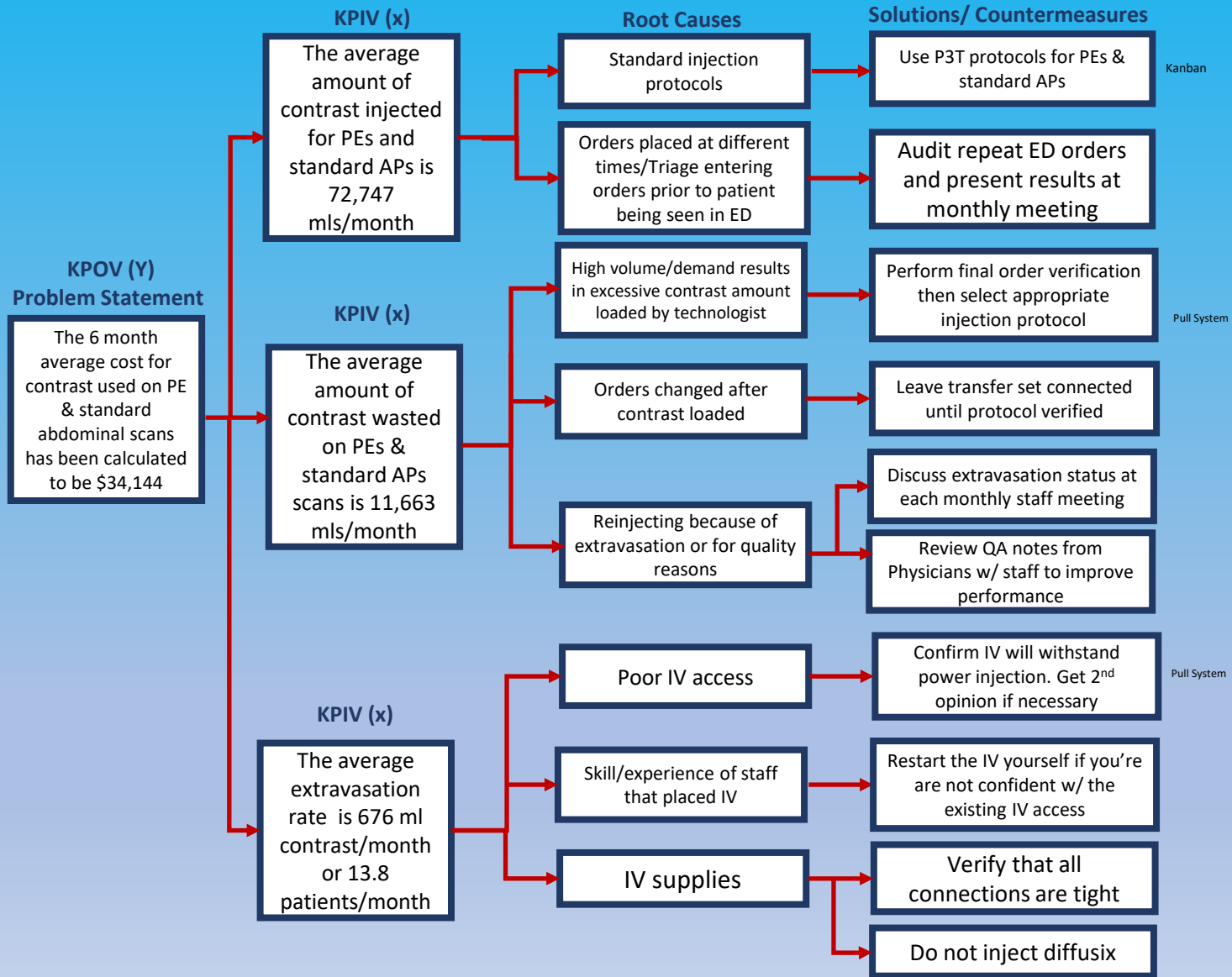
2023

| Month         | # PE Studies Performed | # Standard AP Studies Performed | Total ml's of contrast used | # Isovue 370 Cases/month | Total Cost (@\$279/case of 6) |
|---------------|------------------------|---------------------------------|-----------------------------|--------------------------|-------------------------------|
| January       | 266                    | 537                             | 70,990                      | 23.66                    | \$6,601.14                    |
| February      | 206                    | 537                             | 67,090                      | 22.36                    | \$6,238.44                    |
| March         | 261                    | 538                             | 70,765                      | 23.58                    | \$6,578.82                    |
| April         | 236                    | 554                             | 70,740                      | 23.58                    | \$6,578.82                    |
| May           | 276                    | 547                             | 72,640                      | 24.21                    | \$6,754.59                    |
| June          | 252                    | 590                             | 75,380                      | 25.12                    | \$7,008.48                    |
| July          | 254                    | 586                             | 75,110                      | 25.03                    | \$6,983.37                    |
| August        | 247                    | 577                             | 73,755                      | 24.58                    | \$6,857.82                    |
| September     | 260                    | 598                             | 76,700                      | 25.56                    | \$7,131.24                    |
| October       | 281                    | 539                             | 72,165                      | 24.05                    | \$6,709.95                    |
| November      | 256                    | 559                             | 72,540                      | 24.18                    | \$6,746.22                    |
| December      | 286                    | 565                             | 75,090                      | 25.03                    | \$6,983.37                    |
| <b>Totals</b> | <b>3,081</b>           | <b>6,727</b>                    | <b>872,965</b>              | <b>290.94</b>            | <b>\$81,172.26</b>            |





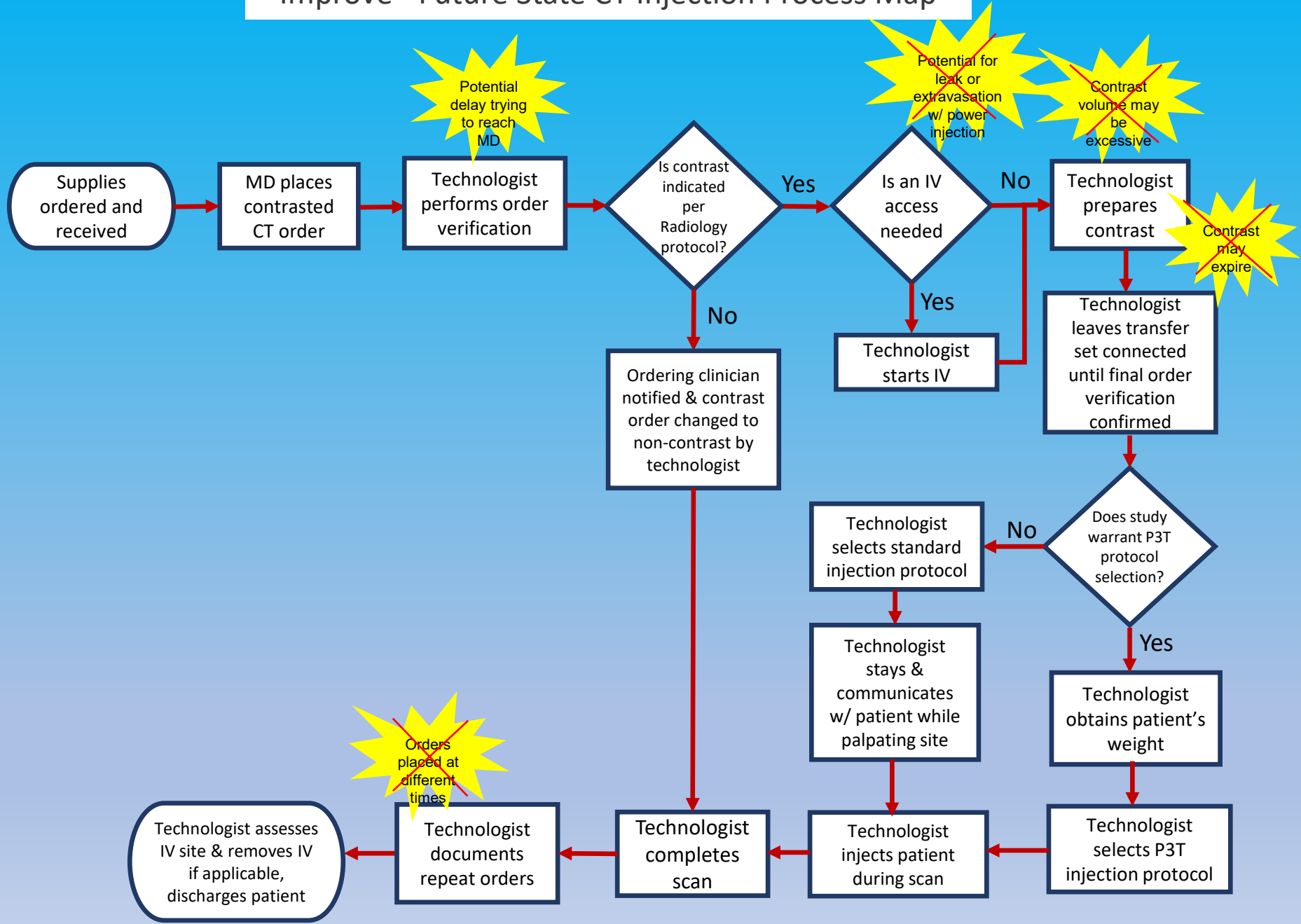
# Improve - Counter Measure Matrix Template



# Improve - Lean Six Sigma RACI Matrix Template

| <b>Project Name:</b>   | <b>CT Contrast Cost Reduction</b>                                     | <b>Date:</b>        | <b>2.19.2024</b>   |                         | <b>Student Name:</b>  | <b>Maureen Gregory</b> |                      |                    |             |                              |            |               |
|--|---|---------------------|--------------------|-------------------------|---|------------------------|----------------------|--------------------|-------------|------------------------------|------------|---------------|
| <b>Responsible (R): Those who perform the activity</b>                             |   |                     |                    |                         | <b>Accountable (A): Person who approves work done by those Responsible</b>      |                        |                      |                    |             |                              |            |               |
| <b>Consulted (C): Those who must be consulted before the activity is performed</b> |   |                     |                    |                         | <b>Informed (I): Those who must be informed after the activity is completed</b> |                        |                      |                    |             |                              |            |               |
| Step   | Process Activities  | Department Director | Department Manager | Chief Technologist (me) | Senior Technologists  | AHN Technologists      | Agency Technologists | Ordering Physician | Radiologist | Inventory Control Specialist | Patient RN | ED Management |
| 1  | Order supplies  | A                   | A,C                | R,A,C                   |   |                        |                      |                    |             | R                            |            |               |
| 2  | Place contrast study order in Epic                                    |                     |                    |                         | I   | I                      | I                    | R                  | A           |                              |            |               |
| 3  | <b>Order verification</b>   |                     |                    | R,A                     | R,A,I   | R,I                    | R,I                  | C                  | C           |                              |            |               |
| 4  | Prepare contrast/injector   |                     |                    | R,A                     | R,A   | R                      | R                    |                    |             |                              |            |               |
| 5  | <b>Leave transfer set connected until order verification complete</b> |                     |                    | R,A                     | R,A   | R                      | R                    |                    |             |                              |            |               |
| 6  | <b>Assess existing or place IV</b>                                    |                     |                    | R,A                     | R,A,I   | R,I                    | R,I                  |                    |             |                              | C          |               |
| 7  | <b>Start new IV if necessary</b>                                      |                     |                    | R,A                     | R,A,I   | R,I                    | R,I                  |                    |             |                              |            |               |
| 8  | <b>Select injection protocol</b>                                      |                     |                    | R,A                     | R,A,I   | R,I                    | R,I                  |                    | R           |                              |            |               |
| 9  | <b>Select P3T for PE &amp; standard AP studies</b>                    |                     |                    | R,A                     | R,A   | R,A                    | R                    |                    | R           |                              |            |               |
| 10   | Inject during scan  |                     |                    | R                       | R,A,I   | R,I                    | R,I                  |                    |             |                              |            |               |
| 11   | Bill contrast in Epic   |                     | A                  | R,A                     | R   | R                      | R                    |                    |             |                              |            |               |
| 12   | Assess IV site, remove IV if applicable                               |                     |                    | R,A                     | R,A   | R                      | R                    |                    |             |                              |            |               |
| 13   | <b>Review study</b>   |                     |                    | R,A,I                   | R,A,I   | R,I                    | R,I                  | R                  | R,A         |                              |            |               |
| 14   | <b>Review QA notes from MDs w/ staff</b>                              |                     |                    | R,A                     |   |                        |                      |                    | C           |                              |            |               |
| 15   | <b>Discuss extravasation status at monthly staff meeting</b>          |                     |                    | R,A                     |   |                        |                      |                    |             |                              |            |               |
| 16   | <b>Audit repeat ED orders and present results at monthly meeting</b>  | A                   | A                  | R,A                     | R   | R                      | R                    |                    |             |                              |            | I             |
| 17   | <b>Do not inject diffusix catheters</b>                               |                     |                    | R,A                     | R   | R                      | R                    |                    |             |                              |            |               |

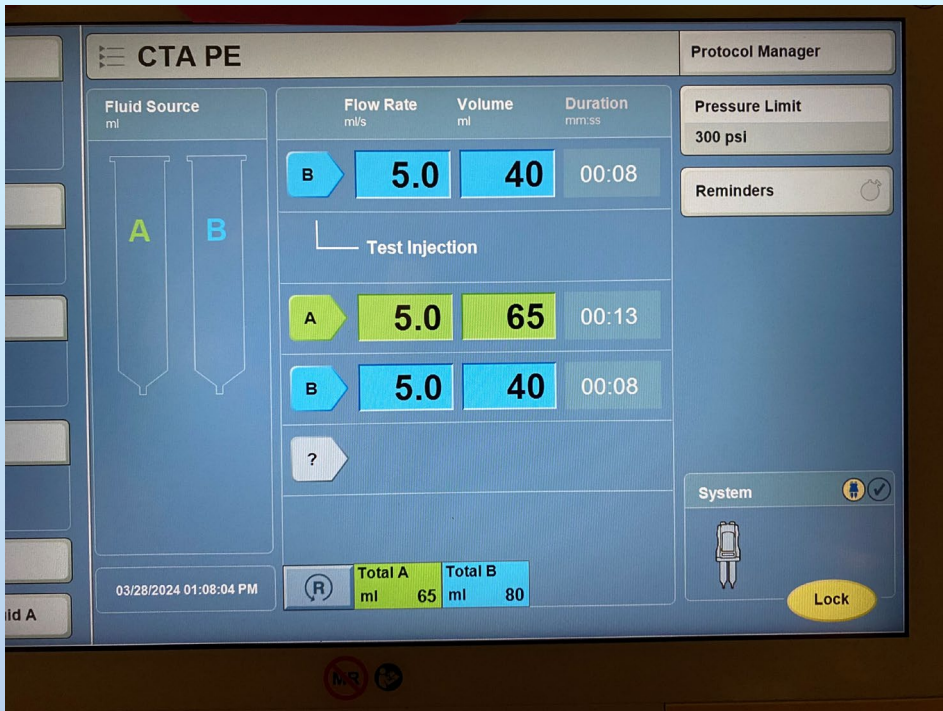
# Improve - Future State CT Injection Process Map





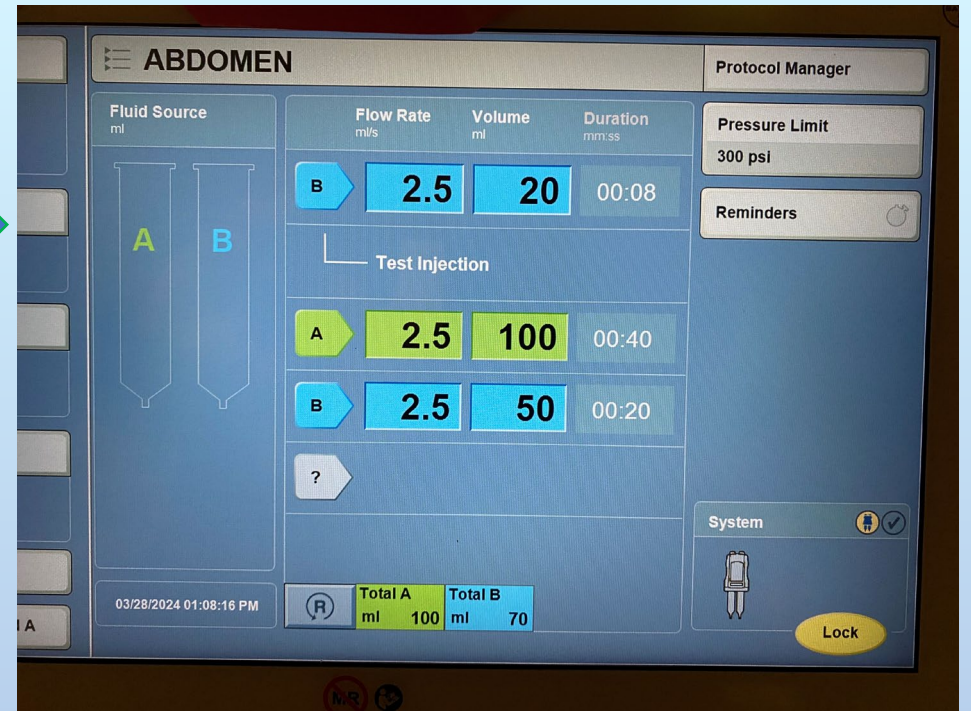
### Control - Action Item Log Template

| DATE    | # | ACTION   | RESPONSIBLE            | DUE DATE | STATUS   | COMMENTS |
|---------|---|--|------------------------|----------|----------|----------|
| 12.5.24 | 1 | Begin discussions about P3T utilization  | MG                     | 2.29.24  | Complete |          |
| 1.2.24  | 2 | Implement P3T use for PEs & Standard APs   | Staff<br>Technologists | 2.29.24  | Complete |          |
| 2.14.24 | 3 | Display P3T reminder on injector console   | MG                     | 2.29.24  | Complete |          |
| 2.28.24 | 4 | Share Future state process map at March staff meeting  | MG                     | 3.31.24  | Complete |          |
| 2.28.24 | 5 | Send studies to MDs for quality approval using P3T   | MG                     | 3.31.24  | Complete |          |
| 2.28.24 | 6 | Add injection process to orientation packet  | MG                     | 3.31.24  | Complete |          |
| 3.4.24  | 7 | Record how many patients return for same day additional injections                           | Staff<br>Technologists | 3.31.24  | Ongoing  |          |
| 3.4.24  | 8 | Begin practice of leaving extension set connected to syringes until final order verification | Staff<br>Technologists | 3.31.24  | Complete |          |
| 3.4.24  | 9 | Collect Cetegra Data   | MG                     | Monthly  | Ongoing  |          |



← BEFORE →

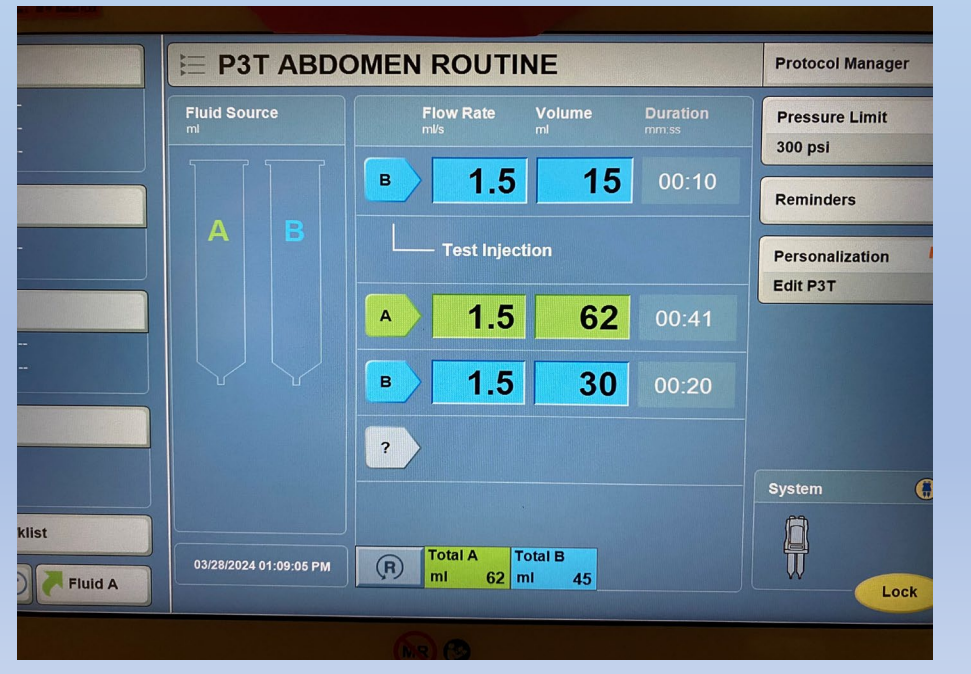
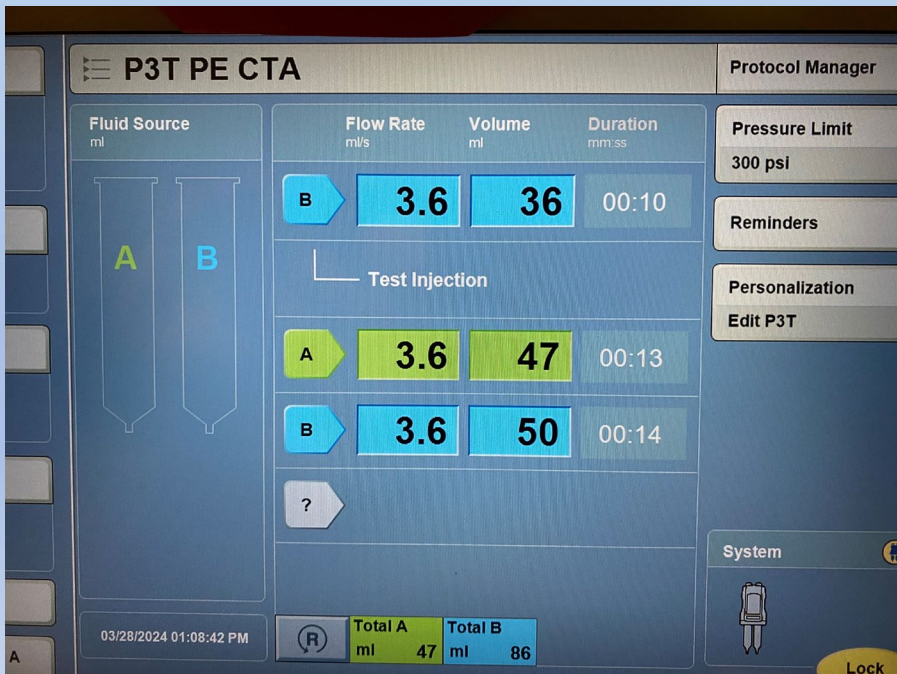
Programmed standard injection rates



P3T Implementation

← AFTER →

Programming weight based contrast volumes





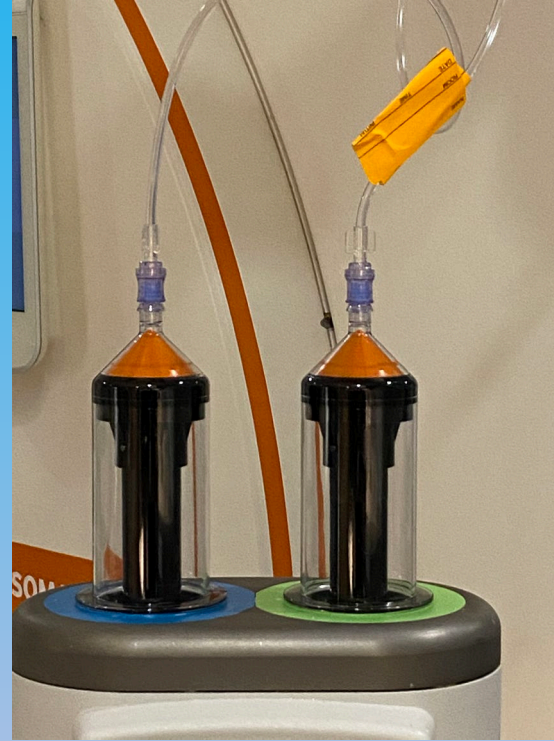
# BEFORE

Loading injectors with standard volumes and/or a random volume of contrast



# AFTER

Waiting for final order verification prior to selecting/loading contrast volume



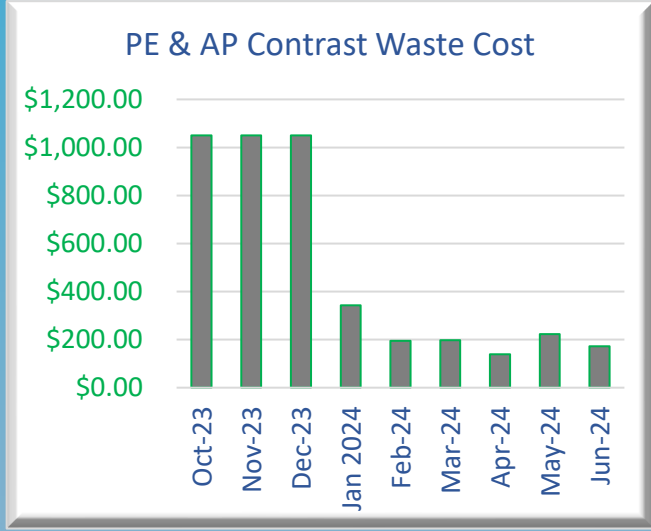
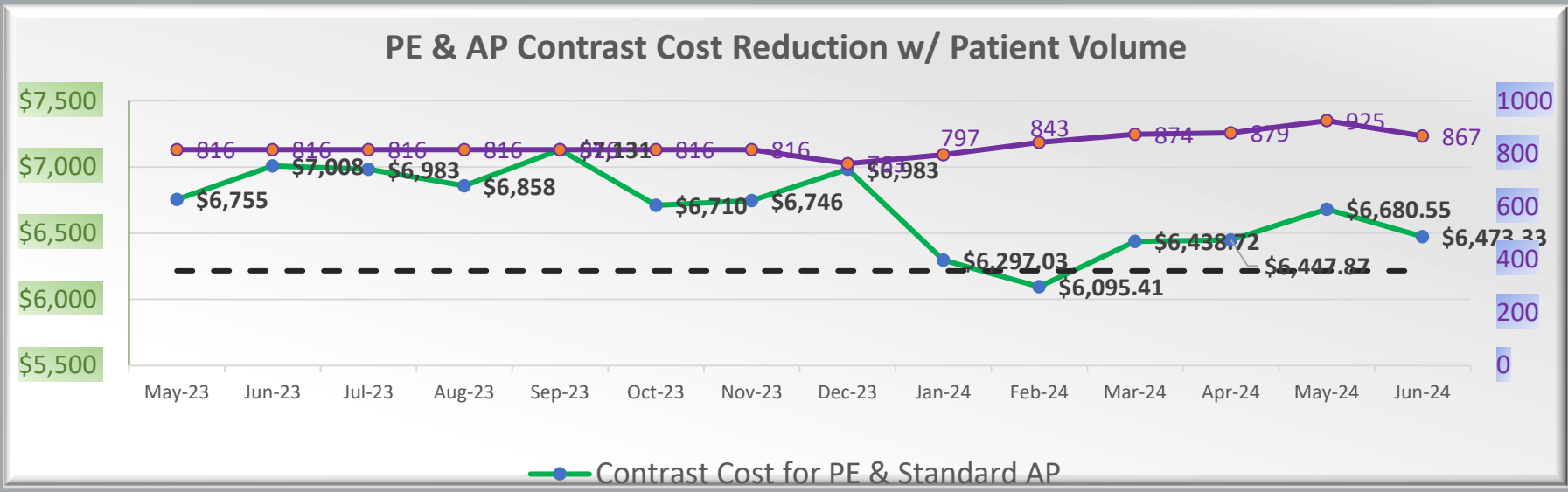
## Workflow Implementation

Educating the agency staff to use the posted reminder for P3T use



# Control – Primary Metric

| Month                              | May-23  | Jun-23  | Jul-23  | Aug-23  | Sep-23  | Oct-23  | Nov-23  | Dec-23  | Jan-24     | Feb-24     | Mar-24     | Apr-24     | May-24     |
|------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|------------|------------|------------|------------|------------|
| Contrast Cost for PE & Standard AP | \$6,755 | \$7,008 | \$6,983 | \$6,858 | \$7,131 | \$6,710 | \$6,746 | \$6,983 | \$6,297.03 | \$6,095.41 | \$6,438.72 | \$6,447.87 | \$6,680.55 |
| # of PE & AP Patients              | 816     | 816     | 816     | 816     | 816     | 816     | 816     | 763     | 797        | 843        | 874        | 879        | 925        |
| Target Line                        | \$6,216 | \$6,216 | \$6,216 | \$6,216 | \$6,216 | \$6,216 | \$6,216 | \$6,216 | \$6,216    | \$6,216    | \$6,216    | \$6,216    | \$6,216    |



# Radiologist Image Quality Review



| PE Studies |              |          |          |                 | Quality   |
|------------|--------------|----------|----------|-----------------|---|
| Scanner    | Weight (Lbs) | MR       | Acc      | Contrast Volume |   |
| Edge       | 96           | 132168   | 31027286 | 45ml            | Excellent   |
| Edge       | 97           | 24684    | 31057750 | 50ml            | Excellent   |
| Force      | 107          | 6351     | 30786787 | 46ml            | Excellent   |
| Force      | 118          | 11315340 | 30678126 | 50ml            | Excellent   |
| Edge       | 120          | 2333364  | 30893853 | 52ml            | Excellent   |
| Force      | 189          | 41132    | 30521342 | 66ml            | Excellent   |
| Force      | 240          | 11433335 | 30631857 | 80ml            | Excellent   |
| Force      | 268          | 1923620  | 30653117 | 75ml            | Excellent   |
| Edge       | 292          | 12805609 | 31049543 | 80ml            | Excellent   |
| Force      | 297          | 3362     | 30711487 | 81ml            | Excellent   |
| Edge       | 322          | 1268355  | 30878394 | 110ml           | Good, but limit may be more pt body habitus than contrast injection |

I graded poor, average, good, and excellent. All were good except 1 excellent and 1 average...see below

| AP      |              |          |          |                 |           |
|---------|--------------|----------|----------|-----------------|-----------|
| Scanner | Weight (Lbs) | MR       | Acc      | Contrast Volume |           |
| Force   | 72           | 10495870 | 31180205 | 54ml            | Good      |
| Force   | 125          | 13284698 | 31129793 | 54ml            | average   |
| Force   | 126          | 28831    | 31131029 | 63ml            | good      |
| Force   | 135          | 10709626 | 31189165 | 66ml            | good      |
| Force   | 154          | 13170595 | 31187683 | 76ml            | good      |
| Force   | 167          | 4840980  | 31180148 | 82ml            | good      |
| Force   | 216          | 5946416  | 31172049 | 106ml           | excellent |
| Force   | 197          | 11455389 | 3130855  | 103ml           | good      |
| Force   | 238          | 11299099 | 31184359 | 121ml           | good      |
| Force   | 290          | 115655   | 30917270 | 143ml           | good      |
| Force   | 301          | 10226750 | 31106166 | 148ml           | good      |