



Clinical Safety & Effectiveness Cohort 19 Team #5

“Appropriate Ordering of CTA in the Diagnostic Workup of Pulmonary Embolism Improves Patient Safety by Reducing Harmful Radiation Exposure and Improves the Quality of Care by Reducing the Overall Treatment Cost”



CENTER FOR PATIENT SAFETY & HEALTH POLICY

UT HEALTH SCIENCE CENTER™

SAN ANTONIO

Team Collaborators

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CS&E Participant

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The slide features a logo on the left with the letters 'CS&E' inside a circular arrow graphic. The text is arranged in a clean, professional layout with a white background and a green grass border at the bottom.

Aim Statement



To decrease the amount of inappropriately ordered CTAs in the MICU / 5th Floor Medical and the ED by mid-December 2016.

Project Milestones

Team Created - 8/16
AIM statement created - 8/16
Weekly Team Meetings
Began - 8/16

Background Data- 9/16
Brainstorm Sessions – 9/16
Workflow - 9/16
Fishbone Analyses – 9/16

Interventions Implemented
10/17/16
Analysis - Ongoing
CS&E Presentation – 1/13/17

The Team used the Plan, Do, Study, Act Model for Improvement





Background Information

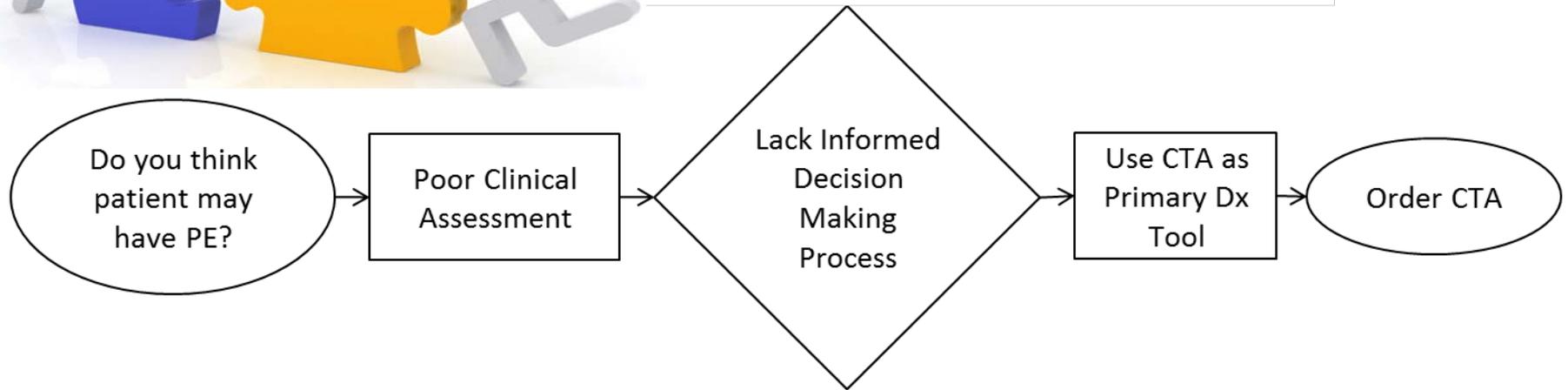
Pulmonary embolism (PE) is the third most common cause of cardiovascular death, affecting between 300,000 to 600,000 patients annually. Presenting symptoms are non-specific, resulting in the reflexive decision to evaluate with computed tomography pulmonary angiography (CT PE protocol), which is not without risk and has a low diagnostic yield (10-20%). However, clinical tools such as Wells' Criteria and D-dimer levels are validated non-radiographic methods of ruling out PE and effectively reduce diagnostic time, cost, and potential complications.

Bibliography

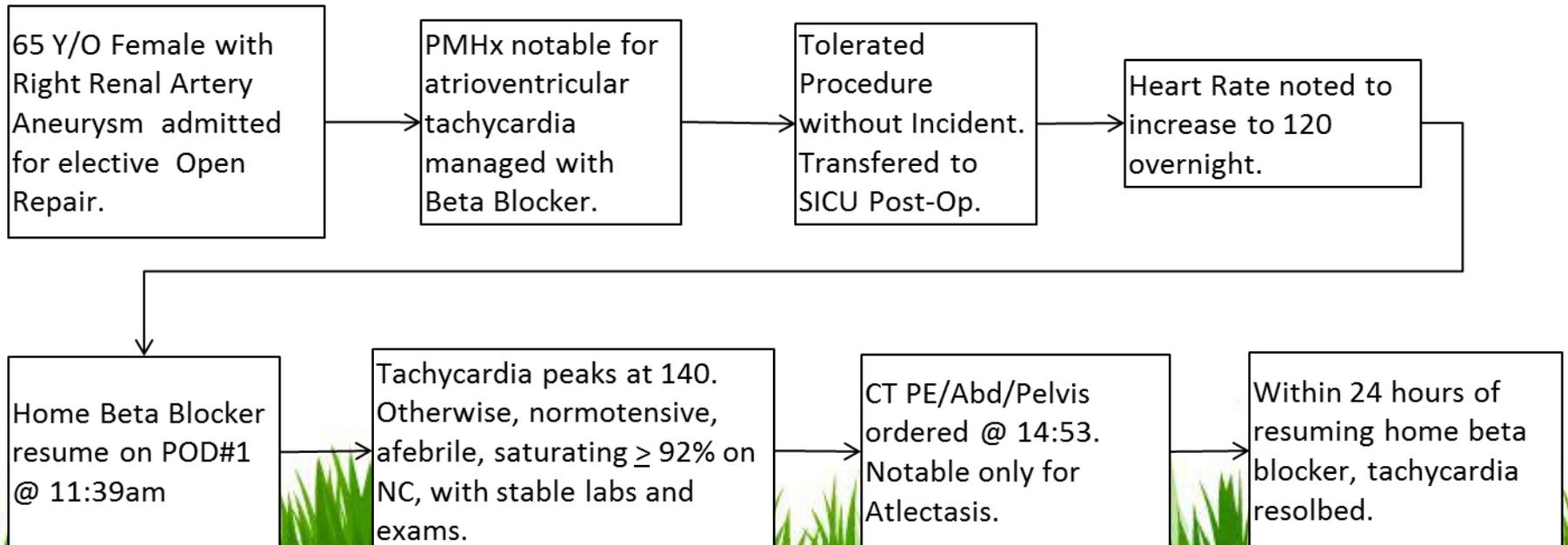
- 1) Green DB, Raptis CA, et al. Negative Computed Tomography for Acute Pulmonary Embolism. *Radiol Clin North Am* 2015; 53:789-799.
- 2) Pasha SM, Klok FA, et al. Safety of Excluding Acute Pulmonary Embolism based on an Unlikely Clinical Probability by the Wells Rule and normal D-dimer Concentration: A meta-analysis. *Thrombosis Research* 2010; 125 (123-127).
- 3) Van Belle A, Buller HR, et al. Effectiveness of Managing Suspected Pulmonary Embolism Using an Algorithm Combining Clinical Probability, D-Dimer Testing, and Computed Tomography. *JAMA* 2006; 295: 172-179.



Theoretical Flow Process Use of CTA in Diagnosing PE

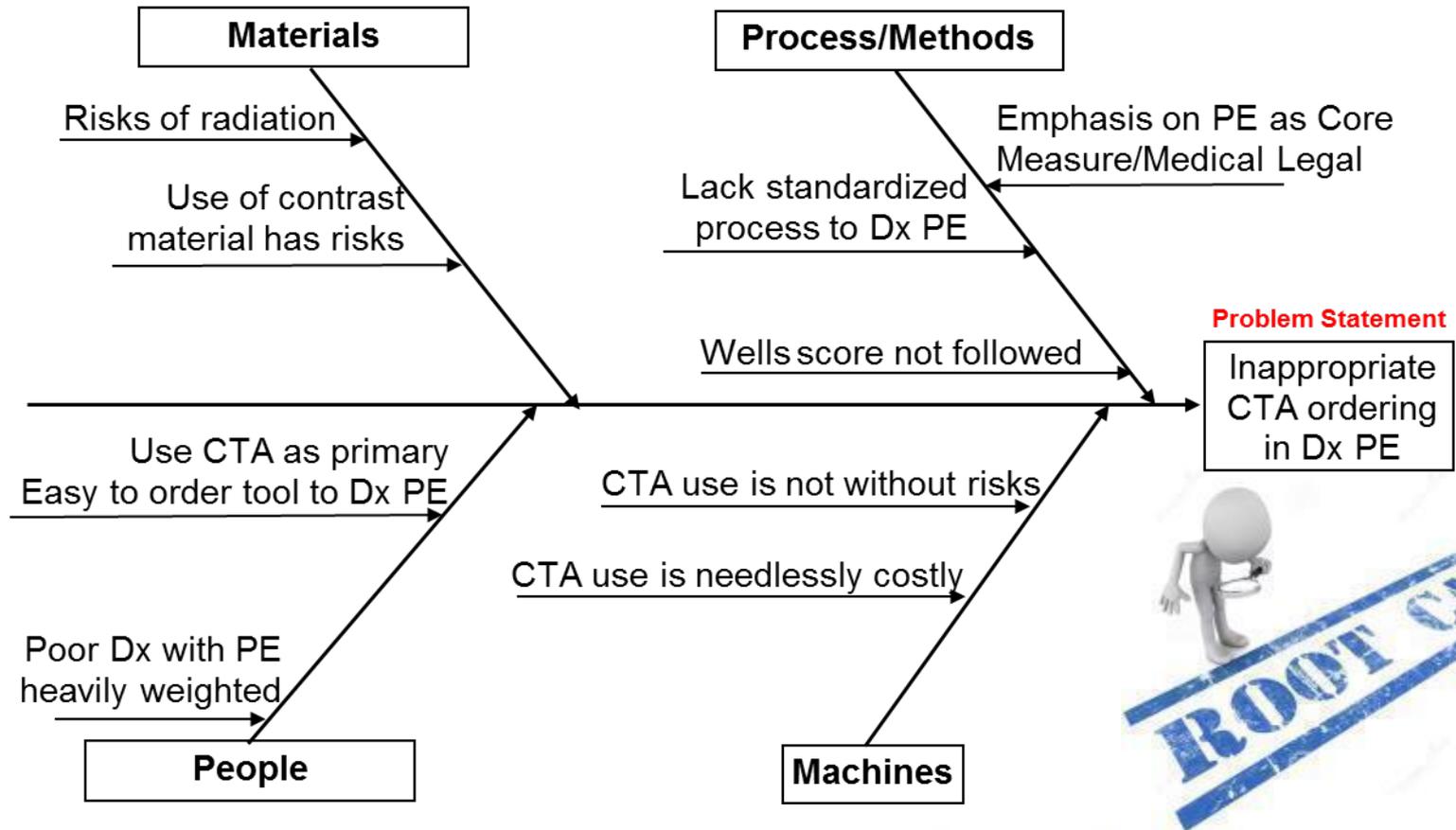


Actual Patient Flow Process Use of CTA in Diagnosing PE



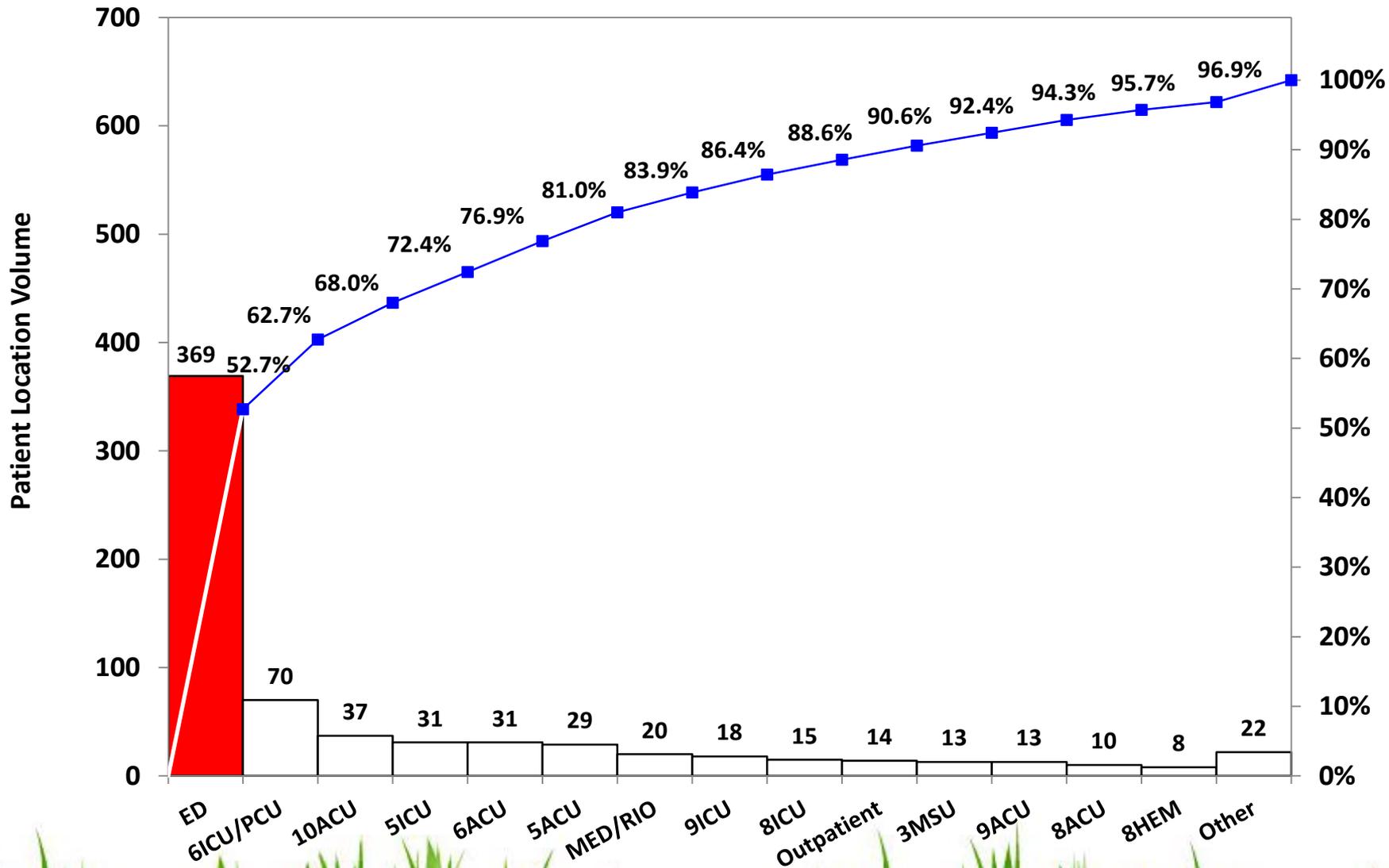
Cause and Effect Diagram

Inappropriate use of CTA ordering in Diagnosing PE



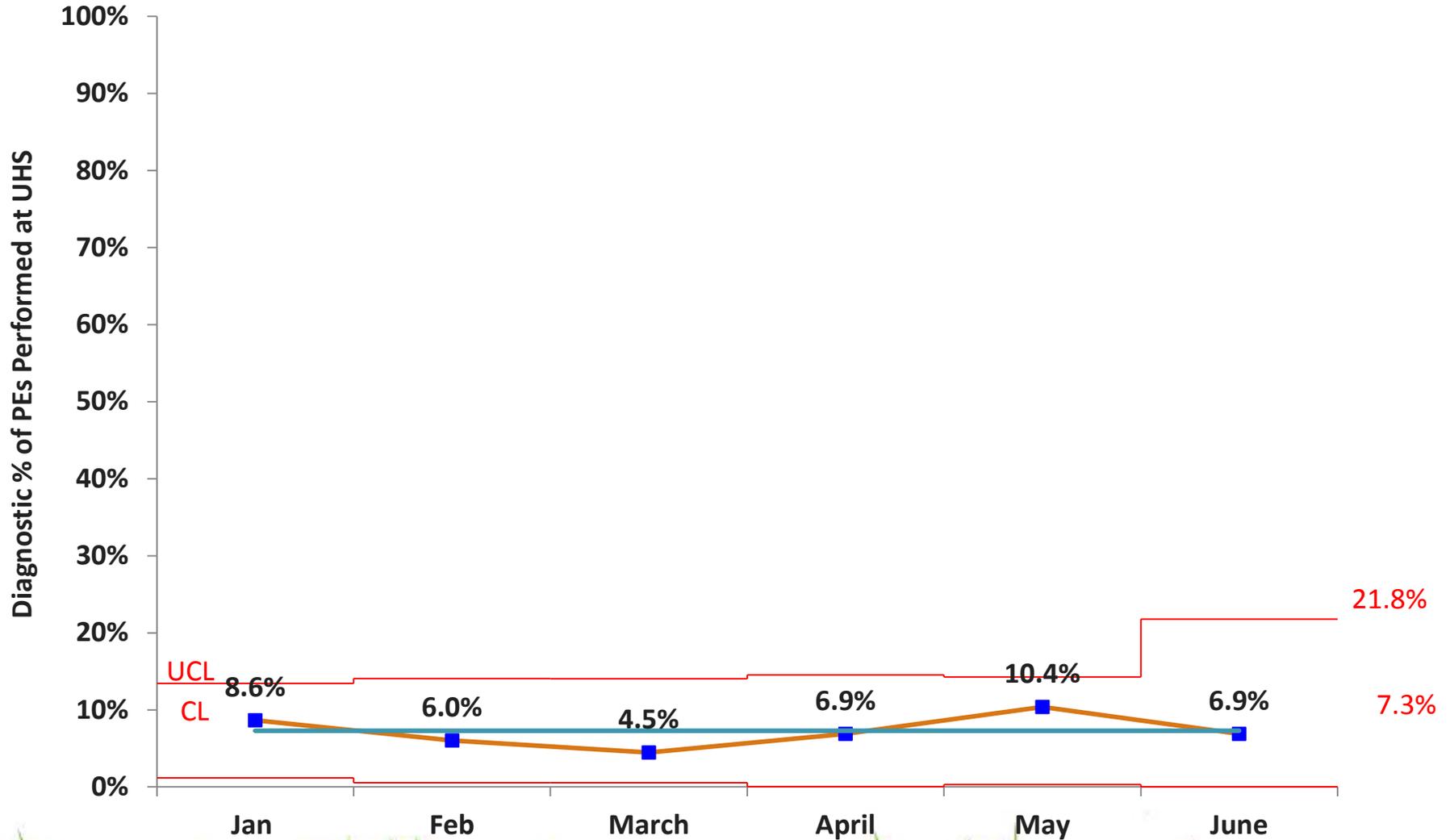
Pareto of Patient Location

Total Exams = 700



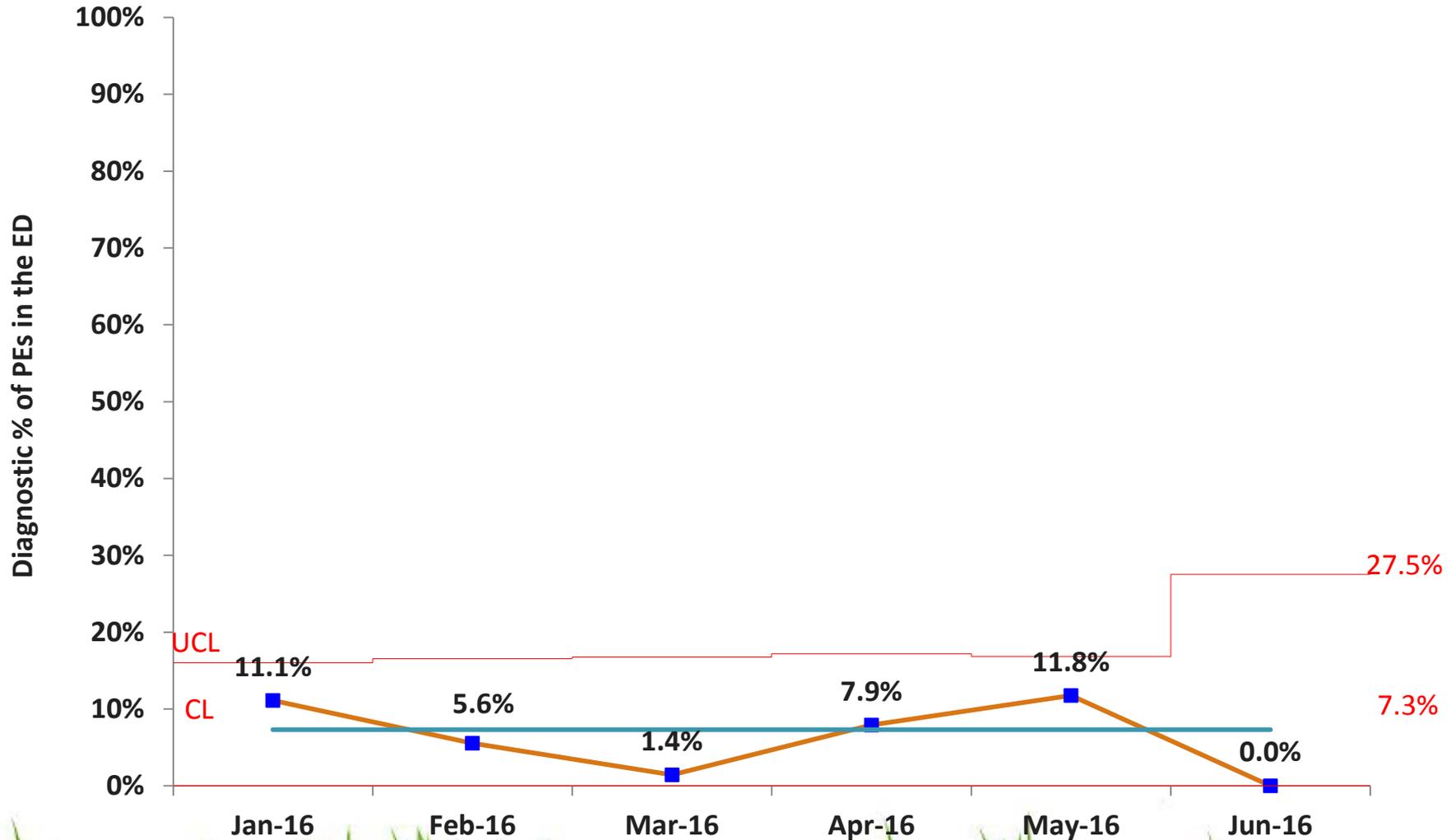
Diagnostic Rate for CT PEs Performed at UHS

p-Chart of Data Jan-Jun 2016



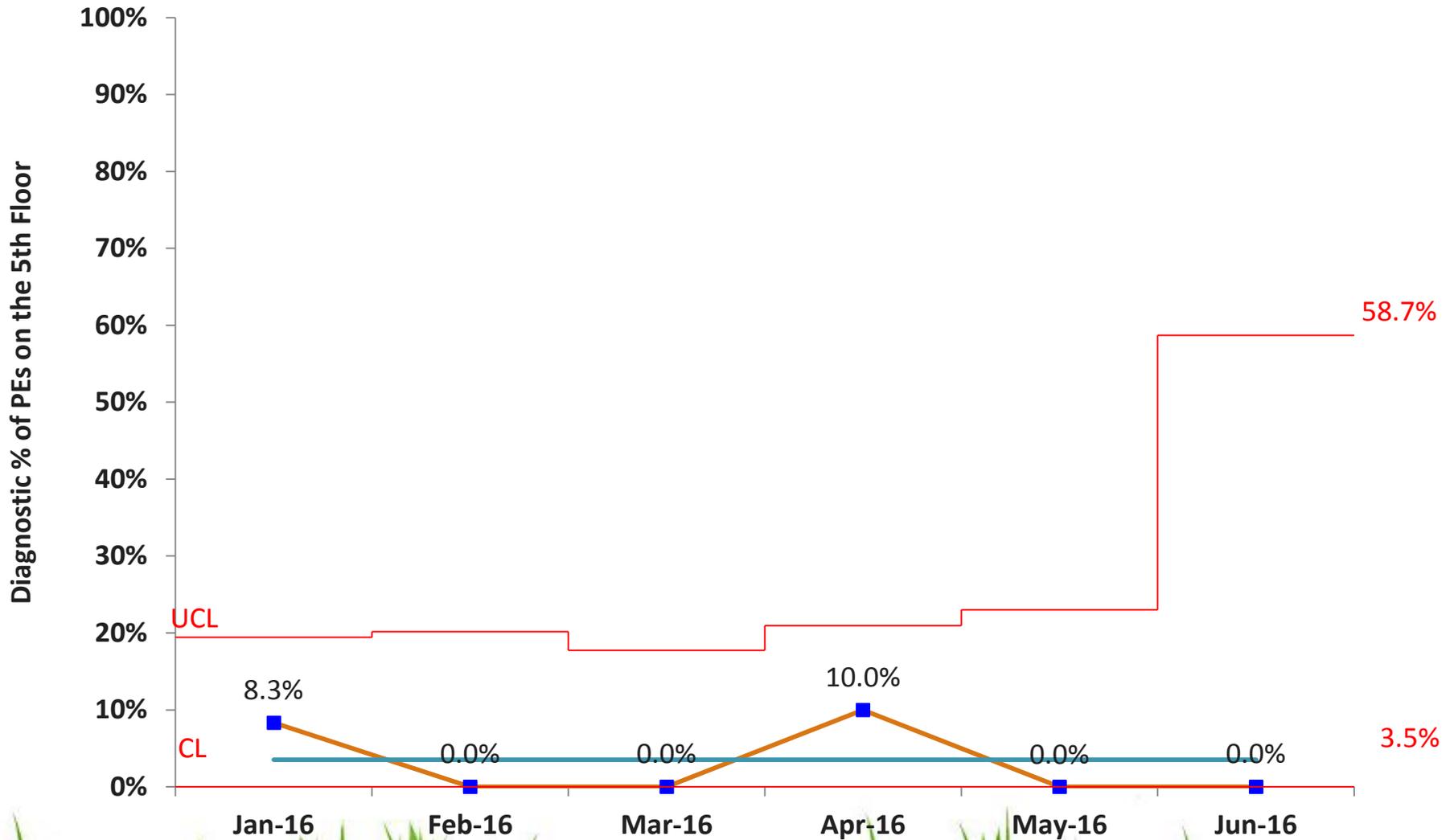
Diagnostic Rate for CT PE in the Emergency Department

p-Chart of Data Jan - Jun 2016



Diagnostic Rate for CT PE on the 5th Floor

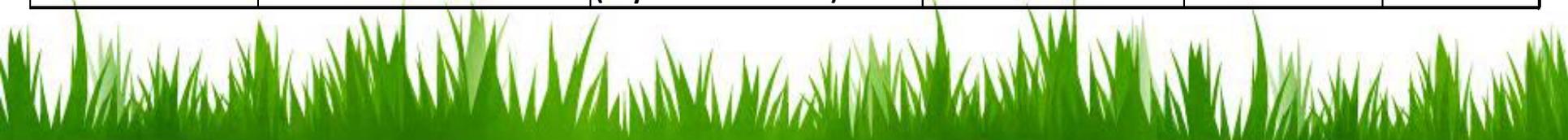
p-Chart of Data Jan - Jun 2016



Action Plan

Aim Statement: To decrease the amount of in appropriately ordered CTAs in the MICU, 5th Medical and ED by Mid-December 2016.

Action Strength	Action Driver (Taken from Flow or Cause & Effect Diagram)	Action	Who?	Why? (Choose one)	Start Date
Strong	Lack Standard Process Wells Score not used	Electronic PE note	Lisa Castellanos, IT Ishmael Salazar, Clinical Informatics Specialist	Standardize Simplify System Change	10/17/2016
Strong	CTA is not without risks Risk of Radiation and Contrast use Excess needless costs	Educate & Train Physicians (MICU, 5th Medical, ED)	Dr. Taylor Hicks	Standardize Simplify	10/17/2016
Intermediate	Lack Standard Process Wells Score not used	Create & post flyers regarding use of CT PE Clinical indication in Medicine workrooms (Sky and Rio Towers)	Dr. H. Baer-Bositis	Standardize Simplify	11/18/2016

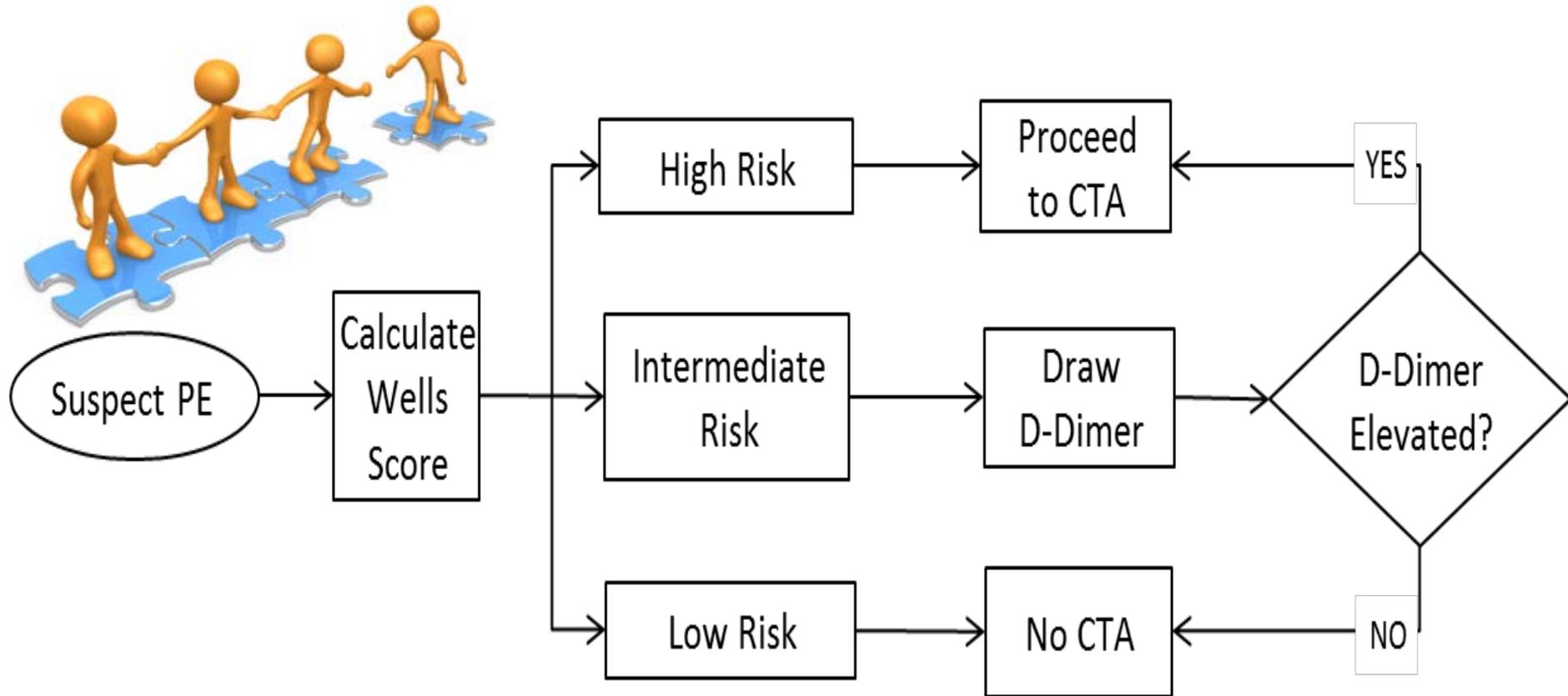


Modified Wells criteria: clinical assessment for pulmonary embolism

Clinical symptoms of DVT (leg swelling, pain with palpation)	3.0
Other diagnosis less likely than pulmonary embolism	3.0
Heart rate >100	1.5
Immobilization (≥ 3 days) or surgery in the previous four weeks	1.5
Previous DVT/PE	1.5
Hemoptysis	1.0
Malignancy	1.0
Probability	Score
Traditional clinical probability assessment	
High	>6.0
Moderate	2.0 to 6.0
Low	<2.0
Simplified clinical probability assessment*	
PE likely	>4.0
PE unlikely	≤ 4.0

Data from van Belle, A, et al. JAMA 2006; 295:172.

Process Intervention for Diagnosing Pulmonary Embolism



CT PE Protocol Clinical Indications

Heart Rate greater than 100

- Yes
 No

Signs or symptoms of DVT (leg swelling, pain with palpation)

- Yes
 No

Immobility (> 3 days) or Surgery (within past 4 weeks)

- Yes
 No

Hemoptysis

- Yes
 No



CT Pulmonary Embolism IT e-Note Template

Malignancy

- Yes
 No

Previous DVT or PE

- Yes
 No

Is PE the most likely diagnosis

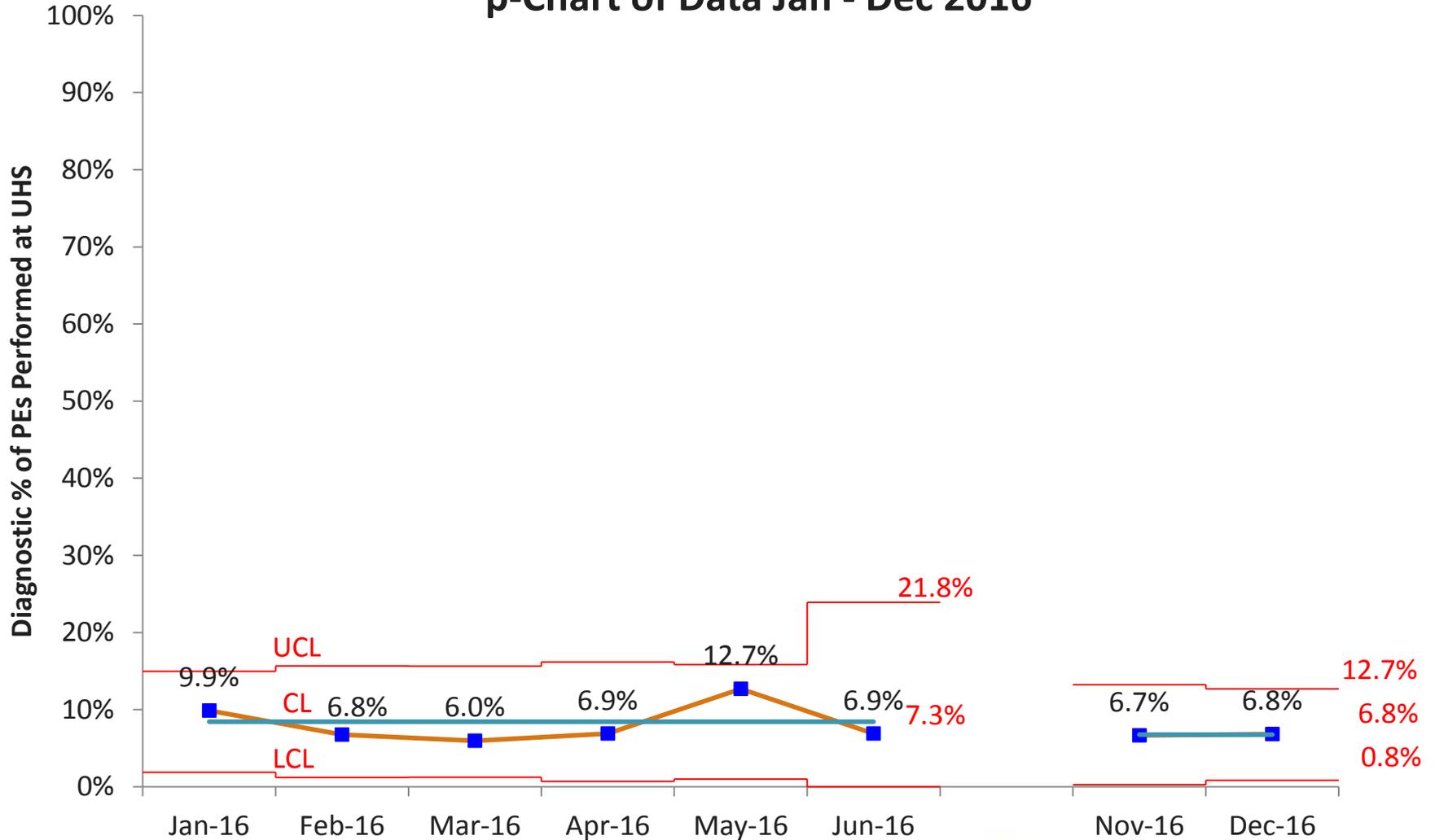
- Yes
 No

CT PE Protocol Score



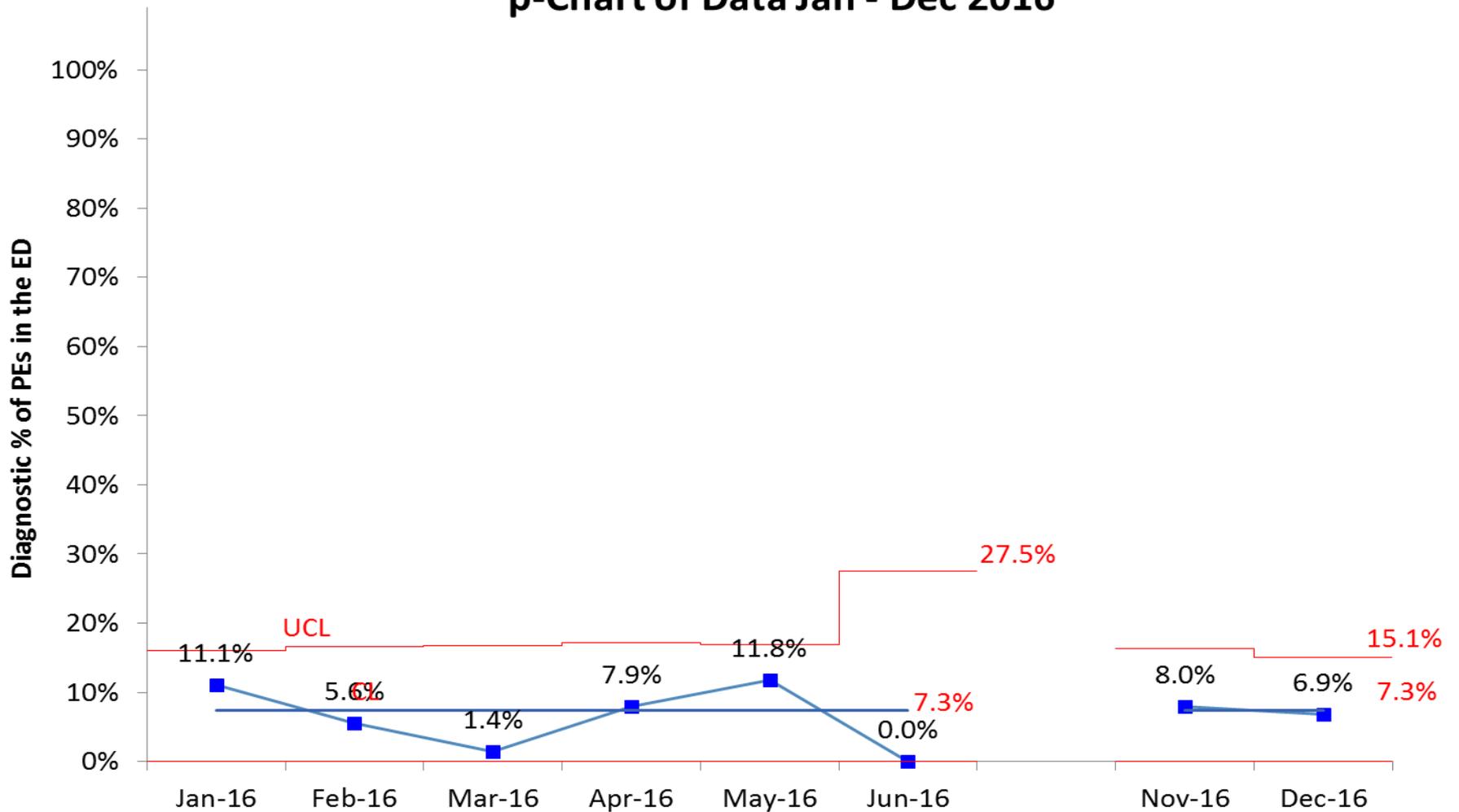
Diagnostic Rate for CT PEs Performed at UHS

p-Chart of Data Jan - Dec 2016



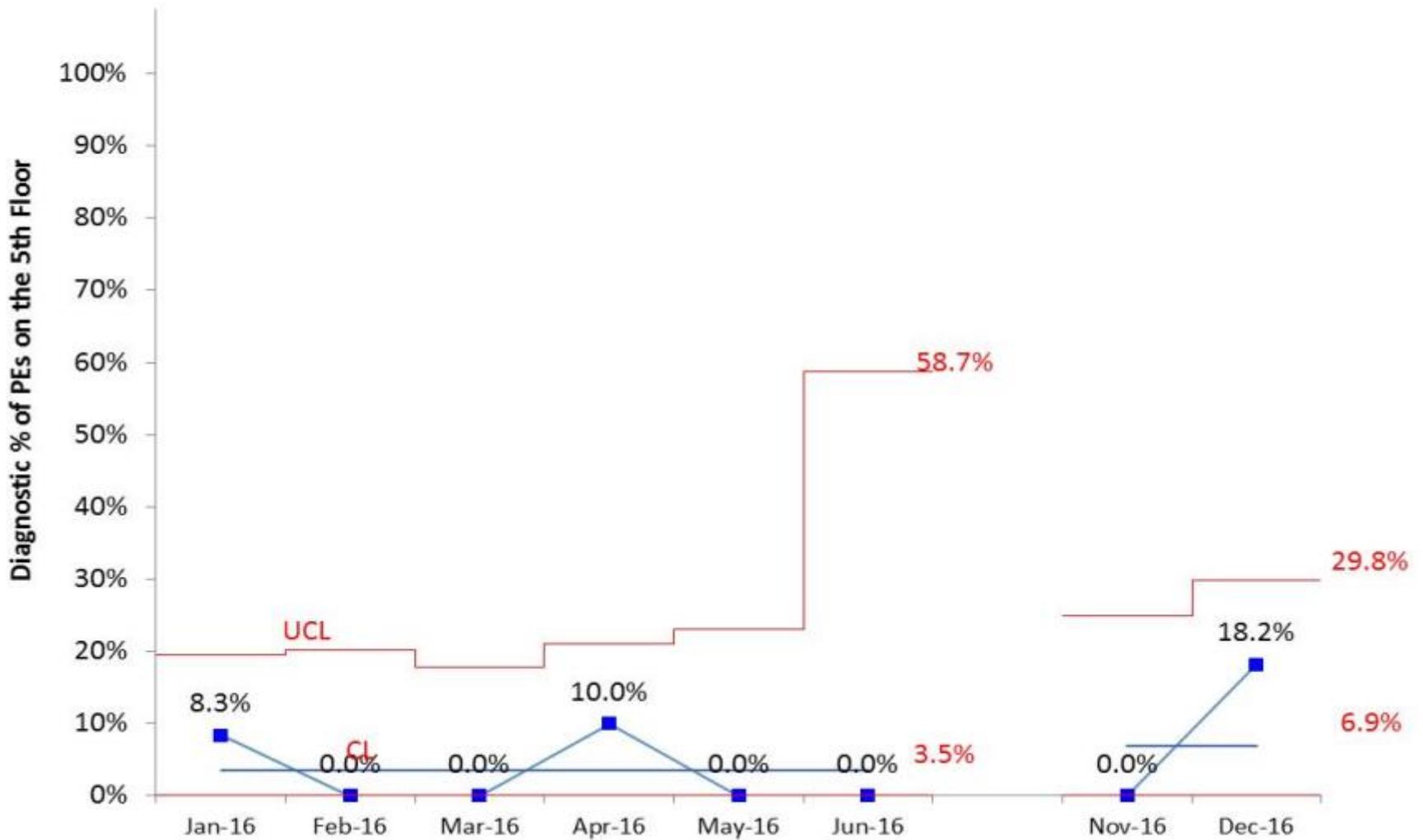
Diagnostic Rate for CT PE in the Emergency Department

p-Chart of Data Jan - Dec 2016



Diagnostic Rate for CT PE on the 5th Floor

p-Chart of Data Jan 0 Dec 2016





NEXT STEPS

- Identify additional adopters of the new process
 - Monitor use of the e-Note Template
 - Report e-Note Template utilization
 - Modify CT physician order process for effectiveness
 - Address this process improvement with University Hospital System (UHS) Administration to gain their support for continued use of the e-Note Template
 - Spread best practice throughout the UHS
- 



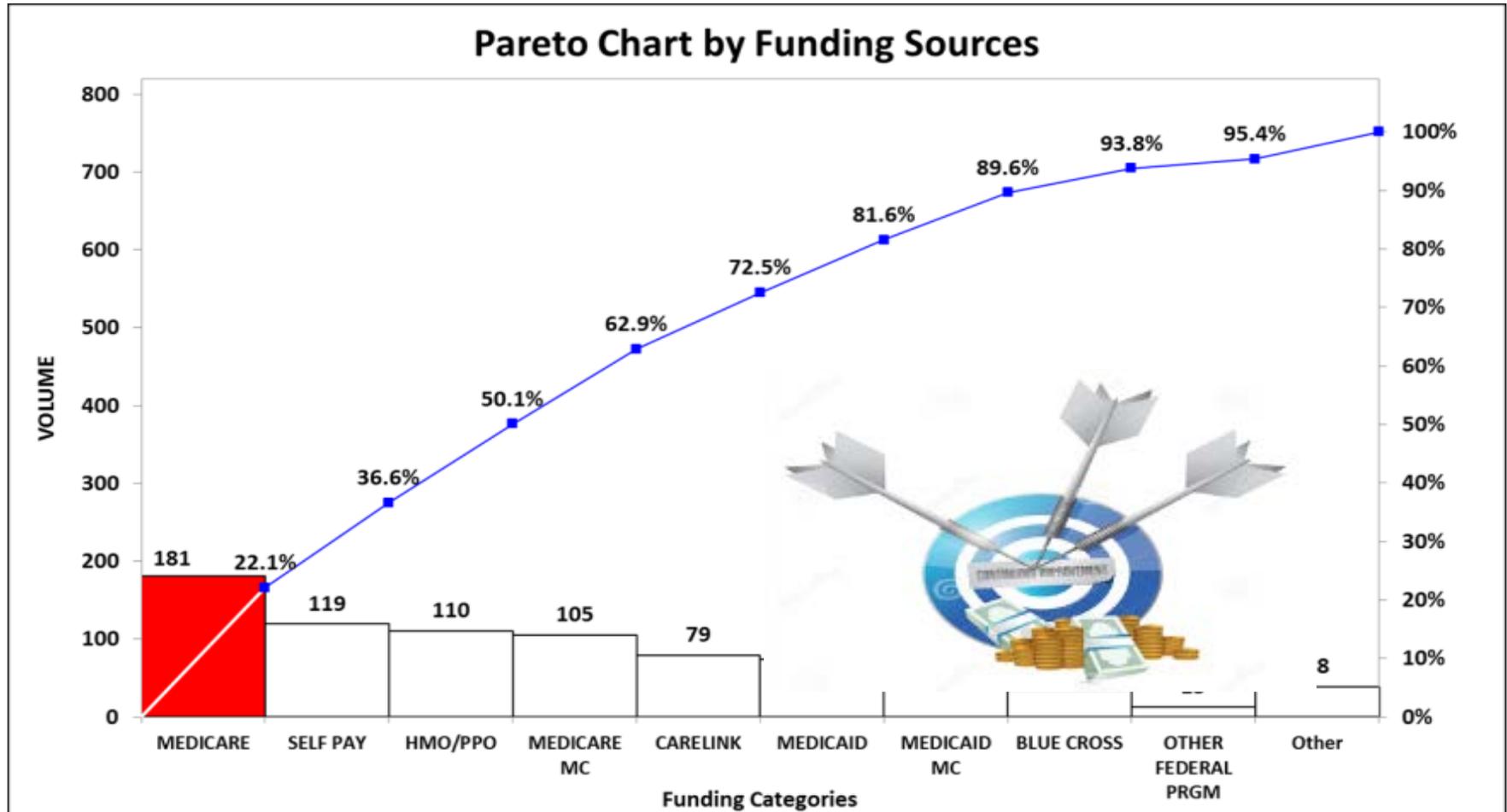
Prevention of CT PE Complications

- Contrast Induced Nephropathy (CIN): 4.96% (95% CI: 3.79 - 6.47) ¹
- Contrast Media Hypersensitivity Reaction: .7 - 3.1% ²

1. Moos S, Van Vemde D, et al. Contrast induced nephropathy in patients undergoing intravenous (IV) contrast enhanced computed tomography (CECT) and the relationship with risk factors: A meta-analysis. *European Journal of Radiology* 2013; 82: 387-399.

2. Rose R, Choi J. Intravenous Imaging Contrast Media Complications: The Basic That Every Clinician Needs to Know. *American Journal of Medicine* 2015; 128: 943-949.

Financial Return On Investment



- UHS is paid a fixed amount by Medicare and many private insurance contracts.
- Any monies remaining after all care is rendered add to the profit margin.



Financial Return On Investment



Pre-Intervention Cost Analysis based on Wells Score

	Direct Cost (\$108.66)	Indirect Cost (\$688.81)	Total Cost (\$797.47)
Low Wells Score (250)	\$27,165.00	\$172,202.50	\$199,367.50
Intermediate/High Wells Score (450)	\$48,897.00	\$309,964.50	\$358,861.50
Total (700)	\$76,062.00	\$482,167.00	\$558,229.00

Financial Return per Patient based on Wells Criteria

	Cost	Potential Savings
Low Risk	\$0.00	\$797.47
Intermediate Risk (D-dimer only)	\$243.25	\$554.22
High Risk (CT Angio PE)	\$797.47	-

Maintaining the Gains

- The physician continues to maintain CT ordering autonomy
- e-Note requires mandatory documentation
 - Lowers the risk of failure to appropriately diagnose and treat
 - No adverse results from using D-Dimer
 - Demonstrates quality care
- Analysis of documentation via research staff support
- Continued physician education based on data results per unit



Maintaining the Gains: Current Best Practice



An initiative of the ABIM Foundation

American College of Radiology



Five Things Physicians and Patients Should Question



Don't do imaging for uncomplicated headache.

Imaging headache patients absent specific risk factors for structural disease is not likely to change management or improve outcome. These patients with a significant likelihood of structural disease requiring immediate attention are detected by clinical screens that have been validated in many settings. Many studies and clinical practice guidelines concur. Also, incidental findings lead to additional medical procedures and expense that do not improve patient well-being.



Don't image for suspected pulmonary embolism (PE) without moderate or high pre-test probability of PE.

While deep vein thrombosis (DVT) and PE are relatively common clinically, they are rare in the absence of elevated blood d-Dimer levels and certain specific risk factors. Imaging, particularly computed tomography (CT) pulmonary angiography, is a rapid, accurate and widely available test, but has limited value in patients who are very unlikely, based on serum and clinical criteria, to have significant value. Imaging is helpful to confirm or exclude PE only for such patients, not for patients with low pre-test probability of PE.



Avoid admission or preoperative chest x-rays for ambulatory patients with unremarkable history and physical exam.

Performing routine admission or preoperative chest x-rays is not recommended for ambulatory patients without specific reasons suggested by the history and/or physical examination findings. Only 3 percent of such images lead to a change in management. Obtaining a chest radiograph is reasonable if acute cardiopulmonary disease is suspected or there is a history of chronic stable cardiopulmonary disease in a patient older than age 70 who has not had chest radiography within six months.

Thank you and . . .



Any Questions?