



# R-SCAN Increasing the Percentage of High Yield CT Pulmonary Angiograms for PE Through Educational Collaboration Between Radiology and Emergency Departments

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## Introduction

### Background:

- Radiology and Emergency Medicine Departments are interdependent and collaborate on many issues for patient care. One of the most frequently ordered exams in this regard is the CT Pulmonary Angiogram or CT PE. This non-invasive test is quick and effective at diagnosing pulmonary embolism and has overtaken the invasive method of pulmonary angiography<sup>1</sup>.
- However, there has been growing concern of overutilization which exposes patients to unnecessary radiation, intravenous contrast, and cost. Moreover, changes in health care legislation have increasingly placed emphasis on providing quality metrics that support the use of obtaining costly exams such as for a CT PE<sup>3</sup>. This has subsequently led to the development of algorithms and tools that could assist in decreasing unnecessary examinations and provide quality metrics<sup>4</sup>.
- One such tool is R-SCAN. R-SCAN is a recently developed and trademarked online tool created by the American College of Radiology (ACR) to assist in performing quality metrics for the ordering of radiological exams.

### Objectives:

- Implement the R-SCAN tool with the goal of increasing the percentage of high yield of CT PE studies ordered from the Emergency Department.
- Increase the percentage of D-Dimers ordered in patients with low Wells' score which would decrease the number of prospective low-value CTA exams.

## Materials and Methods

- We first retrospectively analyzed 100 random CT pulmonary angiogram studies ordered from the Emergency Department from September 2015 to February 2016.
- D-dimer, Wells' criteria score, R-SCAN rating, patient demographics, and test results for each ordered CT pulmonary angiogram study were derived from medical record review. Patients with indeterminate results or prior pulmonary emboli were excluded.
- We then performed an educational collaboration with the Emergency Department in which the above data was presented to ED staff. This data was used by both departments to reach a mutual understanding on how to increase the percentage of high yield CT PE studies. A goal to use D-Dimer values in patients with low clinical suspicion for pulmonary embolism was set.
- Furthermore, an agreed upon terminology was set as exams that would be labeled "Appropriate" by R-SCAN and ACR Appropriateness Criteria were labeled as "High Yield" instead of "Appropriate".
- We then similarly analyzed 100 random CT pulmonary angiogram studies ordered from the Emergency Department post collaboration from February 2017 to March 2017

## Tools Used

- D-Dimer: Value greater than 500 ng/ml was considered positive.
- Modified Wells' Score
  - >4 High or Moderate Risk
  - ≤ 4 Low Risk

Clinical Characteristic	Score
Clinical signs or symptoms of DVT	3
PE most likely or equally likely diagnosis	3
Tachycardia (HR>100)	1.5
History of DVT or PE	1.5
Immobilization >3 days/surgery in previous 4 weeks (not included in modified Wells' Score)	1.5
Hemoptysis	1.0
Active cancer within last 6 months	1.0

### 3. R-SCAN

Acute Chest Pain-Suspected PE R-SCAN 1.0 Scenarios	
Scenario	R-SCAN Score
No clinical suspicion of pulmonary embolism	1
Pulmonary embolism likely, high/moderate clinical probability (modified Wells' criteria score >4.0 or simplified revised Geneva score >2)	9
Pulmonary embolism unlikely, low clinical probability (modified Wells' criteria score ≤ 4.0 or simplified revised Geneva Score ≤2)	3
Pulmonary embolism unlikely, low clinical probability (modified Wells' criteria score ≤ 4.0 or simplified revised Geneva Score ≤2), plus a negative D-Dimer level (<500 ng/ml)	1
Pulmonary embolism unlikely, low clinical probability (modified Wells' criteria score ≤ 4.0 or simplified revised Geneva score ≤2), plus a positive/elevated D-Dimer level (>500ng/mL)	9

### R-SCAN Appropriateness / Yield score

- 1-3: "Usually not appropriate" / "Low Yield"
- 4-6: "May be appropriate"
- 7-9: "Usually appropriate"/ "High Yield"

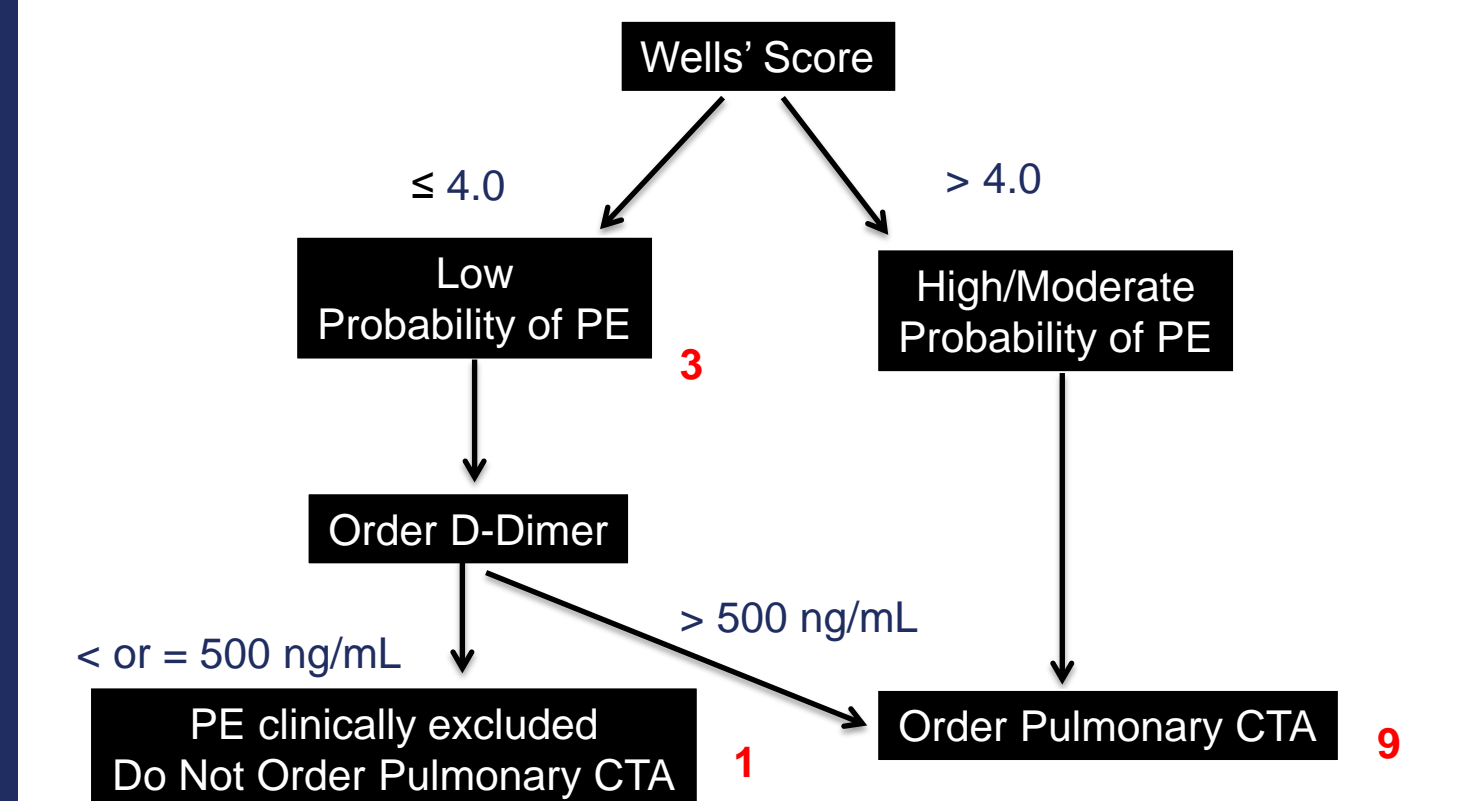
## Pre-Intervention Data

- There were no differences in patient characteristics before and after the collaboration.
- Out of the 100 pre-collaboration studies analyzed, 34 had a Wells' score of >4 and 54 were considered high-yield (R-SCAN>6).
- 29 patients had D-Dimers ordered, 14 of which were positive (>500 ng/mL). All patients with D-Dimers <500 ng/mL were negative for PE.
- Out of the 66 studies with a Wells' score ≤ 4, 22 had a D-Dimer ordered, 9 of which were positive.
- No studies deemed low yield (n=46) were positive for PE.

## Intervention

- Shared results with ED collaborators in a small meeting.
- Attended ED practice meeting.
- Both departments noted the importance of the pre-intervention data demonstrating that all patients with a low Wells' score and D-Dimer level <500 ng/mL (i.e. low yield) were negative for PE.
- ED department handled education component internally
- Shared slides regarding project to ED collaborators for their use
- ED provided separate educational conferences for residents and attending staff with specific recommendations for risk stratification by Wells' (per R-SCAN) and D-Dimer as adequate when ≤ 4.

### RSCAN 1.0 Decision Tree for Patient with Clinical Suspicion for PE

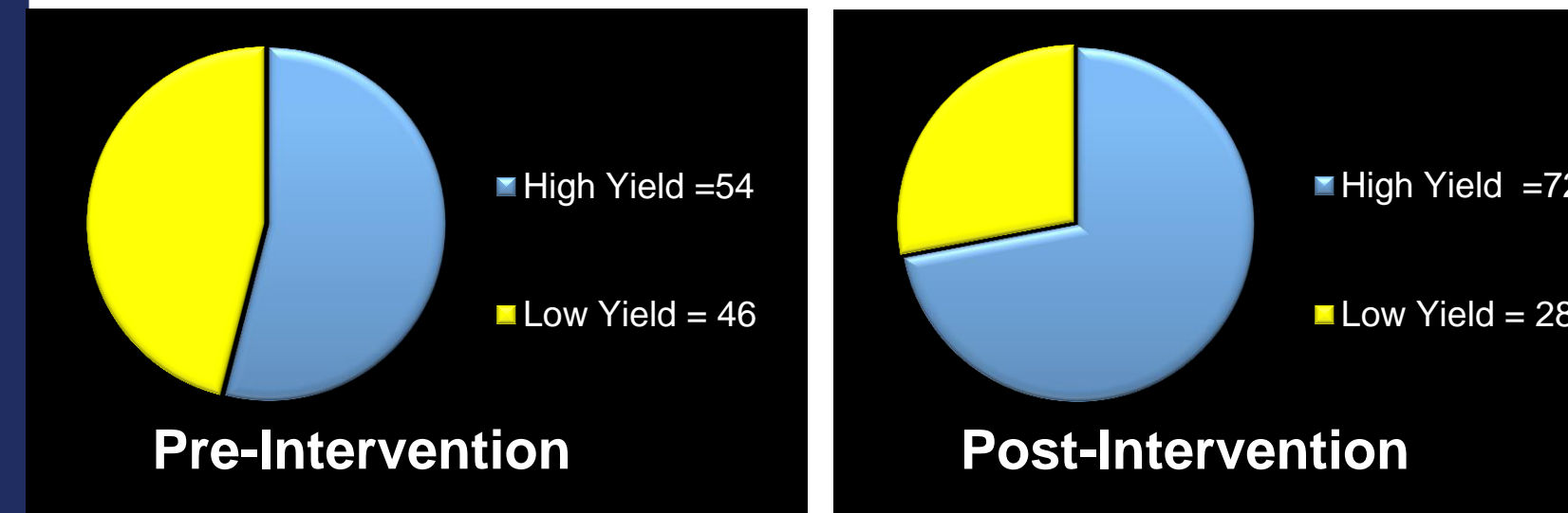


## Post-Intervention Data

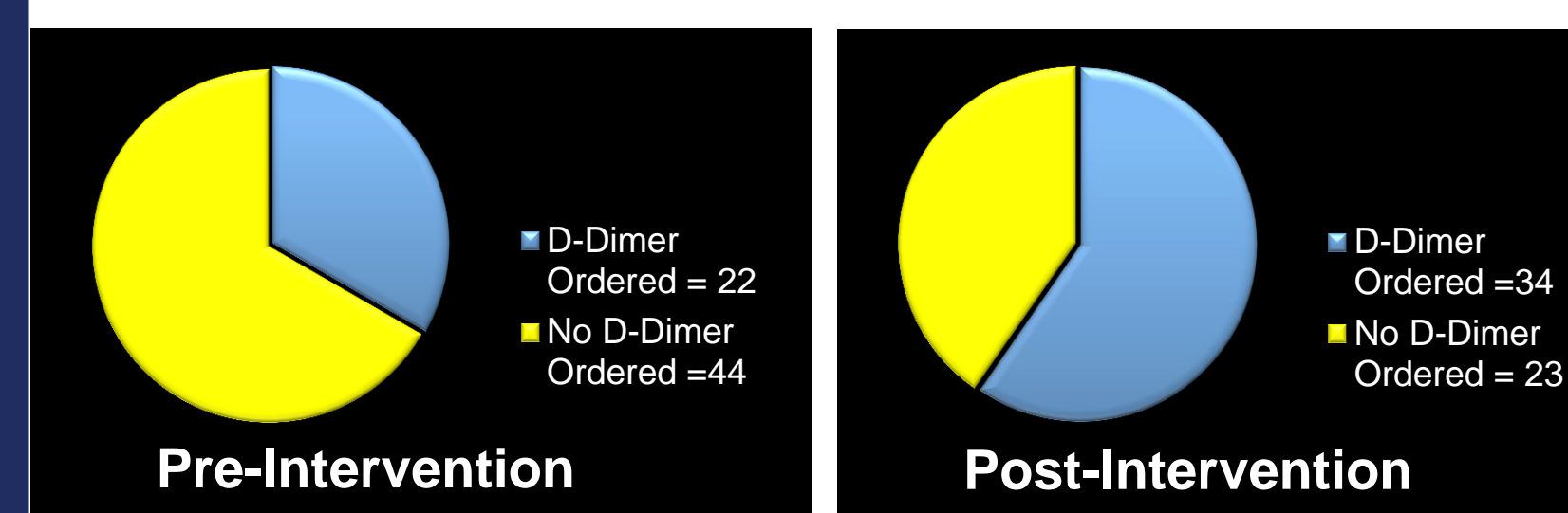
- With the 100 post collaboration studies, 43 had a Wells' score of >4 and 72 were considered high-yield (R-SCAN>6).
- 64 D-Dimers were ordered, 55 of which were positive. Out of the 57 studies with a Wells' score ≤ 4, 34 had a D-Dimer ordered, 25 of which were positive.
- This represented a 33% increase in high-yield CT pulmonary angiogram studies ordered, 120% increase in the number of D-Dimers ordered, and a 79% increase in D-Dimers ordered in patients with a Wells' score ≤ 4.
- Again no studies deemed low yield (n=28) were positive for PE.

## Comparison of Pre and Post Intervention Data

### High Yield Exams Ordered



### D-Dimers ordered in patients with a Wells' score ≤ 4



P values were calculated by comparison of proportions using Chi-squared test.

## Conclusions

- Our educational collaboration succeeded in decreasing the number of low-yield CT PE studies that were ordered by the Emergency Department
- The ordering of D-Dimers was increased in clinical scenarios deemed low-yield as determined by Wells' criteria and R-SCAN appropriateness rating. This suggests fewer CT pulmonary angiogram studies were ordered in patients with negative D-Dimers and clinical scenarios where the diagnosis of PE is unlikely.
- These results further emphasize the importance of data-driven educational collaboration between radiologists and other medical specialties.
- Interdepartmental collaboration will serve Radiology well in an era where having agreed upon methodology to identify high yield exams not only promotes good patient care, but also prevents unnecessary testing and contributes to cost reduction efforts.

## Future Goals and Lessons Learned

- Discuss yearly education with ordering providers
- Consider collecting data at 6 month intervals to see if progress maintained
- Interdepartmental collaboration is challenging, but necessary for system-wide change.
- Framing and vocabulary is important when collaborating (example: appropriately ordered exam versus high yield exam)

## References

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