

# Impact of implementation of the Simplified Wells Criteria on referrals for pulmonary embolism

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# Background

- Conventional pulmonary angiography was previously regarded as the gold standard for the diagnosis of PE.
- Sensitivity of 98% and specificity between 95-98%.
- Limitations:
  - Invasive
  - Performed in large centres only
  - Potential to miss PE that could be detected with CTPA, particularly at the subsegmental level

# Background

- CT pulmonary angiogram (CTPA) has replaced catheter angiography as the study of choice to evaluate patients with suspected pulmonary emboli and underlying pulmonary disease.
- Allows accurate assessment of the peripheral pulmonary arteries to the fifth order (subsegmental branches)

# Background

- PIOPED II study: CTPA has overall diagnostic sensitivity of 83% (95% CI, 76-92%) and specificity of 96% (95% CI, 93-97%).
- The study emphasized the importance of determining a pretest clinical probability for PE.
- CTPA with concordant clinical assessment had a 92-96% PPV and 89-95% NPV.

# Background

## Simplified Wells Score (Gibson et al, 2009)

- Assigns 1 point to each of 7 clinical criteria
  - score of  $\leq 1$  - “PE unlikely” (prevalence of PE - 11.0%)
  - score of  $>1$  - “PE likely” (prevalence of PE - 35.8%)
- Statistically equivalent to the Original and Modified Wells Scores
- In patients with PE “unlikely” and negative D-dimer, only 0.5% developed VTE in 3 months of followup

# Background

- No publications to show the impact of the use of the Wells or simplified Wells Criteria on the number of CTPAs performed.

# Aim

- To determine the impact of implementation of the simplified Wells Criteria on the volume of referrals for suspected PE
- To decrease the number of negative CTPA studies by the implementation of the simplified Wells Criteria.

# Aim: Overview

- Study Group: Patients with a high pre-test probability for PE who require a CTPA.
- Intervention: Risk stratification with the simplified Wells criteria.
- Endpoint: To decrease the number of negative CTPA studies.



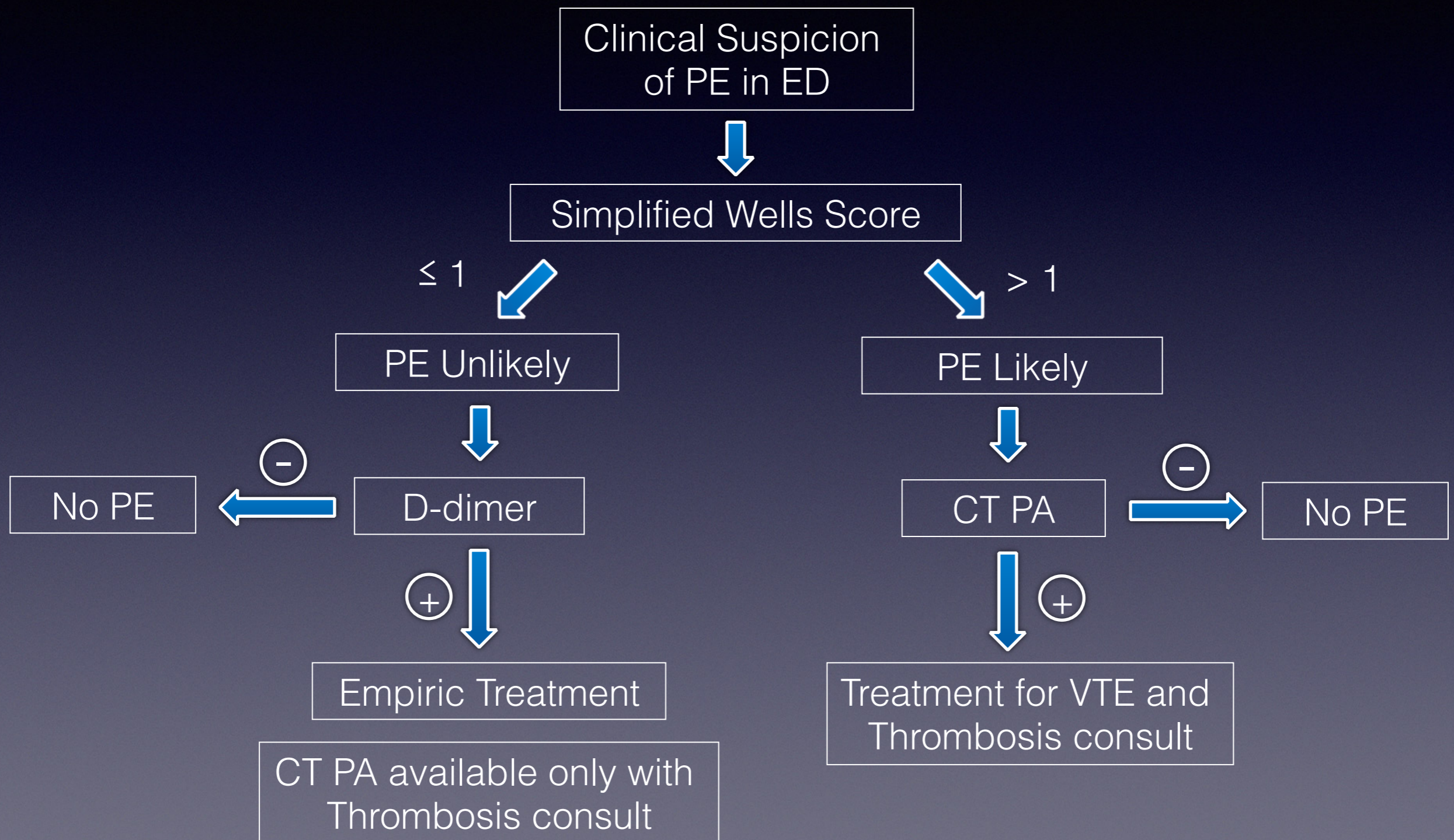
# Method

- Retrospective Study (N=189).
- Only emergency department patients included
  - Felt to be most representative of the general public
- Implemented standardized requisition requiring adherence to algorithm based on simplified Wells Score on January 1, 2013
- Collected and compared data from Jan-Mar 2012 and Jan-Mar 2013.

# Method

Simplified Wells Score	Points
• Clinical Signs/ symptoms of DVT	+1
• Alternative Dx is less likely than PE	+1
• Heart rate greater than 100	+1
• Immobilization or surgery, previous 4 weeks	+1
• Previous DVT or PE	+1
• Hemoptysis	+1
• Malignancy with treatment within 6 months or palliative	+1
D-dimer _____ D/w Thrombo _____	Total: _____

# Method



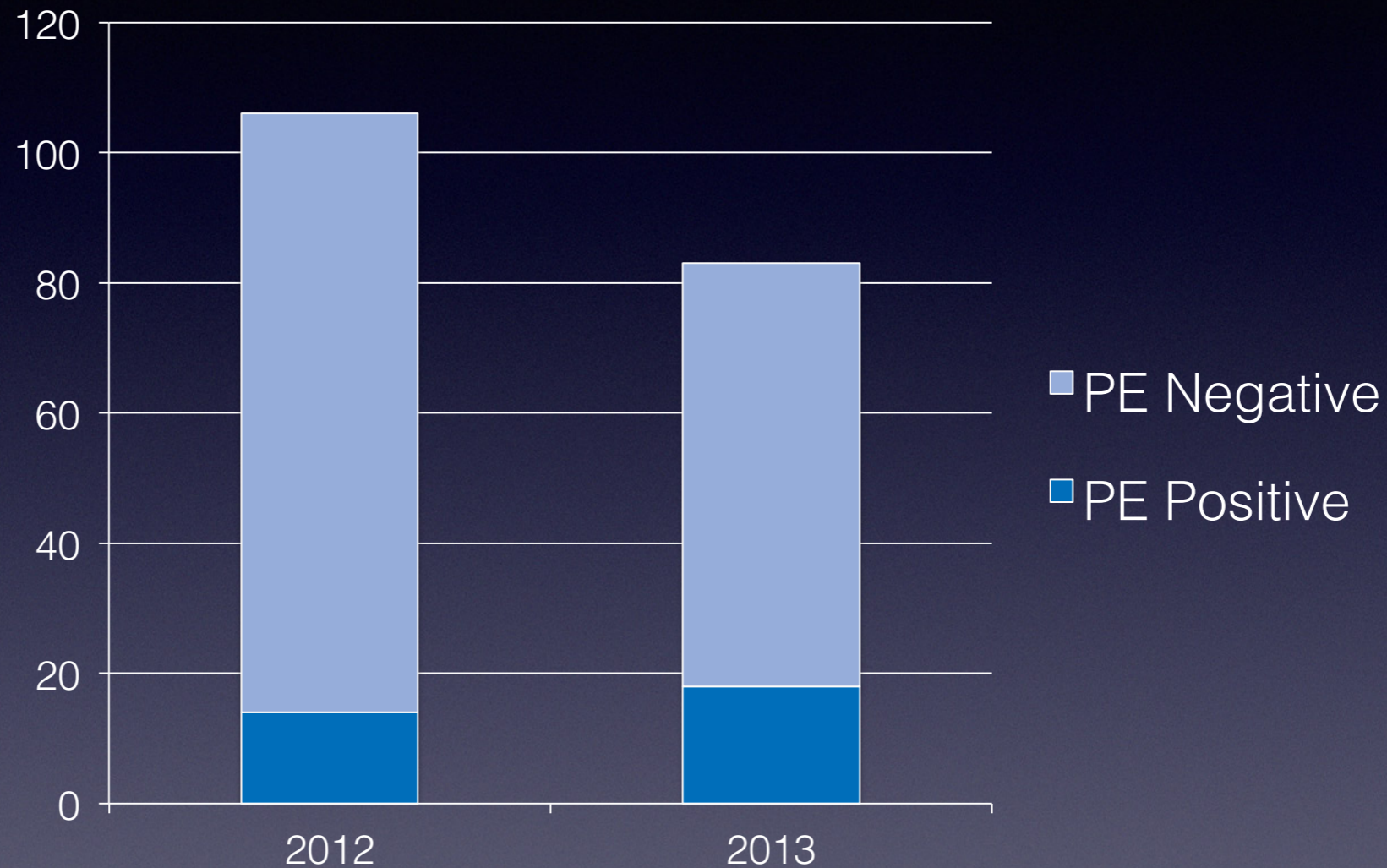
# Method

- Data collection:
  - Age
  - Gender
  - Study Time: In hours, 5pm - Midnight, Midnight - 8am
  - D-Dimer, if applicable
  - Previous CXR result
  - Symptoms and Risk Factors (Prior to implementation of standardized requisition)
  - Simplified Wells Score (After implementation of standardized requisition)
  - CTPA positive or negative

# Results

- 21.7% reduction in studies after introducing a standardized algorithm using the simplified Wells Score. (N=189)
  - 106 studies in January – March 2012.
  - 83 studies in January – March 2013.
- Increase in number of positive studies to 21.7% from 13.2%.

# Results



In 2012, 14 / 106 studies (13.2%) were positive for PE

In 2013, 18 / 83 studies (21.7%) were positive for PE

$p =$   
0.12

# Results

## Demographics

	2012	2013	Total	p-value
Number	106	83	189	N/A
Age (yrs)	55.9	61.4	58.3	0.04
Gender	70/106 F (66.0%)	50/83 F (60.2%)	120/189 F (63.5%)	0.41

# Results

## CTPA Scan Times

	2012	2013	Total
In hours	60 (56.6%)	45 (54.2%)	105 (55.6%)
5pm-Midnight	33 (31.1%)	25 (30.1%)	58 (30.7%)
Midnight-8am	13 (12.3%)	13 (15.7%)	26 (13.8%)

p =  
0.80



# Results

## Positive PE studies by time of scan

	2012	2013
In hours	9/60 (15.0%)	10/45 (22.2%)
5pm- Midnight	3/33 (9.1%)	5/25 (20.0%)
Midnight- 8am	2/13 (15.3%)	3/13 (23.1%)

No statistically significant difference in the yield of studies across scan times ( $p = 0.70$  in 2012,  $p = 0.97$  in 2013)

# Summary of Results

- 21.7% reduction in the number of studies with enforced use of an algorithm based on the simplified Wells Score.
- Higher percentage of positive PE studies after implementation of the algorithm (21.7% vs 13.2%) – but not statistically significant ( $p = 0.12$ )
- No correlation between the scan time and the percentage of positive PE studies.

# Limitations

- The patient predisposition from ER is unclear.
- No standardized method of information transfer to ER physicians and residents.
- Assumed strict compliance with only complete forms accepted by radiology.

# References

Hunsaker AR, Lu MT, Goldhaber SZ et al. Imaging in Acute Pulmonary Embolism With Special Clinical Scenarios. *Circ Cardiovasc Imaging*. 2010;3:491-500.

Guidelines on diagnosis and management of acute pulmonary embolism. Task Force on Pulmonary Embolism. European Society of Cardiology/ *Eur Heart J*. 2000;21(16):1301-1336.

Wittram C, Waltman AC, Shepard JA, Halpern E, Goodman LR. Discordance between CT and angiography in the POIPED II study. *Radiology* 2007;244:883-889.

Gibson NS, Sohne M, Kruip MJHA et al. Further validation and simplification of the Wells clinical decision rule in pulmonary embolism. *Thromb Haemost* 2008;99:229-234.