Discussion

- Cognitive biases
- Must not miss causes of chest pain
- Pre-test probability
- PE scoring criteria
- PE management

POLL

Which of the following best illustrates the concept of diagnostic momentum?

Cognitive biases

- Systematic errors in thinking
- Not random, semi-predictable
- Influence the way we interpret information, make diagnoses and treatment plans

Anchoring bias

Rely too much on the first piece of information

Confirmation bias

- Fur ✓
- Tail ✓
- Four legs ✓
- Eats mice ✓
- Wild animal ~
- Does NOT meow ✗
- Short legs and long body ✗

Confirmation bias

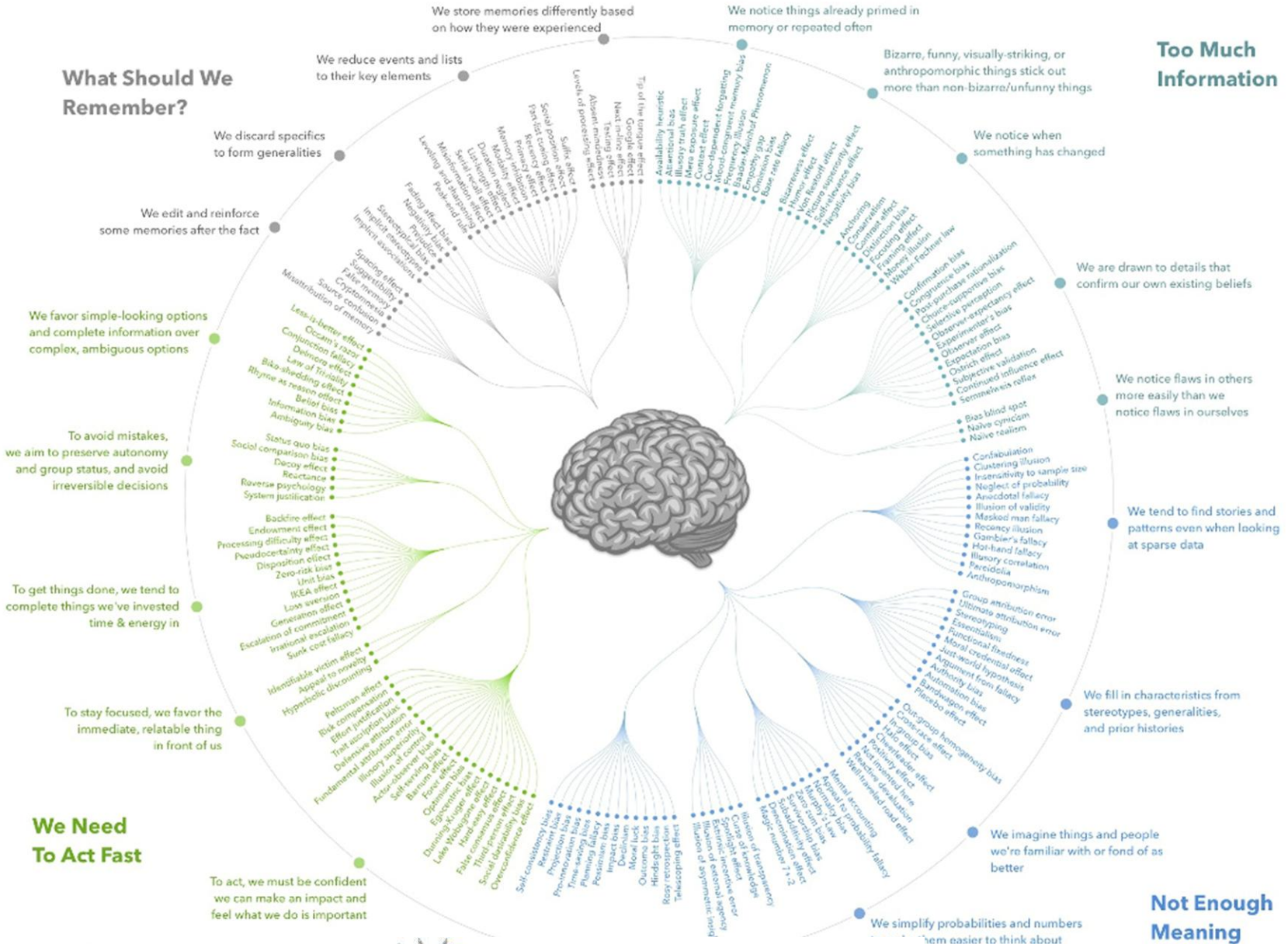
“ Finding facts to fit theories rather than theories to fit facts”

- *Sherlock Holmes*

(Arthur Conan Doyle)

Diagnostic momentum

COGNITIVE BIAS CODEX



Visual & Algorithmic Design: John Manoogian III

Concept & Categorization: Buster Benson

List of 188 Cognitive Biases: Wikipedia

THE REPUBLIC OF UGANDA MINISTRY OF HEALTH

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designhacks.co

CHEST PAIN

MUST NOT MISS DIAGNOSES

Seven Deadly

CHEST PAINS

ACUTE CORONARY SYNDROME

OESOPHAGEAL RUPTURE

CARDIAC TAMPONADE

PULMONARY EMBOLISM

AORTIC DISSECTION

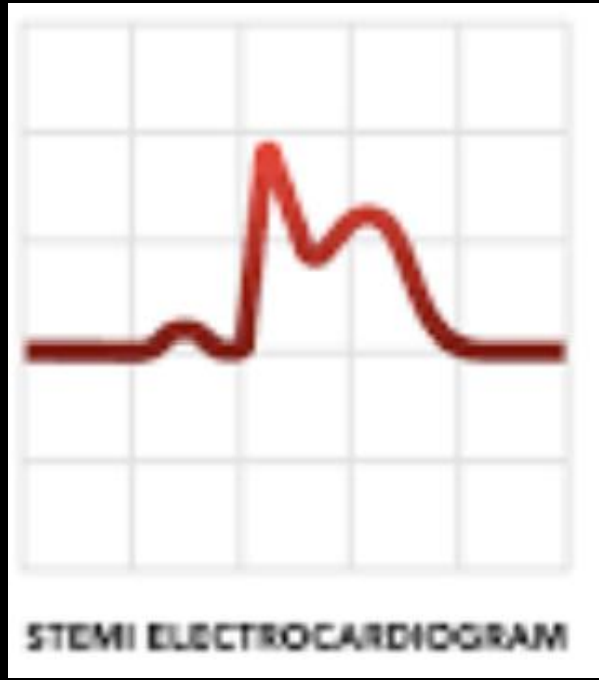
PNEUMOTHORAX

PNEUMONIA

Ami

- Classic pain

Clinical Feature	Likelihood Ratio (95% Confidence Interval)
Pain in chest or left arm	2.7*
Chest pain radiation	
Right shoulder	2.9 (1.4-6.0)
Left arm	2.3 (1.7-3.1)
Both left and right arm	7.1 (3.6-14.2)
Chest pain most important symptom	2.0*

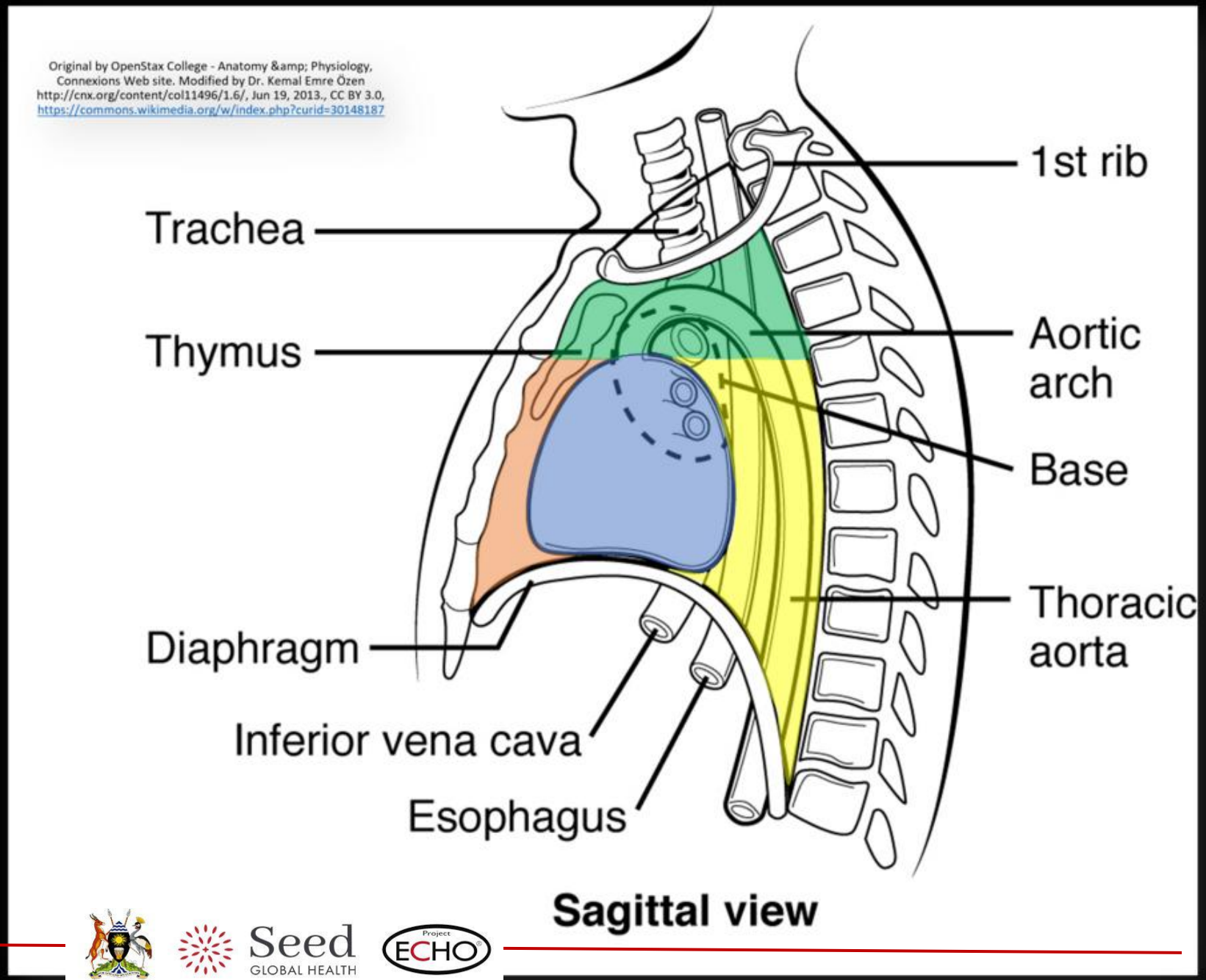


- Atypical pain
  - Different gender
  - Different race

Oesphageal rupture

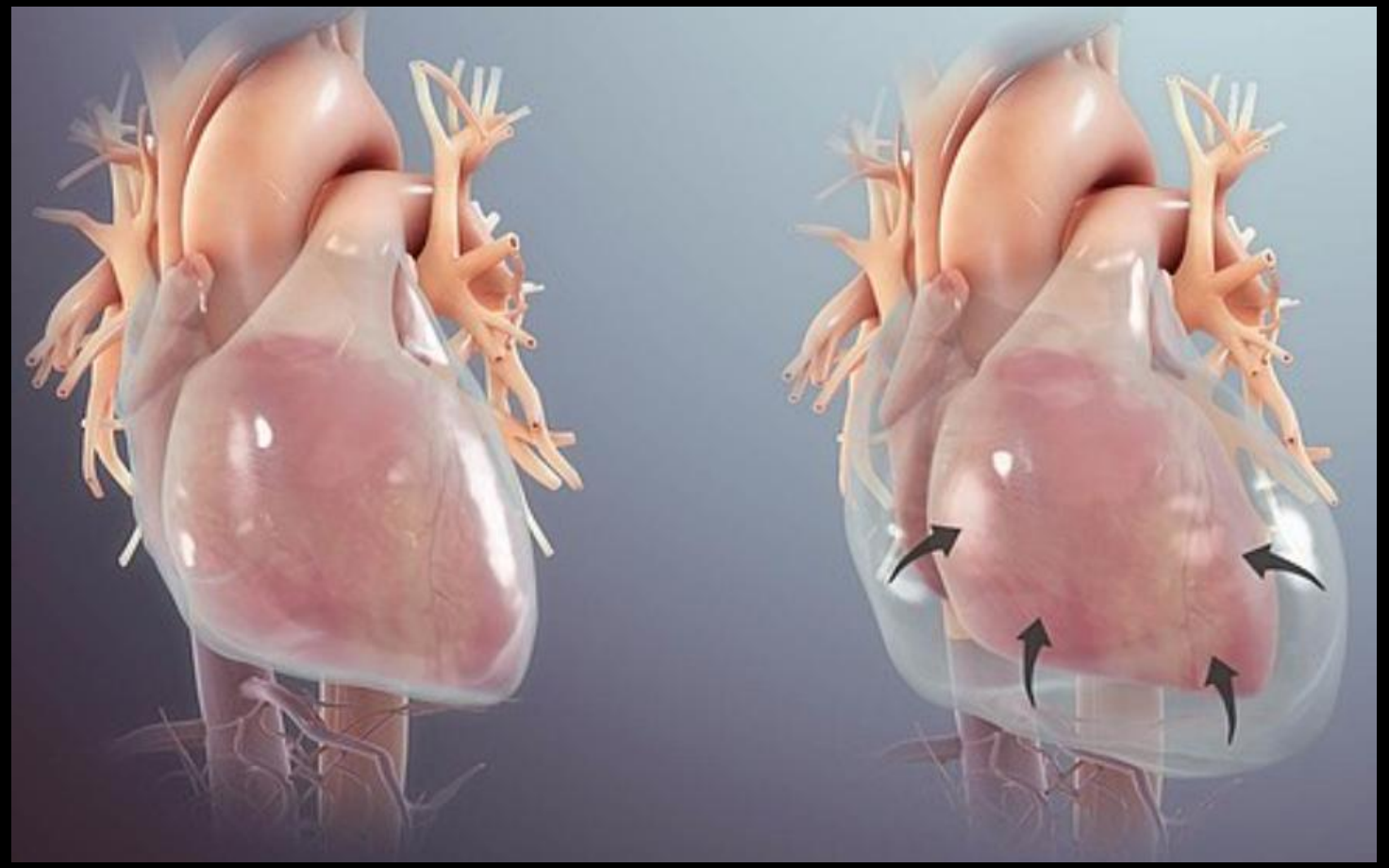
- Forceful vomiting
- Obstruction

- Mediastinitis

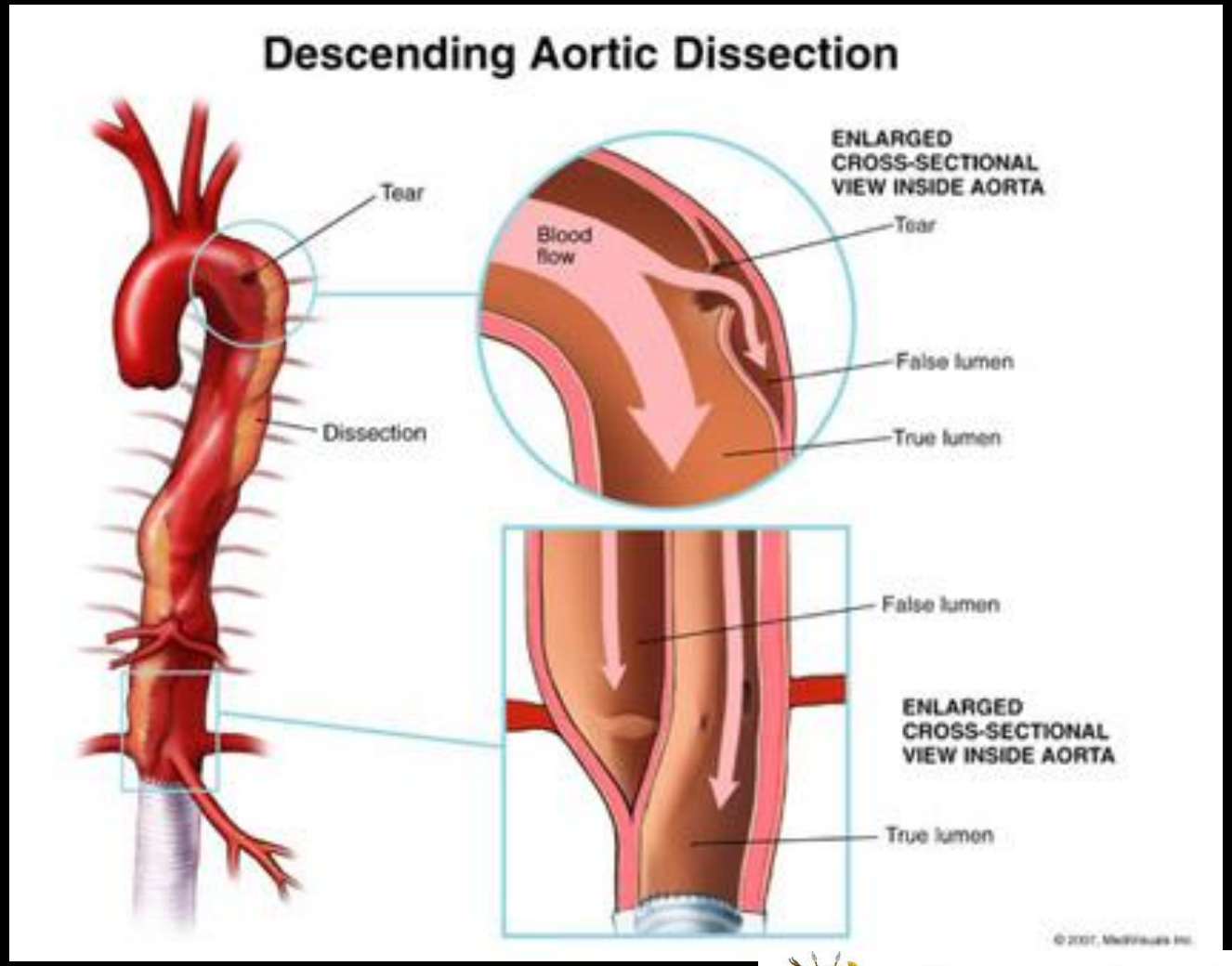


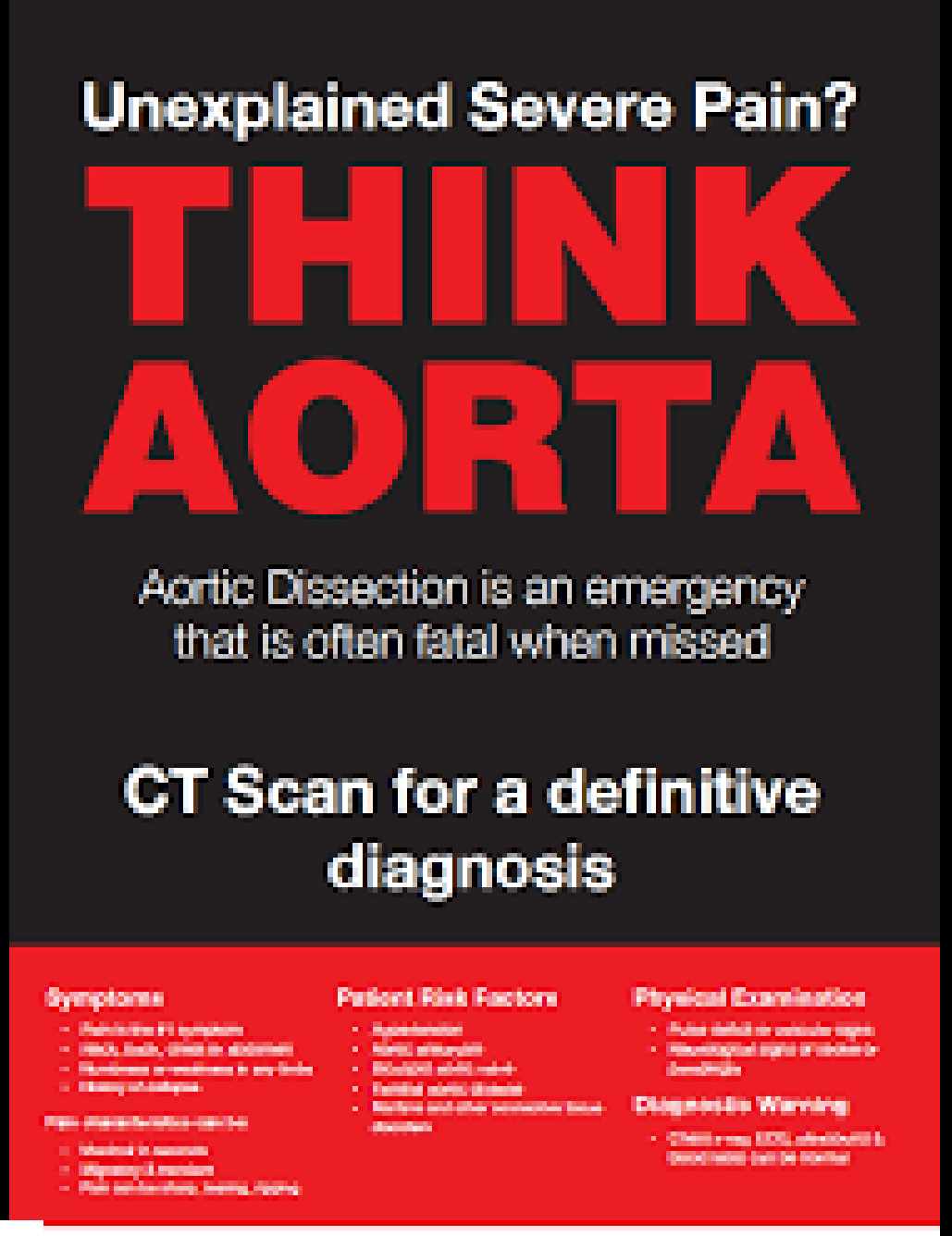
Cardiac tamponade

- Pericarditis
- Pericardial effusion
- Cardiac tamponade



Aortic dissection





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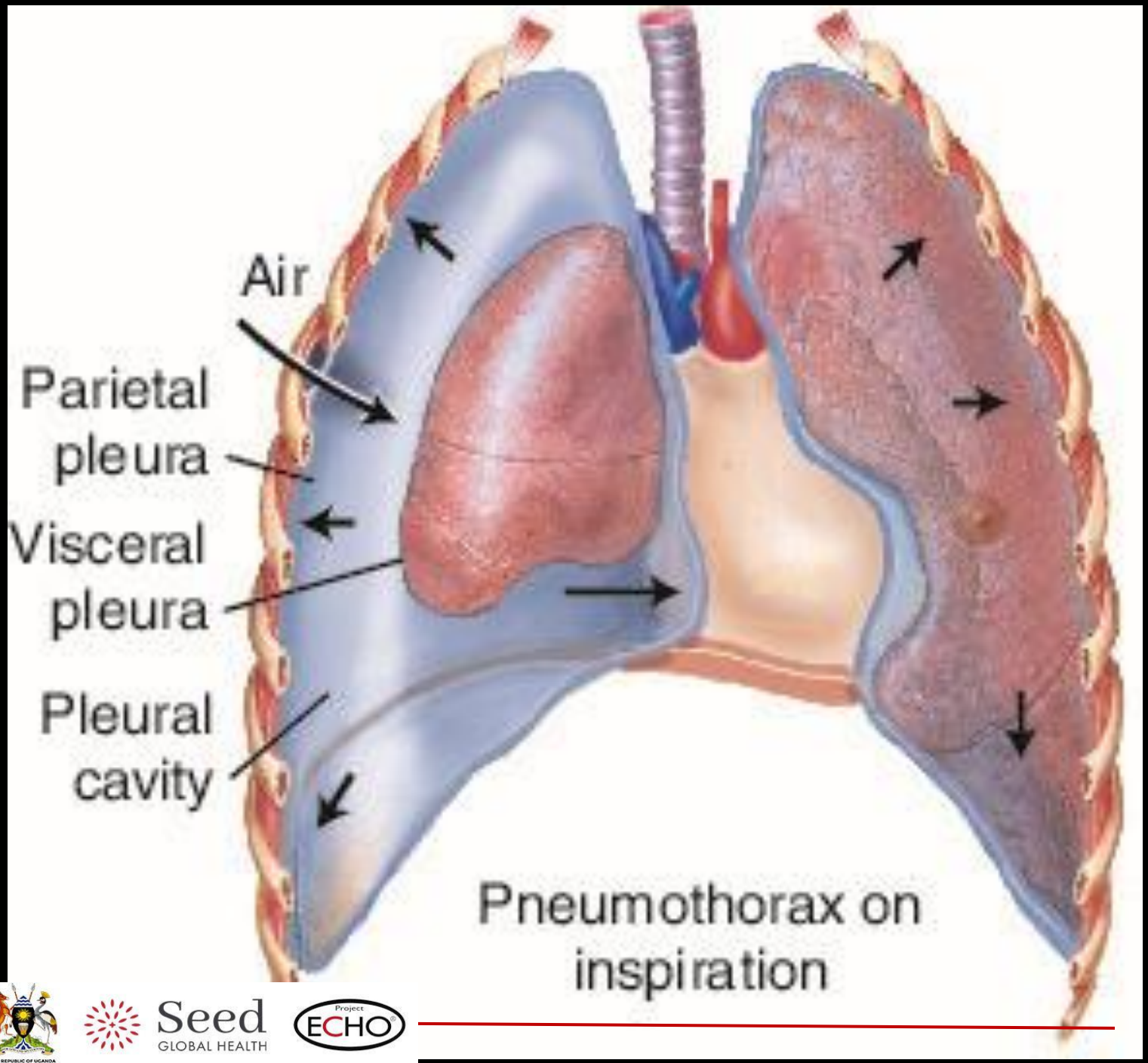
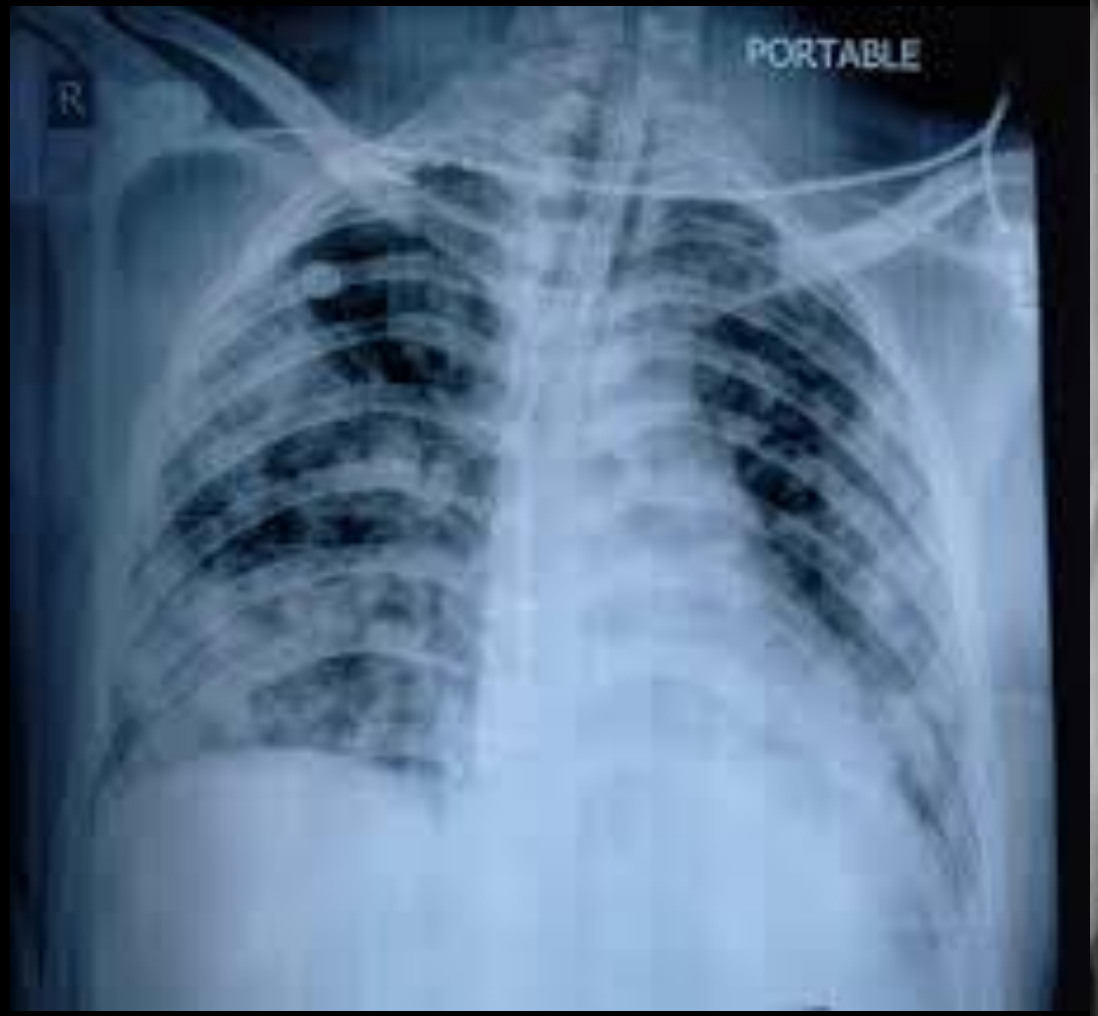
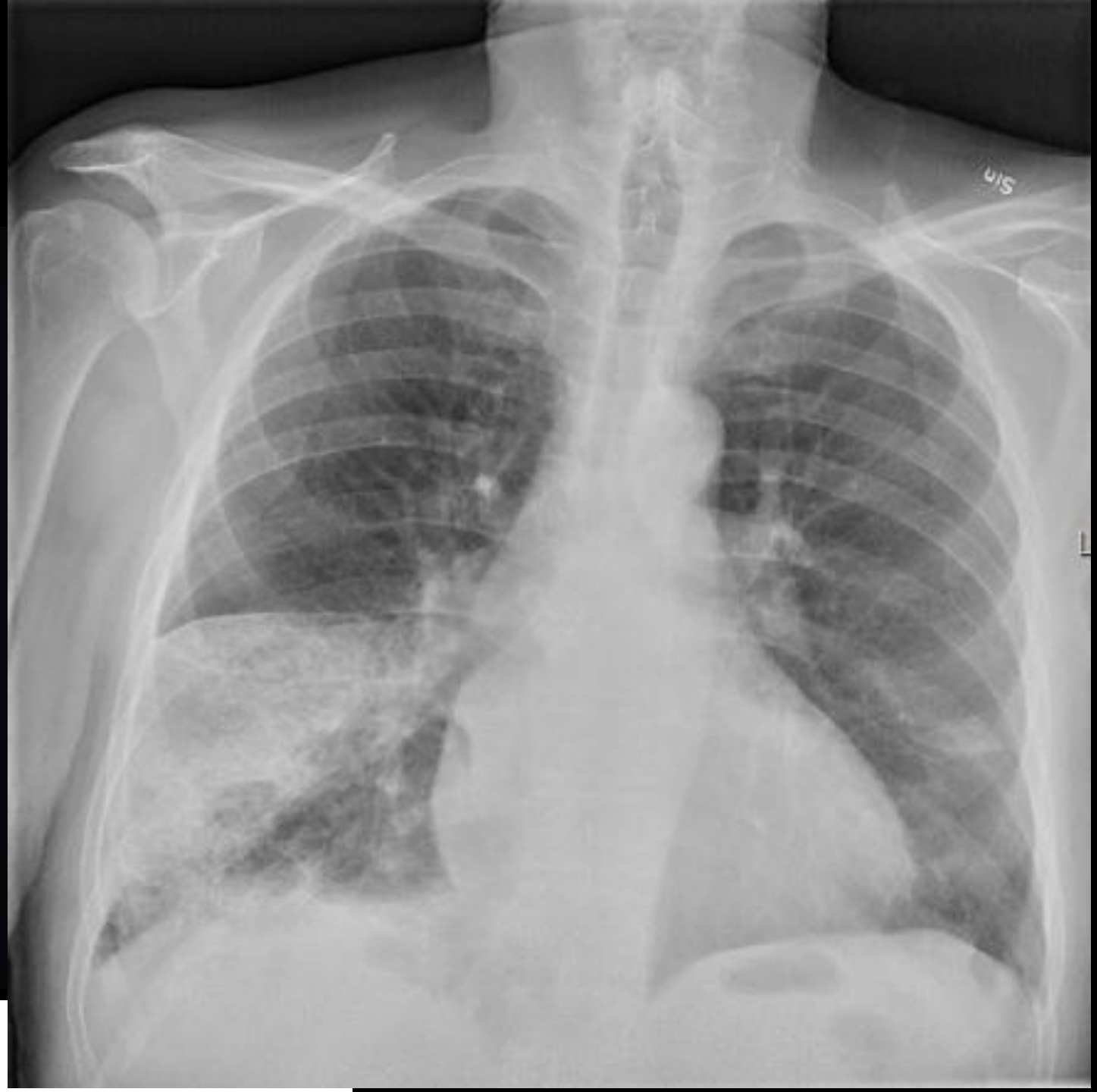
Pneumothorax

- Asymptomatic
- Pleuritic pain
- Air hunger
- Distress



Pneumonia





Skills BREAK

Which of the following correctly pairs

Oxygen delivery DEVICE to
→ Amount of Oxygen Delivered

(FiO2 = fraction of inspired oxygen)

FiO2 room air 21%

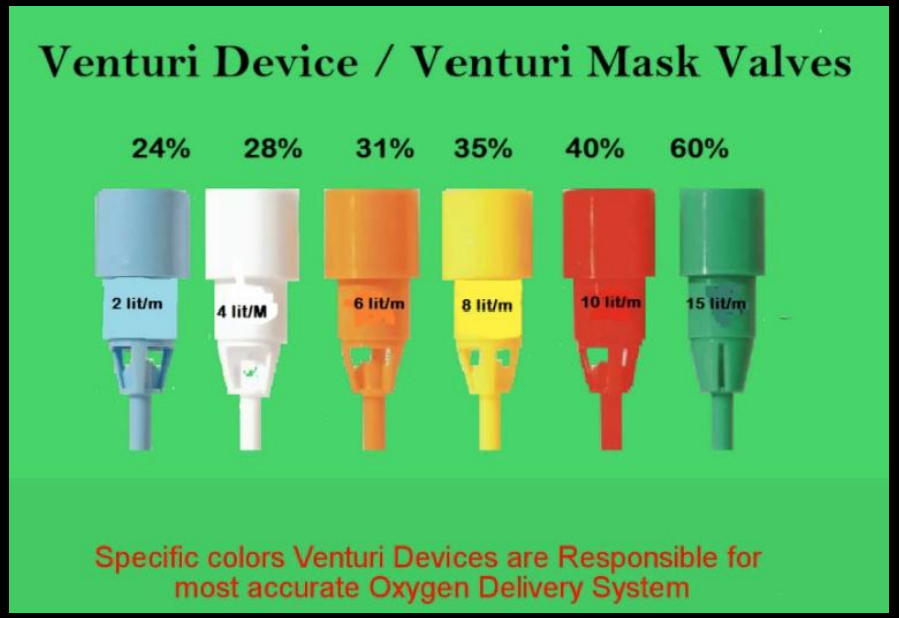
1-6L/min = 24-44%

6-10 L/min = 35-60%

15 L/min = 65-95%

Noninvasive ventilation device	Flow rate	FiO_2
Low-flow oxygen delivery		
Nasal cannula	1-6 L/min (every 1 L/min increase adds ~4% FiO_2 above room air)	~24-44%
Simple face mask	6-10 L/min	~35-60%
Non-rebreather mask (short-term therapy only)	15 L/min	~65-95%

O2



Venturi mask	2-15 L/min	24-60%
Blue adapter	2-4 L/min	24%
White adapter	4-6 L/min	28%
Orange adapter	6-8 L/min	31%
Yellow adapter	8-10 L/min	35%
Red adapter	10-12 L/min	40%
Green adapter	12-15 L/min	55-60%

O2

High-flow nasal cannula	30-60 L/min	21-100%

FiO_2 = fraction of inspired oxygen, L/min = liters per minute

30-60 L/min = 21-100%

Historical and clinical features

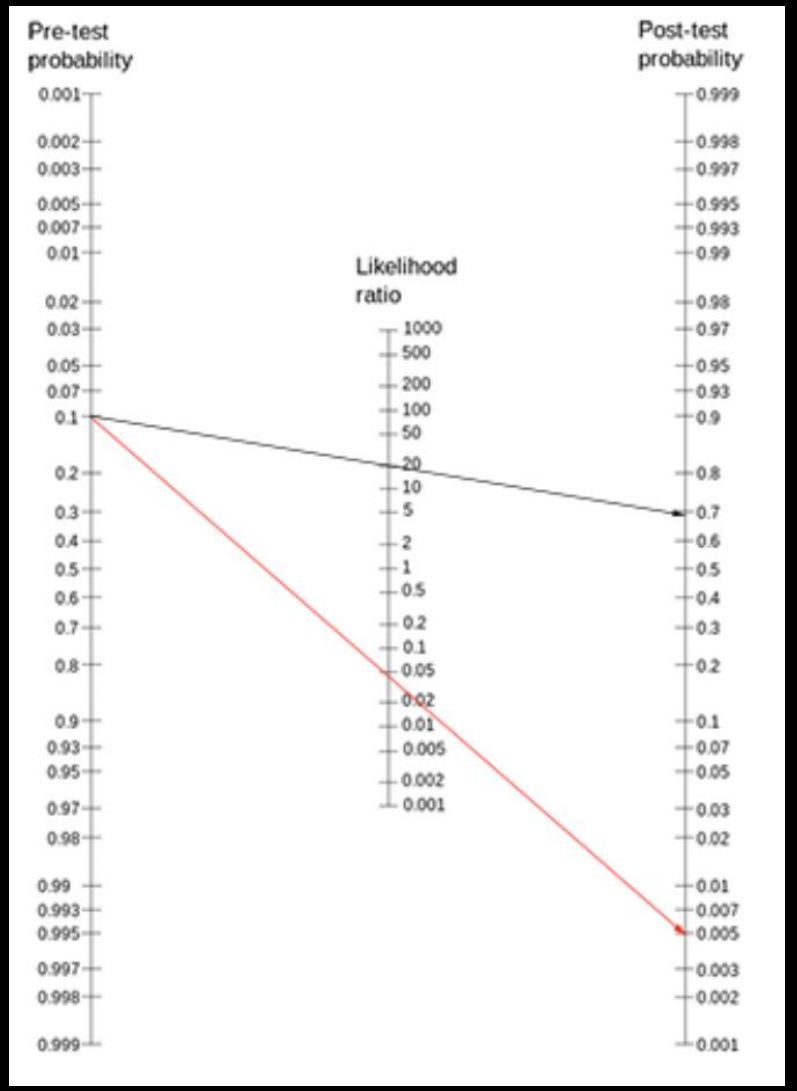
But what else can we use to tell the difference between all of these …

Pre-test probability

- The likelihood that a patient has a specific disease before any diagnostic tests are performed

- The estimation of pre-test probabilities is important and necessary:

1. to decide whether or not further testing should be done,
2. to identify which test to use, and
3. to revise the probability of disease after the test results are in.



How?

- 1. Prevalance from studies
- 2. Data sets around what are the most important symptoms and signs to illicit.....

JAMA

The Rational Clinical Examination

Explore JAMA's groundbreaking series on evidence-based use of the medical history, physical examination, and testing to diagnosis disease.

The Rational Clinical Examination | Clinician's Corner

Does This Patient Have Pulmonary Embolism?

Sanjeev D. Chunilal, MB, ChB, FRACP, FRCPA; John W. Eikelboom, MBBS, MSc, FRACP, FRCPA; John Attia, MD, PhD, FRCPC ;

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How?

- 1. Prevalance from studies
- 2. Data sets around what are the most important symptoms and signs to illicit.....
- 3. Clinical judgment *(improves with experience)*
- 4. Clinical prediction rules

Well's Criteria (PE) (MDCalc)

Clinical signs and symptoms of DVT	No 0	**Yes +3**
PE is #1 diagnosis OR equally likely	No 0	**Yes +3**
Heart rate > 100	No 0	**Yes +1.5**
Immobilization at least 3 days OR surgery in the previous 4 weeks	No 0	**Yes +1.5**
Previous, objectively diagnosed PE or DVT	**No 0**	Yes +1.5
Hemoptysis	No 0	**Yes +1**
Malignancy w/ treatment within 6 months or palliative	**No 0**	Yes +1

10 points

HIGH RISK

(*40.6% chance of PE in ED Population*)

On the right track….confirmatory testing needed

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Diagnostic tools

- D-dimer

- Cardiac enzymes
- Creatine kinase (CK),
- CK-myocardial band (MB),
- Cardiac-specific troponin),

- CTPA
- Ventilation/perfusion (V/Q) scan
- Pulmonary angiography,
- MRI
- Chest X-ray
- ECG
- Echocardiogram
- Lower limb duplex ultrasound

LOW RISK PATIENTS

Useful when negative

If positive you should be prepared to perform further confirmatory testing

HIGH RISK PATIENTS

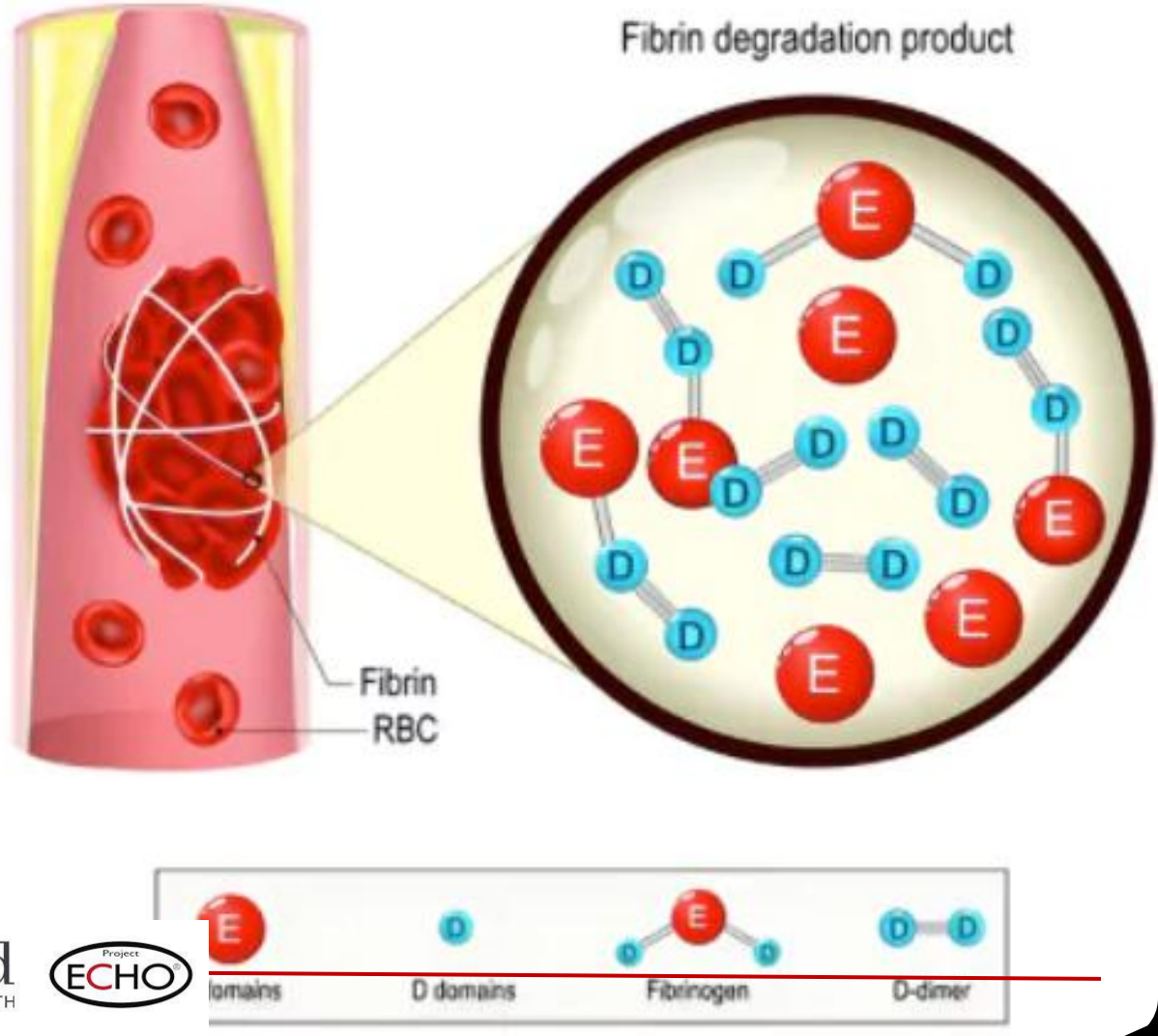
D-dimer doesn't add much

You are going to progress to further confirmatory testing anyway

D-dimer

small protein fragment present in the blood after a blood clot degradation

Many conditions (including infective processes) – can elevate D-Dimer



Treatment for PE

- Anticoagulation
  - LMWH
  - DOACs

Key Points	Rivaroxaban	Apixaban	Edoxaban	Dabigatran
Mechanism of action	Factor Xa inhibitor	Factor Xa inhibitor	Factor Xa inhibitor	Direct thrombin inhibitor
Time to peak	2–4 h	3–4 h	1–2 h	1.5 h
Half-life	9–13 h	12 h	10–14 h	12–17 h
Oral bioavailability	66%	> 50%	62%	3%–7%
Excretion	Kidney, 36%; feces, 7%	Kidney, 28.8%; feces, 56%; minimal biliary	Kidney, 50%; rest is biliary/ intestinal and metabolism	Kidney, 80%

  - At least 3 months depending on risk factors.
  - If high risk non-modifiable factors (e.g. thrombophilia) may need to be life-long

- Reperfusion
  - Systemic thrombolysis
  - Catheter directed thrombolysis
  - Clot retrieval

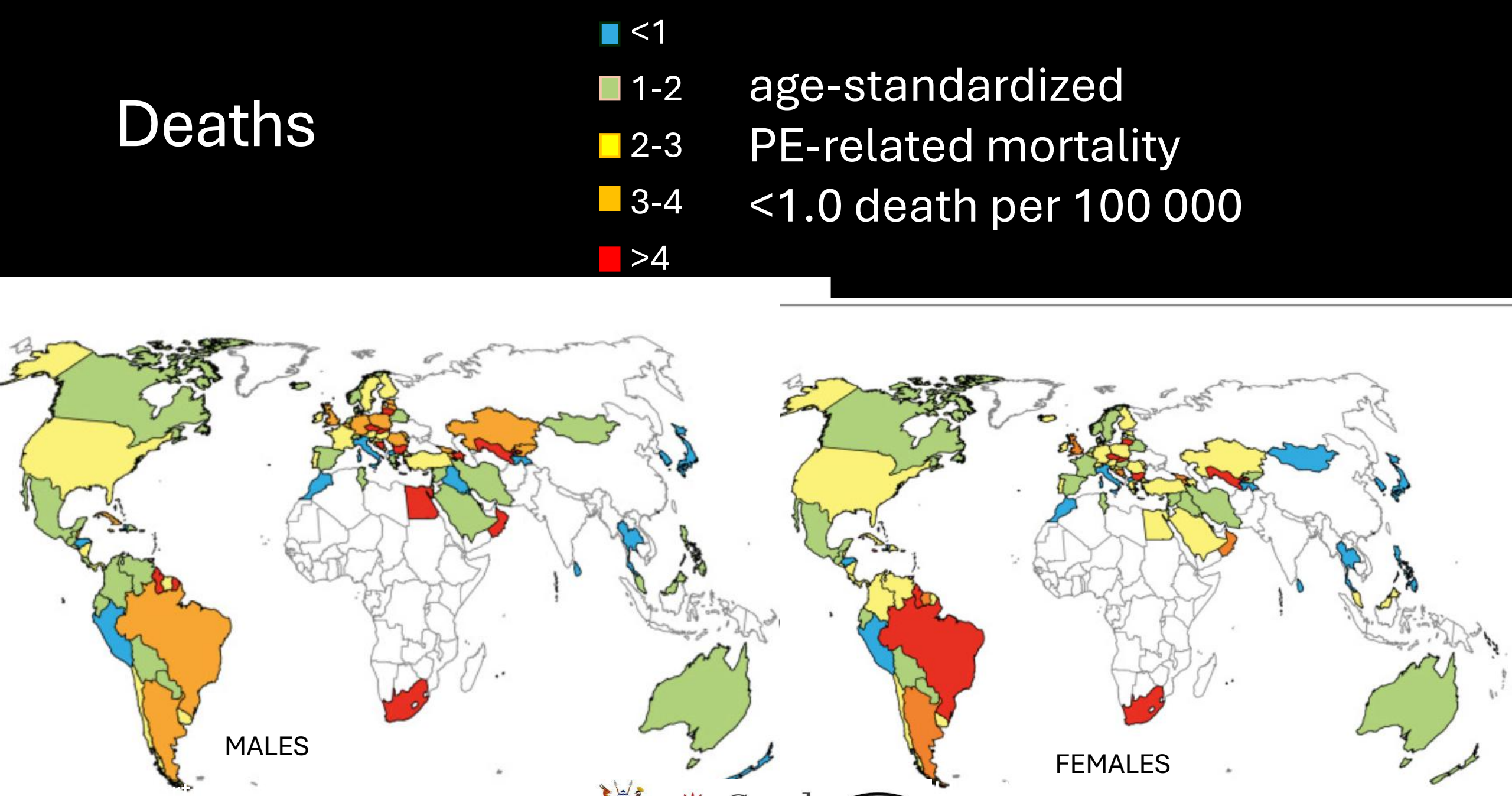
- Supportive measures

Long term consequences for survivors

- Recurrent VTE
- Chronic changes
  - Leg swelling and pain (post-thrombotic syndrome)
  - Pulmonary hypertension
- Impaired quality of life

Mortality

Deaths


<1
1-2
2-3
3-4
>4
age-standardized
PE-related mortality
<1.0 death per 100 000
MALES
FEMALES

From Africa...

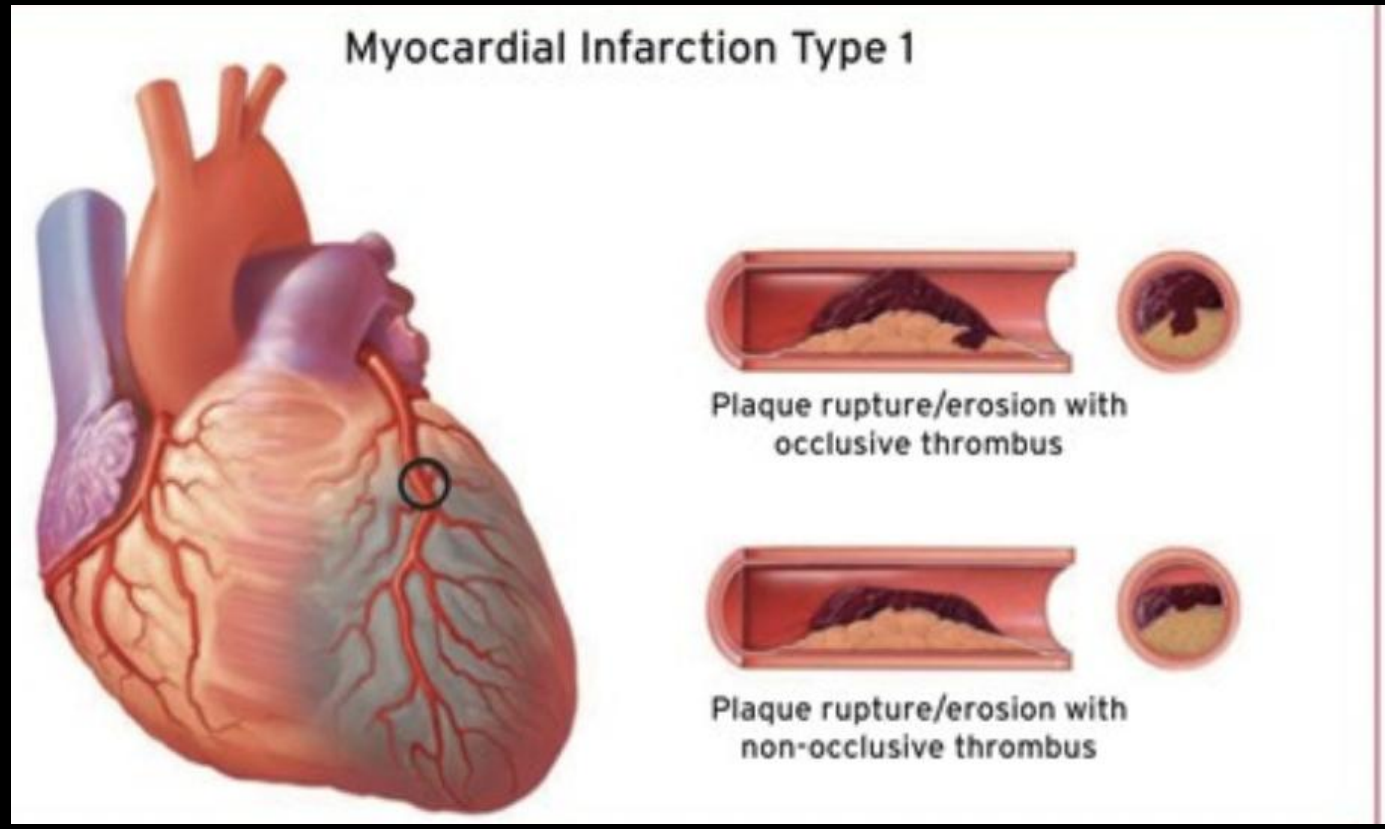
7% Togo

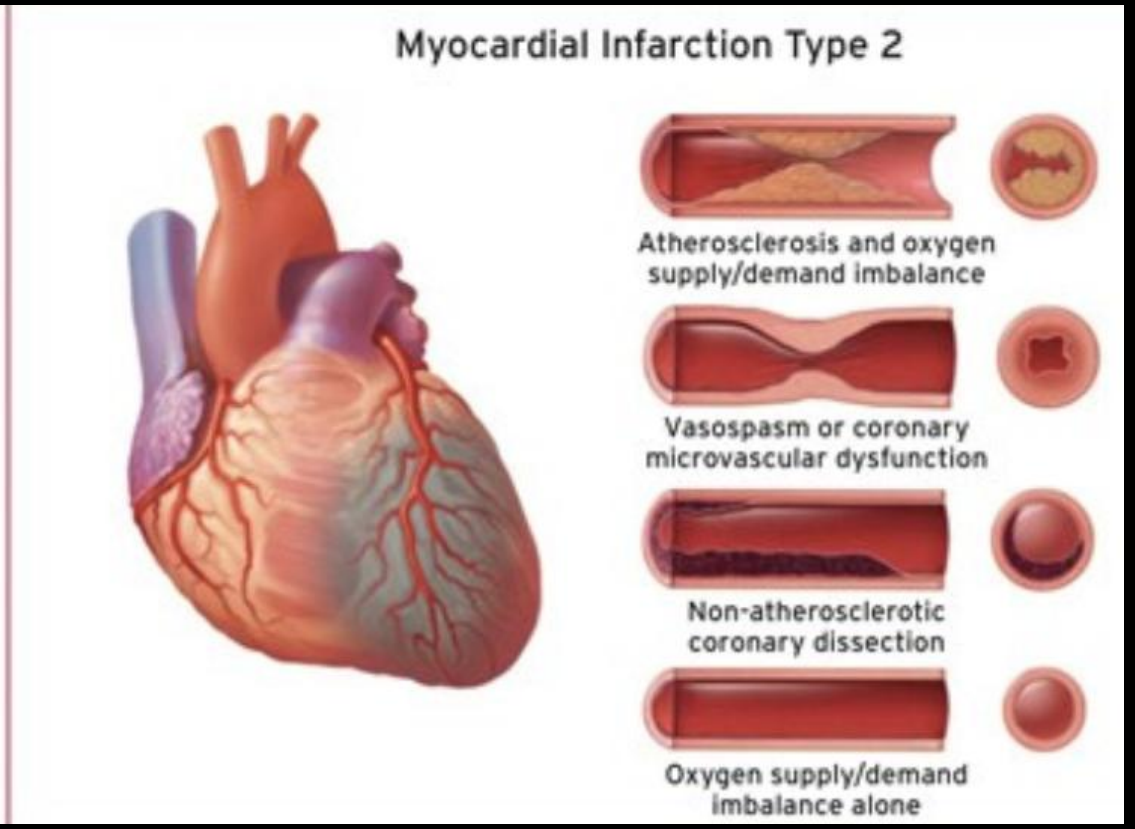
....

41% Angola

Risk Factors and Outcomes of Acute Pulmonary Embolism in African Patients: A Systematic Review

Collins C. Okeke [1], Emmanuel S. Amadi [2], Onyinye E. Ebiliekwe [3], Ifunanya R. Ekeocha [3], Emeka Nnanna Okoro [4], Oluchi J. Nduji [5], Malipeh-Unim Undie [6], Onyinye Ngige [3], Anthony Eze-odurukwe [7], Chinecherem Ezema [3], Afamefuna Onyeogulu [3], Angela Ojo [8], Michael Obuseh [9], Kelechi Okonta [10]





- **Main difference**
- **Type 1 = plaque rupture**
- **Type 2 = no plaque rupture, but imbalance between myocardial oxygen supply and/or demand**

Resources

- https://emcrit.org/ibcc/pulmonary-embolism/
- https://www.nejm.org/doi/full/10.1056/NEJMcp2116489

- Interventional therapies
- https://www.ahajournals.org/doi/10.1161/CIR.0000000000000707

- Controversies in the management of PE
- https://www.jem-journal.com/article/S0736-4679(24)00327-5/fulltext

YOUTUBE VIDEOS

- Understanding and Preventing Cognitive Errors in Healthcare – Standford Health

- https://youtu.be/OXcGciywtgM?si=DdyNn-0NPEyjHByf

- https://evtoday.com/articles/2019-july-supplement/doacs-oral-anticoagulant-treatment-of-choice-for-pulmonary-embolism

TABLE 1. PHARMACOKINETIC PROFILES OF DOACs FOR THE TREATMENT AND SECONDARY PREVENTION OF VTE

Key Points	Rivaroxaban	Apixaban	Edoxaban	Dabigatran
Mechanism of action	Factor Xa inhibitor	Factor Xa inhibitor	Factor Xa inhibitor	Direct thrombin inhibitor
Time to peak	2–4 h	3–4 h	1–2 h	1.5 h
Half-life	9–13 h	12 h	10–14 h	12–17 h
Oral bioavailability	66%	> 50%	62%	3%–7%
Excretion	Kidney, 36%; feces, 7%	Kidney, 28.8%; feces, 56%; minimal biliary	Kidney, 50%; rest is biliary/ intestinal and metabolism	Kidney, 80%
Plasma protein binding	92%–95%	~ 90%	55%	35%
Absorption	Primarily proximal small intestine; some gastric absorption	Primarily proximal small intestine; some gastric absorption	Proximal small intestine	Lower stomach and duodenum
Dosing: for initial VTE treatment	15 mg twice daily for 21 d followed by 20 mg daily (with largest meal)	10 mg twice daily for 7 d followed by 5 mg twice daily	Parenteral agent for 5–10 d followed by 60 mg daily or 30 mg daily if any of following: CrCL 15–50 mL/min, weight ≤ 60 kg, or concomitant P-glycoprotein inhibitor	Parenteral agent for 5–10 d followed by 150 mg twice daily
Dosing: for VTE prophylaxis or extended treatment	10 mg daily after at least 6 mo of therapeutic anticoagulation	2.5 mg twice daily after at least 6 mo of therapeutic anticoagulation	Not studied	No dose adjustment
Special considerations	Avoid if CrCL ≤ 30 mL/min or Child-Pugh class B and C; must be taken with food	Avoid if CrCL ≤ 15 mL/ min or Child-Pugh class B and C	Avoid if CrCL ≤ 15 mL/min or Child-Pugh class B and C	Avoid if CrCL ≤ 30 mL/min or Child-Pugh class B and C, if dyspepsia, upper GI symptoms
Dose adjustments*	None (no adjustments for age, weight, or sex)	None (no adjustments for age, weight or sex)	Decrease to 30 mg daily if any of following: CrCl 15–50 mL/min, weight < 60 kg, or concomitant P-glycoprotein inhibitor	None (no adjustments for age, weight, or sex)
Drug interactions	P-glycoprotein, CYP 3A4/5	P-glycoprotein, CYP 3A4/5	P-glycoprotein	P-glycoprotein, PPIs
Laboratory measurement (to determine if present/ not present only)	Anti-Xa	Anti-Xa	Anti-Xa	Dilute thrombin time
Reversal agent	Andexanet (specific) or 4F-PCC (nonspecific)	Andexanet (specific) or 4F-PCC (nonspecific)	4F-PCC (nonspecific)	Idarucizumab (specific)

Abbreviations: 4F-PCC, four-factor prothrombin complex concentrate; CAD, coronary artery disease; CrCl, creatinine clearance; DOAC, direct oral anticoagulant; GI, gastrointestinal; PAD, peripheral artery disease; PPI, proton pump inhibitor; VTE, venous thromboembolism.

*No dose adjustments are necessary for the treatment and secondary prevention of VTE. There are different doses and dose adjustments for the use of DOACs in other indications such as prevention of stroke in atrial fibrillation, prevention of VTE in elective hip/knee surgery, and prevention of cardiovascular events with PAD or CAD.

Deeper dive on d-dimer…..

- Age adjusted D-dimers
  - https://rebelem.com/age-adjusted-d-dimer-testing/

- YEARS criteria for pregnancy
  - https://rebelem.com/pregnancy-adapted-years-algorithm-for-pe-ready-for-prime-time/

?validation in African countries?

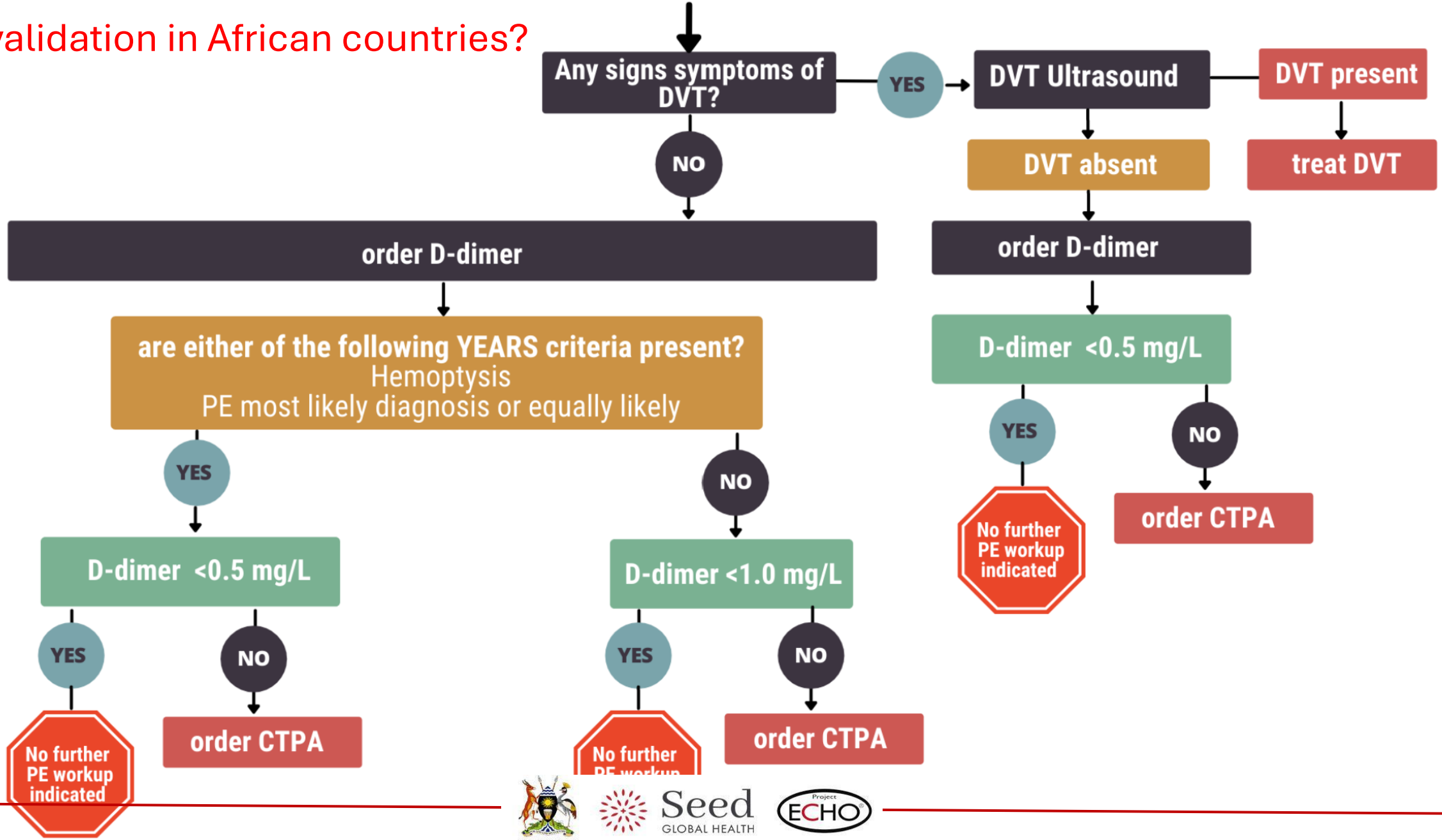
Age adjusted

- Age (years) x 10 ug/L for patients > 50 years of age
- Patient age 88 = age adjusted d-dimer of 880 ug/L

Type of D-Dimer	Age (Years)	Pooled Sensitivity	Pooled Specificity
Conventional	51 - 60	100%	57.6%
Conventional	61 - 70	99.0%	39.4%
Conventional	71 - 80	98.7%	24.5%
Conventional	>80	99.6%	14.7%
Age Adjusted	51 - 60	99.4%	62.3%
Age Adjusted	61 - 70	97.3%	49.5%
Age Adjusted	71 - 80	97.3%	44.2%
Age Adjusted	>80	97.0%	35.2%

PULMONARY EMBOLISM DIAGNOSTIC PATHWAY FOR PREGNANT PATIENTS

?validation in African countries?



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