Acute coronary syndromes: new tests and new opportunity

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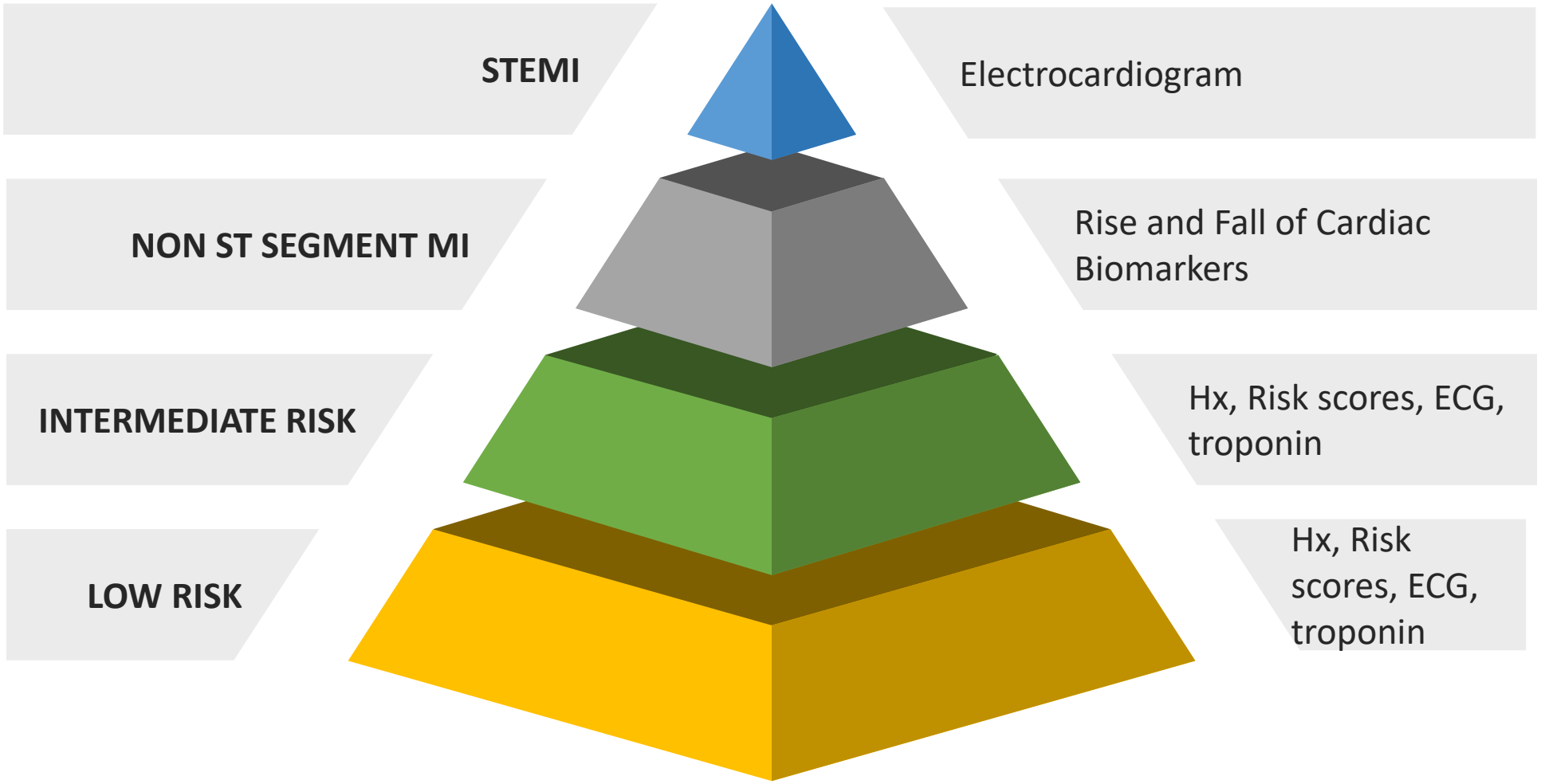
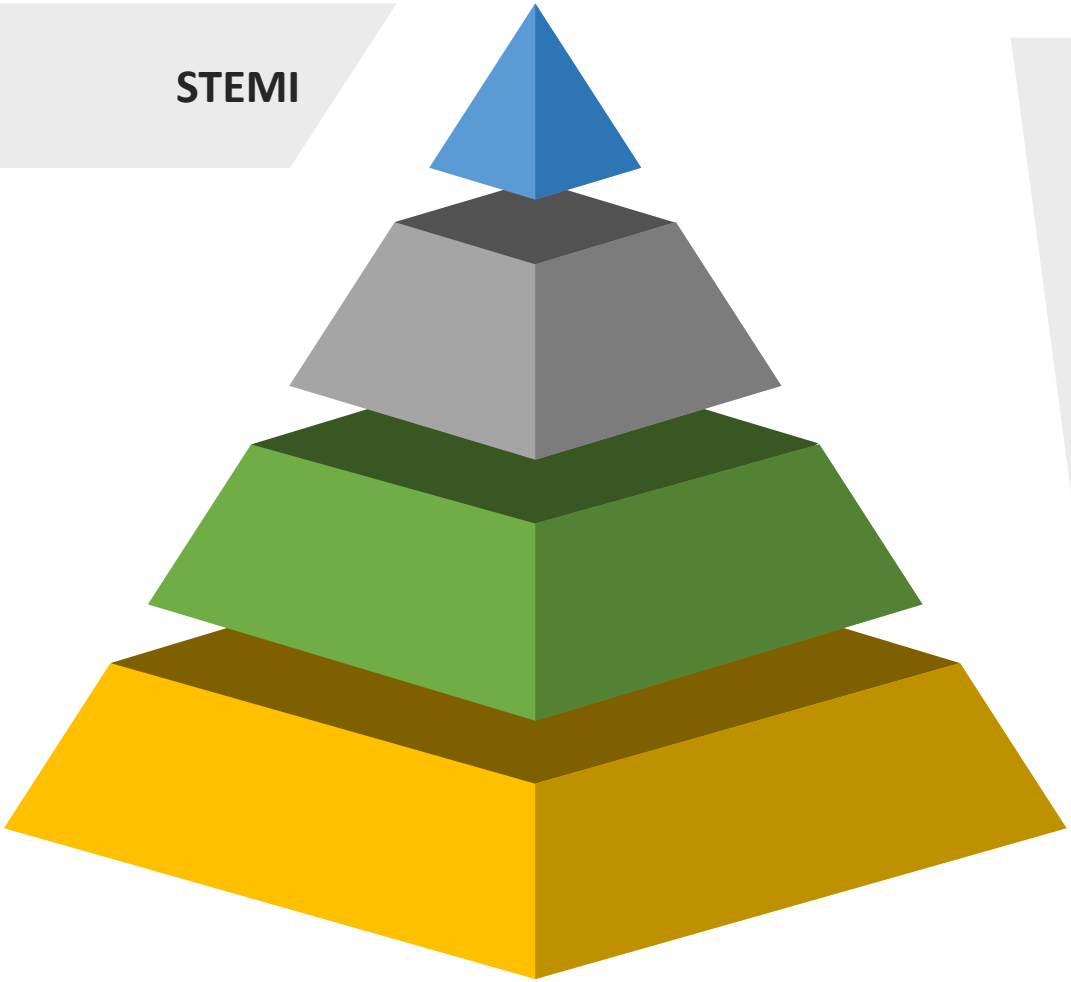
Historical reasons for advancements in diagnosis of the acute chest pain patient

- 1988
  - First chest pain observation unit
  - Decrease admissions to hospital
  - 2001 accreditation began SCPC
- 2004 PCI became standard of care
  - Regionalization of care
- 2008 troponin introduced
- 2009 first study using coronary CT
- 2018 high sensitivity troponins introduced

ED boarding

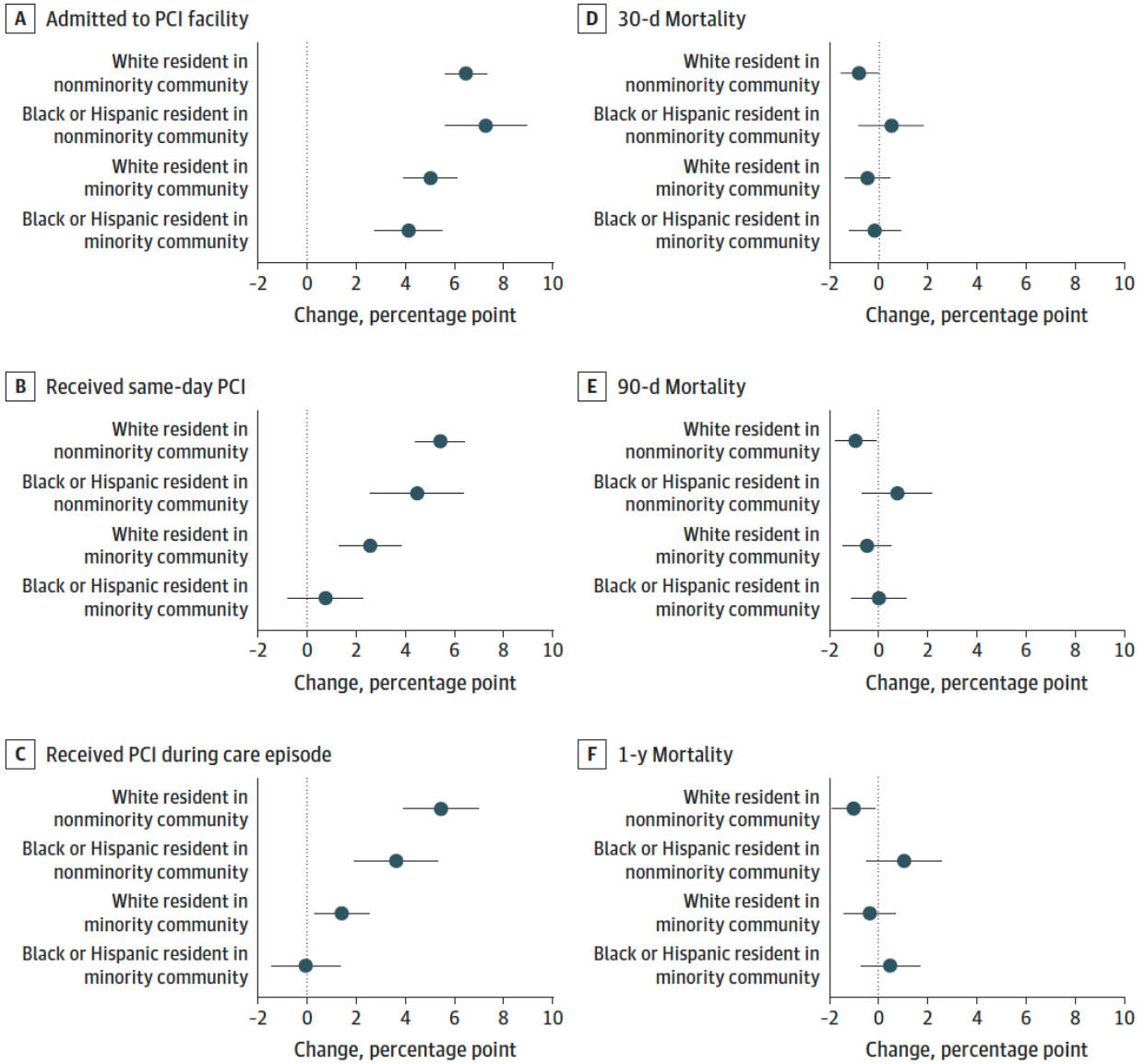

STEMI
NON ST SEGMENT MI
INTERMEDIATE RISK
LOW RISK
Electrocardiogram
Rise and Fall of Cardiac Biomarkers
Hx, Risk scores, ECG, troponin
Hx, Risk scores, ECG, troponin

STEMI



- Pre-hospital:
  - Electrocardiogram
    - Bypass hospital
    - Bypass ED
    - Transfer to another hospital
  - Outcomes
    - Impacted by time

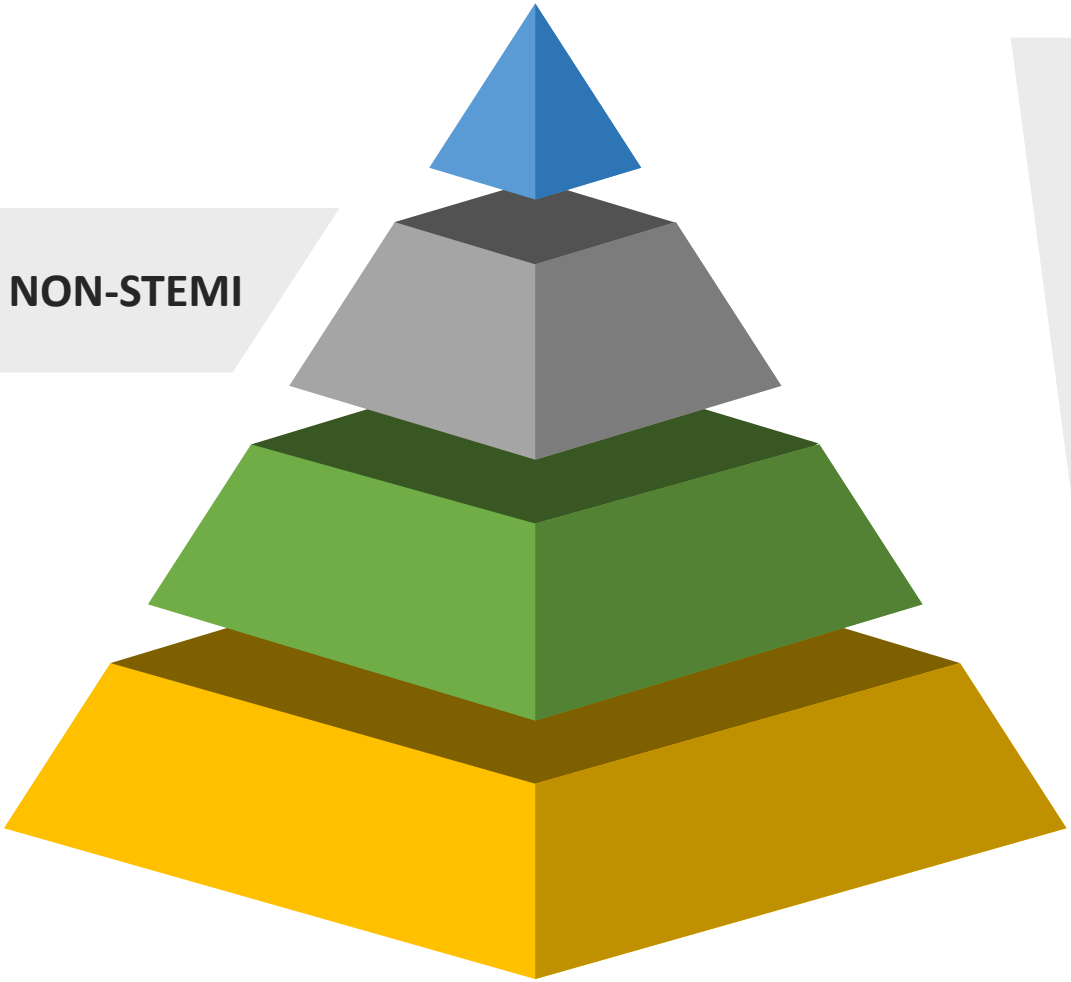
Figure 2. Regression-Adjusted Percentage Point Changes in Outcomes by Minority Status at Individual and Community Levels After Exposure to Regionalization



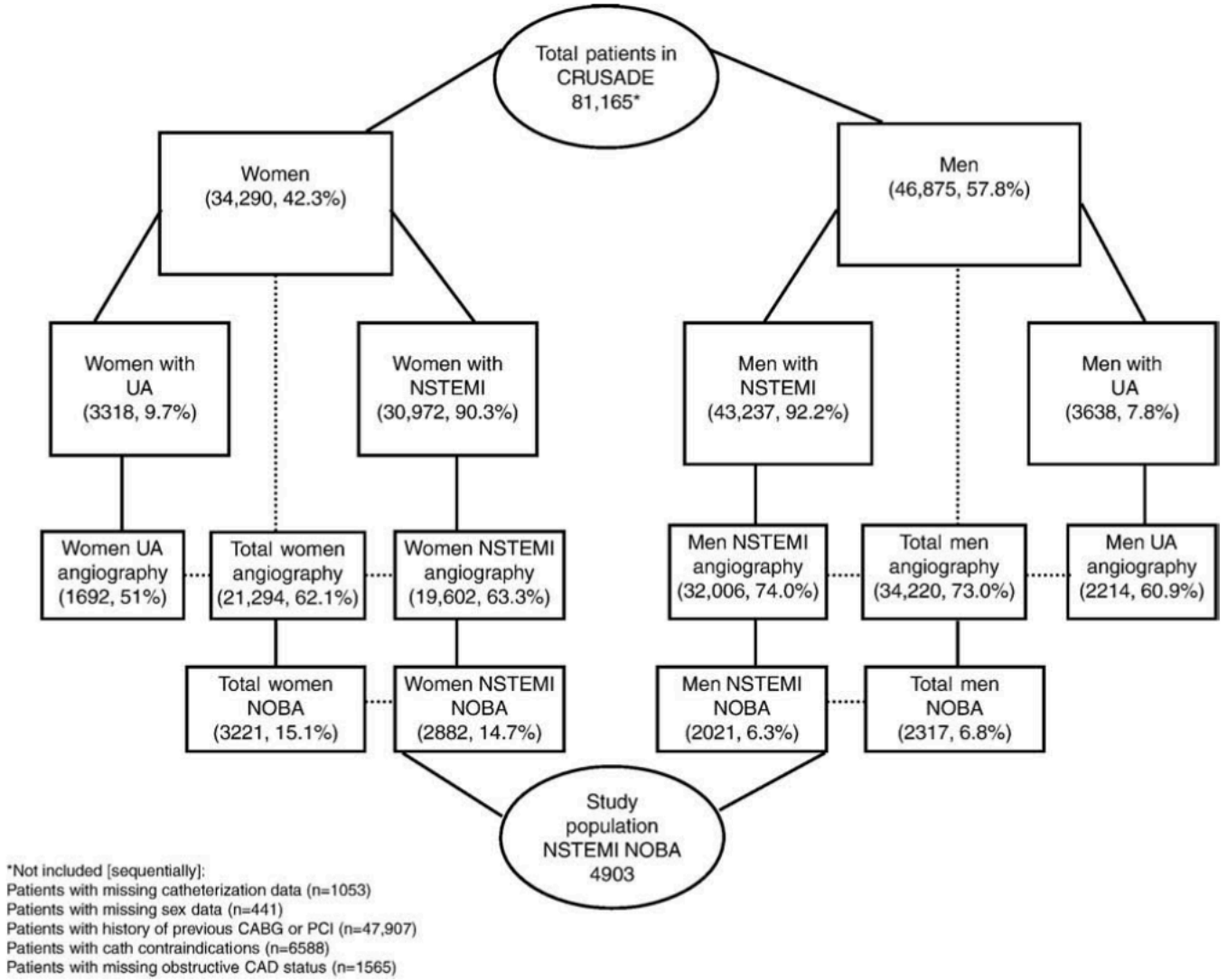
Abbreviation: PCI, percutaneous coronary intervention.

JAMA Netw Open. 2020 Nov 2;3(11):e2025874

NON-STEMI



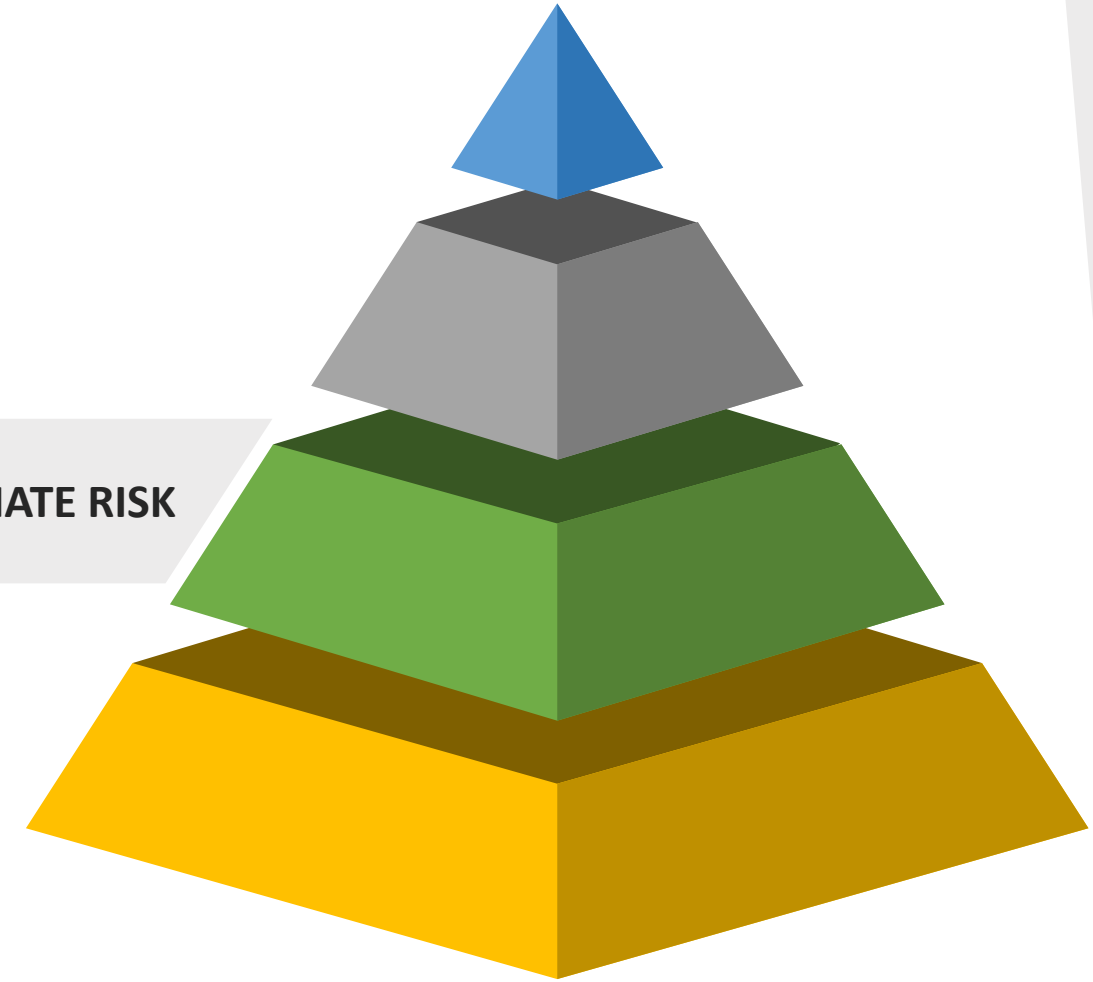
- Diagnosis:
  - Cardiac troponins
    - Optimal timing
  - Electrocardiogram
  - Optimal interventions
    - Early cardiac cath
      - Higher risk
    - Optimize medical management



Flow diagram of patients in CRUSADE. *NOBA*, No obstruction at angiography; *PCI*, percutaneous coronary intervention; *UA*, unstable angina.

Am Heart J. 2009 Oct;158(4):688-94

INTERMEDIATE RISK



- Diagnosis:
  - Not abnormal troponins
  - Non-diagnostic ECG
  - Risk scores
    - History
    - Risk factors
    - Electrocardiogram
    - Cardiac markers
  - Gaps:
    - Optimal risk score
    - Do risk scores increase testing
    - Optimal type of testing
    - Equity of care based on follow-up availability
    - Optimal goal of diagnosis
      - Risk of CAD
      - Risk of adverse events

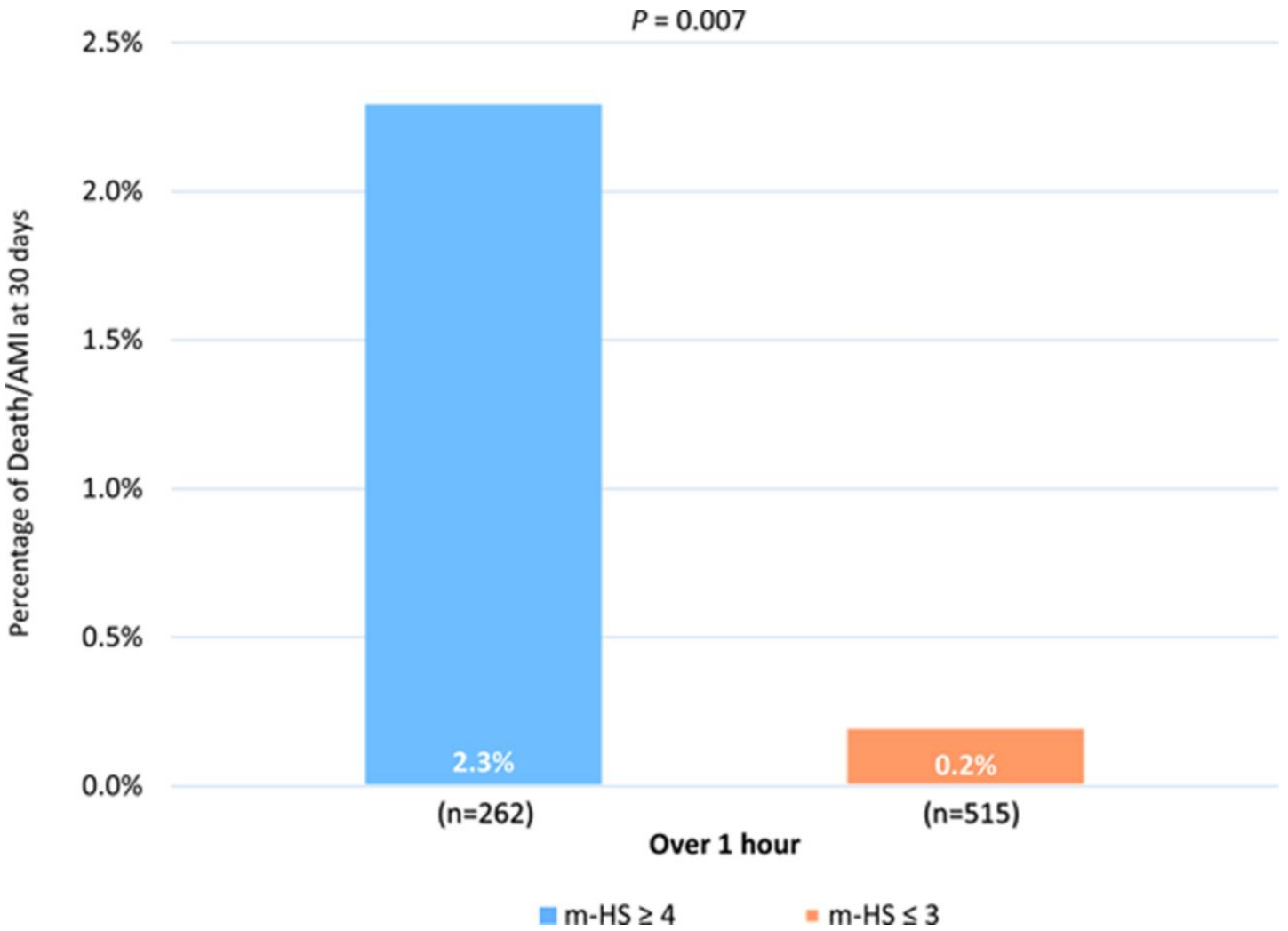
What do we know

- We over test with troponin testing especially in the elderly
  - *Acad Emerg Med. 2020 Jan;27(1):6-14.*
- Even with risk scores we over*test*
  - *Acad Emerg Med. 2016 Jan;23(1):70-7.*
- Without use of tools physicians over estimate risk
  - *Ann Emerg Med. 2014 Mar;63(3):*275-80

TIMI score components low risk 0–1 points; non-low risk ≥ 2 points		HEART score components low risk 0–3 points; non-low risk ≥ 4 points		EDACS Score Components low risk0–15 points; non-low risk ≥16 points	
Age ≥ 65	1	History		Age	
≥ 3 cardiac risk factors*	1	High suspicion	2	18–45	2
Known coronary artery disease	1	Moderate suspicion	1	46–50	4
ECG with ST segment deviation	1	Low suspicion	0	51–55	6
≥ 2 anginal events in last 24 h	1	Electrocardiogram		56–60	8
Aspirin within last 7 days	1	ST segment deviation	2	61–65	10
		Paced, LBBB, RBBB, or LVH	1	66–70	12
		Normal or nonspecific changes	0	71–75	14
		Age		76–80	16
		> 65	2	81–85	18
		45–65	1	86+	20
		< 45	0	Male sex	6
		Cardiac risk factors†		Age 18–15 and either ≥ 3 cardiac risk factors or known CAD[α]	4
		≥ 3 or known CAD	2	Diaphoresis	3
		1–2 risk factors	1	Pain radiating to arm or shoulder	5
		0 risk factors	0	Pain worsened with inspiration	–4
				Pain reproduced by palpation	–6

Curr Cardiol Rep. 2020 May 29;22(7):49

Death/acute myocardial infarction (AMI) at 30 days based on modified HEART score (m-HS) and high-sensitivity cardiac troponin-T (hs-cTnT) <12 ng/L at 0 hour and delta 1 hour <3 ng/L.



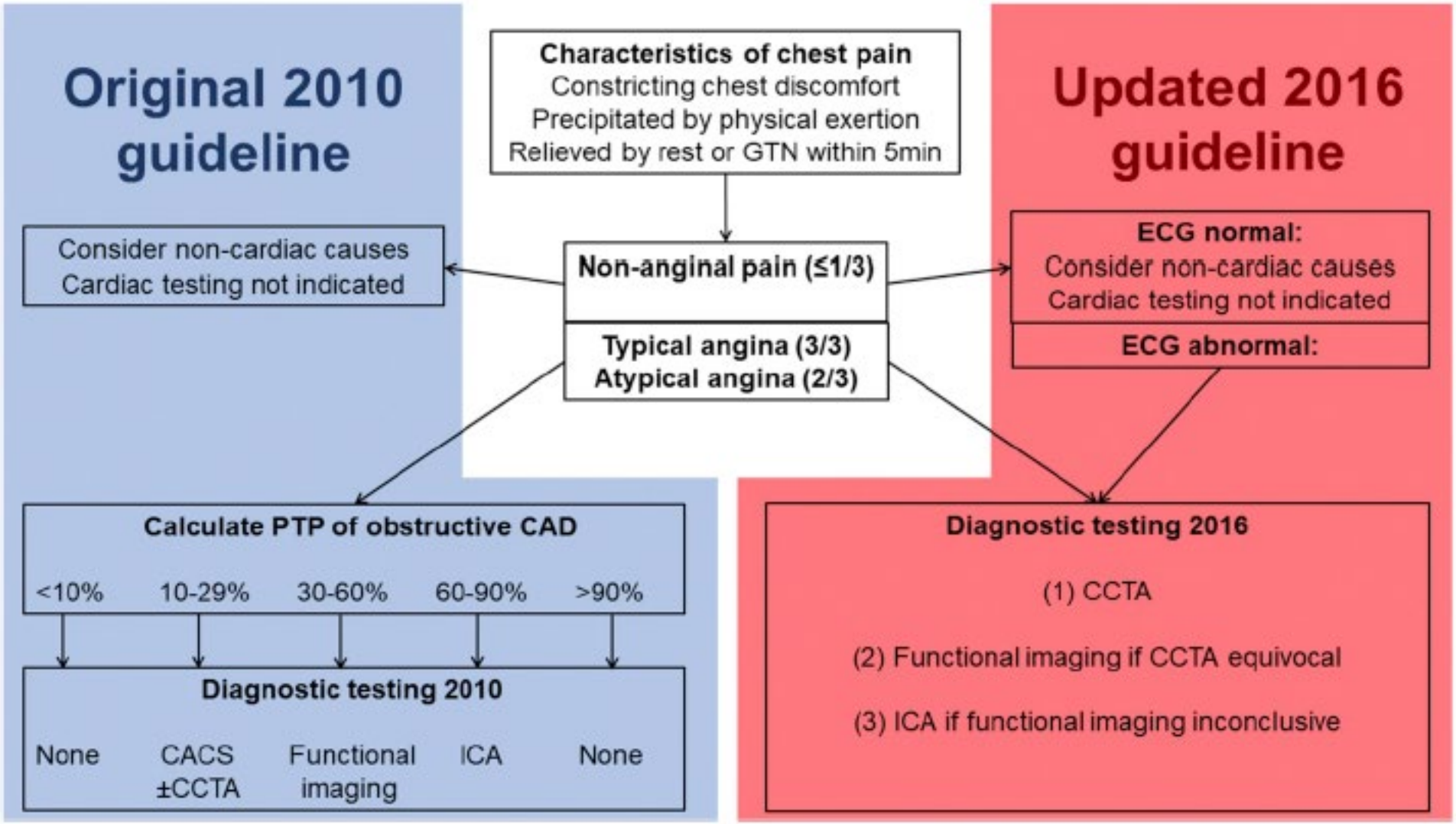
James McCord et al. Circ Cardiovasc Qual Outcomes. 2017;10:e003101

American Heart Association.

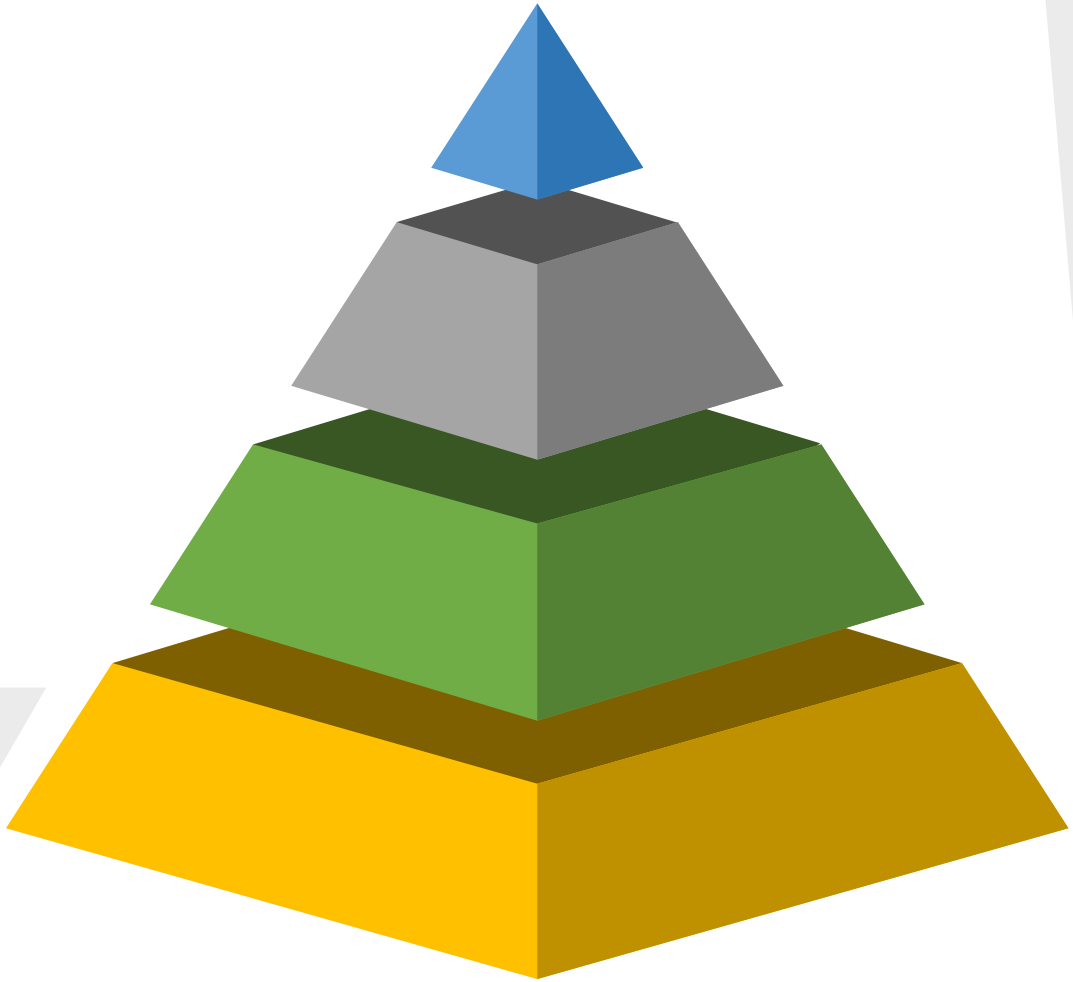
Functional vs Anatomic

- There is a mismatch between coronary stenosis and reduced flow or perfusion
- Stress testing, unlike anatomic testing, detects ischemia
- Functional tests, particularly cardiac magnetic resonance (CMR), more closely approximate invasive fractional flow reserve (FFR)
- Stress testing can detect a variety of clinically important coronary abnormalities
  - microvascular dysfunction

J Am Coll Cardiol Img 2019;12:1254–78



Journal of Cardiovascular Computed Tomography 12 (2018) 516–522

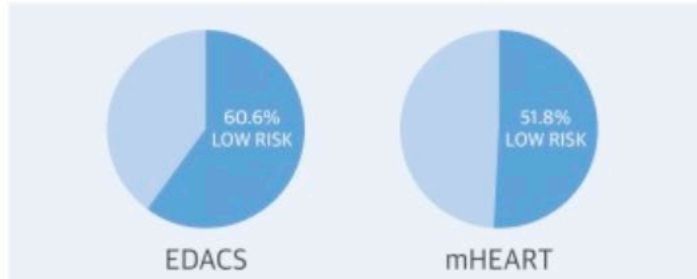


LOW RISK

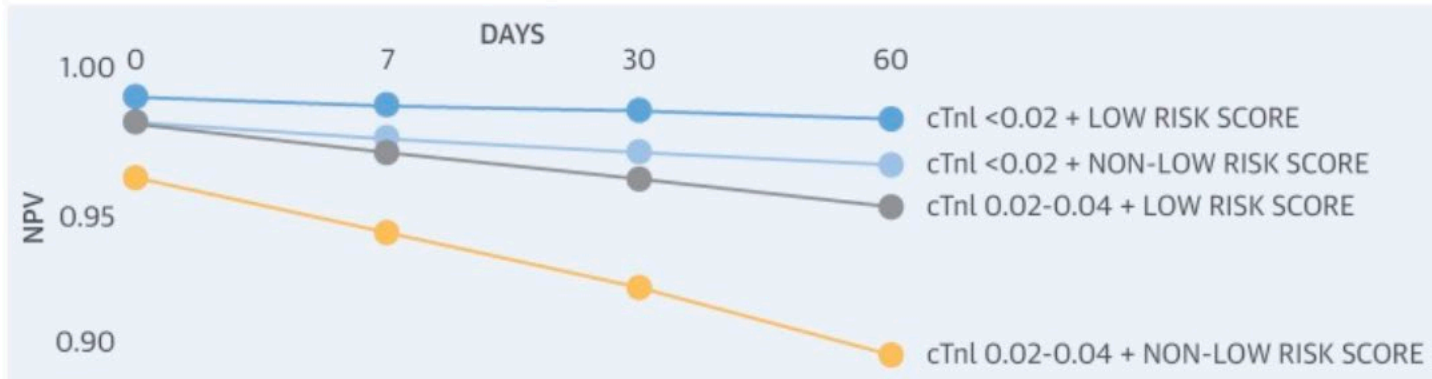
- Diagnosis:
  - Normal troponins
  - Normal ECG
  - Risk scores
    - History
    - Risk factors
    - Electrocardiogram
    - Cardiac markers
  - Gaps:
    - Optimal risk score
    - Value of testing
    - Value of observation
    - Equity of care based on follow-up availability
    - Optimal goal of diagnosis
      - Risk of CAD
      - Risk of adverse events
      - Identify other sources of pain
      - Reduce recurrent visits

CENTRAL ILLUSTRATION: Performance of the EDACS Versus Modified HEART Score Among Emergency Department Patients With Chest Pain

EDACS & mHEART perform similarly in terms of NPV

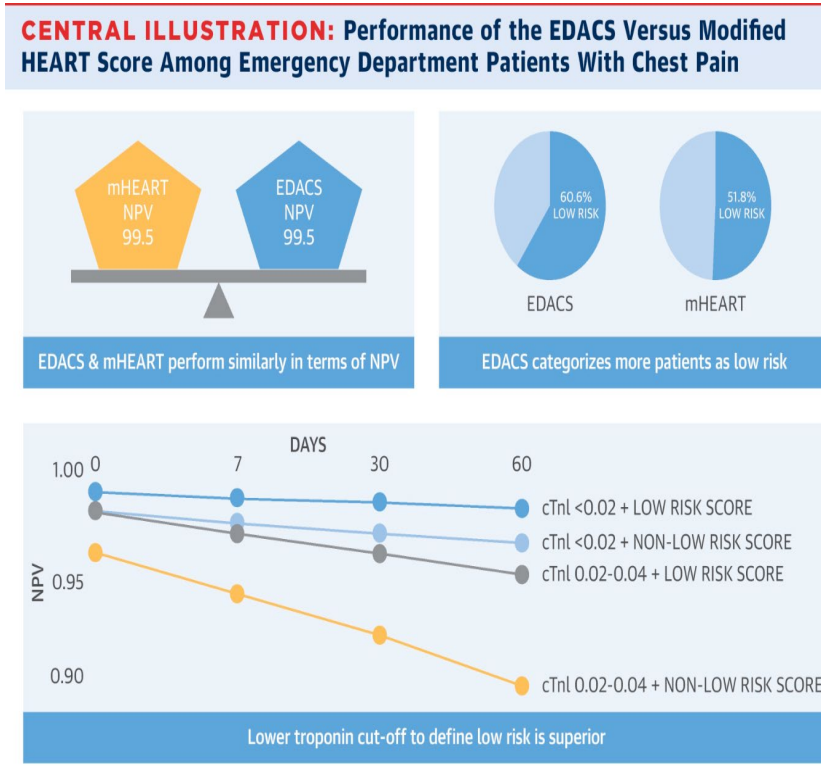


EDACS categorizes more patients as low risk



Lower troponin cut-off to define low risk is superior

Mark, D.G. et al. J Am Coll Cardiol. 2018;71(6):606-16.

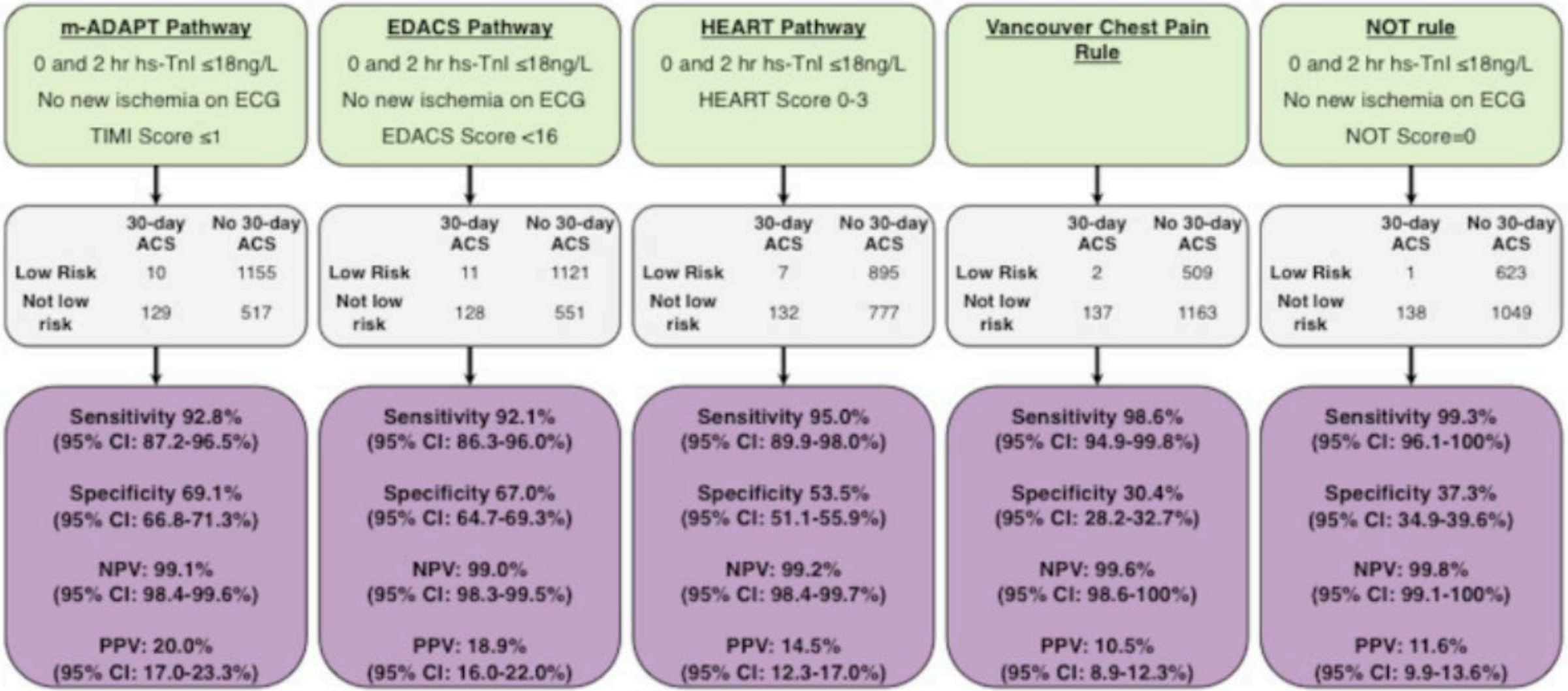


Mark, D.G. et al. J Am Coll Cardiol. 2018;71(6):606-16.

- 40-50% of MACE occur within 7 days
- 80% if non-low risk identified at admission

The risk will never be zero

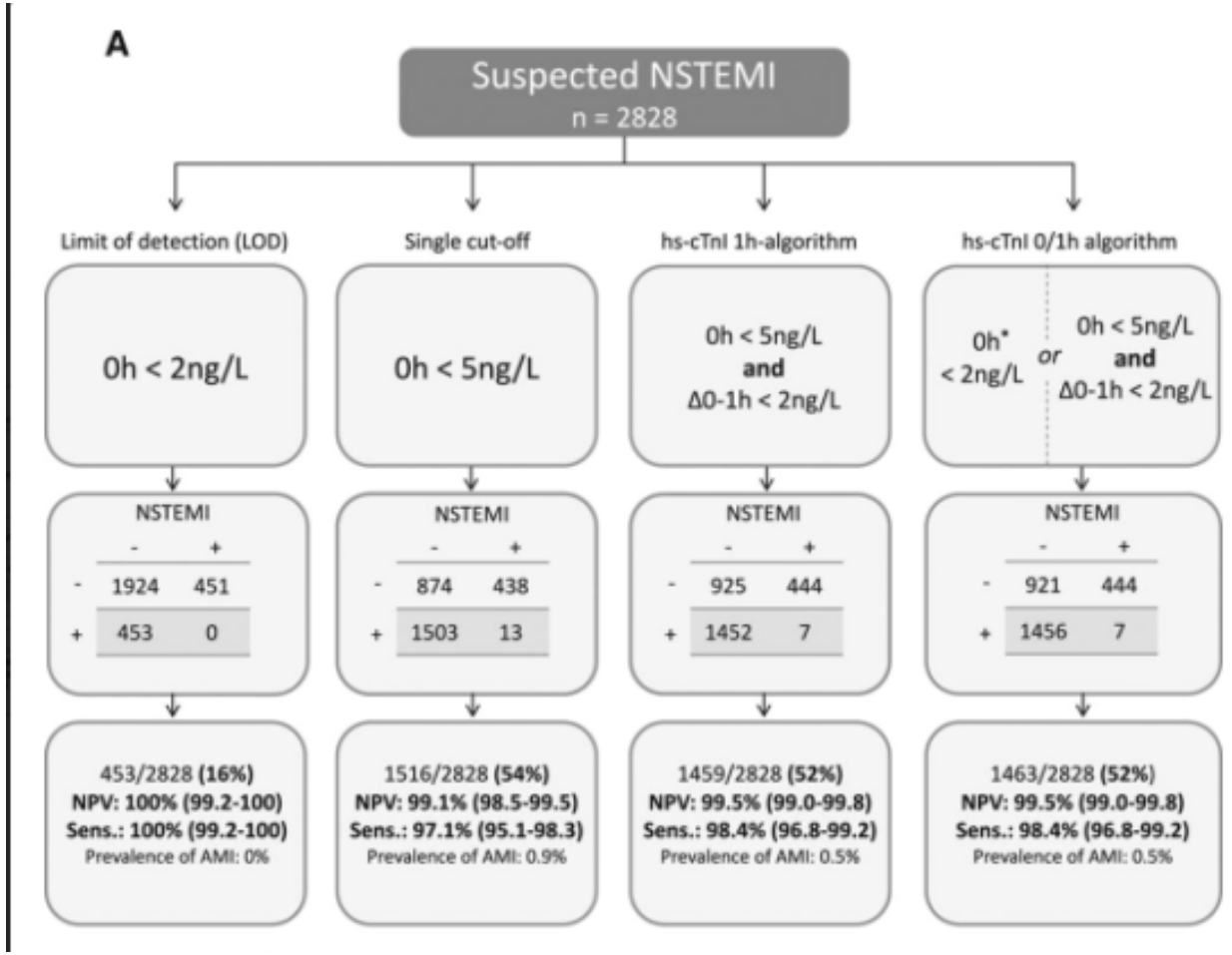
- You will not identify all patients at risk for MACE
  - Unpublished data from Mark et al.
    - 50% of MACE occurred after a negative stress test in non-low risk patients



Ann Emerg Med. 2018 Apr;71(4):439-451

European Society of Cardiology (ESC)-rule-in.

How well does it work?



Circulation. 2017;135:1597-1611

Heart

Evaluation of Outpatient Cardiac Stress Testing After Emergency Department Encounters for Suspected Acute Coronary Syndrome

Shaw Natsui, MD, MPA; Benjamin C. Sun, MD, MPP; Ernest Shen, PhD; Yi-Lin Wu, MS; Rita F. Redberg, MD, MSc; Ming-Sum Lee, MD, PhD; Maros Ferencik, MD, PhD; Chengyi Zheng, PhD; Aniket A. Kawatkar, PhD, MS; Michael K. Gould, MD, MS; Adam L. Sharp, MD, MS*

- ~8000 patients s/p chest pain evaluation had outpatient test ordered
  - 31.3% completed within 3 days
  - 58.7% within 4-30 days
- 0.9% adverse events
- Majority were HEART score 0-3 (72.5%)

Ann Emerg Med. 2019;74:216-223

Summary

- Healthcare disparity still exist in those at greatest risk for poor outcomes
- Utilization of high sensitive troponins provides us to look at opportunities to
  - Reduce overtesting
  - Resource utilization for additional testing