High-value Care in Practice: Appropriate Cardiac Biomarker Use for Hospitalists

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Society of Hospital Medicine

Disclosures

Lily Ackermann has no relevant financial or advisory relationships with corporate organizations related to this activity.

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- *Past Editor-in-Chief of the* Journal of Clinical Outcomes Management
- Unpaid board position

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Dr. David Berg has no relevant financial or advisory relationships with corporate organizations related to this activity.

QUESTIONS

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Question 1

Which of the following cardiac biomarkers have the strongest level of evidence by the AHA/ACC for clinical use?

A. Troponin

B. BNP or NT-pro BNP

C. Ck-MB

D. A and B

E. A, B and C

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Question 1

Which of the following cardiac biomarkers have the strongest level of evidence by the AHA/ACC for clinical use?

A. Troponin

B. BNP or NT-pro BNP

C. Ck-MB

D. A and B

E. A, B and C

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Question 2

For patients found to have an elevated troponin when presenting to the hospital , guidelines recommend serial troponin measurement every 2 hours until the level stabilizes to ensure cardiac ischemia is not missed.

A. True

B. False

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Transforming patient care.

High-value care in practice: Appropriate cardiac biomarker use for Hospitalists

David D. Berg, MD, MPH

Investigator, TIMI Study Group
Cardiologist, Brigham & Women's Hospital
Assistant Professor of Medicine, Harvard Medical School

Cardiac Biomarkers in the Diagnosis of Myocardial Infarction

David D. Berg, MD, MPH

Investigator, TIMI Study Group

Cardiologist, Brigham & Women's Hospital

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Disclosures

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Clinical Case

- 76 yo woman admitted to medicine for productive cough and dyspnea
- PMH: HTN, HLD, T2D, COPD, HFpEF, CKD
- SH: current smoker (1 ppd)
- Meds: ASA, amlodipine, atorvastatin, dapagliflozin, furosemide, BGF, lisinopril

- HR 95, BP 146/82
- Exam: Diffuse wheezes
- ECG: No ischemic changes
- CXR: No infiltrate or edema
- hsTnT 29 ng/L (99% percentile URL 14 ng/L)

How would you approach additional CV biomarker testing?

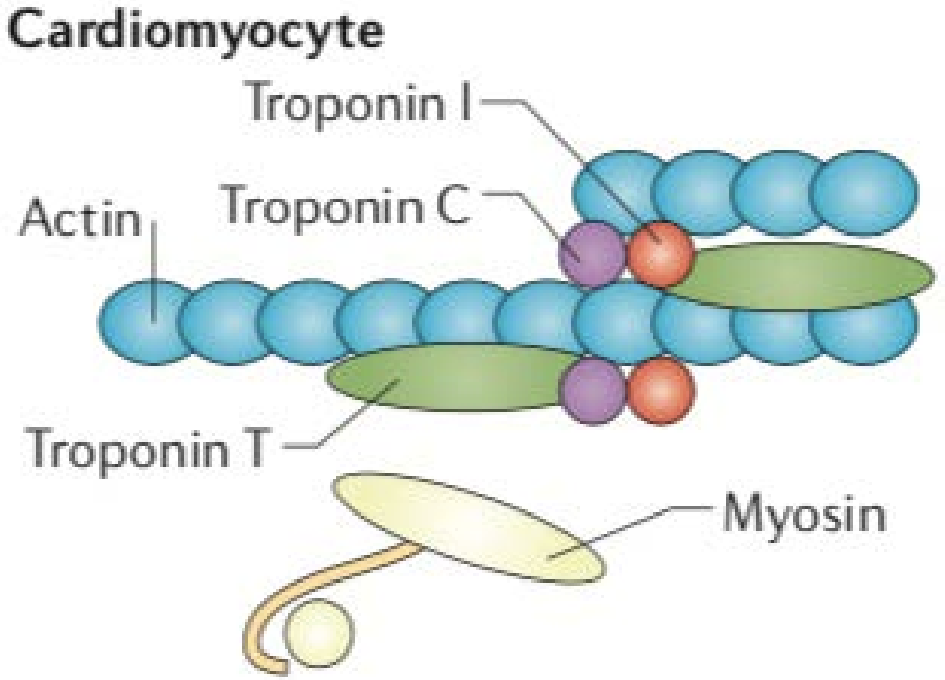
Learning Objectives

- **Describe the criteria and classification of MI according to the Universal Definition of Myocardial Infarction**
- **Recognize the kinetics of troponin elevation in ACS and advantages of high-sensitivity assays**
- **Appreciate the importance of clinical assessment in the diagnosis of myocardial infarction**

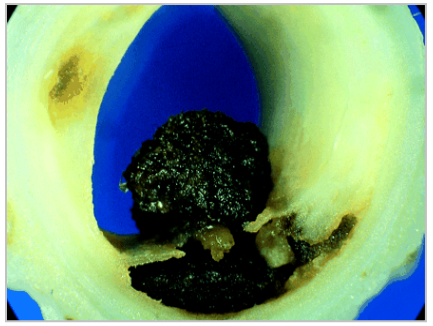
Established Cardiac Biomarkers

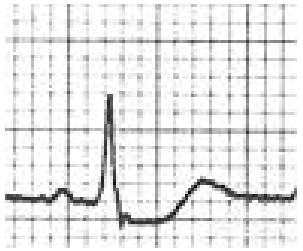
- **Natriuretic peptides**
  - Hormones expressed by cardiomyocytes in response to **hemodynamic stress**
  - BNP and NT-proBNP used for diagnosis and assessment of HF

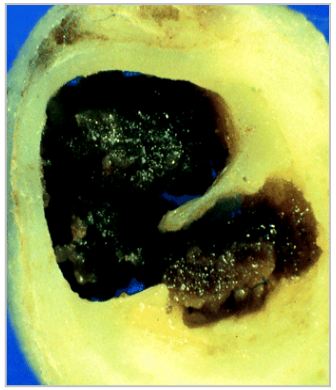
- **Cardiac Troponin**
  - Complex of 3 regulatory proteins involved in cardiac muscle contraction
  - TnI and TnT assays used to detect **myocardial injury**

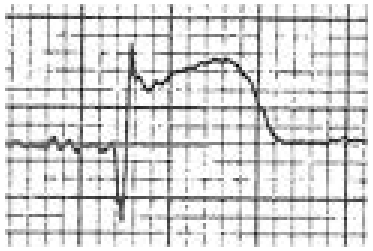


Acute Coronary Syndromes



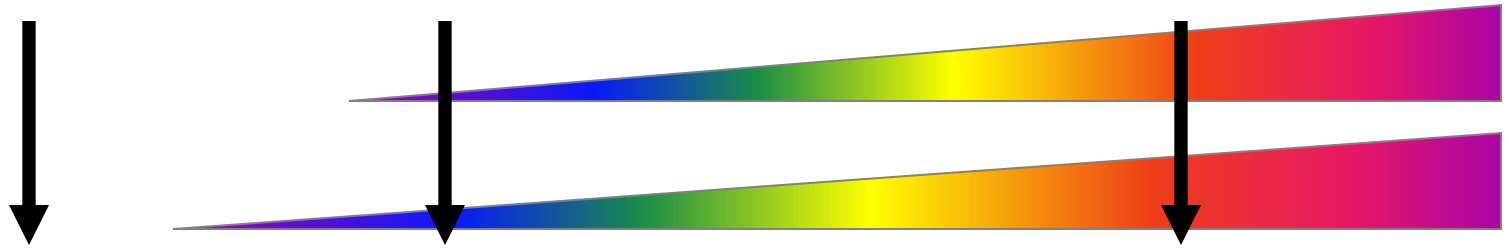






Non-ST elevation ACS

ST elevation ACS



UA

NSTEMI

STEMI

4th Universal Definition of MI

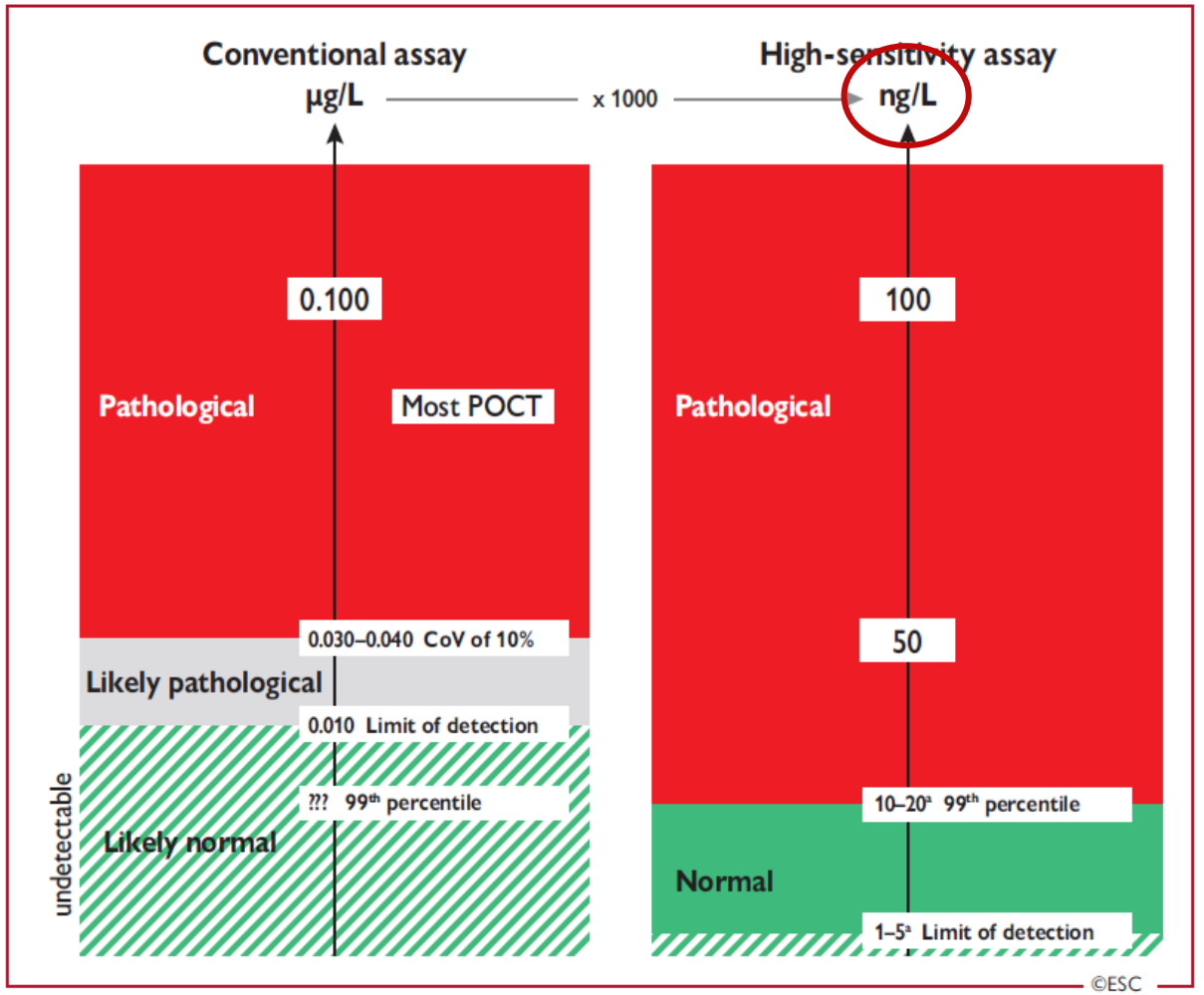
Definition	Criteria
Acute Myocardial Infarction	**Acute myocardial injury** + clinical evidence of acute myocardial ischemia (eg, sx, ECG, imaging)

Thygesen et al. Circulation 2018;138(20):e618-e651.

How Do We Detect Myocardial Injury?

Era	Assay	Measure at presentation + …
1950s	AST & LDH	q12 hrs × 4
1960s	CK	q12 hrs × 2
1980s	CK-MB	q8 hrs × 3
1990s	**Troponin**	q8 hrs × 3
Recent past	Troponin	**3-6 hrs after sx onset**
Now	**hs-Troponin**	**1-3 hrs later** (depending on time from sx onset to presentation) **Examine absolute and Δ**

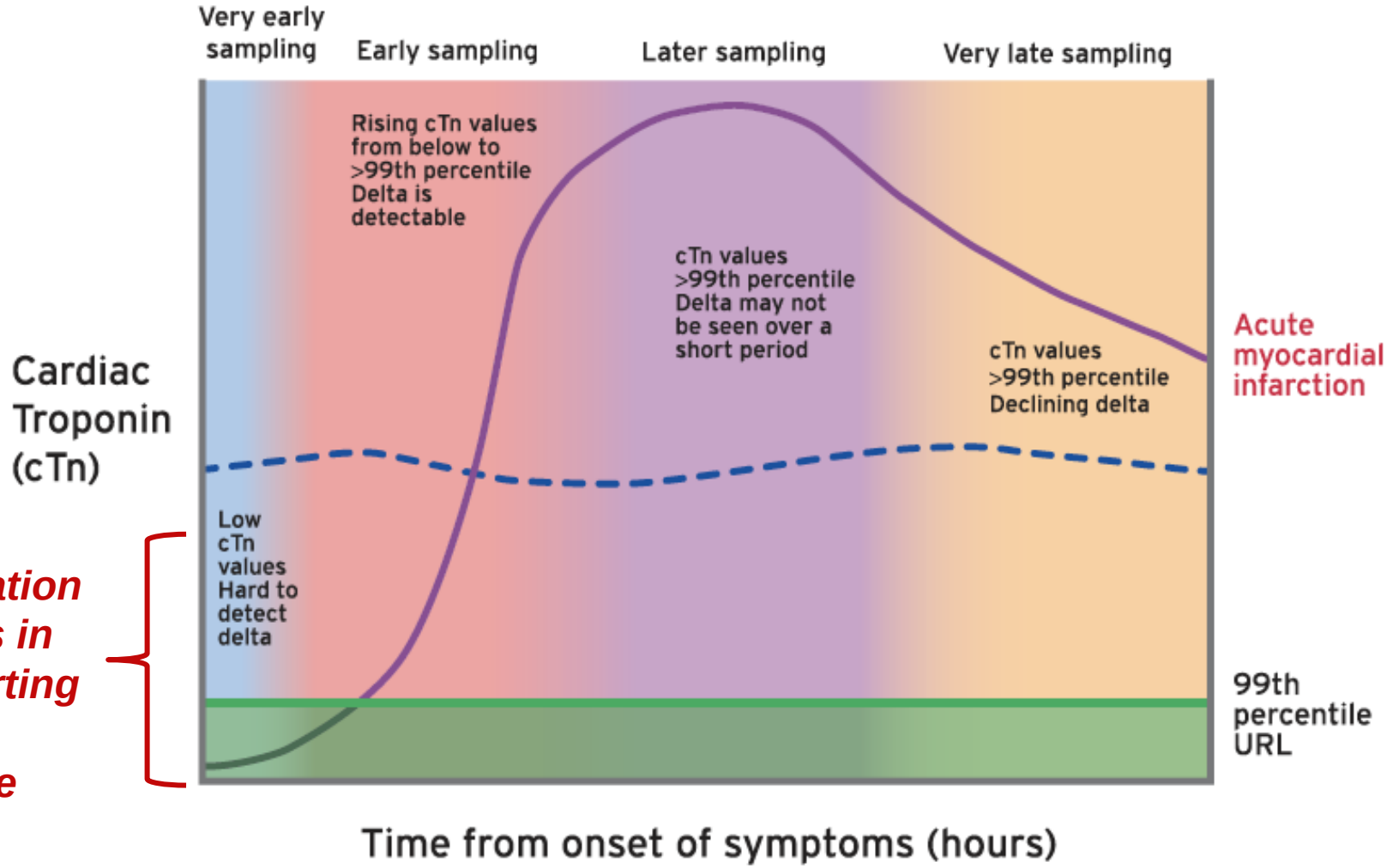
Conventional vs hs-Troponin Assays



Greater precision with differentiating between "normal" and "mildly elevated"

Collet JP, et al. Eur Heart J 2021;42:1289-1367.

Troponin Kinetics



hsTn assays
Greater discrimination of small changes in concentration starting within normal reference range

Thygesen et al. Circulation 2018;138(20):e618-e651.

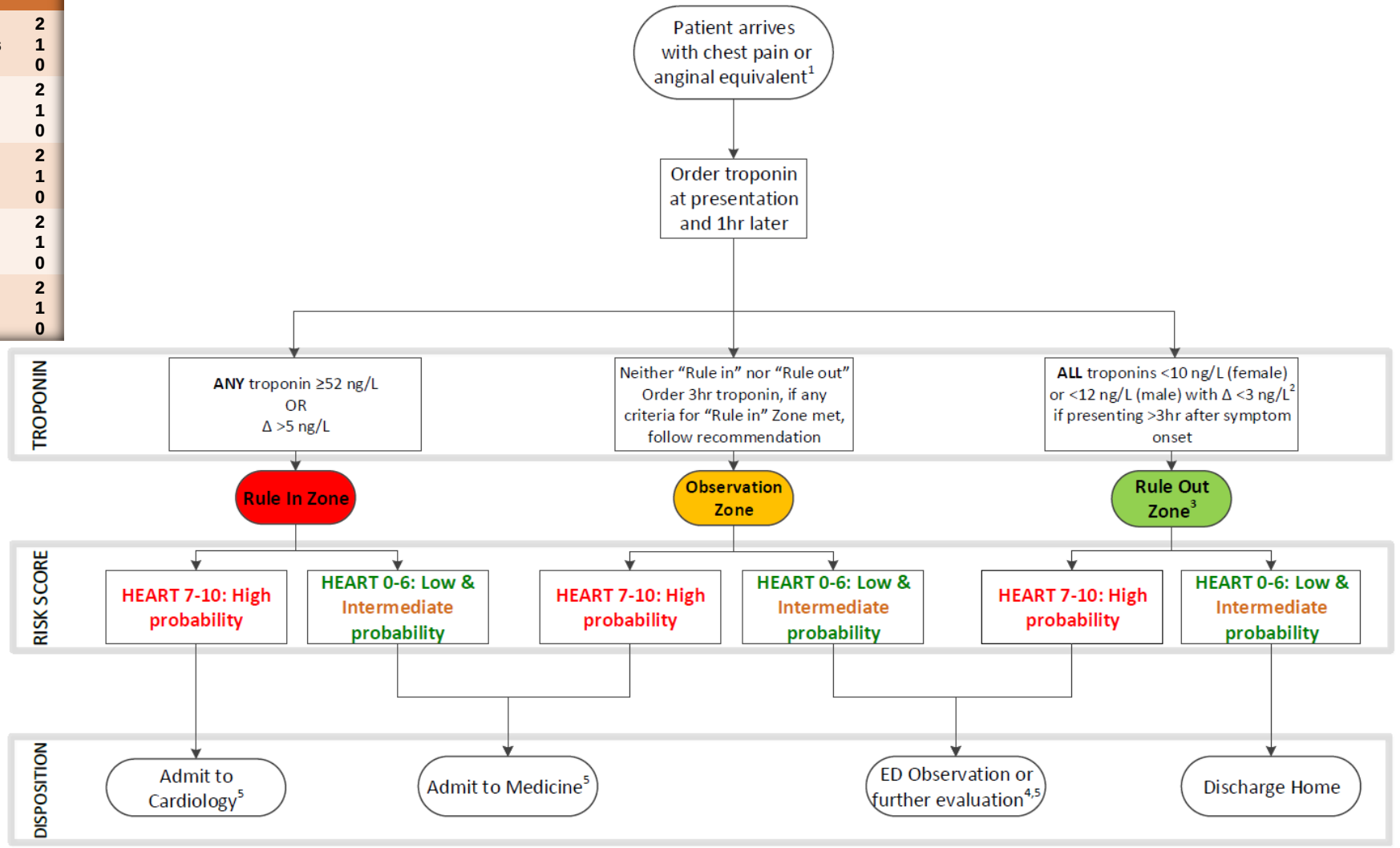
Early Rule-Out Strategies with hsTn

- **Integration of very-low detection limit at early timepoint**
- **Movement of serial sample to earlier timepoints**
- **Addition of delta (Δ) criteria for serial testing**

Morrow DA. Circulation 2017;135(17):1612-1616.

MGB Pathway

HEART Score		
History	Highly suspicious	2
	Moderately suspicious	1
	Slightly suspicious	0
ECG	Signif ST-depression	2
	Non-specific abnl	1
	Normal	0
Age	≥65 y	2
	45 – 65 y	1
	≤45 y	0
Risk factors	≥3 risk factors	2
	1-2 risk factors	1
	None	0
Troponin (serial)	≥3 x 99th percentile	2
	1– 3 x 99th percentile	1
	≤99th percentile	0

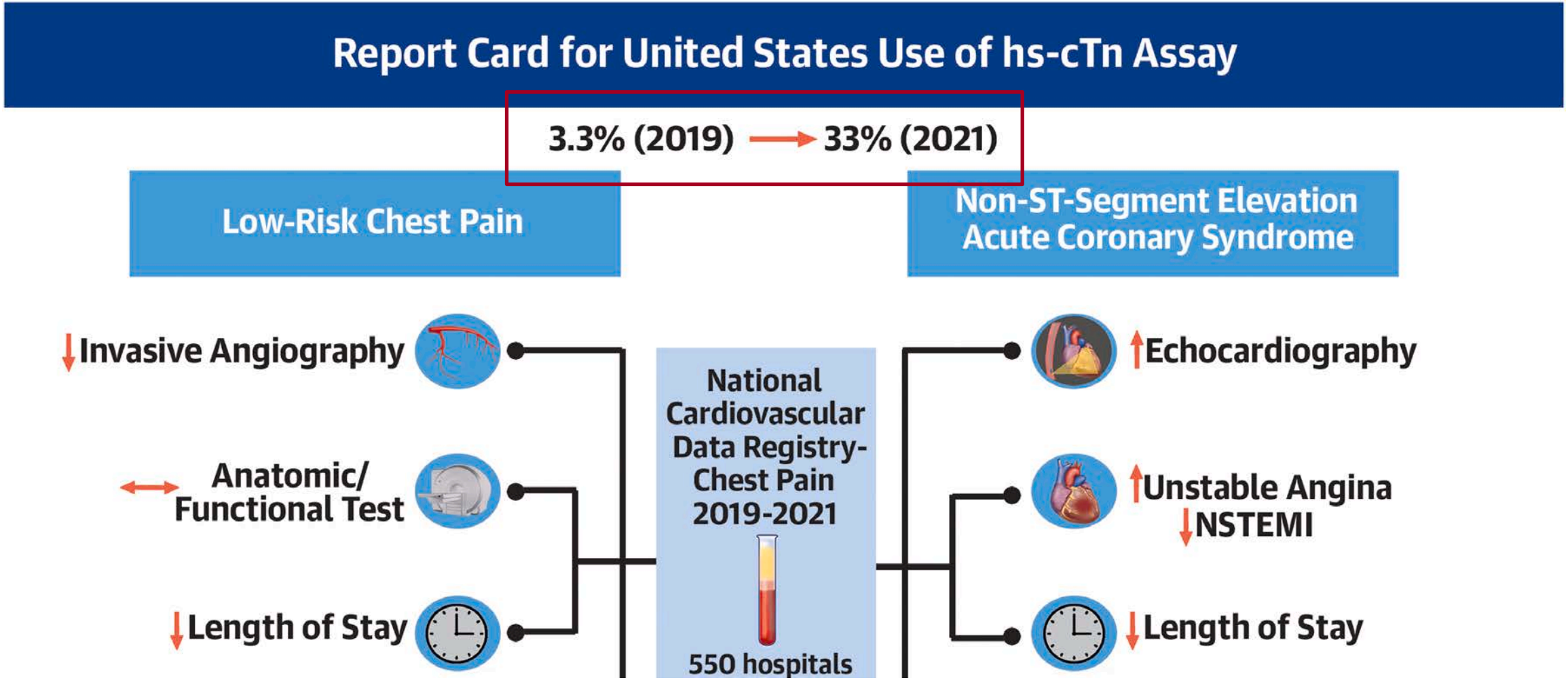


ACC/AHA Chest Pain Guidelines (2021)

Recommendations for Biomarkers		
COR	**LOE**	**Recommendations**
1	**B-NR**	In patients presenting with acute chest pain, serial ~~acute myocardial injury~~ ***Caveat**: Among patients with symptom onset >2 hours, use of a single low hs-cTn measurement may be used to identify patients at low risk for acute MI.*
1	**B-NR**	In patients presenting with acute chest pain, **high-sensitivity cTn is the preferred biomarker** because it enables more rapid detection or exclusion of myocardial injury and increases diagnostic accuracy

Gulati et al. Circulation 2021;144:e368-e454.
Sandoval et al. Circulation 2022;146:569-581.

hsTn Assays in US Hospitals



Gulati M and Berg DD. J Am Coll Cardiol. 2023;81(3):220-223.

Troponin Assays Are Not Standardized

List of FDA-Approved High-Sensitivity Troponin Assays

Assay	LoD, ng/L	LoQ, ng/L	Overall 99th percentile, ng/L	Sex-specific 99thper-centiles, F/M, ng/L
Abbott ARCHITECT hs-cTnI	1.7	2.3	28	17/35
Beckman Coulter Access 2 hs-cTnI (plasma)	1.0–2.0	0.9–2.3	17.5	11.6/19.8

Recommendations for Biomarkers

COR	LOE	Recommendations
1	C-EO	Clinicians should be familiar with the analytical performance and the 99th percentile upper reference limit that defines myocardial injury for the cTn assay used at their institution.

The Challenge for the Hospitalist

EDITORIAL

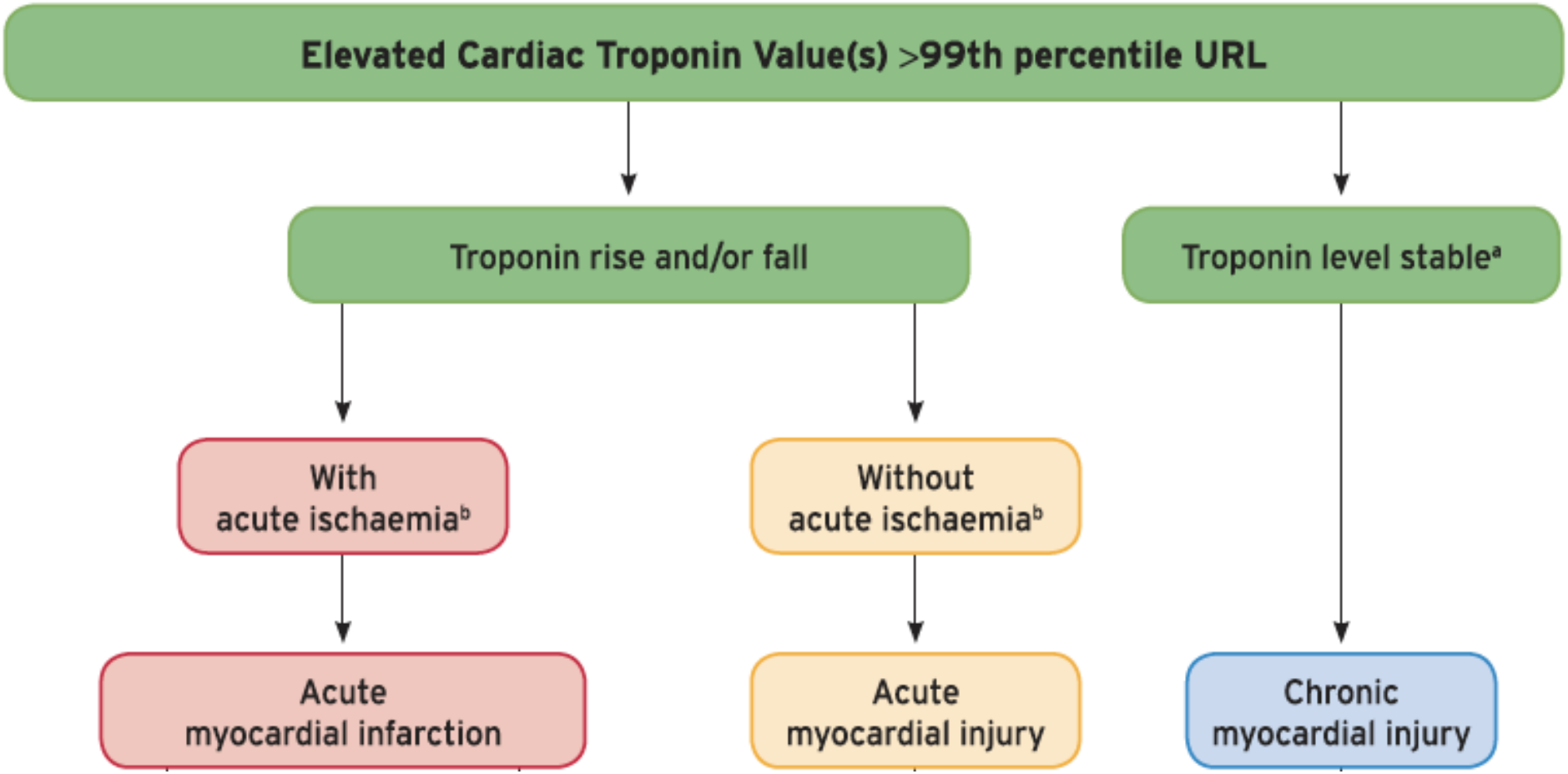
Clinical Application of Sensitive Troponin Assays

David A. Morrow, M.D., M.P.H.

"In these studies, the two groups of investigators showed that a new generation of sensitive assays for troponin **improved overall diagnostic accuracy** and thus functioned as a better test. The findings support current professional guidelines for the use of troponin and a rationale for the use of more sensitive assays. However, their results also confirm a **trade-off of superior clinical sensitivity for diminished clinical specificity** for the diagnosis of myocardial infarction."

Morrow DA. N Engl J Med. 2009;361(9):913-915.

Myocardial Injury vs Myocardial Infarction?



Thygesen et al. Circulation 2018;138(20):e618-e651.

Type 1 MI, Type 2 MI, & Non-ischemic Myocardial Injury?

Type 1 MI

- **Due to ACS (plaque rupture or erosion)**
- Distinction from T2MI generally a clinical dx
- hsTn elevations >5x URL → >90% PPV for T1MI
- Coronary thrombus on angiography confirms dx

Type 2 MI

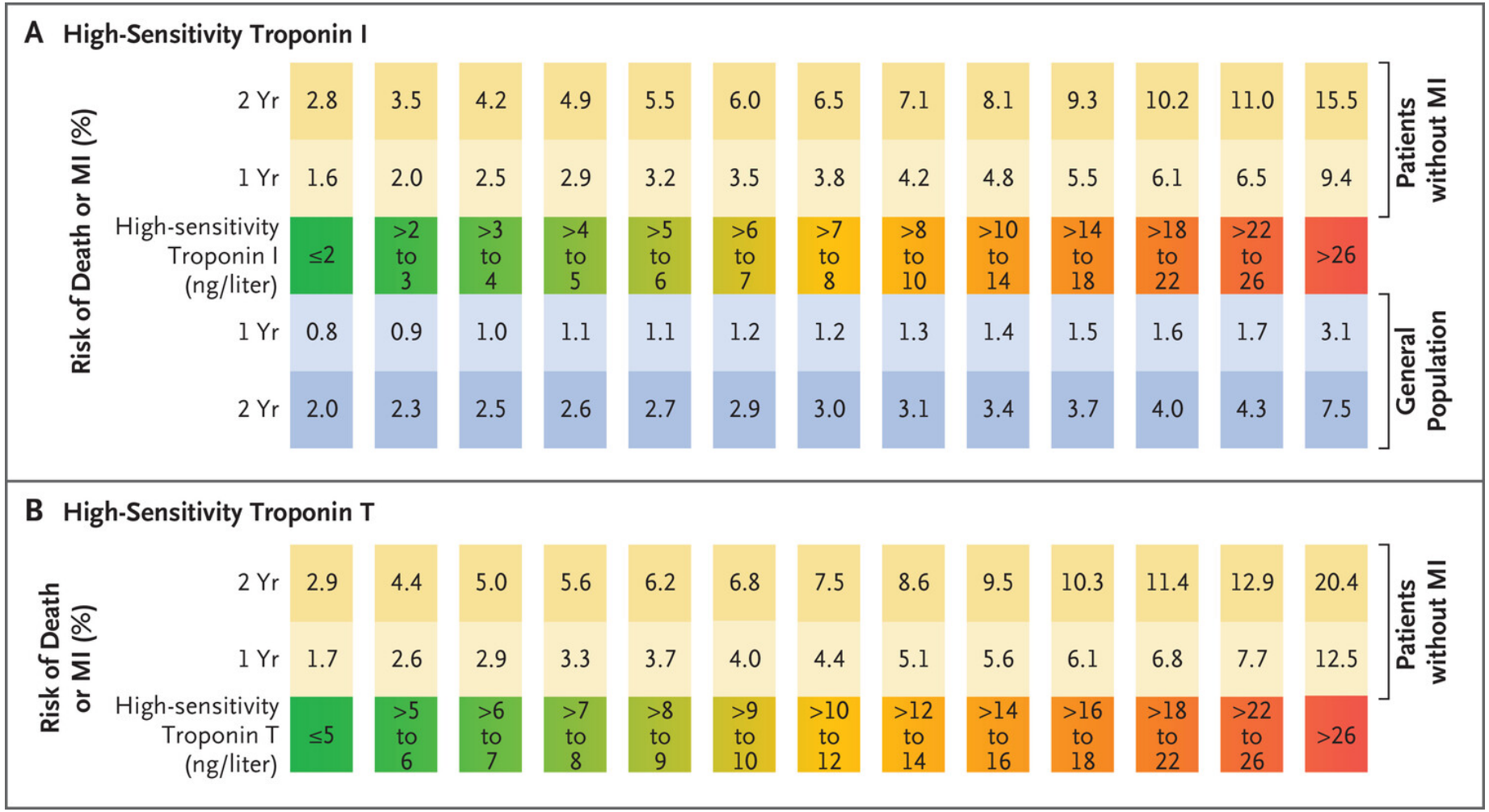
- **NOT due to ACS**
- ↓ myocardial perfusion
  - Coronary artery spasm, embolism, dissection
  - HoTN, sustained bradycardia, anemia
- ↑ myocardial demand
  - Sustained tachycardia, hypertension

Acute myocardial injury

- **↑ Tn w/o s/s ischemia**
- HF, myocarditis, TTC
- Ablation, defib, contusion
- PE, PH
- Sepsis, CKD
- Stroke, SAH
- Strenuous exercise

Thygesen et al. Circulation 2018;138(20):e618-e651.

Elevated Tn in Patients Without MI



Neumann JT et al. NEJM 2019;380:2529-2540.

Clinical Case

- 76 yo woman admitted to medicine for productive cough and dyspnea
- PMH: HTN, HLD, T2D, COPD, HFpEF, CKD
- SH: current smoker (1 ppd)
- Meds: ASA, amlodipine, atorvastatin, dapagliflozin, furosemide, BGF, lisinopril

- HR 95, BP 146/82
- Exam: Diffuse wheezes
- ECG: No ischemic changes
- CXR: No infiltrate or edema
- hsTnT 29 ng/L (99% percentile URL 14 ng/L)

Repeat hsTnT (3h) = 27 ng/L

Dx: AE-COPD with suspected chronic myocardial injury

Summary

- **Diagnose MI based on history, 12-lead ECG, troponin**
- **High-sensitivity troponin assays are preferred to conventional troponin assays**
  - Greater analytic precision
  - Superior diagnostic accuracy
  - Ability to more rapidly “rule-out” MI
- **Good clinical judgment is important for distinguishing between non-ischemic myocardial injury, type 1 MI, and type 2 MI**

Thank you

dberg1@bwh.harvard.edu

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Empowering hospitalists.
Transforming patient care.

High-value care in practice: Appropriate cardiac biomarker use for Hospitalists

Christine Soong, MD, MSc
Medical Director, Quality and Safety
Hospital Medicine Division Head
Sinai Health System, University of Toronto

Society of Hospital Medicine

Objectives

1. How can hospitalists avoid unnecessary biomarkers testing from admission to discharge during hospitalization?

2. What are effective quality improvement interventions to reduce unnecessary biomarker testing among hospitalized patients?

Objective #1

1. How can hospitalists avoid unnecessary biomarkers testing from admission to discharge during hospitalization?

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Low-value cardiac biomarker testing: CK-MB in AMI

Don't test for myoglobin or CK-MB in the diagnosis of acute myocardial infarction (AMI). Instead, use troponin I or T.

Unlike CK-MB and myoglobin, the release of troponin I or T is specific to cardiac injury.

Troponin is released before CK-MB and appears in the blood as early as, if not earlier than, myoglobin after AMI. Approximately 30% of patients experiencing chest discomfort at rest with a normal CK-MB will be diagnosed with AMI when evaluated using troponins. Single-point troponin measurements equate to infarct size for the determination of the AMI severity. Accordingly, there is much support for relying solely on troponin and discontinuing the use of CK-MB and other markers.

Journal of Hospital Medicine

Original Research | Full Access

Trends in Troponin-Only Testing for AMI in Academic Teaching Hospitals and the Impact of Choosing Wisely®

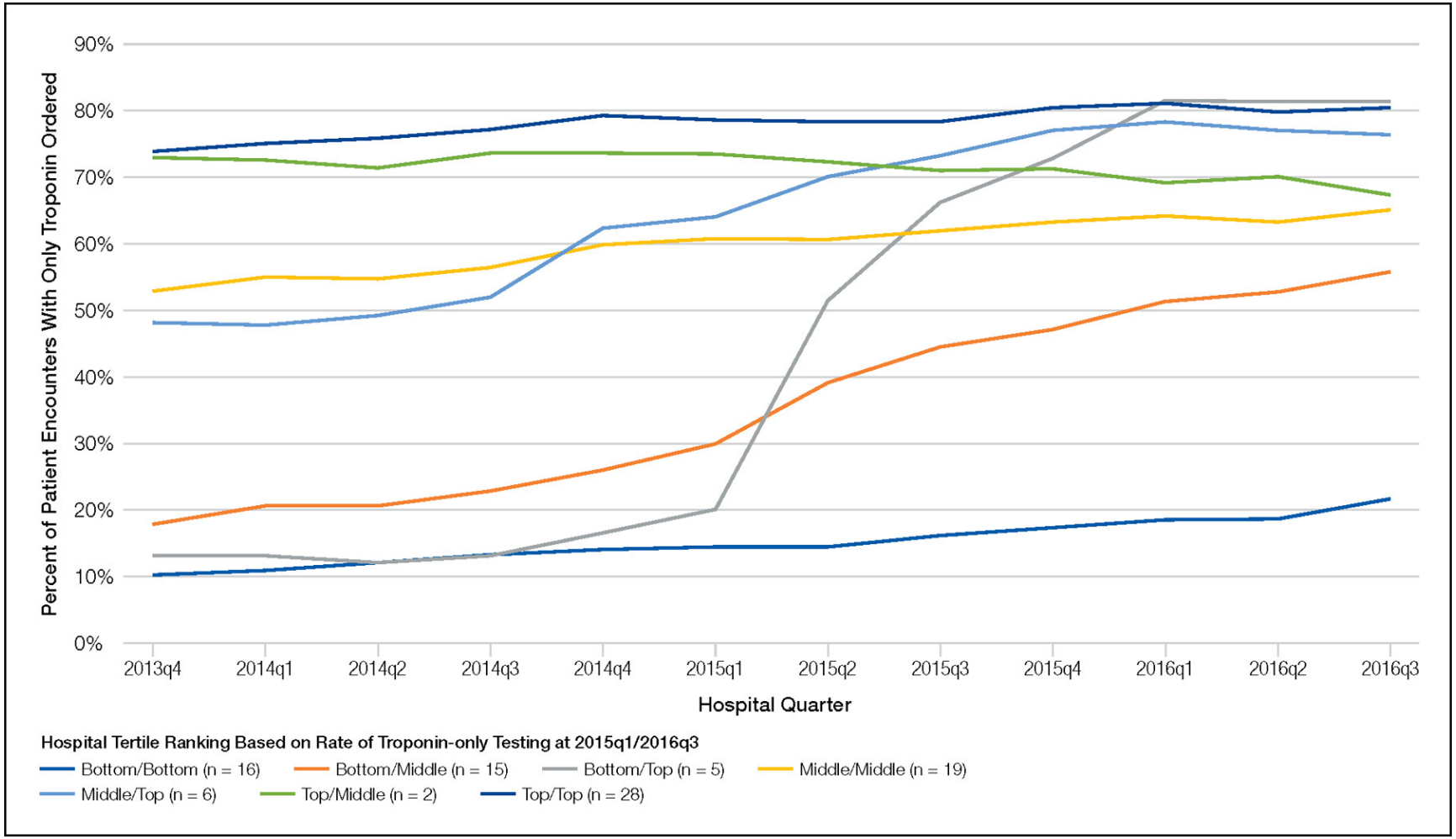
Micah T. Prochaska MD, MS, Samuel F. Hohmann PhD, MS-HSM, Matthew Modes MD, MPH, Vineet M. Arora MD, MAPP

First published: 20 September 2017 | https://doi.org/10.12788/jhm.2846 | Citations: 7

Additional Supporting Information may be found in the online version of this article.

Society of Hospital Medicine

Trends in Troponin-Only Testing for AMI in Academic Teaching Hospitals and the Impact of Choosing Wisely®



Journal of Hospital Medicine, Volume: 12, Issue: 12, Pages: 957-962, First published: 20 September 2017, DOI: (10.12788/jhm.2846)

Low-value cardiac biomarker testing in the ED

Original Investigation

January 2015

Use of Cardiac Biomarker Testing in the Emergency Department

Anil N. Makam, MD, MAS[1]; Oanh K. Nguyen, MD, MAS[1]

» Author Affiliations | Article Information

JAMA Intern Med. 2015;175(1):67-75. doi:10.1001/jamainternmed.2014.5830

2009-2010 National Hospital Ambulatory Medical Care Survey database
All ED visits
Age 18+
Primary outcome=cardiac biomarker(CK-MB, troponin I/T) testing in ED

JAMA Network™

From: **Use of Cardiac Biomarker Testing in the Emergency Department**

JAMA Intern Med. 2015;175(1):67-75. doi:10.1001/jamainternmed.2014.5830

Table 2. Use of Cardiac Biomarker Testing in the ED by Selected Characteristics[a]

Characteristic	All ED Visits		Individuals Subsequently Hospitalized		Individuals Discharged From the ED	
	Unadjusted % (95% CI)	No. (95% CI) of Visits With Testing, Million	Unadjusted % (95% CI)	No. (95% CI) of Visits With Testing, Million	Unadjusted % (95% CI)	No. (95% CI) of Visits With Testing, Million
Overall	16.9 (15.2-18.7)	28.6 (24.4-32.9)	47.0 (43.3-50.8)	14.2 (12.0-16.3)	10.4 (9.1-11.8)	14.4 (12.1-16.8)
Cardiovascular comorbidities, No.						
0	13.4 (11.8-15.1)	19.1 (16.1-22.1)	41.6 (37.5-45.7)	7.9 (6.7-9.2)	9.0 (7.8-10.4)	11.2 (9.3-13.1)
1	33.3 (30.4-36.2)	7.3 (6.1-8.5)	54.7 (50.3-58.9)	4.5 (3.7-5.3)	20.2 (17.8-22.8)	2.7 (2.2-3.3)
2-4	47.0 (42.0-52.0)	2.2 (1.8-2.6)	61.8 (55.4-67.8)	1.7 (1.4-2.1)	25.3 (21.0-30.2)	0.5 (0.4-0.6)
Symptom of ACS						
None	8.2 (7.1-9.5)	8.5 (7.0-10.0)	35.4 (31.6-39.3)	4.5 (3.7-5.2)	4.5 (3.7-5.3)	4.1 (3.2-4.9)
Atypical	24.2 (21.7-26.9)	12.4 (10.5-14.2)	47.9 (43.6-52.3)	5.7 (4.9-6.6)	17.0 (14.8-19.4)	6.6 (5.5-7.7)
Chest pain	51.7 (47.2-56.2)	7.7 (6.5-9.0)	72.0 (68.9-77.4)	4.0 (3.2-4.7)	39.9 (35.7-44.2)	3.8 (3.1-4.4)
Visit related to an injury or poisoning						
No	21.6 (19.4-24.0)	24.4 (20.7-28.0)	49.8 (45.8-53.9)	11.9 (10.0-13.8)	14.0 (12.3-15.9)	12.5 (10.4-14.5)
Yes	7.5 (6.6-8.5)	4.2 (3.6-4.9)	36.3 (32.1-40.8)	2.3 (1.9-2.6)	3.9 (3.3-4.6)	2.0 (1.6-2.4)
Cardiovascular visit diagnosis						
No	11.5 (10.2-13.0)	16.9 (14.2-19.5)	36.2 (32.8-39.7)	7.0 (5.9-8.0)	7.8 (6.7-9.0)	9.9 (8.2-11.6)
Yes	51.2 (46.8-55.5)	11.7 (9.9-13.6)	66.4 (60.9-71.5)	7.2 (6.0-8.4)	37.5 (33.6-41.7)	4.5 (3.7-5.4)
Other tests or services in the ED, No.						
0-5	4.5 (3.8-5.2)	5.6 (4.5-6.7)	18.9 (15.7-22.7)	2.1 (1.6-2.5)	3.1 (2.6-3.7)	3.5 (2.8-4.3)
6-10	50.3 (46.4-54.2)	20.6 (17.2-23.9)	60.8 (56.5-65.0)	10.3 (8.7-12.0)	42.8 (38.5-47.3)	10.2 (8.4-10.1)
>10	78.1 (71.6-83.4)	2.4 (1.8-3.1)	80.5 (74.8-85.2)	1.8 (1.3-2.2)	72.4 (58.4-83.0)	0.7 (0.4-1.0)

Abbreviations: ACS, acute coronary syndrome; ED, emergency department.

[a] Percentages and estimated number of visits shown are weighted to reflect the complex survey design.

- 44,448 ED visits
- 16.9% (extrapolated to 28.6M visits) had cardiac biomarkers tested
- 8.2% (extrapolated to 8.5M visits) lacked ACS symptoms

Indiscriminate testing

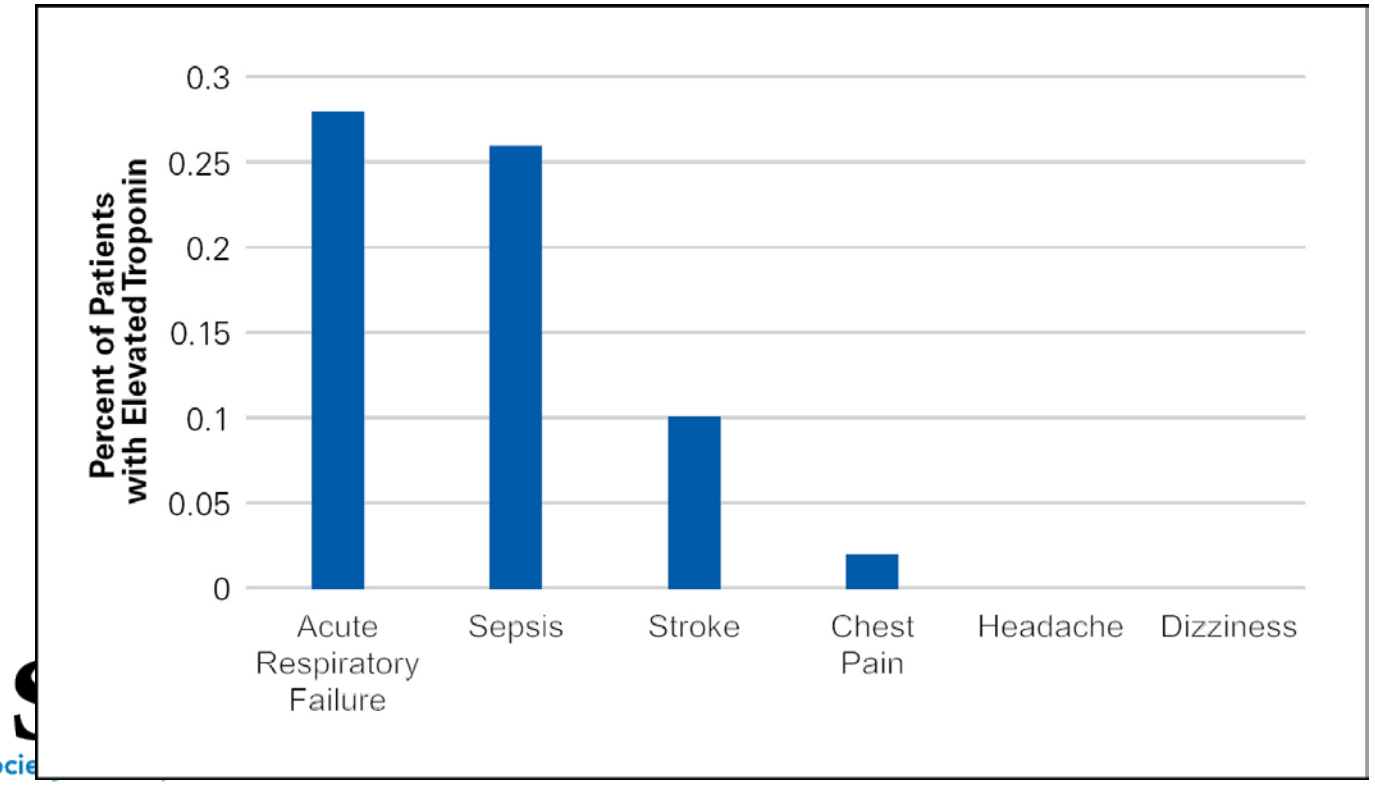
Journal of Hospital Medicine

Brief Report | Full Access

Overuse of Troponin? A Comprehensive Evaluation of Testing in a Large Hospital System

Gibbs Wilson MD, Kyler Barkley MD, Kipp Slicker DO, Robert Kowal MD, PhD, Brandon Pope PhD, Jeffrey Michel MD, FACC

First published: 01 May 2017 | https://doi.org/10.12788/jhm.2732 | Citations: 12



- All associated troponin values performed at 14 hospitals over 12 months and primary and secondary diagnoses for each visit
- 3.5% of tested patients having a primary or secondary diagnosis of AMI
- 79% of elevated troponin values were associated with primary diagnoses other than AMI.

Inappropriate testing frequency

JOURNAL ARTICLE

Cardiac Troponin Testing Is Overused after the Rule-In or Rule-Out of Myocardial Infarction FREE

Olaia Rodriguez Fraga, Yader Sandoval, Sara A Love, Zeke J McKinney, MaryAnn M Murakami, Stephen W Smith, Fred S Apple ✉

Clinical Chemistry, Volume 61, Issue 2, 1 February 2015, Pages 436–438,
https://doi.org/10.1373/clinchem.2014.232694
Published: 01 February 2015

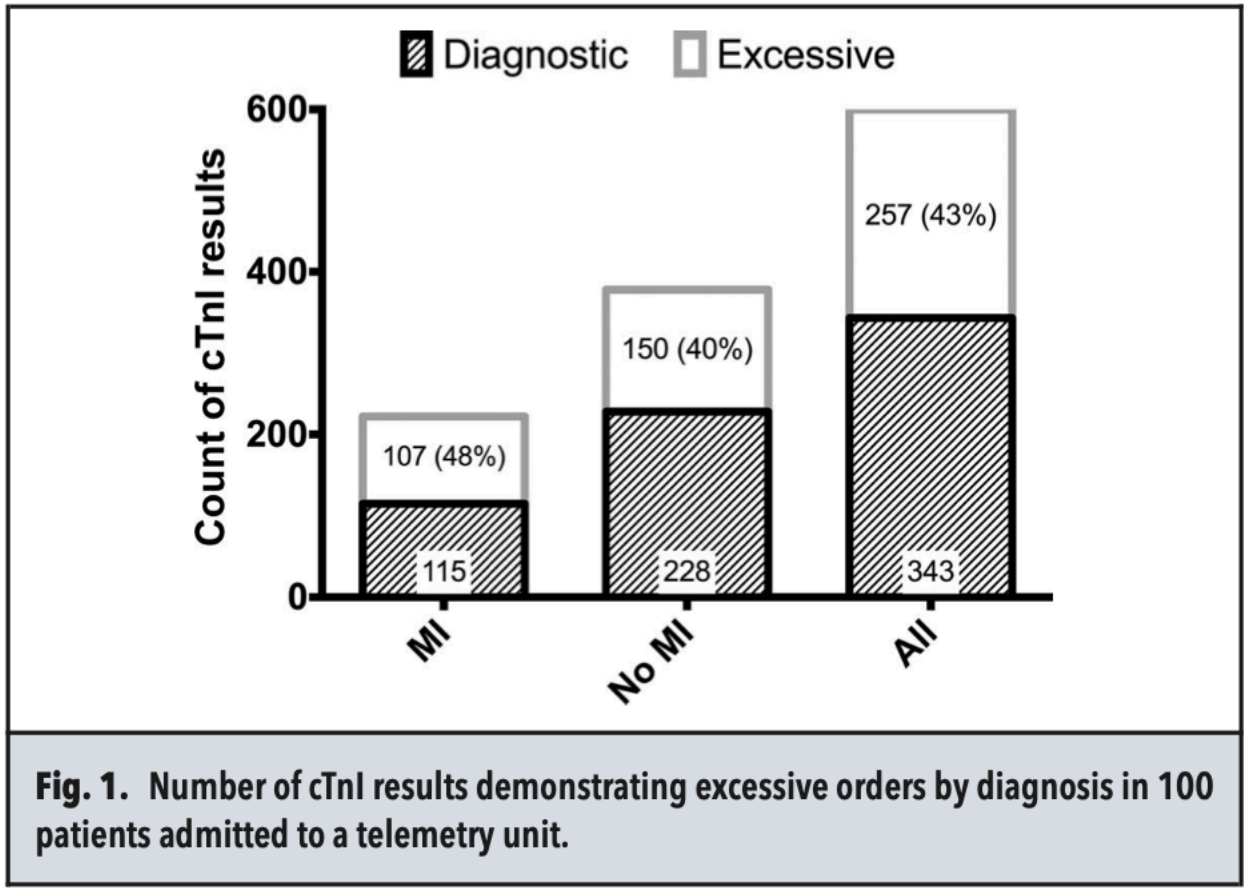


Fig. 1. Number of cTnI results demonstrating excessive orders by diagnosis in 100 patients admitted to a telemetry unit.

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Practical considerations: Older patients

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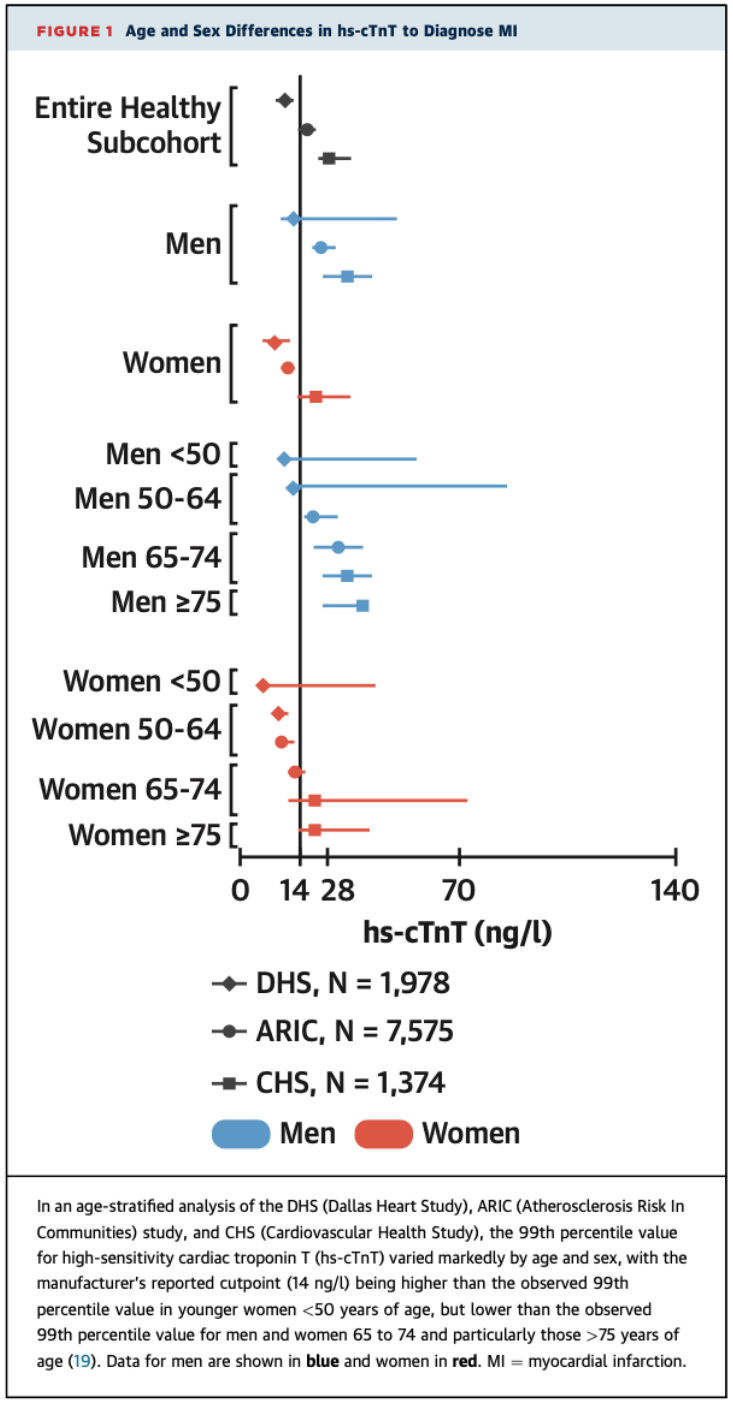
THE PRESENT AND FUTURE

JACC COUNCIL PERSPECTIVES

Cardiovascular Biomarkers and Imaging in Older Adults

JACC Council Perspectives

Daniel E. Forman, MD,[a,b] James A. de Lemos, MD,[c] Leslee J. Shaw, PhD,[d] David B. Reuben, MD,[e] Radmila Lyubarova, MD,[f] Eric D. Peterson, MD, MPH,[g] John A. Spertus, MD, MPH,[h] Susan Zieman, MD, PhD,[i,*] Marcel E. Salive, MD, MPH,[i,*] Michael W. Rich, MD,[j] for the Geriatric Cardiology Section Leadership Council



Uniform troponin threshold to define 'normal' results in:

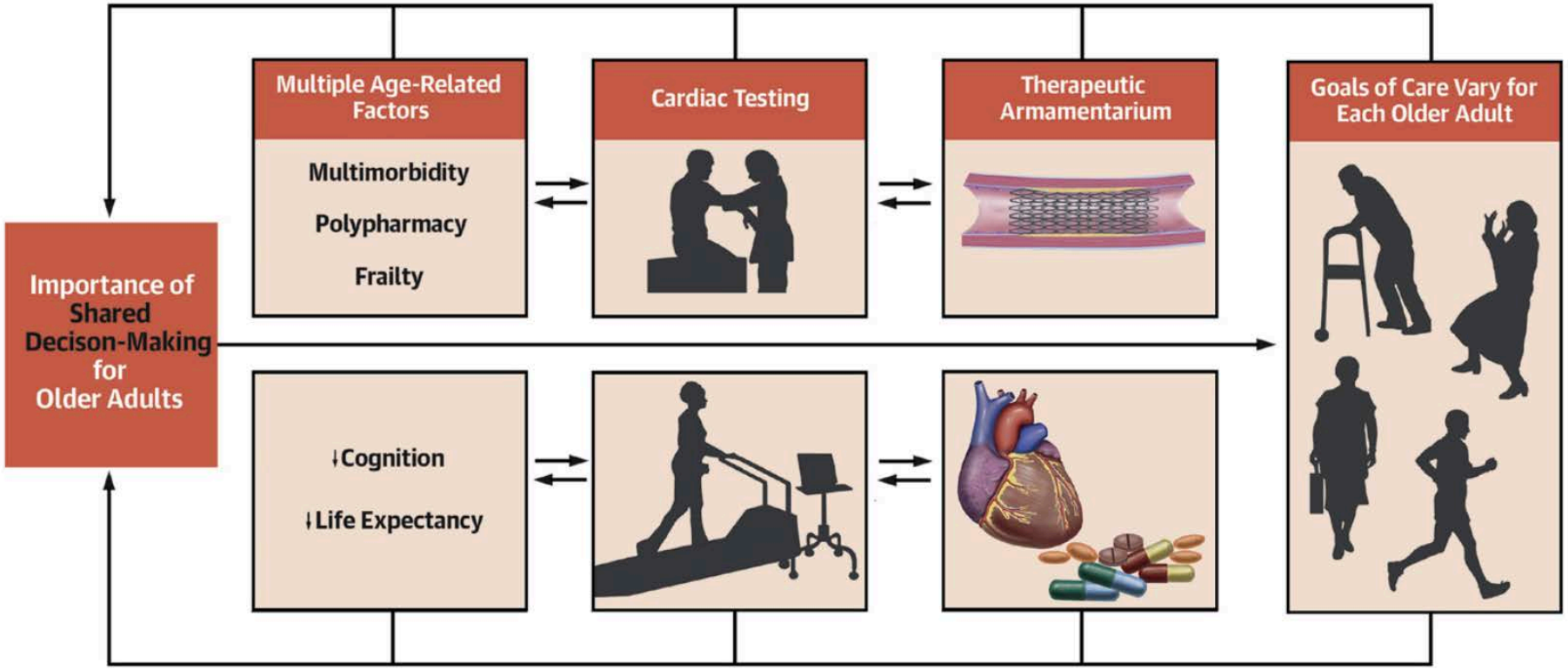
false-positive MI diagnoses in older adults and men

false-negative diagnoses in younger women

Goals of care and patient preferences are also important factors in testing, especially in MINS

Considerations for older adults

CENTRAL ILLUSTRATION: The Increased Importance of Shared Decision Making When Considering Testing for Older Adults With or at Risk for Cardiovascular Disease



Forman, D.E. et al. J Am Coll Cardiol. 2020;76(13):1577-94.

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Objective #2

What are effective quality improvement interventions to reduce unnecessary biomarker testing among hospitalized patients?

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JAMA Internal Medicine | Special Communication | LESS IS MORE

Eliminating Creatine Kinase–Myocardial Band Testing in Suspected Acute Coronary Syndrome

A Value-Based Quality Improvement

Matthew D. Alvin, MD, MBA, MS, MA; Allan S. Jaffe, MD; Roy C. Ziegelstein, MD, MACP; Jeffrey C. Trost, MD

Table. Trials Eliminating CK-MB Testing

Source	No.	Duration	Intervention	Results
Baron et al,[43] 2012	Not specified	4 mo	Implemented BPA in the CPOE system when physicians searched for CK-MB, tracked searches/Orders by provider Restricted CK-MB testing to patients who were post-PCI and postcardiac surgery	87% reduction in CK-MB tests (n = 1106 to 139/mo) Fewer orders after searches for CK-MB testing Fewer searches for CK-MB testing Physicians who had not seen the BPA (0 prior searches) were more likely ($P < .01$) to place a search
Larochelle et al,[44] 2014	84 835	12 mo	Developed institutional guideline in consultation with cardiologists to order troponin alone in patients with suspected ACS Conducted educational sessions with IM and ED physcians Disseminated a pocket-size guideline reference card Removed CK-MB from CPOE ACS routine order sets and created BPA when physicians attempted to order CK-MB tests	95% reduction in CK-MB tests with $720 000 in annual savings No decrease in ACS incidence
Singh and Baweja,[12] 2014	37 418	6 y	Removed CK-MB testing from CPOE ACS routine order sets Reviewed cases (n = 171) where CK-MB tests were still ordered	99.8% reduction in CK-MB tests (12 057 in 2007, 36 in 2013) No CK-MB test for the 171 patients provided diagnostic or prognostic value
Le et al,[45] 2015	14 571	12 mo	Removed CK-MB testing from CPOE ACS routine order sets	80% reduction in CK-MB tests with $47 286 in annual savings No missed diagnosis of ACS
Sullivan et al,[46] 2016	Not specified	12 mo	Removed CK-MB testing from CPOE ACS routine order sets	84% reduction in CK-MB tests (43.7 to 6.8 tests per day) Costs decreased from $546 per day to $85 per day, $168 000 annual savings No adverse effects on mortality

Abbreviations: ACS, acute coronary syndrome BPA, best practice alert; CK-MB, creatine kinase–myocardial band; CPOE, computerized provider order entry; ED, emergency department; IM, internal medicine; PCI, percutaneous intervention.

JAMA Intern Med. 2017;177(10):1508-1512.

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EMR-based interventions

High Value Practice Academic Alliance Pocket Card
Cardiac Biomarker Ordering for ACS/AMI

Obtain troponin *only if* you suspect Acute Coronary Syndrome (ACS)/Acute Myocardial Infarction (AMI)

Initial presentation

6-9 hours later

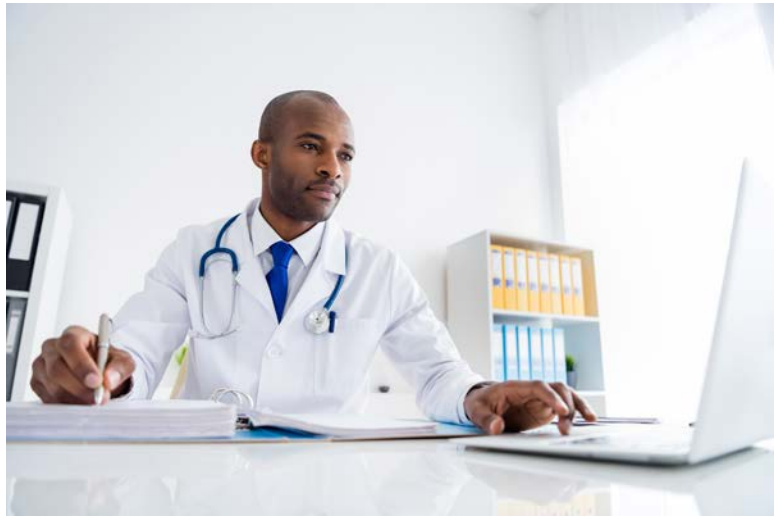
12-24 hours later *IF* intermediate to high clinical suspicion and/or recurrence of symptoms

STOP

STOP CHECKING. If troponin is abnormal:

- correlate with clinical presentation to determine likihood of ACS
- there is no utility to trending abnormal troponin to peak or resolution
- *IF* patient has ACS, ***AND*** there is clinical concern for reinfarction, additional troponin measurements may be useful

CK-MB in addition to troponin offers no incremental diagnostic value.



Best Practice Alert – CK-MB Lab Test

Based on national evidence-based guidelines[1,2,3]:
- Troponin is the preferred marker in diagnosing AMI/ACS
- CK-MB in addition to troponin adds no incremental diagnostic value

1. Anderson JL, Adams CD, Antman EM, et al. 2012 ACCF/AHA focused update incorporated into the ACCF/AHA 2007 guidelines for the management of patients with unstable angina/non-ST-elevation MI. J Am Coll Cardiol. 2013; 61:e179-e347.
2. Amsterdam EA, Wenger NK, Brindis RG, et al. 2014 AHA/ACC Guideline for the Management of Patients with Non-ST-Elevation Acute Coronary Syndromes: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol. 2014; 64:e139-228.
3. O'Gara PT, Kushner FG, Ascheim DD, et al. 2013 ACCF/AHA guideline for the management of ST elevation MI. J. Am Coll Cardiol. 2013; 61:e78-e140.

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CDS interventions

Home > BMC Medical Informatics and Decision Making > Article

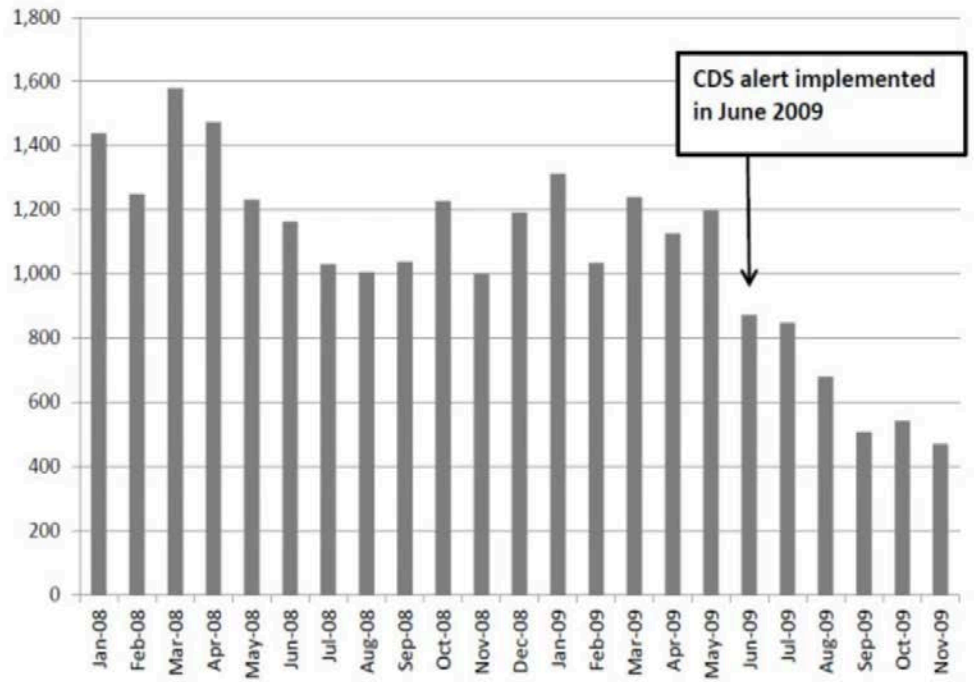
"Reducing unnecessary testing in a CPOE system through implementation of a targeted CDS intervention"

Research article | Open access | Published: 08 April 2013

Volume 13, article number 43, (2013) Cite this article

Alerts for biomarker testing more frequently than recommended (e.g., BNP more than once a day)

BNP reduced by 21% post intervention.



Number of monthly inpatient BNP tests, January 2008 – November, 2009.

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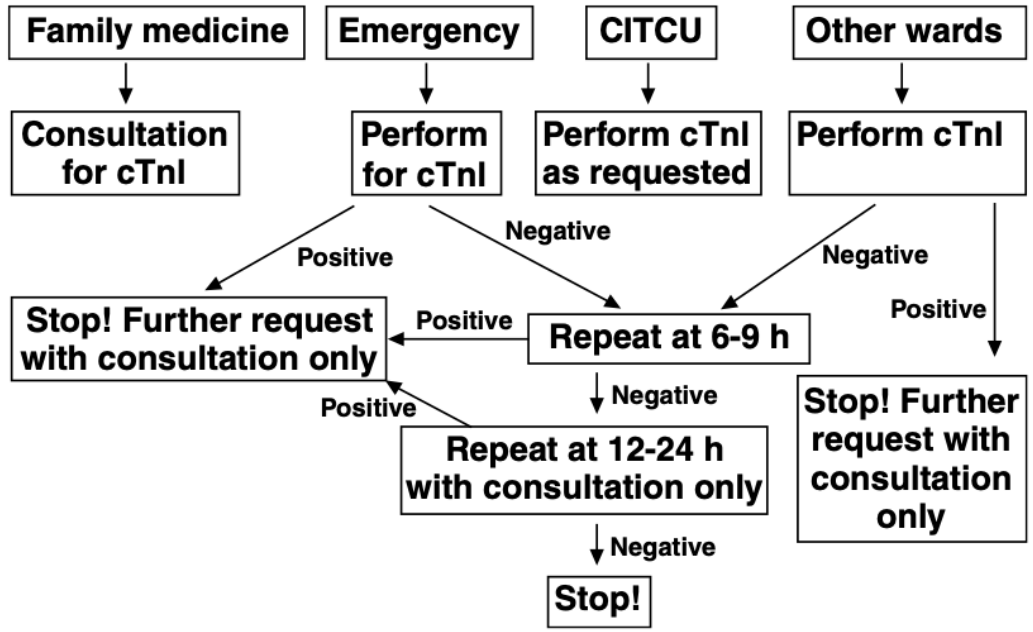
Implementing an evidence-based algorithm

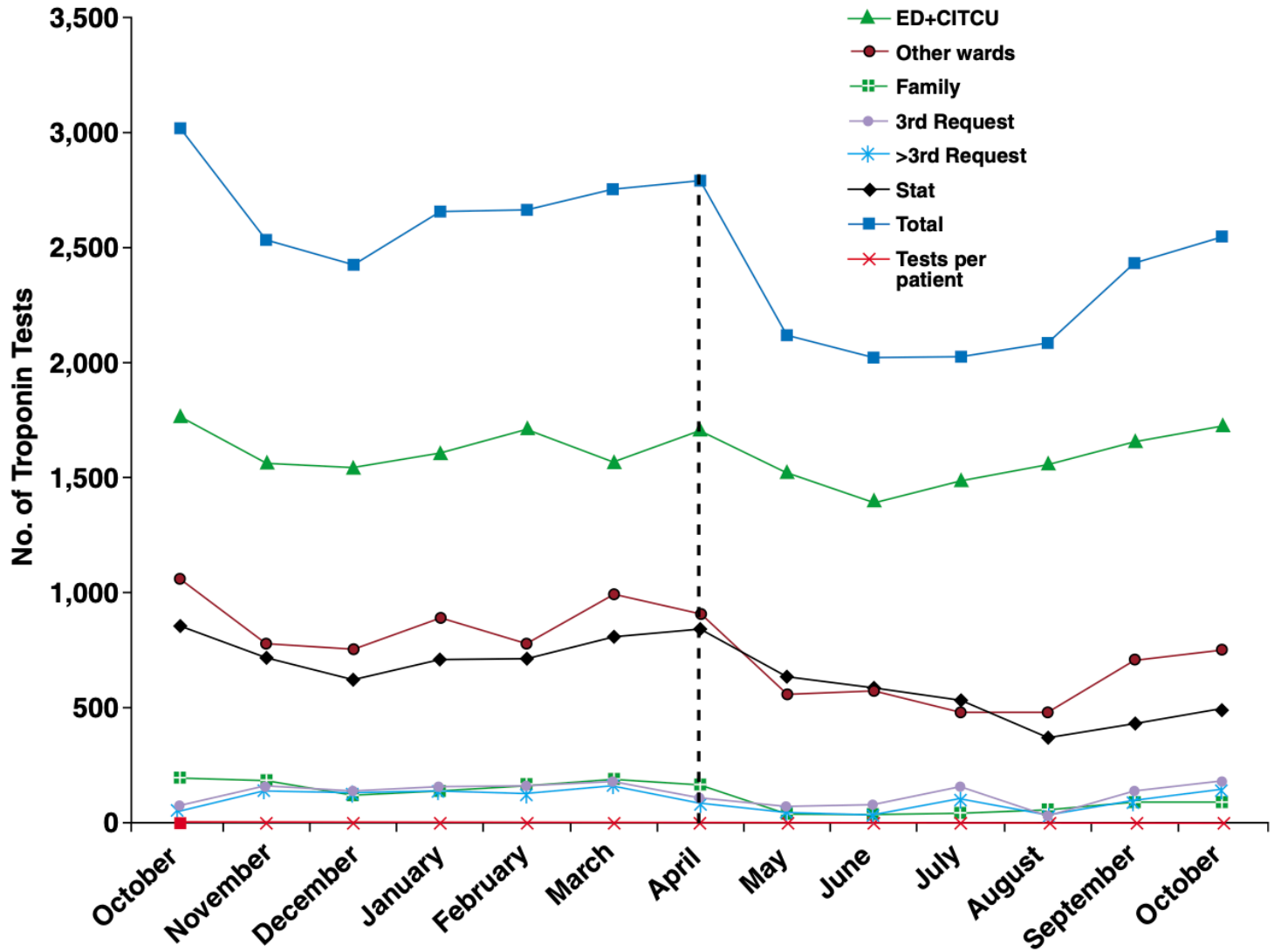
Impact of the Cardiac Troponin Testing Algorithm on Excessive and Inappropriate Troponin Test Requests

Qing H. Meng, MD, PhD, Shiming Zhu, MD, PhD, Cheryl Booth, MT, Linda Stevens, MT, Bonnie Bertsch, MT, Mabood Qureshi, MS, and Jawahar Kalra, MD, PhD

Key Words: Cardiac troponin I; Acute coronary syndrome; Acute myocardial infarction; Algorithm



Am J Clin Pathol 2006;126:195-199



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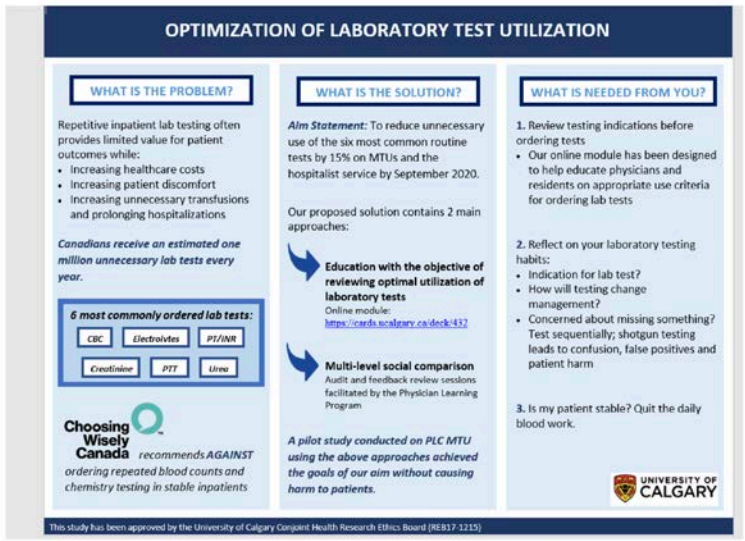
Audit and feedback



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BMJ Quality & Safety 2023;32:517-525

Study diagram for stepped-wedge implementation of the routine laboratory test optimisation INT bundle across eight units by site.

	Control period	Feasibility period	Period 1	Period 2	Period 3	Period 4	Follow-up
SITE 1 (CTU+ Hospitalist unit)	Control	Trial	INT	INT	INT	INT	INT
SITE 2 (CTU + Hospitalist unit)	Control	Trial	Control	INT	INT	INT	INT
SITE 3 (CTU+ Hospitalist unit)	Control	Trial	Control	Control	INT	INT	INT
SITE 4 (CTU+ Hospitalist unit)	Control	Trial	Control	Control	Control	INT	INT
Time	4 weeks (Oct 19 2020- Nov 15 2020)	9 weeks (Nov 16 2020 to Jan 10 2021)	4 weeks (Jan 11 2021- Feb 7)	4 weeks (Feb 8- Mar 7)	4 weeks (Mar 8- Apr 4)	4 weeks (Apr 5- May 2)	Period 5: May 3-30 Period 6: May 31- Jun 30

Anshula Ambasta et al. BMJ Qual Saf 2023;32:517-525

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BMJ Quality & Safety

Results

- 14% (incidence rate ratio (IRR)=0.86, 95% CI 0.79 to 0.92) overall reduction in ordering of routine tests with the intervention
- 14% (β coefficient=−0.14, 95% CI −0.07 to −0.21) reduction in costs of routine testing. Total cost savings of $C1.15 per patient-day.
- 15% (IRR=0.85, 95% CI 0.79, 0.92) reduction in ordering of all common tests with the intervention and a 20% (IRR=1.20, 95% CI 1.10 to 1.30) increase in routine test-free patient-days.
- No worsening was noted in patient safety endpoints with the intervention

Considerations for older adults

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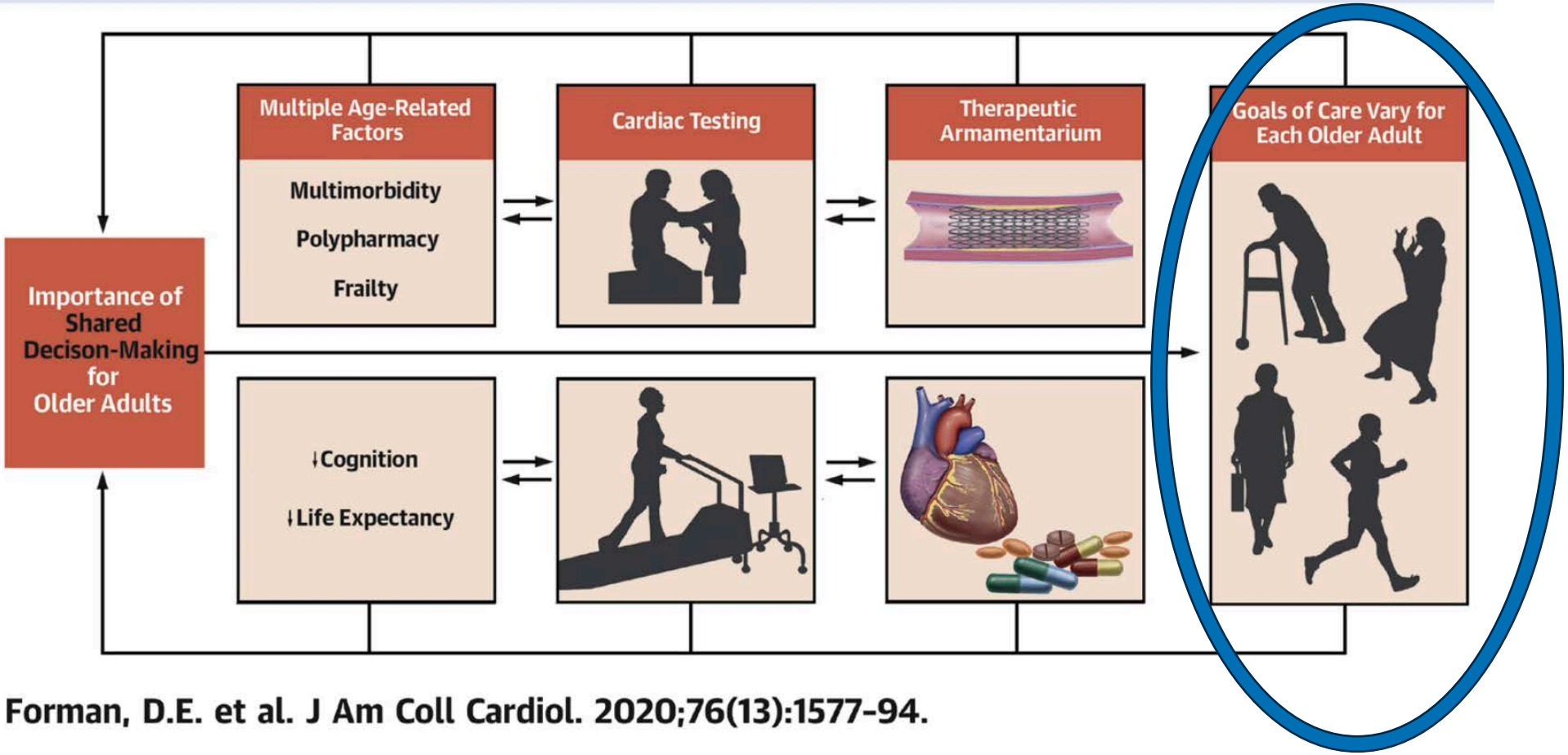

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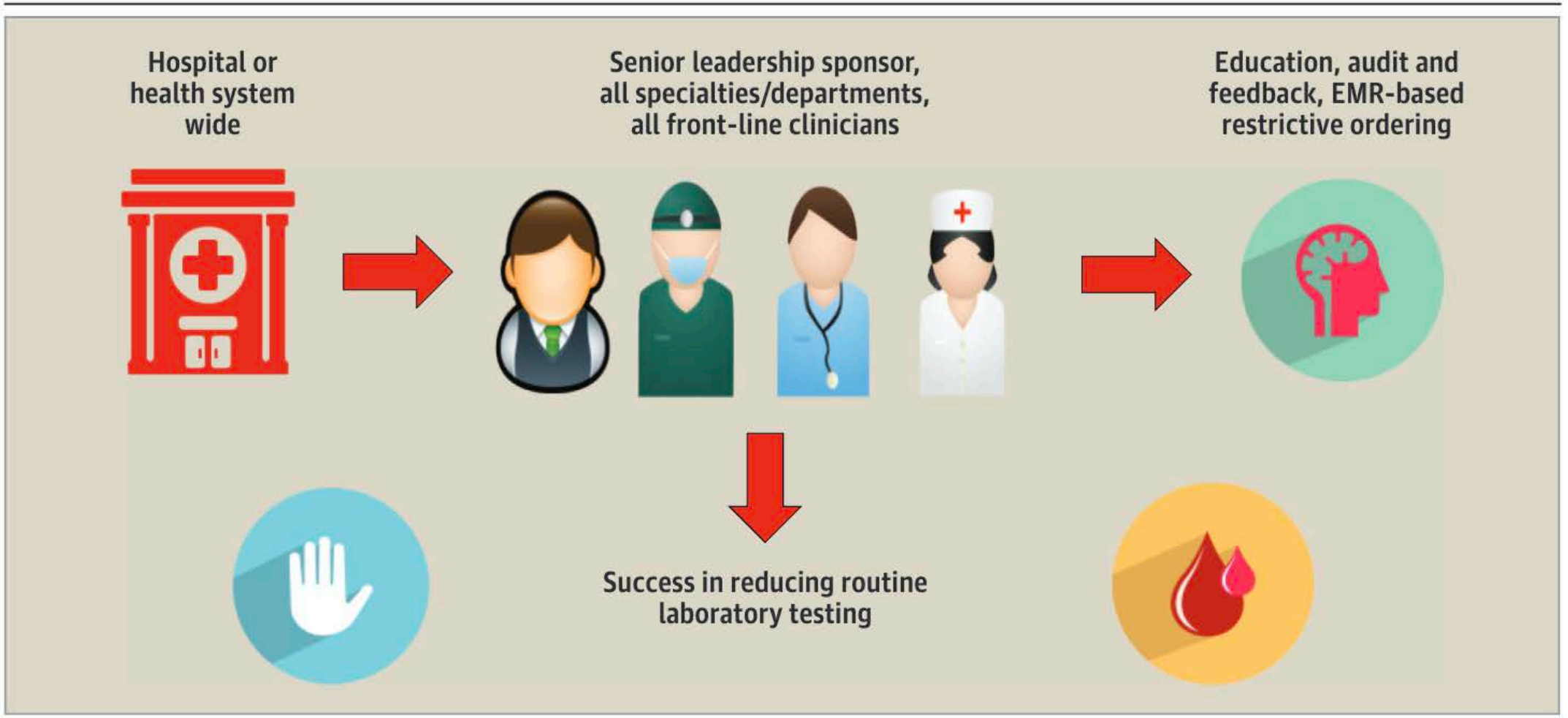
Leverage QI methodology



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Summary

1. Common low-value cardiac biomarker testing include CK-MB use when troponin is available, indiscriminate testing (ie in absence of ischemic signs or symptoms), or testing too frequently
2. Leverage CDS, CPOE changes, audit and feedback and QI methodology to identify opportunities for high value cardiac biomarker testing

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Thank you

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