Should All Hospitals Transition to High-sensitivity Cardiac Troponin Testing?

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Disclosures

I have no conflicts of interest to disclose.

What constitutes a high-sensitivity cardiac troponin assay?

1) A cardiac troponin concentration should be measurable above the limit of detection in at least 50% of healthy individuals

and

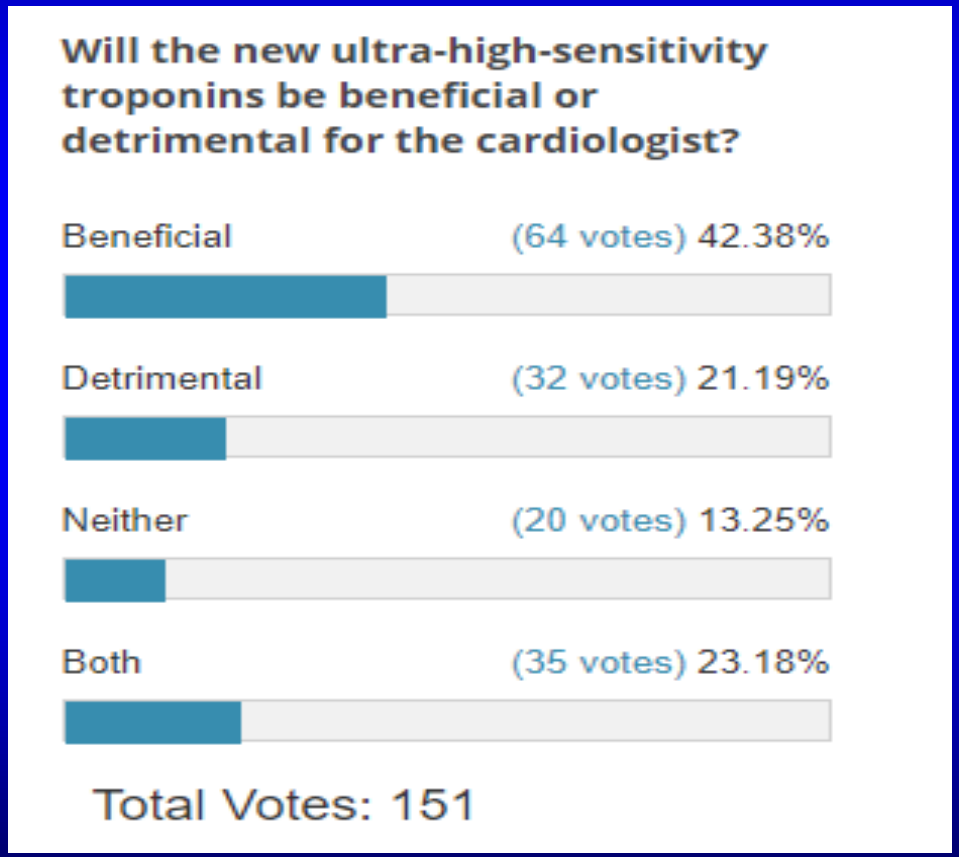
1) The coefficient of variation (precision) at the 99th percentile value should be 10% or less

Implementation of high-sensitivity cardiac troponin assays

- High-sensitivity cardiac troponin (hs-cTn) assays have been used in Europe, Australia, New Zealand, and Canada since 2010
- The first hs-cTn assay was cleared for clinical use by the FDA in the United States in 2017
- Current FDA approved hs-cTn assays:
  1) Fifth-generation Elecsys Troponin T STAT assay (Roche)
  2) Beckman Access hs-cTnI assay
  3) Siemens Healthineers Atellica IM and ADVIA hs-cTnI assays
  4) Abbott ARCHITECT STAT hs-cTnI assay

Apprehension regarding hs-cTn assays

Poll by Dr. Kontos published on ACC.org in October 2018

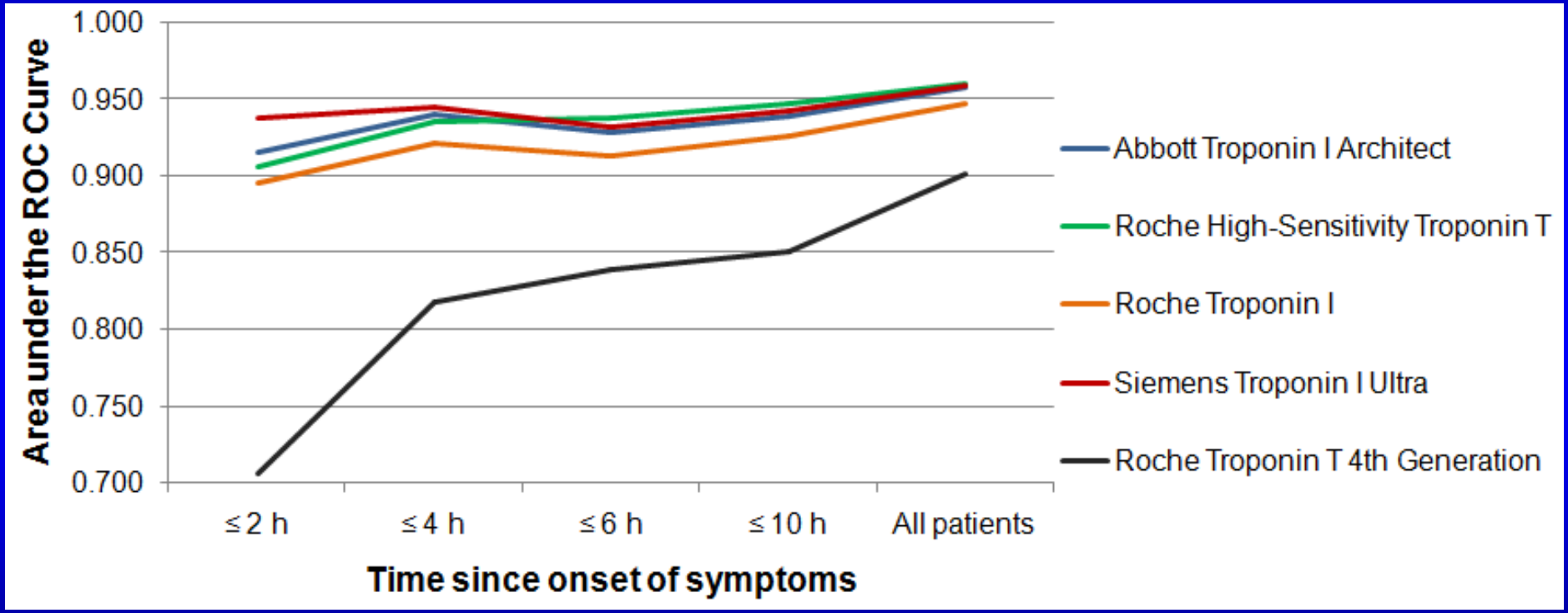


Advantages of hs-cTn assays

Clinical Benefits:

- **Improved accuracy for diagnosing MI with higher sensitivity and high negative predictive value for MACE**: reduces rates of missed events.
- **Earlier rule-out of MI:** reduces ED overcrowding. The majority of patients presenting to the ED with chest pain do not have acute MI.
- **Earlier detection of MI:** earlier initiation of evidence-based therapies and triage to cardiology.
- **Identification of patients at high-risk of CV events**

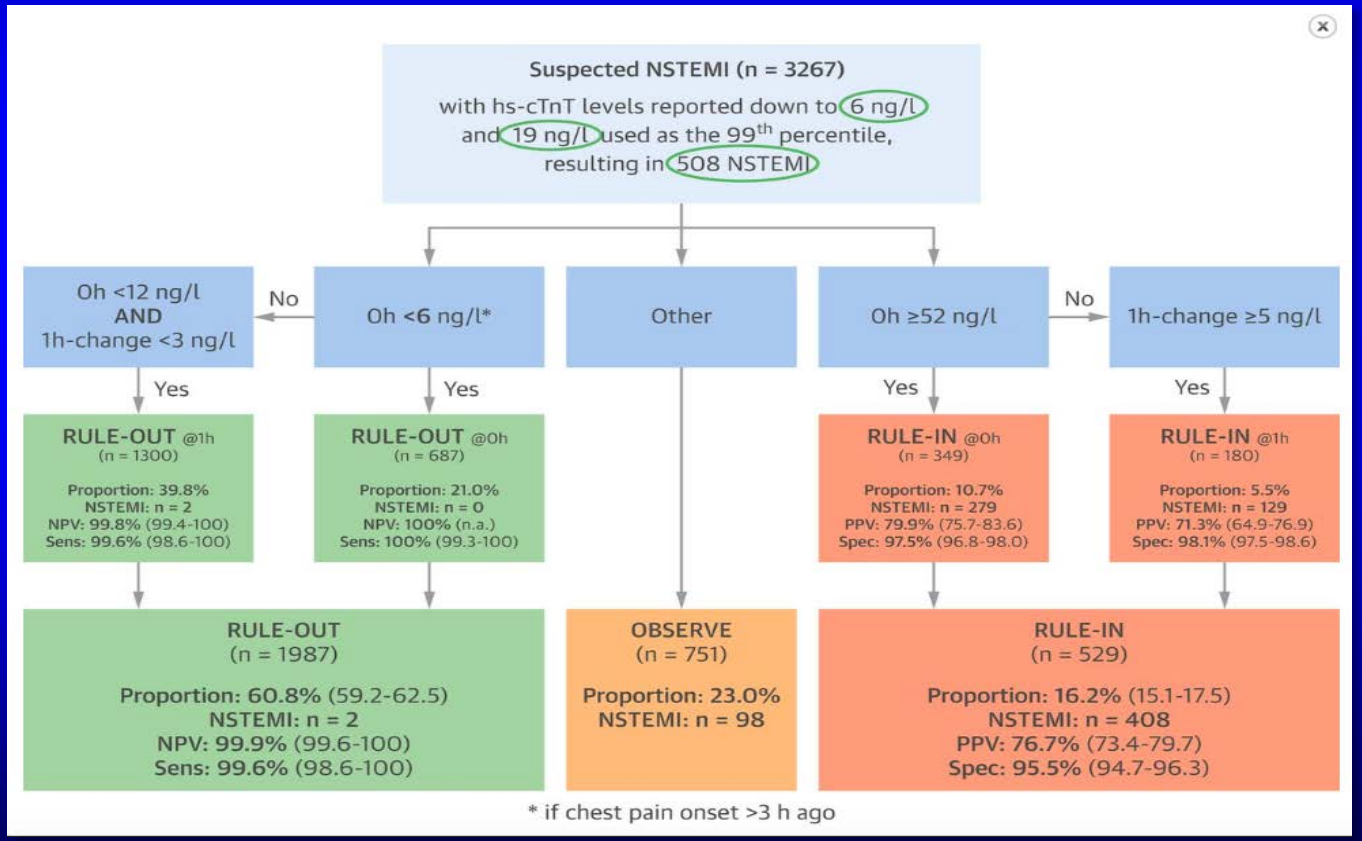
Sensitive troponin assays improve the early diagnosis of acute MI



N ENGL J MED 361;9 NEJM.ORG AUGUST 27, 2009

Development of rapid rule-in and rule-out pathways

Modified ESC 0/1-h Algorithm for Rapid Diagnosis of MI



Twerenbold et al. Effect of the FDA Regulatory Approach on the 0/1-h Algorithm for Rapid Diagnosis of MI. J Am Coll Cardiol. 2017 Sep 19;70(12):1532-1534

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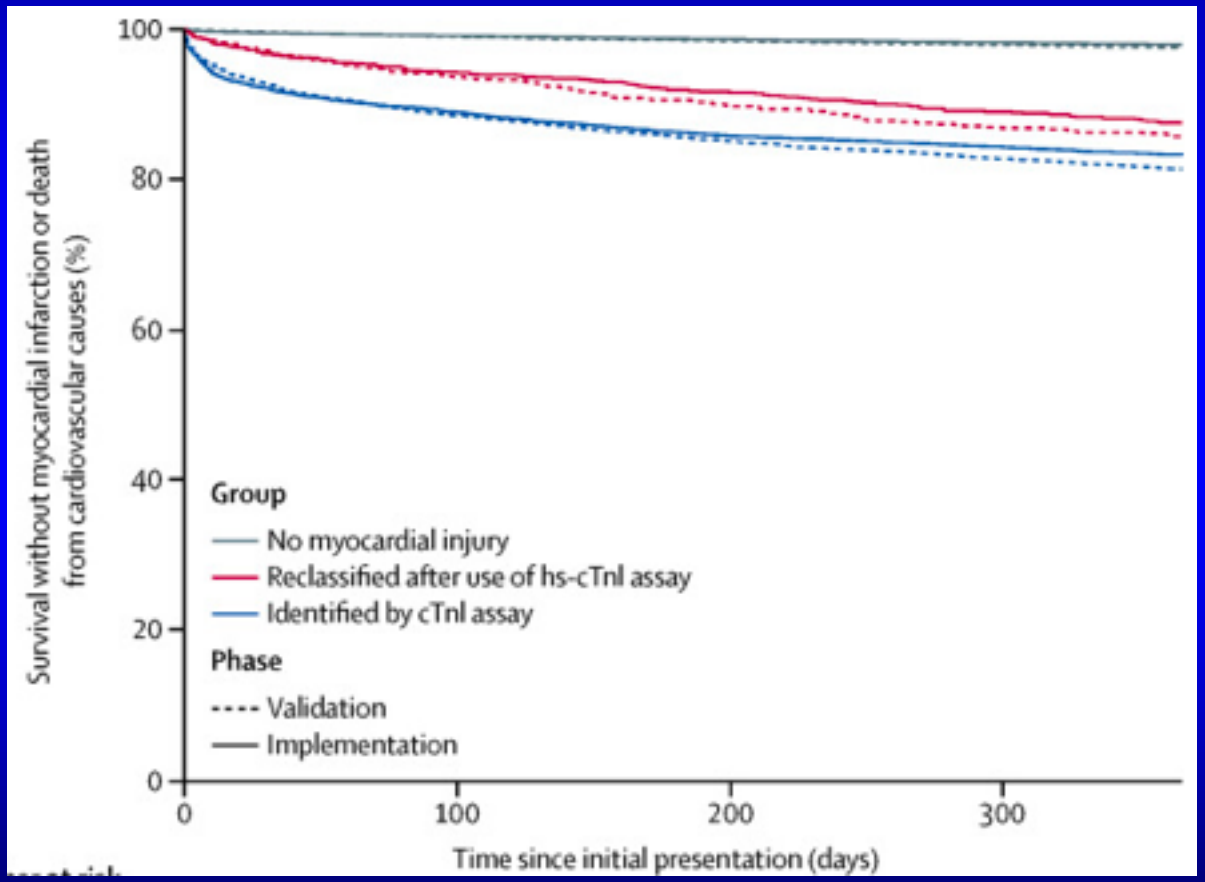
Increased detection of MI and non-ischemic myocardial injury

High-sensitivity troponin in the evaluation of patients with suspected acute coronary syndrome: a stepped-wedge, cluster-randomised controlled trial

Anoop S V Shah, Atul Anand*, Fiona E Strachan*, Amy V Ferry, Kuan Ken Lee, Andrew R Chapman, Dennis Sandeman, Catherine L Stables, Philip D Adamson, Jack P M Andrews, Mohamed S Anwar, John Hung, Alistair J Moss, Rachel O'Brien, Colin Berry, Iain Findlay, Simon Walker, Anne Cruickshank, Alan Reid, Alasdair Gray, Paul O Collinson, Fred S Apple, David A McAllister, Donogh Maguire, Keith A A Fox, David E Newby, Christopher Tuck, Ronald Harkess, Richard A Parker, Catriona Keerie, Christopher J Weir, Nicholas L Mills, on behalf of the High-STEACS Investigators†*

- High-STEACS was a stepped-wedge, cluster-RCT, examining implementation of hs-cTnI in 48,282 patients
- Hs-cTnI identified 10,360 patients with myocardial injury or MI. Of these, 17% were not identified by the contemporary assay (3.6% absolute increase with hs-cTn).
- 33% of those reclassified with hs-cTn were type 1 MI

Hs-cTn assay identifies patients at high-risk for CV events



Patients reclassified as having myocardial injury by a hs-cTn assay had a 13% risk of CV death or MI at 1-year

Shah ASV et al. High-sensitivity troponin in the evaluation of patients with suspected acute coronary syndrome: a stepped-wedge, cluster-randomised controlled trial. Lancet. 2018;392(10151):919-928.

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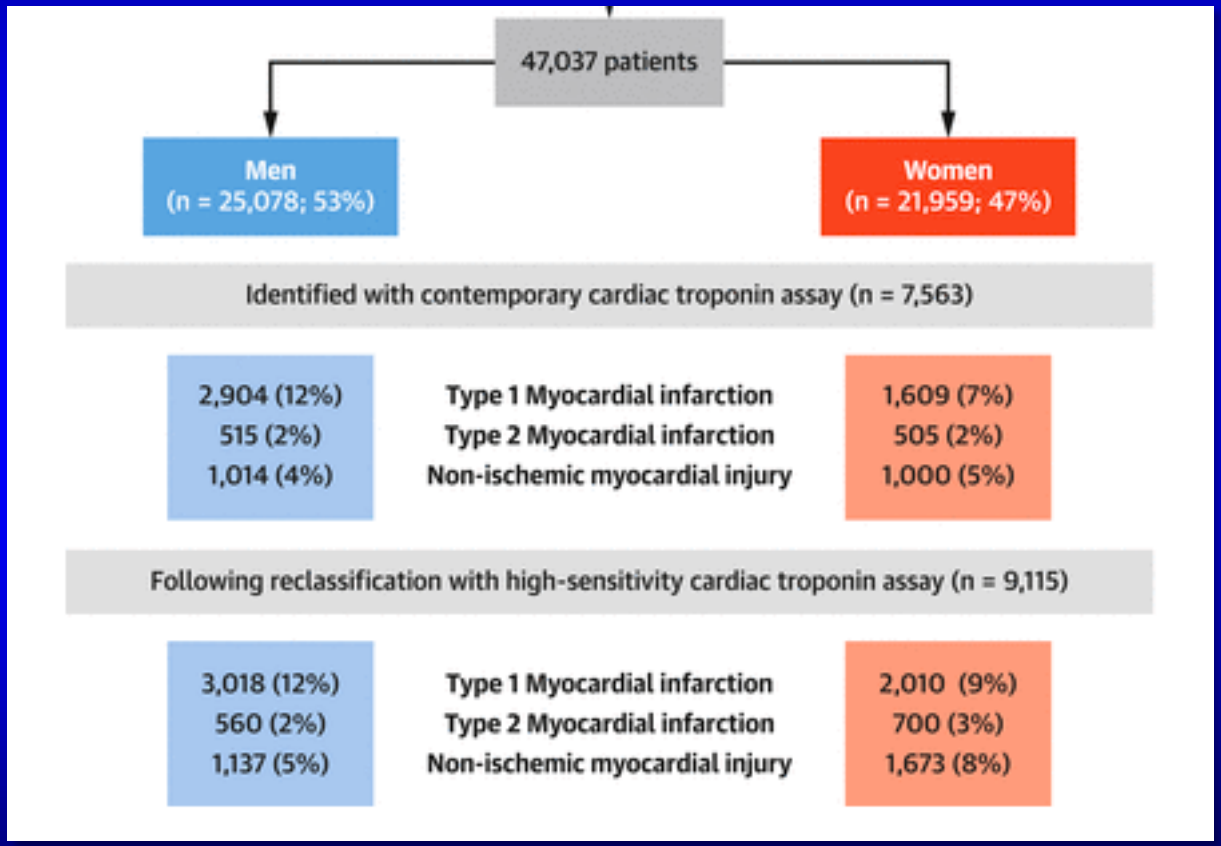
Hs-cTn assays may increase detection of MI in women



Hs-cTn assay led to a relative increase in the diagnosis of type 1 MI in women by 25%

Lee KK et al. Sex-Specific Thresholds of High-Sensitivity Troponin in Patients With Suspected Acute Coronary Syndrome. J Am Coll Cardiol. 2019;74(16):2032-2043.

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Concerns regarding hs-cTn assays

- Implementation of hs-cTn assays may not improve CV outcomes
- Limited implementation data exists from U.S. populations to date
- There is potential for increased unnecessary downstream testing and associated costs
- Institutional inertia and activation energy required to transition to hs-cTn assays

Hs-cTn assays may not improve cardiovascular outcomes

- The implementation of hs-cTn did not reduce the risk of CV death or MI at 1-year in High-STEACS (6% versus 5%; OR 1.05, 95% CI 0.92–1.19; p=0.48)
- Similarly, CV death and MI at 1-year were not improved in women pre- and post-implementation of hs-cTn I

Shah ASV et al. High-sensitivity troponin in the evaluation of patients with suspected acute coronary syndrome: a stepped-wedge, cluster-randomised controlled trial. Lancet. 2018;392(10151):919-928.

Why were CV outcomes not improved in High-STEACs?

- 2/3 of patients reclassified by hs-cTn had non-ischemic myocardial injury and type 2 MI, both with no proven therapies to improve outcomes
- New prescriptions of secondary prevention therapies and revascularization rates were low among patients reclassified by hs-cTn

Impact on downstream testing?

- Analysis of multicenter APACE study of 2,544 patients presenting with symptoms suggestive of MI to ED before (1,455 patients) and after (1,089 patients) hs-cTnT implementation
- Coronary angiography rates were similar before and after the introduction of hs-cTnT (23 vs. 23%, P= 0.09)
- Stress testing was substantially reduced from 29% to 19% (P <0.001)
- Mean total costs decreased by 20% after the introduction of hs-cTnT (P= 0.002)

Twerenbold R et al. Impact of high-sensitivity cardiac troponin on use of coronary angiography, cardiac stress testing, and time to discharge in suspected acute myocardial infarction. Eur Heart J. 2016;37:3324–3332

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THE PRESENT AND FUTURE

JACC SCIENTIFIC EXPERT PANEL

Recommendations for Institutions Transitioning to High-Sensitivity Troponin Testing

JACC Scientific Expert Panel

James L. Januzzi, Jr, MD,[a] Simon A. Mahler, MD, MS,[b] Robert H. Christenson, PhD,[c] Jennifer Rymer, MD, MBA,[d] L. Kristin Newby, MD, MHS,[d] Richard Body, MBChB, PhD,[e] David A. Morrow, MD, MPH,[f] Allan S. Jaffe, MD[g]

Summary

1. hs-cTn assays improve speed and accuracy of MI diagnosis
2. hs-cTn implementation reduces time to exclude MI and reduces ED stay times
3. hs-cTn accurately identifies patients at low-risk for MACE at 30-days
4. Most patients reclassified with hs-cTn will have non-ischemic myocardial injury; ~1/3 will have a type 1 MI. Reclassified patients are at high-risk for subsequent CV death or MI
5. hs-cTn testing alone may not decrease risk of subsequent MI or CV death
   - A blood test alone can not modify a patients risk
   - Only our response (prescriptions, revascularization, etc) to the result can potentially impact outcomes