# *10 Ways to Make the Use of High Sensitivity Cardiac Troponin Values Easier and Better*

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***Dr. Jaffe is or has been a consultant to most of the major diagnostic companies as well as Amgen.**

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**Use the proper definition for high sensitivity**

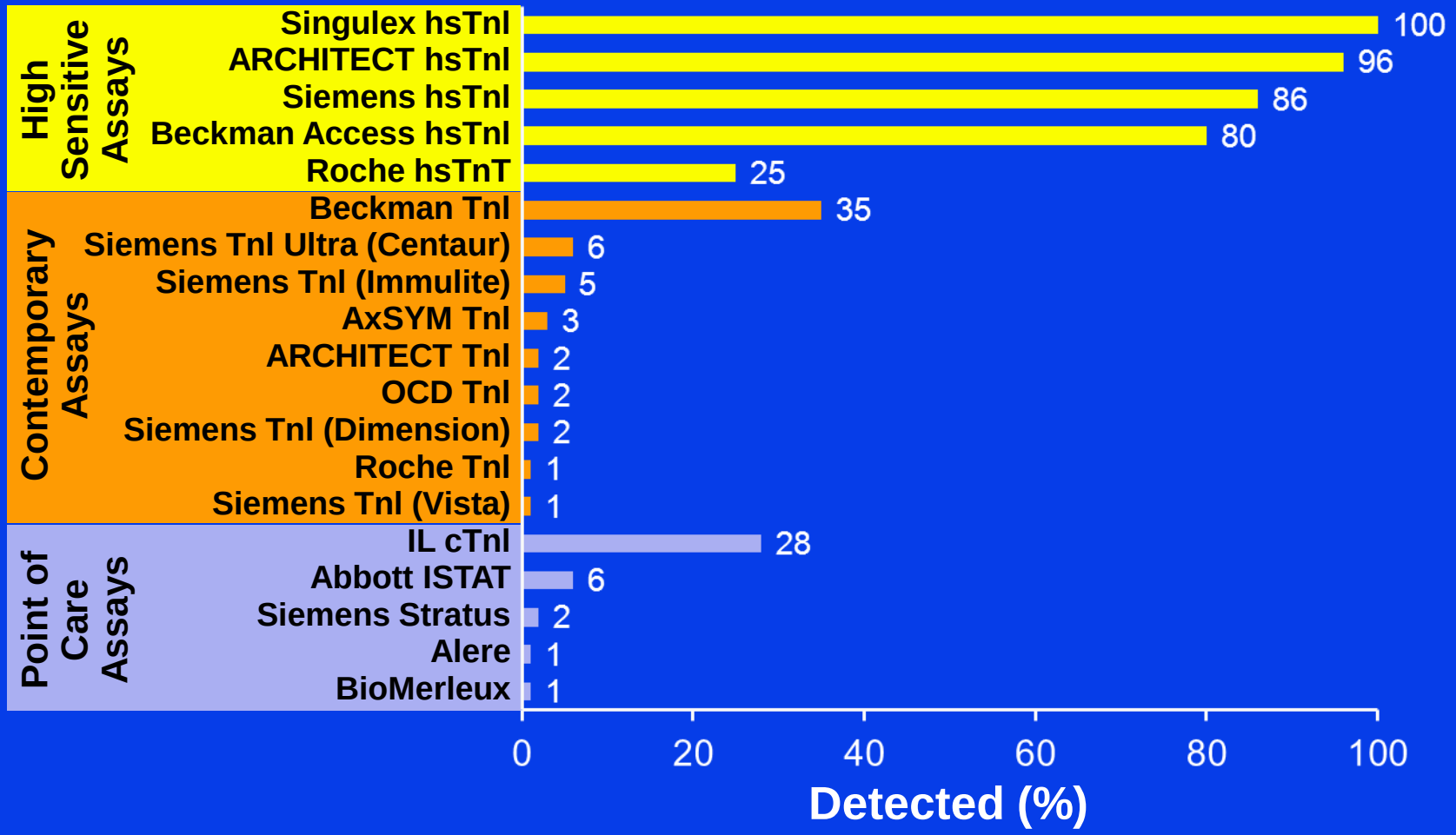
# Cardiac Troponin Assay Score Card

| Acceptance Designation | Total Precision at 99th Percentile |
|---|---|
| Guideline Acceptable | ≤ 10% |
| Clinically Usable | >10 to ≤ 20% |
| Not Acceptable | > 20% |
| Assay Designation | Measurable Normal Values below 99th percentile |
| Level 4<br>3rd gen hs | ≥ 95% |
| Level 3<br>2nd gen hs | 75 to < 95% |
| Level 2<br>1st gen hs | 50 to < 75% |
| Level 1<br>Contemporary | < 50% |

gen = generation; hs = high sensitivity

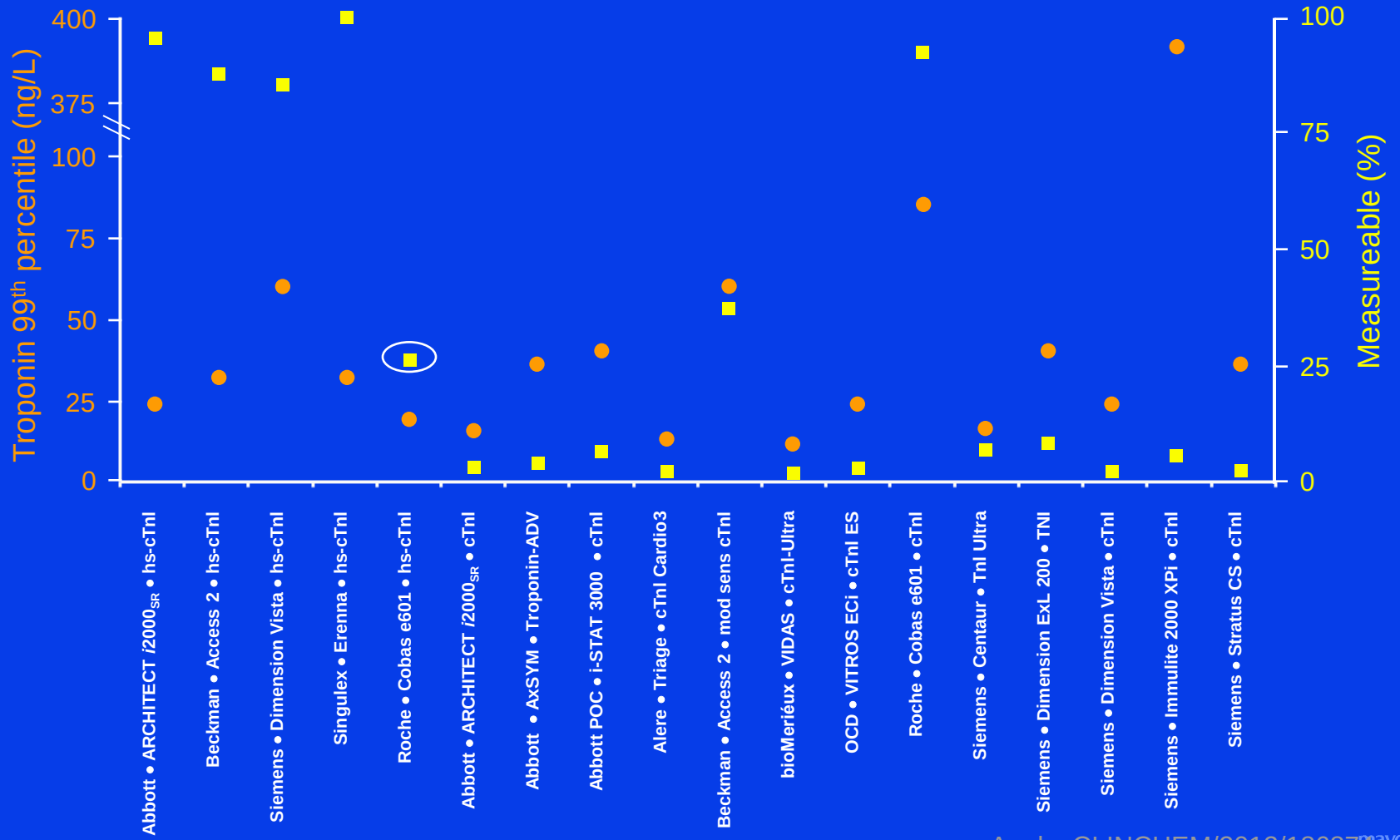
Apple 2009 Clin Chem 2009

# Comparison of Normals Detected With Various Assays




Apple et al: Clin Chem 58(11):56, 2012

# 99th Percentile Values and Percent of Patients Detected by Various Cardiac Troponin Assays




Apple, CLINCHEM/2012/186874

The New England Journal of Medicine

ORIGINAL ARTICLE

Early Diagnosis of Myocar
with Sensitive Cardiac Tr

Tobias Reichlin, M.D., Willibald Hochholzer, M
Stephan Steuer, M.D., Claudia Stelzig, M.Sc.,
Stefan Biedert, M.Sc., Nora Schaub, M.D.,
Mihael Potocki, M.D., Markus Noveanu, M.D
Raphael Twerenbold, M.D., Katrin Winkler, M
and Christian Mueller

ABSTRACT

BACKGROUND

The rapid and reliable diagnosis of acute myoc
clinical need.

METHODS

We conducted a multicenter study to examine t
tive cardiac troponin assays performed on bloo
department from 718 consecutive patients wi
tive of acute myocardial infarction. Cardiac
blinded fashion with the use of four sensitive
Roche High-Sensitive Troponin T, Roche Tro
and a standard assay (Roche Troponin T). T
two independent cardiologists.

RESULTS

Acute myocardial infarction was the adjud
(17%). The diagnostic accuracy of measure
fied by the area under the receiver-operati
early higher with the four sensitive cardia
assay (AUC for Abbott-Architect Tropon
0.98 to 0.98; for Roche High-Sensitive

From the Department of Internal Medi-
cine, University Hospital, Basel (T.R., W.H.,
C.S., S.H., S. Biedert, N.S., C.B., M.P.,
M.N., T.B., R.T., R.B., C.M.); Kantonsspi-
tal Olten, Olten (S. Bassetti); and Lim-
mattalspital, Zurich (S.S.) — all in Swit-
zerland; Herz Zentrum Bad Krozingen,
Bad Krozingen, Germany (M.P.); and Cen-
tro de Investigación en Red de Enferme-
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Pneumología, Hospital del Mar–Institut
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N Engl J Med 2009;361:858-67.
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ORIGINAL CONTRIBUTION

Implementation of a Sensitive Tro
Assay and Risk of Recurrent Myo
Infarction and Death in Patients
With Suspected Acute Coronary

Nicholas L. Mills, MD, PhD
Antonia M. D. Churchhouse, BSc, MD
Kuan Ken Lee
Atul Anand, BSc, MD
David Gamble, MD
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Keith A. A. Fox, FESC, FMedSci
David E. Newby, FESC, FMedSci

**Context** Although troponin assays have becom
whether further reductions in the threshold of det
will improve clinical outcomes in patients with su

**Objective** To determine whether lowering
infarction (MI) with a sensitive troponin assa

**Design, Setting, and Patients** All conse
ACS to the Royal Infirmary of Edinburgh, Edi
ruary 1-July 31, 2008, during the validation p
31, 2009, during the implementation phase
myocardial necrosis from 0.20 to 0.05 ng/
stratified into 3 groups (<0.05 ng/mL, 0.0
the validation phase, only concentrations
0.20 ng/mL were reported to clinicians.

**Main Outcome Measure** Event-free s
patients grouped by plasma troponin con

**Results** Plasma troponin concentrations w
0.05 to 0.19 ng/mL in 170 patients (8%).
During the validation phase, 39% of patie
to 0.19 ng/mL were dead or had recurren
those patients with troponin concentratio
mL or more ($P = .007$), respectively. Durin
nostic threshold to 0.05 ng/mL was assoc
(from 39% to 21%) in patients with tropo
ratio, 0.42; 95% confidence interval, 0.

**Conclusions** In patients with suspec
nin assay increased the diagnosis of M
MI and death. Lowering the diagnos
with major reductions in morbidity a

JAMA. 2011;306(12):1329-1216

RECENT REPORTS HAVE INDICATED that the latest generation of sensitive troponin assays can increase diagnostic performance and improve the early diagnosis of myocardial infarction (MI).[1,2] Lowering the threshold for detecting cardiac troponin is a highly controversial issue among clinicians with cardiologists, physicians, and clinical biochemists uncertain as to whether the benefits of small improvements in sensitivity will outweigh the problems that

From the Department of Medicine II (T.K., T.Z., S.T., A.R., E.C., A.W., C.R.S., M.S.E., P.S.W., R.B.S., E.L., S.G.-Z., F.P., T.F.M., S.B.) and the Institute for Clinical Chemistry and Laboratory Medicine (D.P., N.J., K.J.L.), University Medical Center, Johannes Gutenberg University, Mainz; the Department of Internal Medicine, Federal Armed Forces Hospital, Koblenz (C.B.); and the Department of Cardiology and Angiology, Heart Center, University Hospital Hamburg-Eppendorf, Hamburg (S.B., M.P.) — all in Germany; Boston University School of Medicine; the Framingham Heart Study, Framingham, MA (R.B.S.); the Department of Medicine, Brigham and Women's Hospital and Harvard Medical School — both in Boston, MA (E.L.); and INSERM, Unité 525, Faculté de Médecine, Paris-Saclay-Ivry, Paris (S.G.-Z.). Address reprint requests to Dr. Blankenberg at the Department of Cardiology, University Heart Center, Hamburg-Eppendorf, Martinistr. 52, 20246 Hamburg, Germany, or at blankenberg@

The New England Journal of Medicine

ORIGINAL ARTICLE

Sensitive Troponin I Assay in Early
Diagnosis of Acute Myocardial Infarction

Till Keller, M.D., Tanja Zeller, Ph.D., Dirk Peetz, M.D., Stergios Tzikas, M.D.,
Alexander Roth, Ph.D., Ewa Czyz, M.D., Christoph Bickel, M.D.,
Stephan Baldus, M.D., Ascan Warnholtz, M.D., Meike Fröhlich, M.D.,
Christoph R. Sinning, M.D., Medea S. Eleftheriadis, Philipp S. Wild, M.D.,
Renate B. Schnabel, M.D., Edith Lubos, M.D., Nicole Jachmann, Ph.D.,
Sabine Genth-Zotz, M.D., Felix Post, M.D., Viviane Nicaud, M.A.,
Laurence Tiret, Ph.D., Karl J. Lackner, M.D., Thomas F. Münzel, M.D.,
and Stefan Blankenberg, M.D.

ABSTRACT

BACKGROUND

Cardiac troponin testing is central to the diagnosis of acute myocardial infarction. We evaluated a sensitive troponin I assay for the early diagnosis and risk stratification of myocardial infarction.

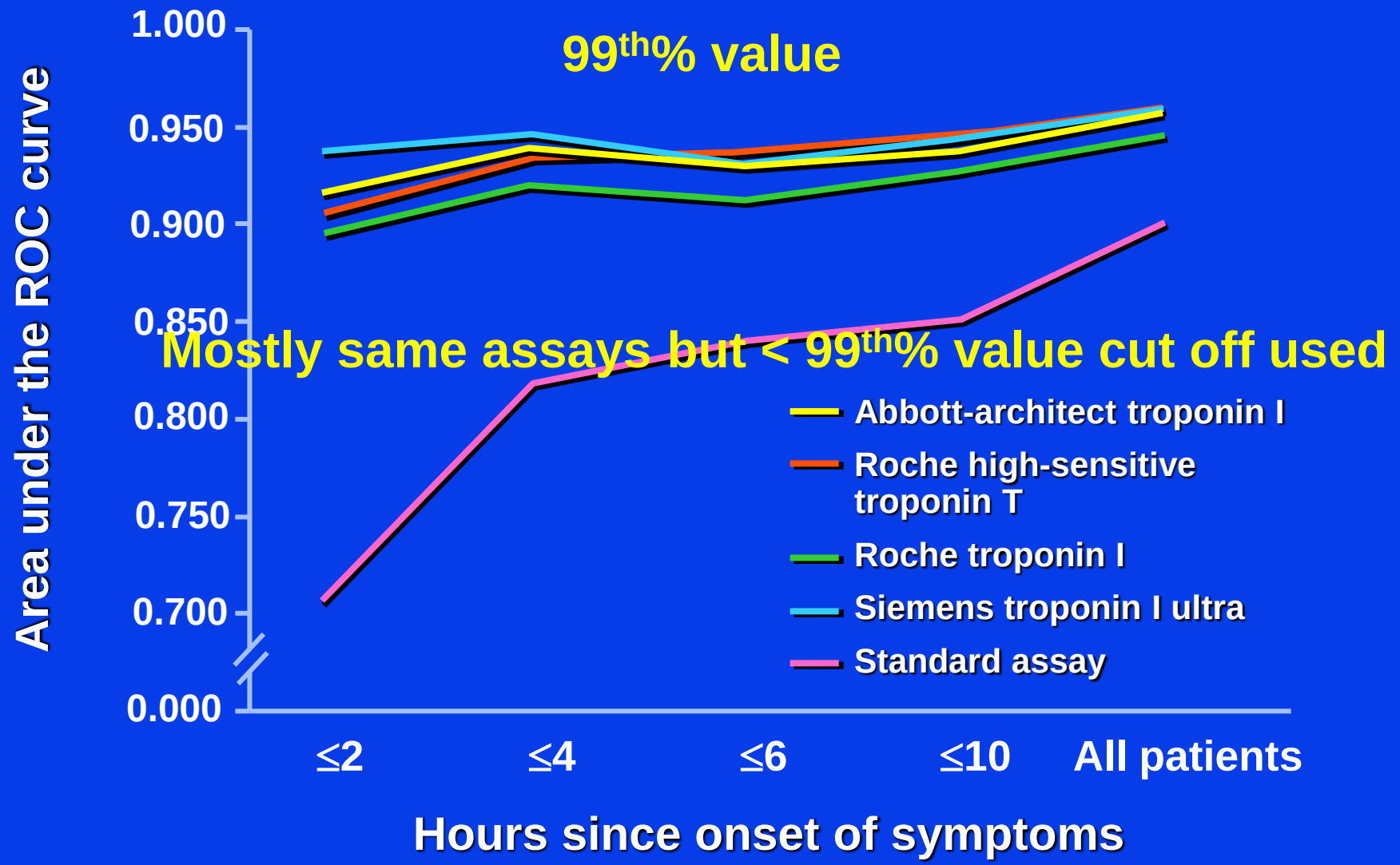
METHODS

In a multicenter study, we determined levels of troponin I as assessed by a sensitive assay, troponin T, and traditional myocardial necrosis markers in 1818 consecutive patients with suspected acute myocardial infarction, on admission and 3 hours and 6 hours after admission.

RESULTS

For samples obtained on admission, the diagnostic accuracy was highest with the sensitive troponin I assay (area under the receiver-operating-characteristic curve [AUC], 0.96), as compared with the troponin T assay (AUC, 0.85) and traditional myocardial necrosis markers. With the use of the sensitive troponin I assay (cutoff value, 0.04 ng per milliliter) on admission, the clinical sensitivity was 90.7%, and the specificity was 90.2%. The diagnostic accuracy was virtually identical in baseline and serial samples, regardless of the time of chest-pain onset. In patients presenting within 3 hours after chest-pain onset, a single sensitive troponin I assay had a negative predictive value of 88.3% and a positive predictive value of 80.2%; these findings produced a 36% rise in the troponin I level within 6 hours in patients

# Accuracy by Time of Admission




NEJM 361:858, 2009

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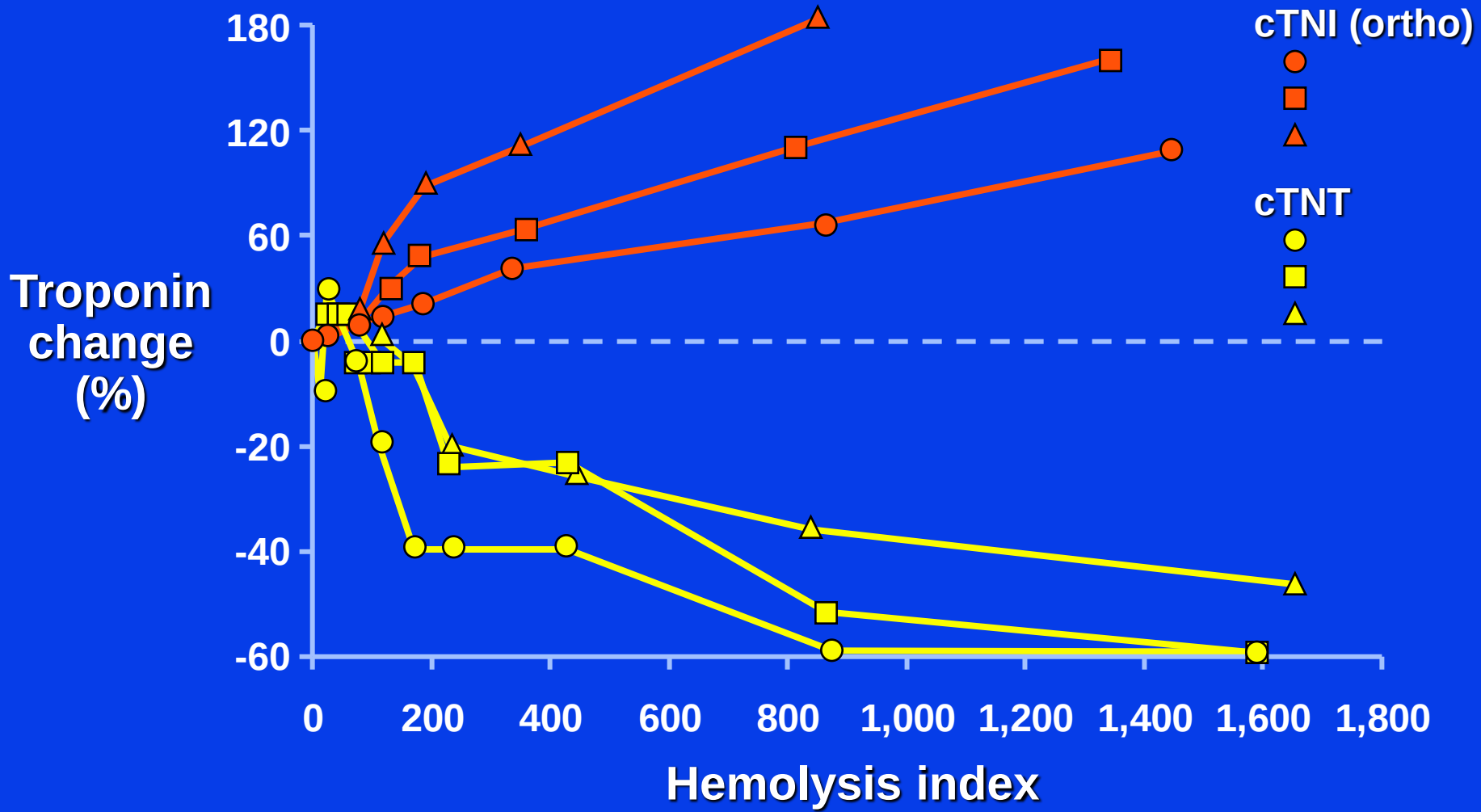
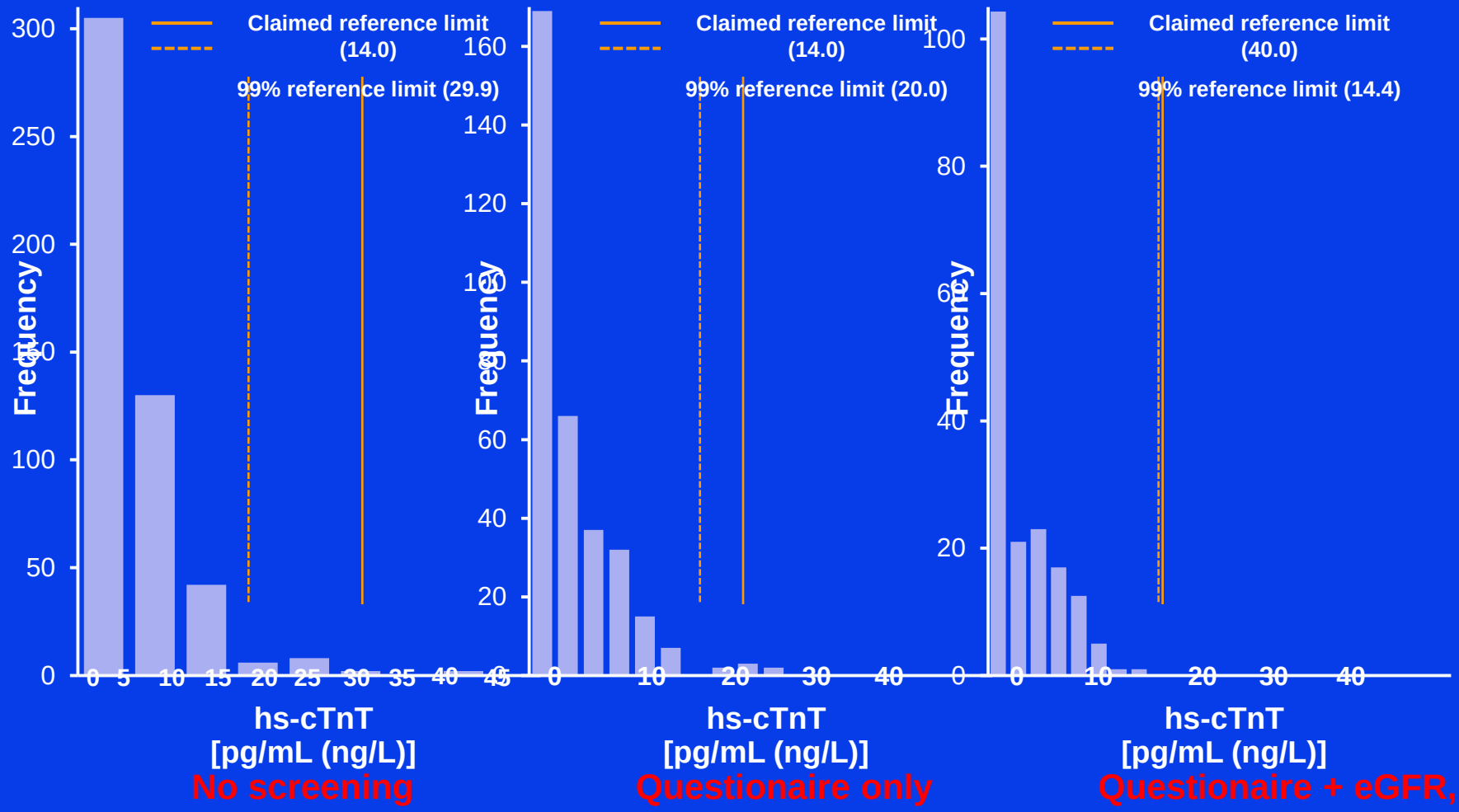
# *Effects of Hemolysis on hscTnT Values*



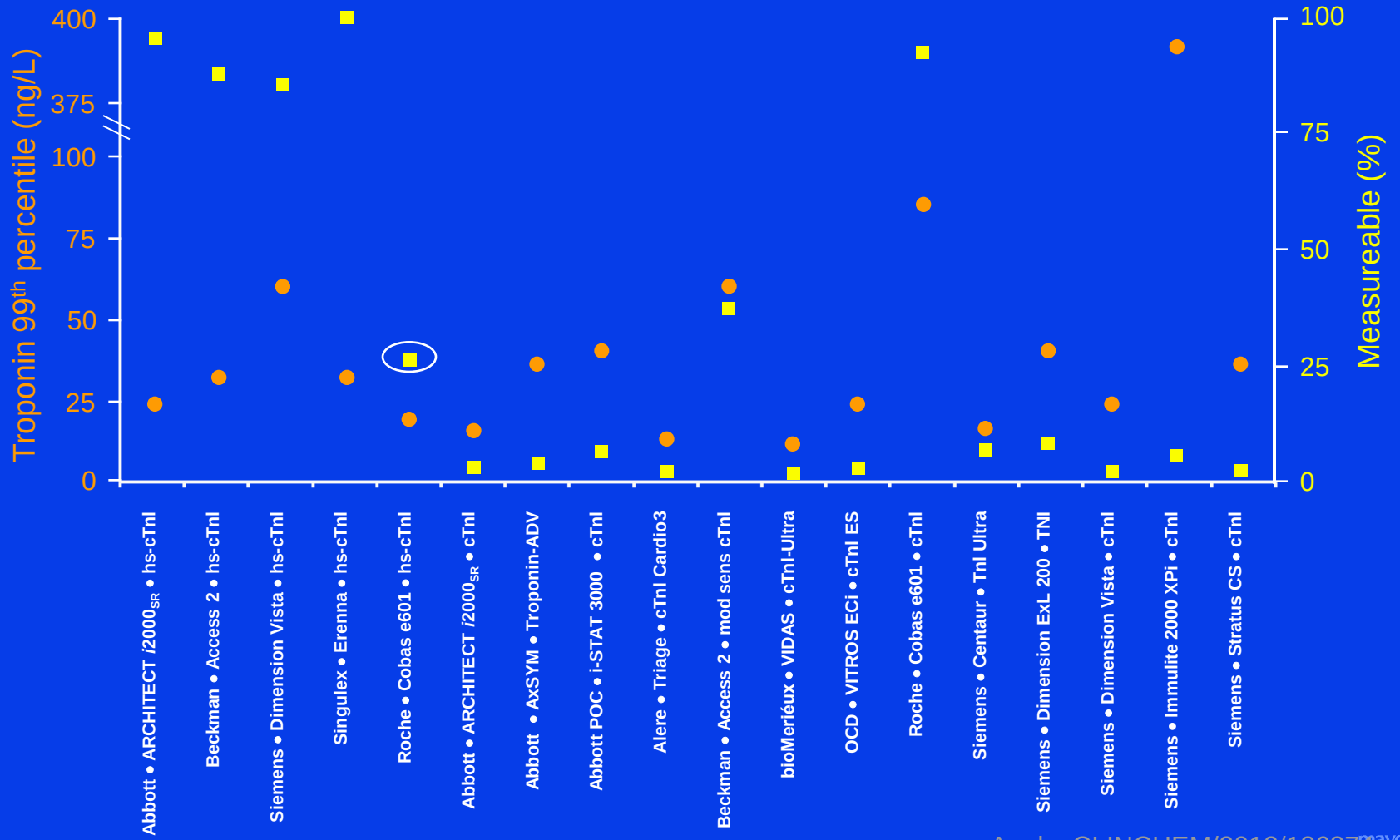

Bais: Clin Chem, 2010 (in press)

# Reference Range for cTn Assays (hscTnT – Roche)




Collinson et al: Clinical Chemistry 58:1, 219-225 (2012)

# 99th Percentile Values and Percent of Patients Detected by Various Cardiac Troponin Assays




Apple, CLINCHEM/2012/186874

## Clinical Implications of a Recent Adjustment to the High-Sensitivity Cardiac Troponin T Assay: User Beware

*To the Editor:*

Roche Diagnostics recently issued a technical bulletin calling for an adjustment to the calibration curve for the Elecsys Troponin T hs and Elecsys Troponin T hs STAT assays. Although this bulletin was disseminated widely in some countries, it was less widely distributed in others. The Roche high-sensitivity (hs) assays are in clinical use worldwide except within the US, where they are used for research but have not yet been

99th percentile value of 14 ng/L that has consistently been reported in the literature? Second, what percentage increase in detectable results will be seen among patients presenting for emergency care? Third, how does this change affect findings from the hundreds of published studies that have used both the 99th percentile value and $\delta$ changes over time to examine diagnostic accuracy, and how does it change the findings for risk stratification of acute coronary syndrome patients and apparently healthy patients? Fourth, what mechanisms are in place to alleviate customers' concerns that similar product adjustments for this hs assay that have substantial down-

*(3)*. This percentage fell even further, with only 25% above this limit in a community-based study *(4)*. In addition, the original diagnostic study *(1)* found that the hs assay for cardiac troponin T did not detect more myocardial infarctions than conventional assays *(5)*. Was this decrease due to the change now reported by Roche, or did some other change occur very early in the assay?

We believe that these findings have major implications for patient care. We urge that in addition to correcting the lot issues it has defined, Roche reevaluate (at a minimum) subsets of the key research sample sets to ensure that: (*a*) there is no need to recalculate

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# DEMOGRAPHIC CHARACTERISTICS, CARDIOVASCULAR RISK FACTORS, AND CARDIAC PHENOTYPES ACROSS INCREASING CATEGORIES OF CARDIAC TROPONIN T LEVEL

| Variable | cTnT Category, ng/mL[a] <0.003 (n = 2589) | 0.003–0.00440 (n = 278) | 0.441-0.00657 (n = 279) | 0.0066-<0.0014 (n = 278) | ≥ 0.0014 (n = 122) | *P* for Trend |
|---|---|---|---|---|---|---|
| cTnT ≥ 0.01 ng/mL with standard assay, No/total (%) | 0/2589 | 0/278 | 0/279 | 1/277 (0.4) | 40/120 (33.3) | <.001 |
| Age, median (QR), y | 41 (35-49) | 47 (39-55) | 49 (41-55) | 52 (45-58) | 53 (44-68) | <.001 |
| Men, No./total, (%) | 895/2589 (34.6) | 175/278 (62.9) | 196/279 (70.3) | 214/278 (77.0) | 85/122 (69.7) | <.001 |
| Race/ethnicity, No./total (%) | | | | | | |
| Black | 1229/2589 (47.5) | 150/278 (54.0) | 173/279 (62.0) | 182/278 (65.5) | 94/122 (77.0) | <.001 |
| White | 794/2589 (30.7) | 88/278 (31.7) | 78/279 (28.0) | 61/278 (21.9) | 21/122 (17.2) | <.001 |
| Hispanic | 500/2589 (19.3) | 37/278 (13.3) | 27/279 ( 9.7) | 30/278 (10.8) | 7/122 ( 5.7) | <.001 |
| Other | 66/2589 (2.5) | 3/278 (13.7) | 1/279 (0.4) | 5/278 (1.8) | 0/278 | .008 |

# 99th Percentile Values in Normal Subjects Measured By Contemporary, Sensitive and High-Sensitivity Cardiac Troponin Assays

| | 99th Percentile | Percent Measurable | Male 99th Percentile | Female 99th Percentile | LoD | |
|---|---|---|---|---|---|---|
| **High Sensitivity** | **ng/L** | **>LoD** | **ng/L** | **ng/L** | **ng/L** | |
| Abbott ARCHITECT | 23.4 | 95.0 | 35.8 | 15.1 | 1.2 | 524 |
| Beckman Access | 32.2 | 87.4 | 52.2 | 23.1 | 3.0 | 524 |
| Siemens Dimension Vista | 57.5 | 85.3 | 81.0 | 42.3 | 0.5 | 503 |
| Singulex Erenna | 31.4 | 100.0 | 36.3 | 30.3 | 0.009 | 523 |
| Roche cTnT | 14.5 | 25.4 | 20.3 | 12.9 | 5.0 | 523 |

**Apple et al: CLINCHEM/2012/186874**

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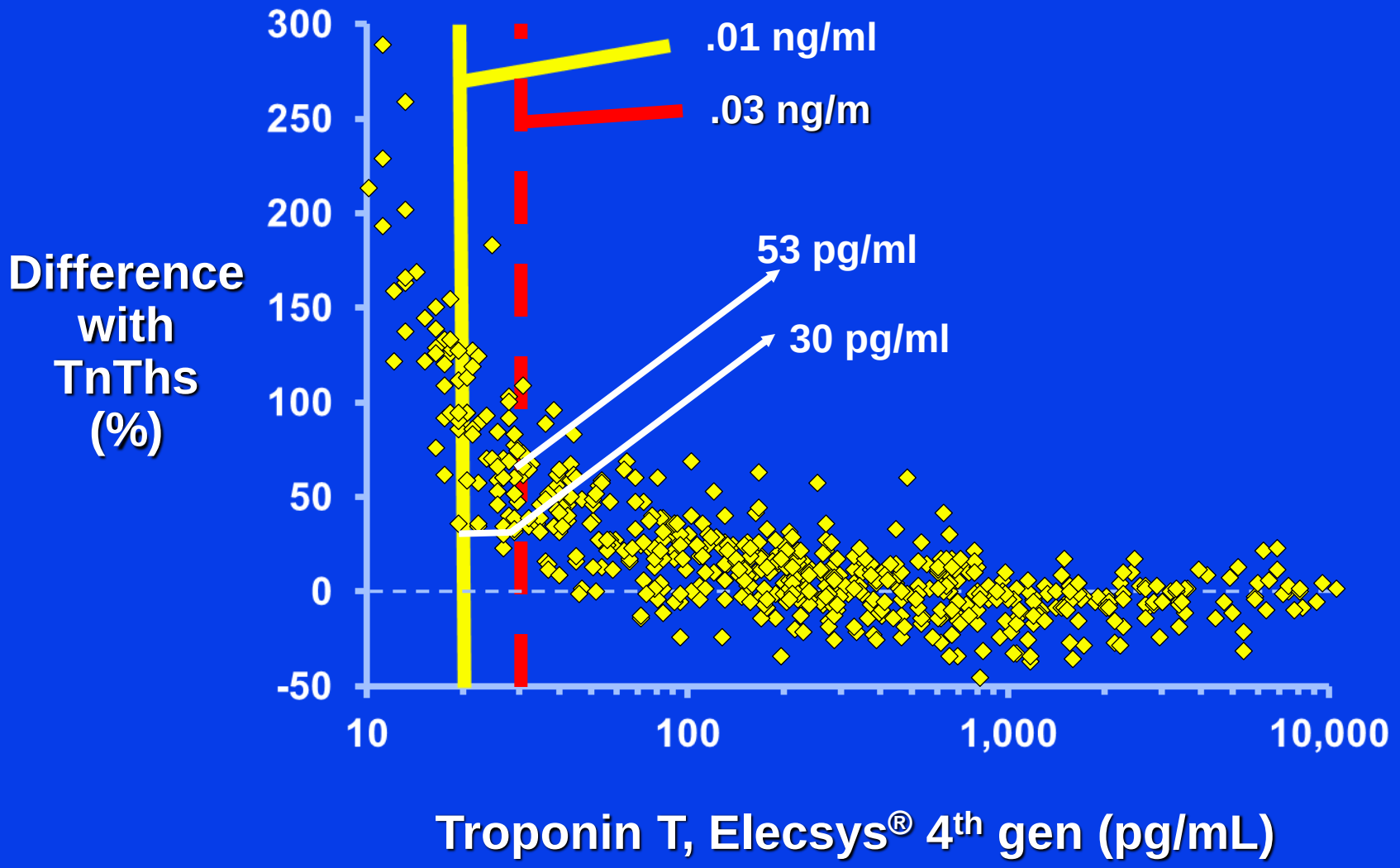
- **Use anchor values from previous assays to gauge differences**

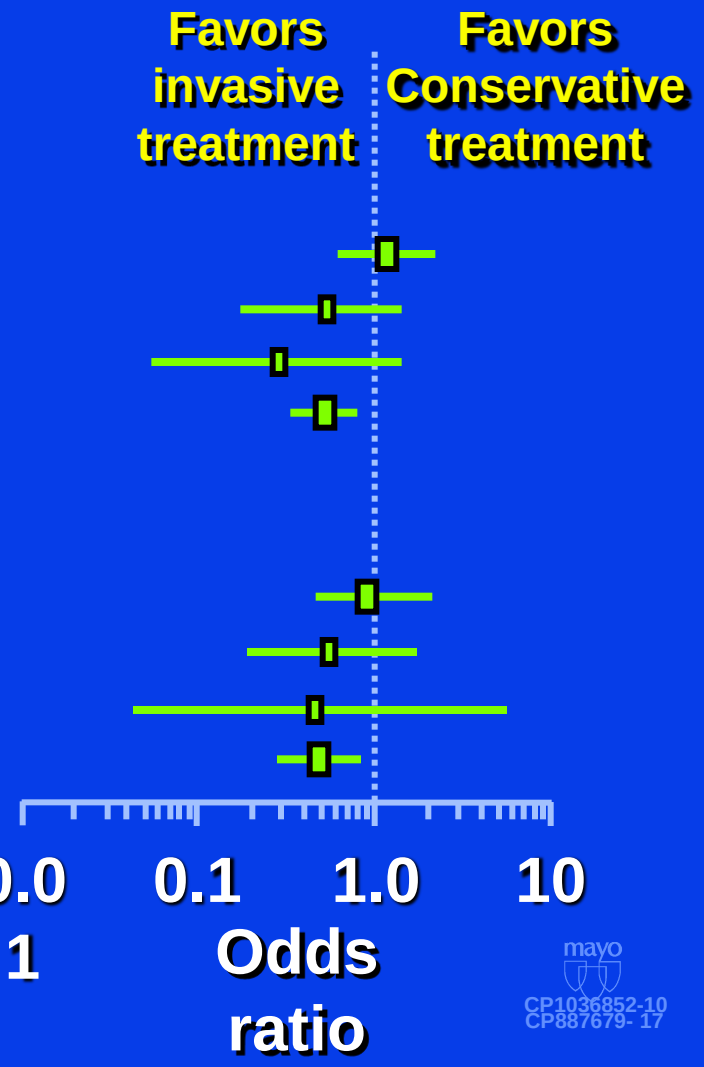
# Low-End Comparability



# TACTICS (TIMI 18) Subgroups

## Cardiac troponin T

| | No. | Conservative treatment | Invasive treatment |
|---|---|---|---|
| **Primary endpoint** | | | |
| <0.1 ng/mL | 840 | 5.6 | 6.0 |
| 0.1 - <0.4 | 137 | 16.2 | 8.7 |
| 0.4 - <1.5 | 101 | 12.2 | 3.9 |
| ≥1.5 | 748 | 16.8 | 8.3 |
| **Death or MI** | | | |
| <0.1 ng/mL | 810 | 3.1 | 2.9 |
| 0.1 - <0.4 | 137 | 13.2 | 7.3 |
| 0.4 - <1.5 | 101 | 4.1 | 1.9 |
| ≥1.5 | 748 | 11.0 | 5.5 |




JAMA 286:2405, 2001

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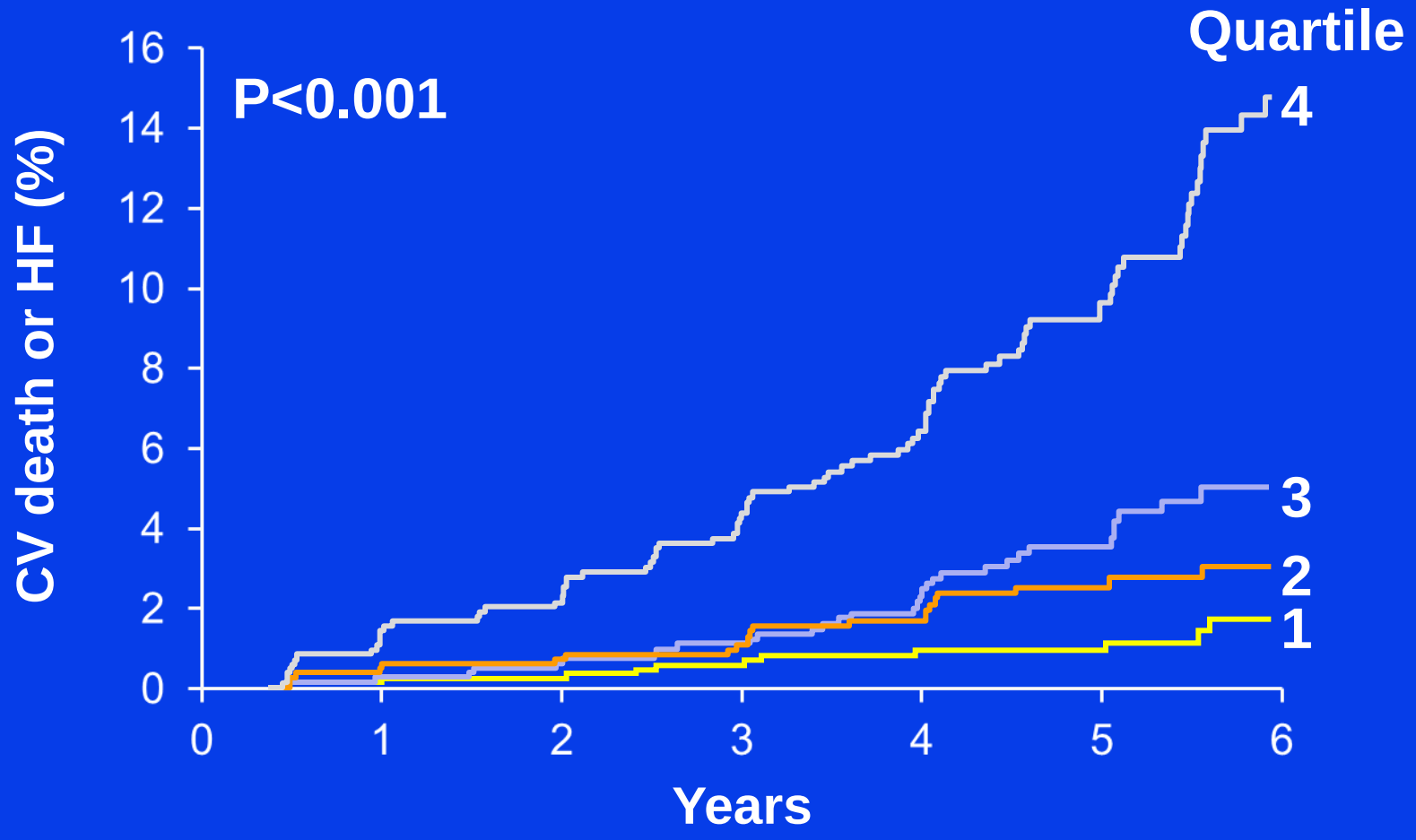
- **Recognize there will be more elevations**

# Prevalence of Detectable cTnT & levels ≥ 99th Percentile URL

| Group | Sample Size, No. | cTnT Level, ng/mL ≥ 0.003 No. (%) | ≥ 0.003 Sample Weight-Adjusted Prevalence, % (95% CI) | ≥ 0.014 No. (%) | ≥ 0.014 Sample Weight-Adjusted Prevalence, 95% CI) |
|---|---|---|---|---|---|
| Overall population | 3546 | 957 (27.0) | 25.0 (22.7 – 27.4) | 122 (3.4) | 2.0 (1.5 – 2.6) |
| Restricted population Without CHD | 3428 | 891 (26.0) | 24.2 (21.8 – 26.5) | 103 (3.0) | 1.8 (1.2 – 2.4) |
| Without cardiovascular disease | 3277 | 813 (24.8) | 23.7 (21.3 – 26.1) | 82 (2.5) | 1.9 (1.0 – 2.0) |
| Without cardiovascular disease or CKD[a] | 3222 | 773 (24.0) | 23.1 (20.7 – 25.5) | 65 (2.3) | 1.2 (0.8 – 1.7) |
| Without cardiovascular disease, CKD, subclinical heart disease, diabetes, or hypertension[b] | 2554 | 510 (20.0) | 19.3 (16.8 – 21.8) | 43 (1.7) | 1.1 (0.6 – 1.7) |

# Risk of CV Death or Heart Failure by hscTnI (Abbott) in PEACE




Omland et al: JACC, 2013

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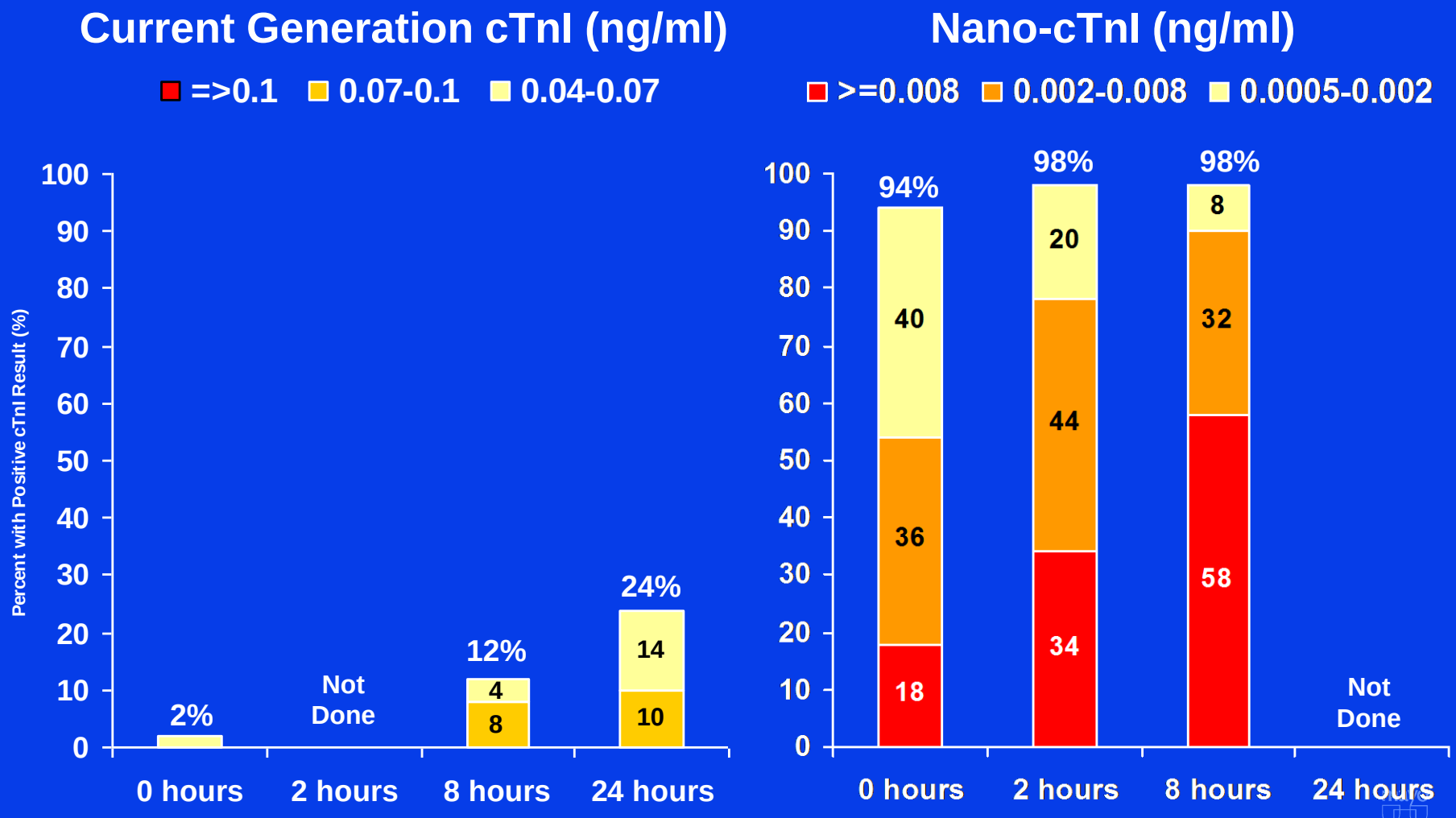
- Use anchor values from previous assays to gauge differences
- Recognize there will be more elevations
- **Recognize that more patients will be diagnosed with AMI**

# Detection of cTnI in Patients with Unstable Angina



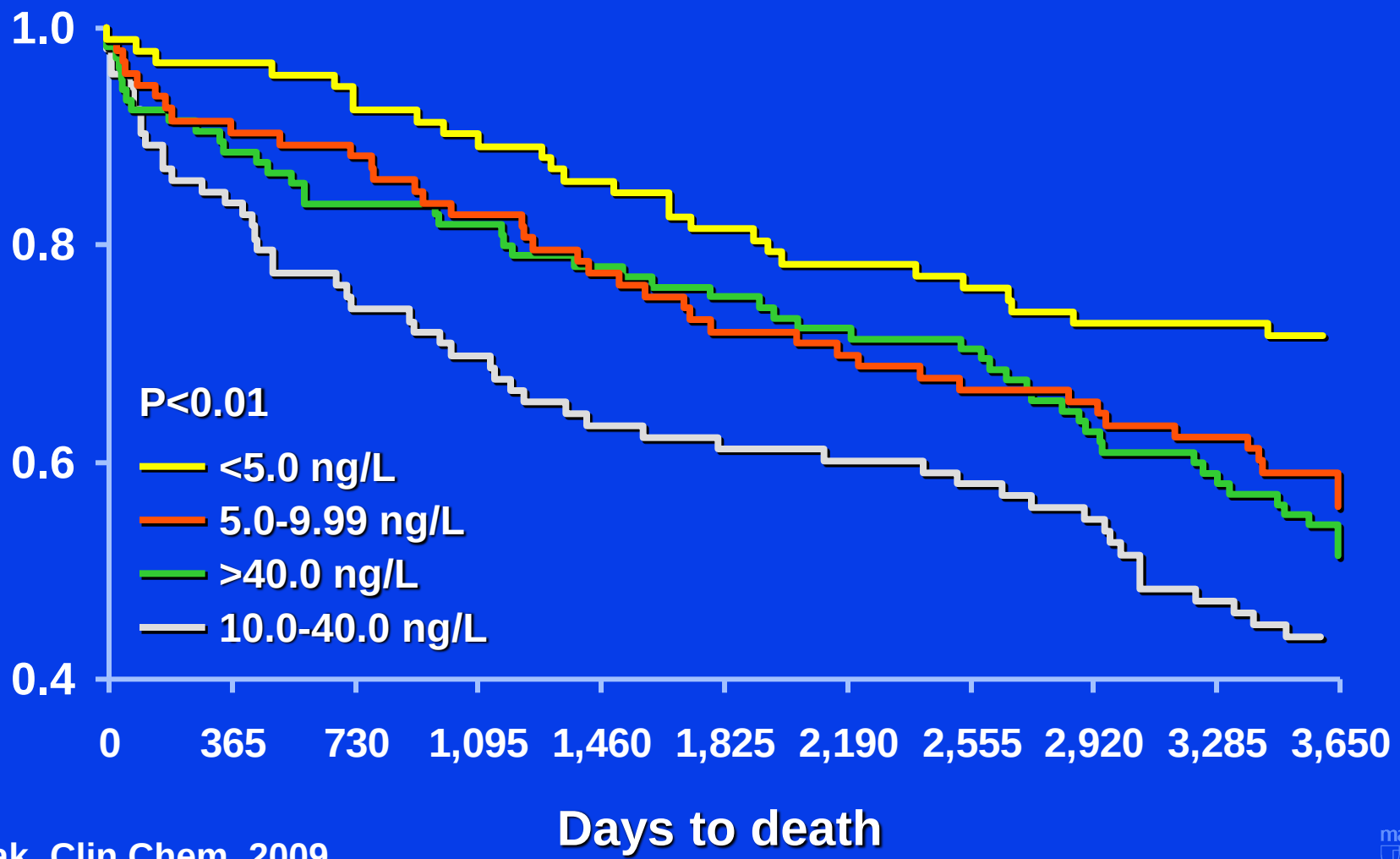

Wilson and Morrow, AHJ September 2009

# Differences with hs-cTnI in Patients Presenting Early with Chest Discomfort

| Change criteria | Myocardial injury present[a] | Myocardial injury absent[a] |
|---|---|---|
| **Earliest pair (median interval 1 h; IQR 1-3 h)[b]** | | |
| hs-cTnI change positive | 88 [44.0 ng/L (19.0-153)] | 75 [15.4 ng/L (6.3-34.7)] |
| hs-cTnI change negative | 20 [13.4 ng/L (5.9-54.5)] | 107 [5.4 ng/L (4.0-9.7)] |
| AccuTnI change positive | 67 [0.06 μg/L 0.02-0.21] | 7 [0.00 μg/L (0.00-0.01)] |
| AccuTnI change negative | 41 [0.05 μg/L 0.02-0.16] | 175 [0.00 μg/L (0.00-0.01)] |
| **Any specimen pair (median 4 specimens/subject; IQR 2-6)[c]** | | |
| hs-cTnI change positive | 107 [323 ng/L (77.0-4099)] | 104 [31.9 ng/L (15.7-101)] |
| hs-cTnI change negative | 1 | 78 [6.2 ng/L (4.8-9.4)] |
| AccuTnI change positive | 95 [0.55 μg/L (0.11-5.5)] | 13 [0.03 μg/L (0.03-0.04)] |
| AccuTnI change negative | 13 [0.09 μg/L 0.05-0.18] | 169 [0.01 μg/L (0.01-0.02)] |

[a]Peak AccuTnI concentration was used to define if myocardial injury was present (>99$^{th}$ percentile) or absent (≤99$^{th}$ percentile)
[b]Data are n [median cTnI concentration at presentation (IQR)]
[c]Data are n [median cTnI concentration at peak (IQR)]
Kavsak et al: Clin Chem 55:573, 2009

# Survival by hscTnI Values - Preface




Kavsak, Clin Chem, 2009

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Use whole numbers and gender specific cut off values

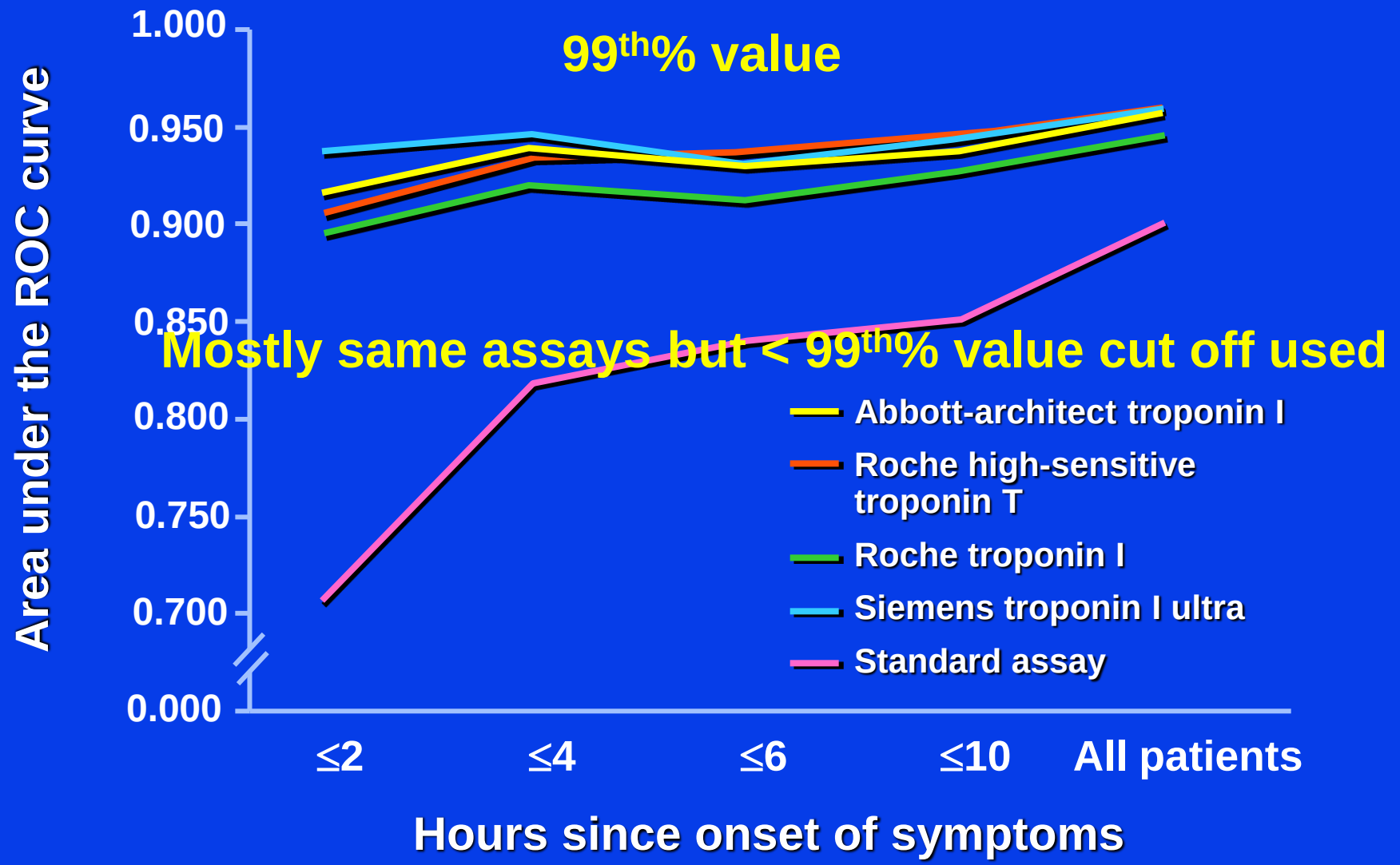
Use anchor values from previous assays to gauge differences

Recognize there will be more elevations

Recognize that more patients will be diagnosed with AMI

**Recognize that the time to ruling in, despite the hype may not be shortened**

# Accuracy by Time of Admission




NEJM 361:858, 2009

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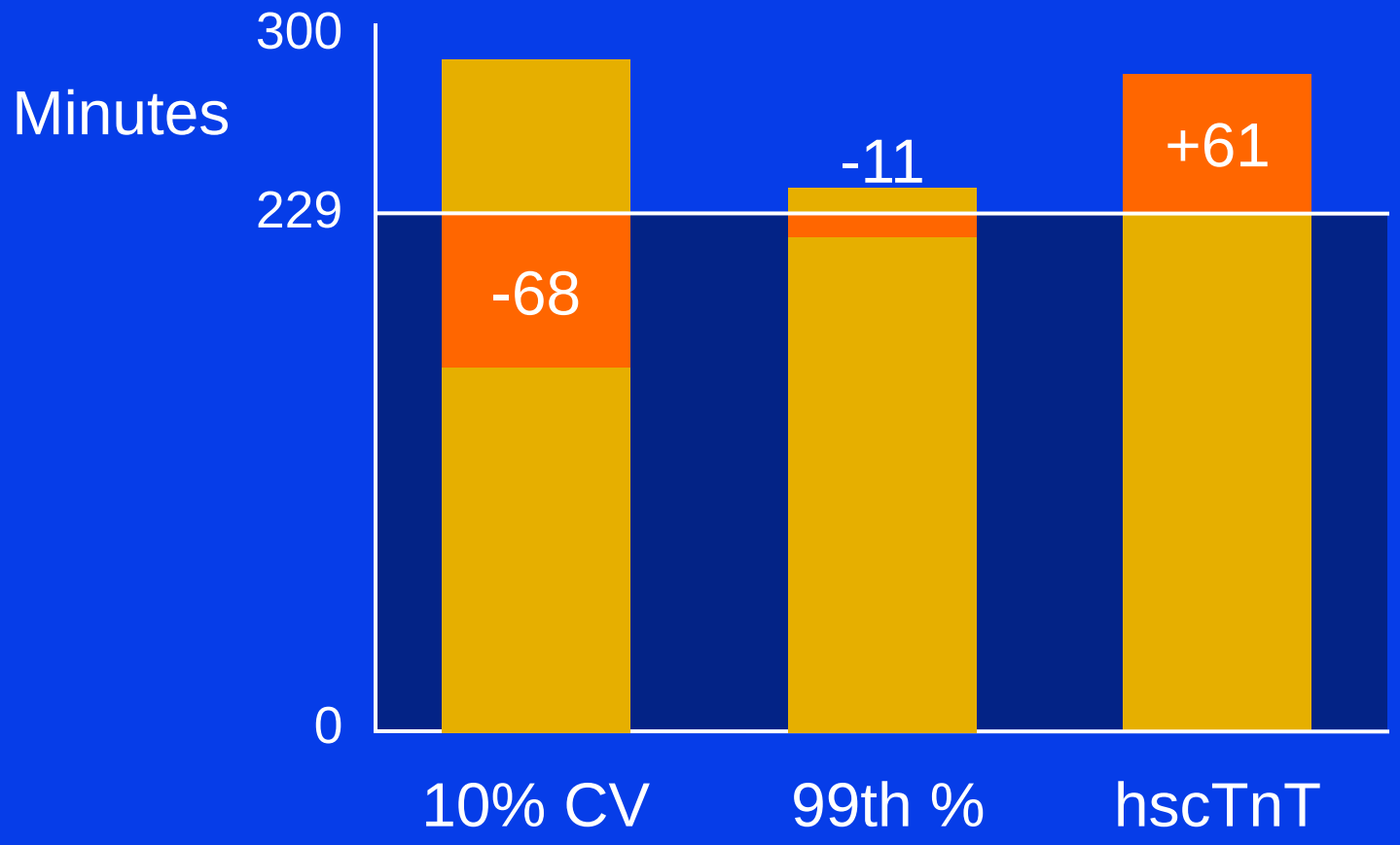
# Time to Diagnosis with hscTnT
## Based on The Gold Standard




**TUSCA**

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- Use whole numbers and gender specific cut off values
- Use anchor values from previous assays to gauge differences
- Recognize there will be more elevations
- Recognize that more patients will be diagnosed with AMI
- Recognize that the time to rule in will be shortened for many but, despite the hype may not be shortened overall

**New strategies will reduce the time to rule out AMI in many patients.**

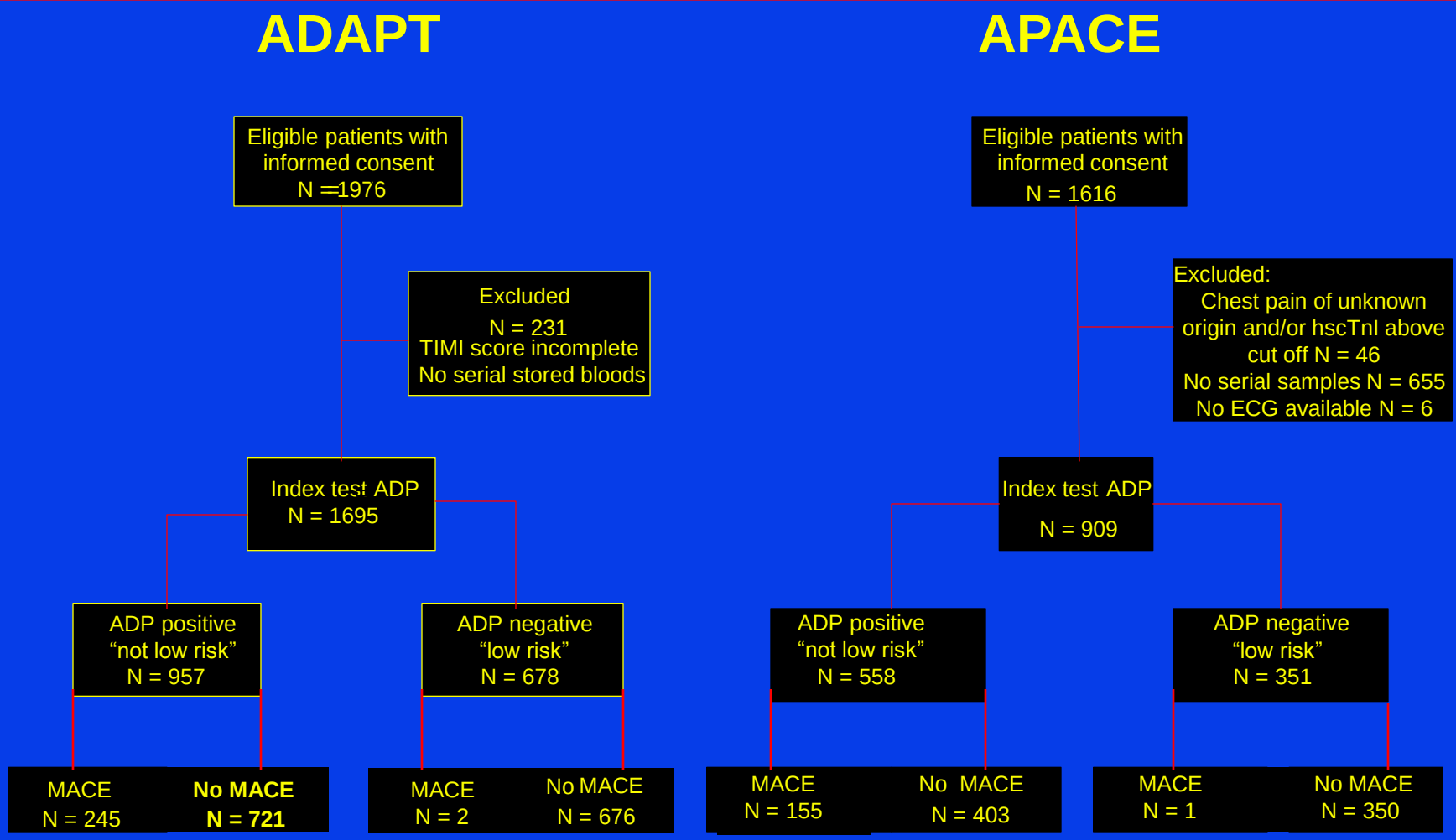
mayo

# DIAGNOSTIC PERFORMANCE OF THREE MODELS INCORPORATING hsTnT AND ECG FINDINGS FOR EARLY EXCLUSION OF AMI

| Model | Sensitivity (95% CI) | Specificity (95% CI) | PPV (95%CI) | NPV (95% CI) |
|---|---|---|---|---|
| A | 100.0 (97.1 – 100.0) | 30.1 (26.3 – 34.0) | 23.7 (20.2 – 27.6) | 100.0 (97.9 – 100.0) |
| B | 95.2 (89.9 – 98.2) | 69.4 (65.5 – 73.2) | 40.4 (34.8 – 46.2) | 98.5 (96.8 – 99.5) |
| C | 100.0 (97.1 – 100.0) | 66.4 (63.1 – 69.5) | 30.3 (25.9 – 35.0) | 100.0 (99.4 – 100.0) |

Model A: hsTnT <3 ng/L and no ECG ischaemia;
Model B: hsTnT <14 ng/L and no ECG ischaemia;
Model C: (hsTnT <3 ng/L and no ECG ischaemia) OR (hsTnT <14 ng/L and no ECG ischaemia and symptom onset <6h)
Reference: Body

# Accelerated Diagnostic Protocols with hscTnI (Abbott) – 30 Day MACE Rates




**Submitted – Cullen, Than et al**

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Recognize that the time to rule in will be shortened for many but, despite the hype may not be shortened overall

New strategies will reduce the time to rule out AMI in many patients

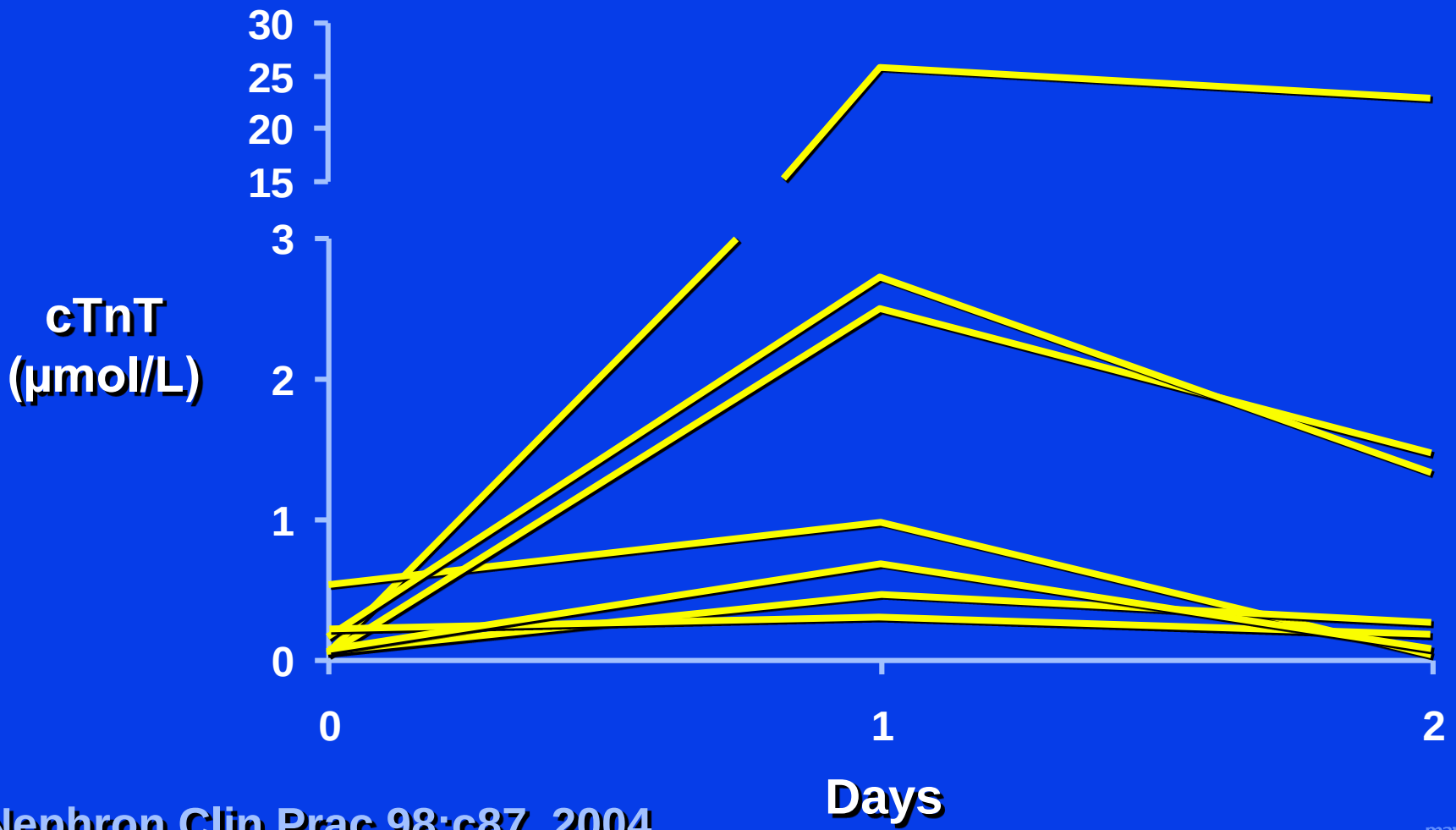
**Use changing values to diagnose AMI**

# Criteria for Acute Myocardial Infarction

- Detection of a rise and/or fall of cardiac biomarker values (preferably cardiac troponin (cTn) ) with at least one value above the 99$^{th}$ percentile upper reference limit (URL) and with at least one of the following:
- Ischaemic symptoms
- ECG changes of new ischaemia (new ST-T changes or new LBBB)
- Development of pathologic Q waves in the ECG
- Imaging evidence of new loss of viable myocardium or new regional wall motion abnormality
- Identification of an intracoronary thrombus by angiography or autopsy

**Third Universal Definition of Myocardial Infarction**

# *Changes in cTnT in Dialysis Patients with ACS*




Nephron Clin Prac 98:c87, 2004

# Determining Assay Values are Different

| | | | | | | |
|---|---|---|---|---|---|---|
| BUN (Bld Urea Nitr... | 8-24 mg/dL | 48 * | 23 Jan 08 | | | |
| Chloride..... | 100-108 mmol/L | 110 * | 23 Jan 08 | | | |
| Bicarbonate, P/S,..... | 22-29 mmol/L | 22 | 23 Jan 08 | | | |
| Anion Gap..... | 7-15 | 10 | 23 Jan 08 | | | |
| - CARDIAC CHEMIS... | | | | | | |
| Troponin T, S..... | <0.01 ng/mL | 0.11 * | 23 Jan 08 | | 0.11 * | |
| 3H Troponin T, S..... | <0.01 ng/mL | 0.12 * | 23 Jan 08 | | 0.12 * | |
| 6H Troponin T, S..... | <0.01 ng/mL | 0.15 * | 23 Jan 08 | | 0.15 * | |
| 3H Delta..... | ng/mL | Not Sig @ | 23 Jan 08 | | Not Sig @ | |
| 6H Delta..... | ng/mL | Sig Delta @ | 23 Jan 08 | | Sig Delta @ | |
| - LIPIDS 63 AG | | | | | | |
| - LIPIDS 1 AG | | | | | | |
| LDL Subfractionati... | 100-200 g/dL | .@b0 | 23 Jan 08 | | | |
| Beta LDL Choleste... | 100-200 g/dL | .@b1 | 23 Jan 08 | | | |
| Percentile Rank..... | 100-200 g/dL | 1.01 @b3 | 23 Jan 08 | | | |

```
3H Delta.....57001-ROCLIS

23 Jan 2008 15:38
Value: Not Sig
Facility: MCR
Reference Range: ng/mL
Comment:
No significant delta observed
Delta=.01
Entry User: INTERFACE USER, INTE
Accession Number: G9086672937
Performing Loc: DEPT LAB MED PATH
```

# Short-Term Analytical and Biological Variation by hs-cTnI Assays

| | Abbott[a] | Beckman[a] | Roche (E170)[b] | Siemens[a] | Singulex[c] |
|---|---|---|---|---|---|
| CV-A (%)[d] | 13.8 | 14.5 | 7.8 | 13.0 | 8.3 |
| CV-I (%) | 15.2 | 6.1 | 15.0 | 12.9 | 9.7 |
| CV-G (%) | 70.5 | 34.8 | NA | 12.3 | 57.0 |
| Index of individuality | 0.22 | 0.46 | NA | 0.11 | 0.21 |
| RCV (%)[e] | NA | NA | 47.0 | NA | NA |
| RCV increase (%)[f] | 69.3 | 63.8 | NA | 57.5 | 46.0 |
| RCV decrease (%)[f] | -40.9 | -38.9 | NA | -36.5 | -32.0 |
| Within-individual mean (ng/L) | 3.5 | 4.9 | NA | 5.5 | 2.8 |

[a] Apple et al (38); [b] Vasile et al (36); [c] Wu et al (35)
[d] CV-A, analytical CV; CV-I, within-individual CV; CV-G, between individual CV; NA, not available; RCV, relative change value; [e] REC percentage applies to parametric data
[f] RCV increase and decrease percentages refer to nonparametric data and are log-transformed
Apple et al: Clin Chem 58:1, 2012

# PERCENTILES OF CHANGE IN cTnT CONCENTRATION IN CORONARY CARE UNIT PATIENTS WITHOUT MI

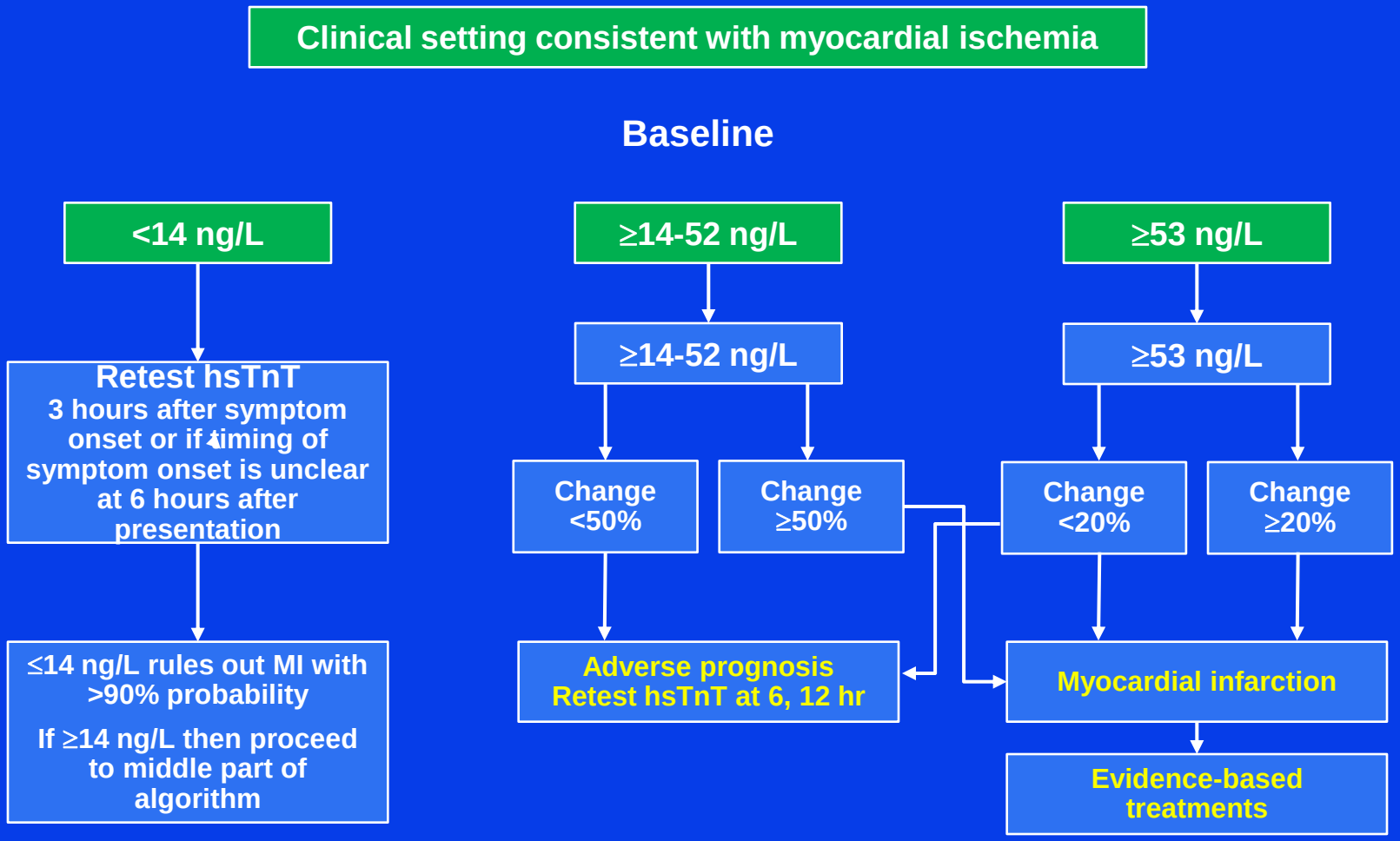
| | Relative change, % | | Absolute change, ng/L | | |
|---|---|---|---|---|---|
| Diagnosis | 50th (95% CI) | 97.5th (95% CI) | 50th (95% CI) | 97.5th (95% CI) | n[a] |
| All diagnoses | 10 (10 - 11) | 59 (48 - 71) | 1.6 (1.4 - 1.7) | 14.1 (10.1 - 18) | 866 |
| Heart failure | 10 ( 9 - 12) | 51 (38 - 65) | 3.1 (2.5 - 3.7) | 30 (17.3 - 42.5) | 204 |
| Stable angina pectoris | 10 ( 9 -1 2) | 67 (34 - 99) | 1.4 (1.2 - 1.6) | 13.6 (9.4 - 17.8) | 343 |
| Atrial fibrillation | 9 ( 6 - 12) | 66 (29 - 104) | 1.1 (0.8 - 1.4) | 9.1 (6.4 - 11.8) | 86 |
| Noncardiac chest pain | 12 (10 - 15) | 64 (46 - 82) | 1.2 (1 - 1.5) | 7.5 (5.9 0- 9.1) | 229 |

[a] Number of cTnT measurements included in calculations.

[b] NA, not applicable, because the absolute change in cTnT concentration differed among diagnosis groups (heart failure vs atrial fibrillation, stable angina pectoris, and noncardiac chest pain, all P <0.02, and atrial fibrillation vs stable angina pectoris, P = 0.017, for difference in medians.

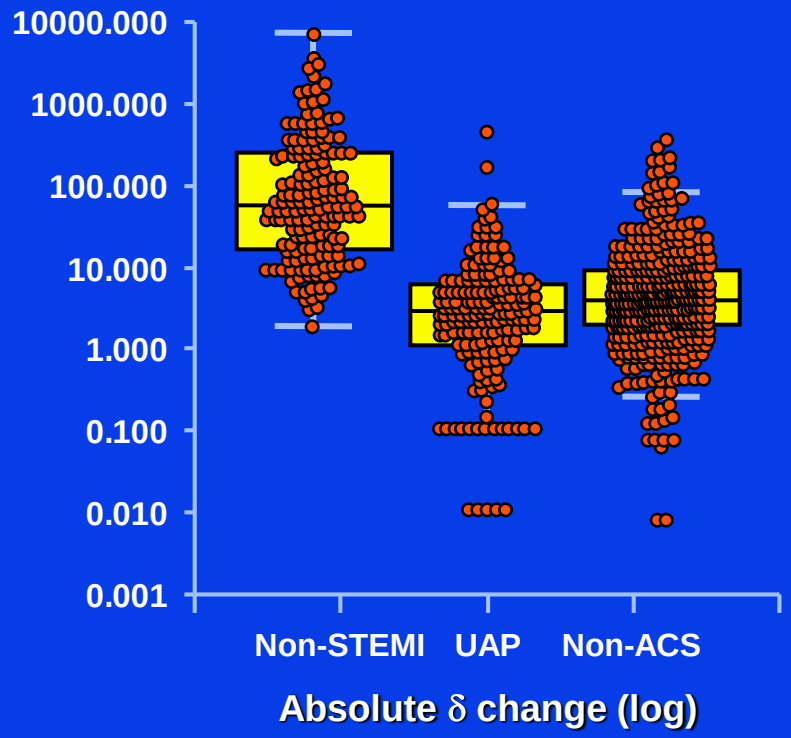
Reference Clin Chem 2012;58(3)

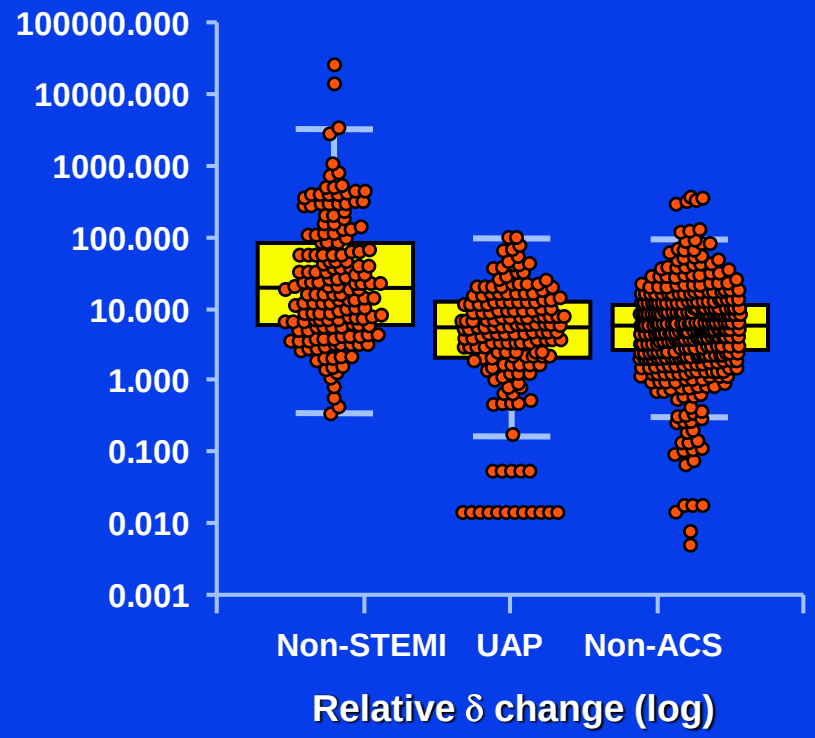
# Use of High Sensitivity Troponin T to Diagnose Myocardial Infarction




White HD; AHJ 2010

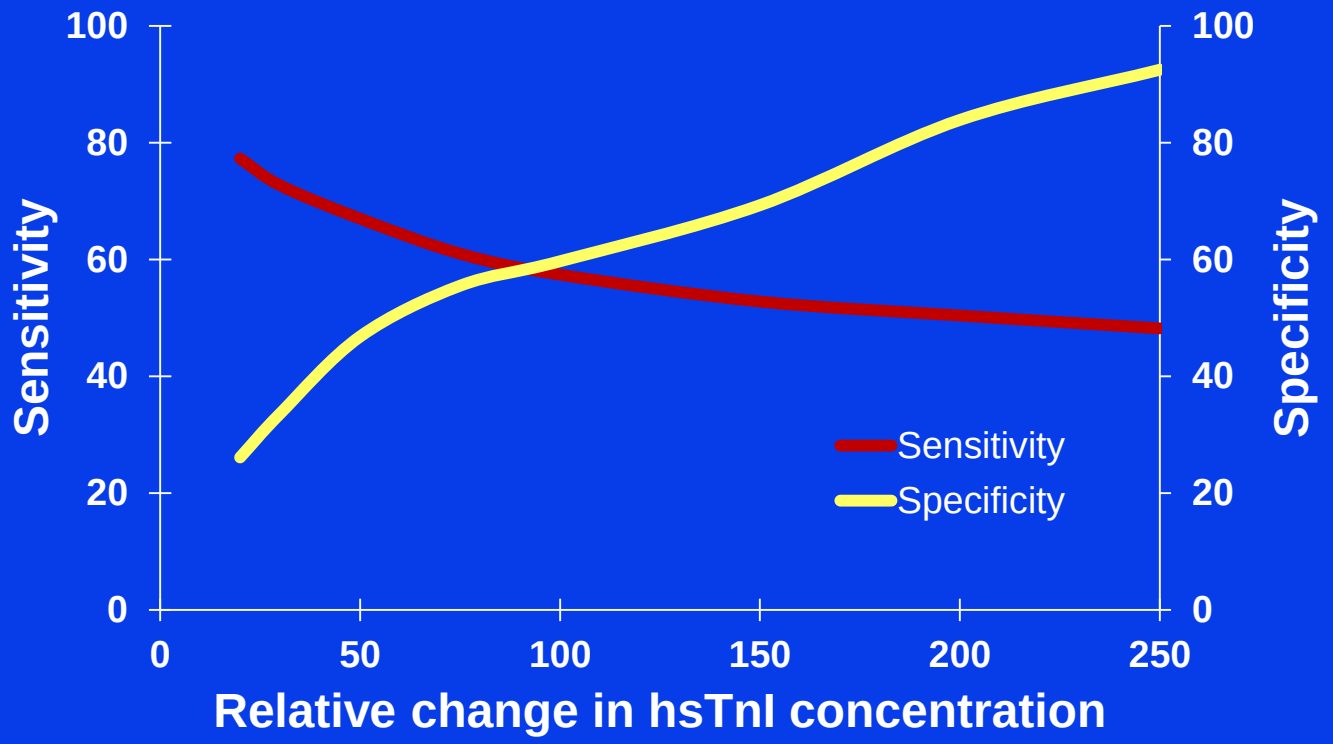
# Absolute and Relative Changes in Patients with AMI, Unstable Angina and "Non-Cardiac Chest Pain"



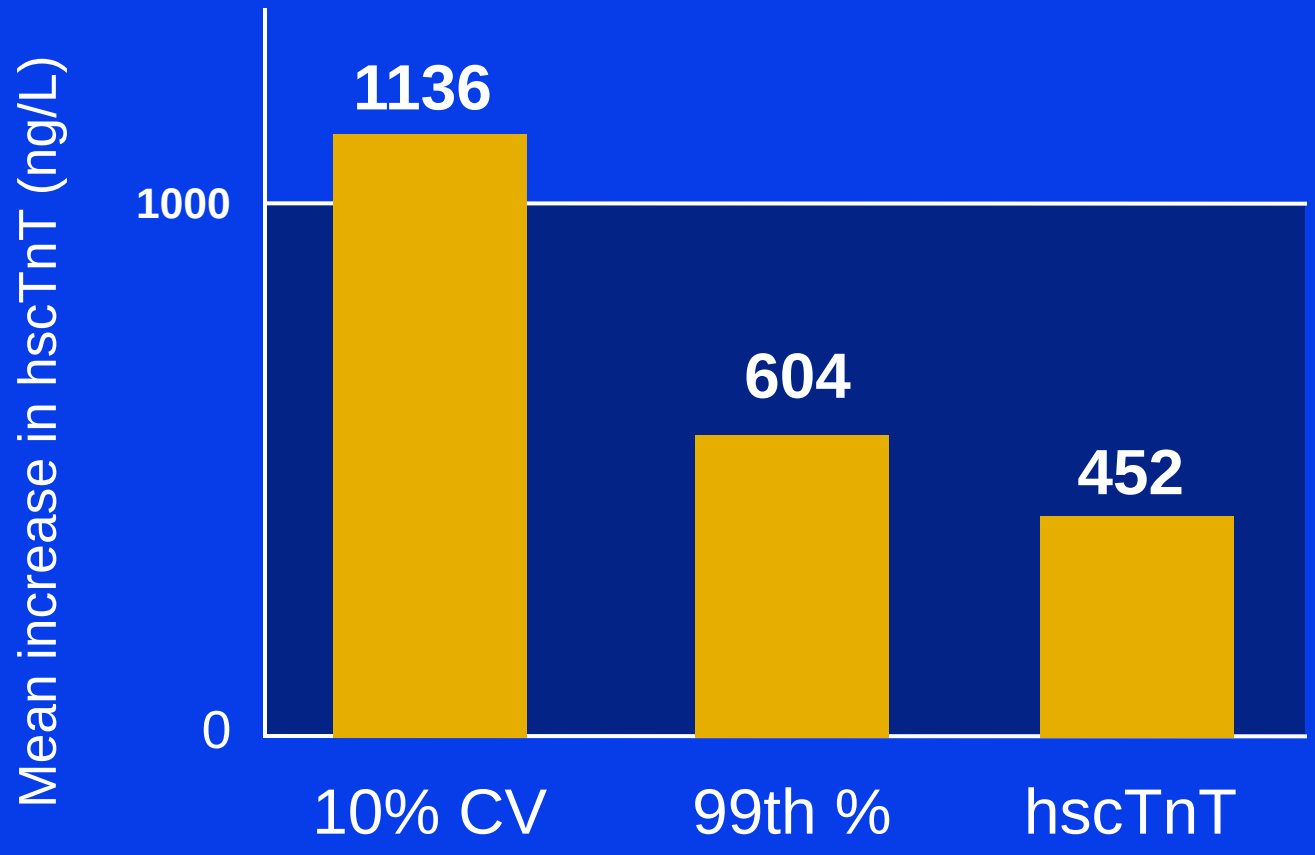

Mueller et al: Clinical Chemistry 58:1 (2011)

# Defining the Optimal Delta: The Tension Between Sensitivity and Specificity




Data from Keller et al (JAMA 2012)

# Delta for the Diagnosis of AMI with hscTnT
## Based on The Gold Standard (T0-T3hr)




**TUSCA, AJM in press**

# Delta Guidance

**MUST USE FIXED TIMING**

**Near 99$^{th}$% URL value**

- **The greater the change, the more likely AMI**
- **The lesser the change, the less likely AMI**
- **Percentages and absolute values may provide similar information**

**At higher levels**

- **Absolute values may be better**

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## Avoid

**Extrapolating the data from one assay to another assay**

**The idea that release is continuous so that one can use a one or 2 hour delta by dividing by the delta found at 5 or 6 hours.**

mayo

# *10 Ways to Make the Use of High Sensitivity Cardiac Troponin Values Easier and Better*

- Use the proper definition for high sensitivity
- Be aware that hs assays will be more sensitive to pre -analytical and analytical confounds
- Use whole numbers and gender specific cut off values
- Use anchor values from previous assays to gauge differences
- Recognize there will be more elevations
- Recognize that more patients will be diagnosed with AMI
- Recognize that the time to rule in will be shortened for many but, despite the hype may not be shortened overall
- New strategies will reduce the time to rule out AMI in many patients
- Use changing values to diagnose AMI

**Remember it is the clinician who makes the diagnosis of AMI and not the laboratory results**

# It is not the Data but How You Intepret it that is Important