E·QUAL | EMERGENCY QUALITY NETWORK

Chest Pain Wave I

Risk Stratification Scores and Shared Decision Making

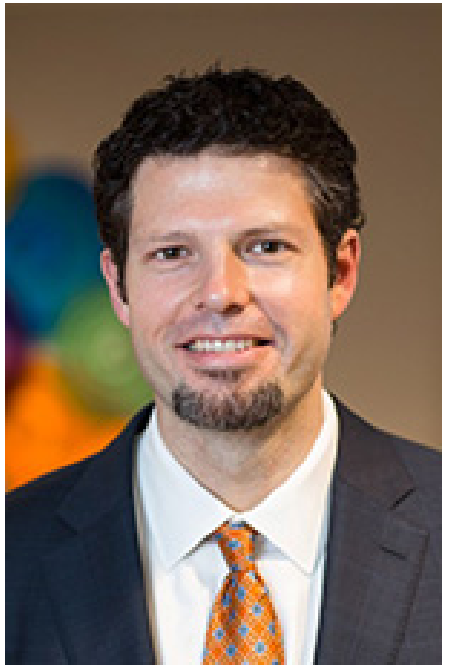
TCPi | Transforming Clinical Practices Initiative

American College of Emergency Physicians®
ADVANCING EMERGENCY CARE

E·QUAL | EMERGENCY QUALITY NETWORK

Presenters

Simon A. Mahler, MD, MS



Erik P. Hess MD MSc

TCPi | Transforming Clinical Practices Initiative

American College of Emergency Physicians®
ADVANCING EMERGENCY CARE

Be Sensitive!

Improving chest pain care using risk stratification tools

Simon A. Mahler, MD, MS, FACEP
Director of Clinical Research
Associate Professor
Department of Emergency Medicine
Wake Forest School of Medicine

Wake Forest® School of Medicine

Disclosures

- Research funding:
  - NIH: Heart Lung and Blood Institute
  - NCATS: National Center for Advancing Translation Sciences
  - Donaghue Foundation/ Association of American Medical Colleges
  - Duke Endowment
  - Abbott Laboratories
  - Siemens Healthcare
  - Roche Diagnostics
- Author for Up-to-Date
- Chief Medical Officer: Impathiq, Inc.

Question 1.

What is the impact of care variability on the quality of chest pain care?

Staggering Chest Pain Numbers

> 8 M

ED Chest Pain Visits

> 50%

Patients Admitted

$13 B

Chest Pain Evaluation

< 10%

Diagnosed with ACS

2-4%

Missed ACS

U.S., per year

Care Variability

Providers:

- Experience/Training
- Risk tolerance
- Fear of malpractice
- Use of gestalt or old and unreliable tools for risk stratification

Pines et al. *AJEM* 2010:

- Measured providers risk aversion using a risk taking scale(RTS)
- The most risk-averse quartile of providers had higher admission rates compared to the least risk-averse quartile. ($P < 0.001$)

Problem with Clinician Gestalt

- Multiple studies show gestalt is inaccurate:
- Most clinicians overestimate risk
- Some underestimate risk
    - Atypical presentations
    - Women

Body et al. *EMJ*. 2014

458 chest pain patients

Gestalt:

Probable ACS = 77% had NO MACE

Definite ACS = 47% NO MACE

Definitely Not ACS = 9% HAD MACE

Outdated Risk Stratification Tools

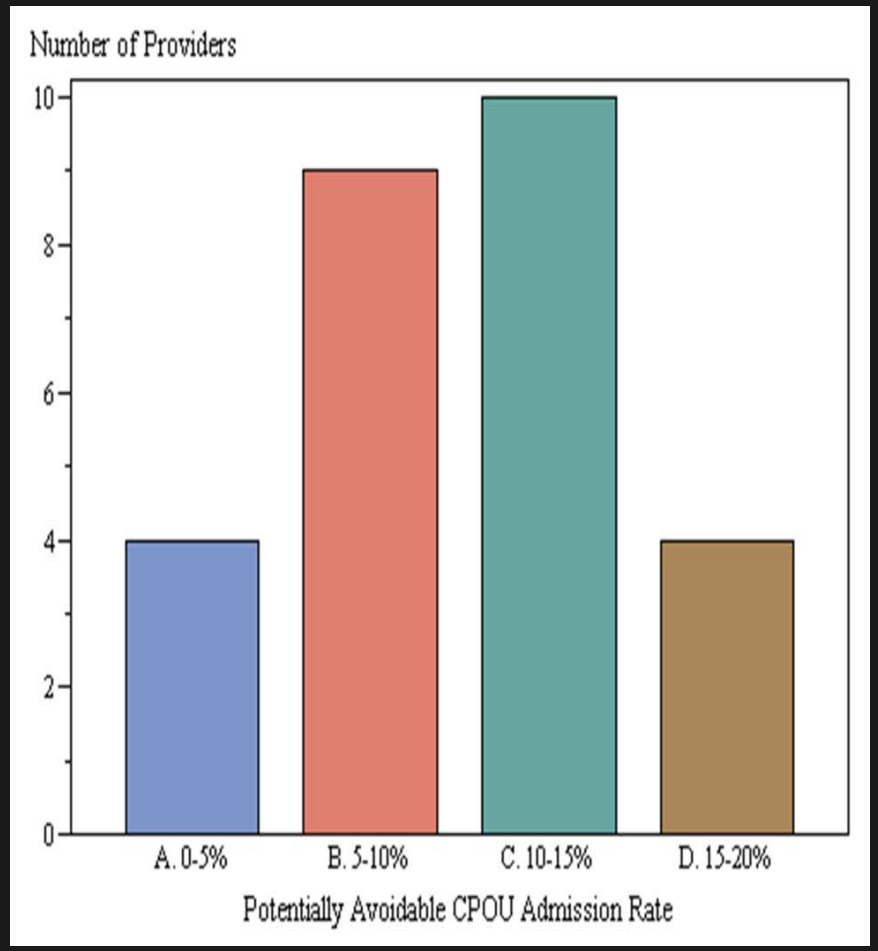
TIMI and GRACE

- Developed and initially validated in patients with ACS
- Not designed for ED use
- Low scores not sufficiently sensitive to identify patients that can be discharged from the ED.
- 2-4% adverse event rates seen in the lowest risk groups.

Pollack CV, et al. Acad Emerg Med. 2006, Hess EP, et al. CMAJ. 2010, Lyon R, et al. Resuscitation. 2007

Over-Testing and Provider Variability

- Data from 1731 Chest Pain Observation Unit admissions 2008-2011 WFBMC.
- Avoidable = Age <35 years, TIMI 0-1, & normal or non-diagnostic ECG
- 0% MACE at 30 days among Avoidable admissions



Mahler SA, et al. Avoidable Utilization of the Chest Pain Observation Unit: Evaluation of Very-Low-Risk Patients. Critical Pathways In Cardiology. 2013 Jun;12(2):59-64.

Impact of Massive Over-Triage

- Crowding
- Radiation exposure
- False-positive and non-diagnostic tests
- Increased costs
- Not patient-centered
- Low Quality
- Low Value

Consequences of Under-Triage

- 2-4% of myocardial infarctions are inappropriately discharged from the ED every year
- Patients with missed MI have an increase in short-term mortality
- Missed ACS is a top cause of malpractice claims
  - Malpractice fear drives over-testing
- Low Quality
- Low Value

Optimal Risk Stratification

- Identify patients unlikely to benefit from hospitalization or stress testing/cardiac imaging **for early discharge**
- Focus hospitalization and stress testing/cardiac imaging on patients likely to benefit

Question 2.

How do you standardize care?

Improving Quality and Value

Commonwealth fund for Hospital Quality Improvement:
Protocols and practices, including **evidence-based** **policies** and procedures, **clinical pathways** **and guidelines**, error-reducing software, and patient flow management techniques, leading to . . .

greater **uniformity in practice** and…

improved outcomes in process and health-related measures (e.g., patient flow, errors, complications, mortality), satisfaction and work environment, and “bottom line” indicators such as reduced length of stay and increased market share.

Risk Stratification Decision Aids & ADPs

Decision Aids:

Tools that objectively combine data to risk stratify a patient:

- History
- Risk factors
- ECG
- Biomarker data (troponin)

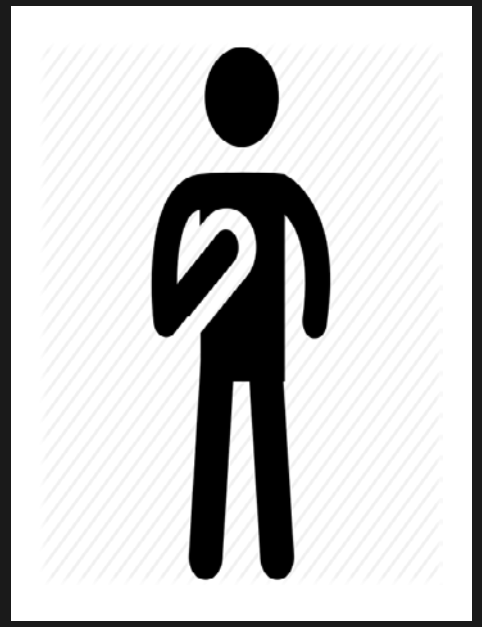
Accelerated Diagnostic Pathways (ADPs):

Decision aid + serial troponins

What’s the ideal tool?

- Safe
- Reduces admissions
- Reduces hospital length of stays
- Reduces unnecessary testing
- Validated in a US patient population

Stakeholders

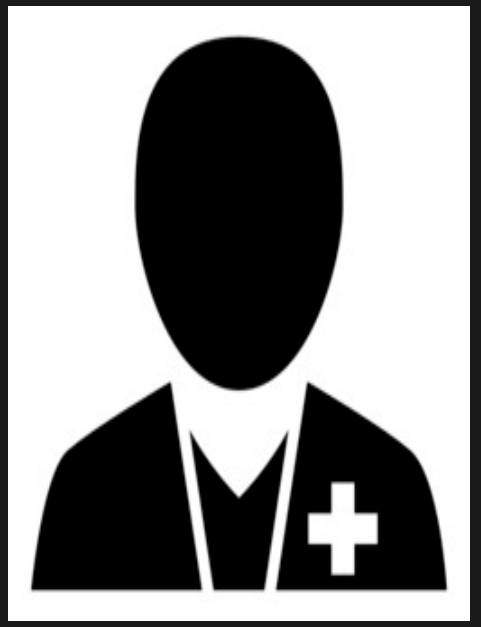


Am I having a heart attack?

What tests do I need?

How long do I have to stay here?

When can I go home safely?



Is this patient at serious risk?

What tests should I order?

Do I need to admit them?

Can they be safely sent home?

Can we improve patient outcomes?

Can we reduce unnecessary tests?

Can we reduce length of stay?

Can we cut costs?

Validated Tools

TIMI

GRACE

ADAPT

EDACS

HEART score

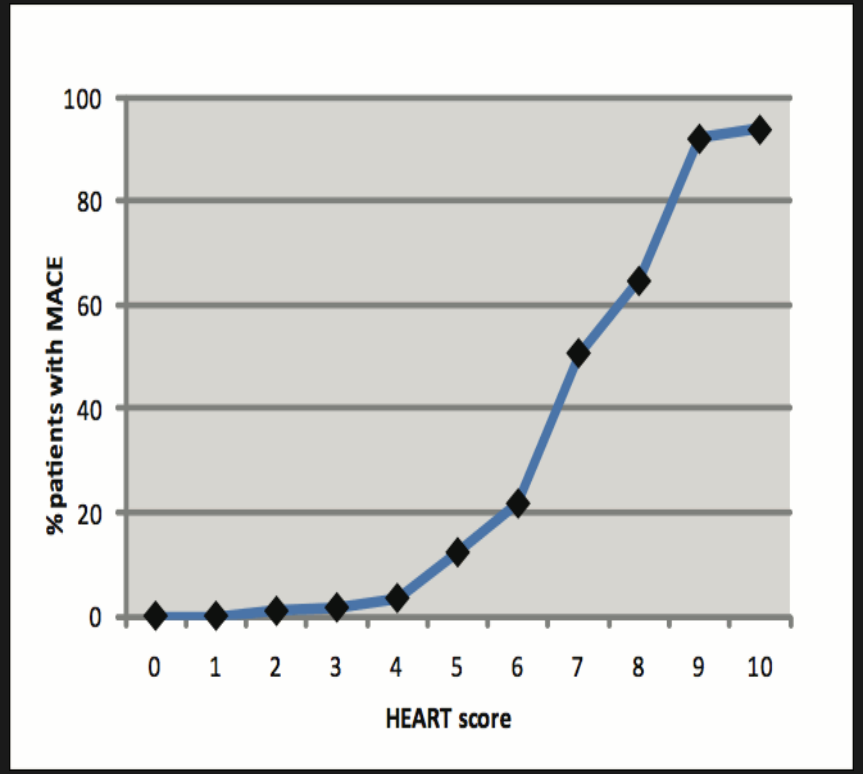
HEART Pathway

HEART Score

Designed to identify chest pain patients for early discharge without stress testing.

Validated in >5000 patients.

>98 % negative predictive value, >96% sensitivity for ACS.



Backus, et al., Int J Cardiol, 2013

Six, et al., Crit Path Cardiol, 2013

HEART Score

HEART Score		Points
History	Highly Suspicious	2
	Moderately Suspicious	1
	Slightly Suspicious	0
ECG	Significant ST-depression	2
	Non-specific repolarization abnormality	1
	Normal	0
Age	≥ 65	2
	45-65	1
	≤ 45	0
Risk factors	3 or more risk factors	2
	1-2 risk factors	1
	No risk factors	0
Troponin	≥ 3x normal limit	2
	1-3x normal limit	1
	≤ normal limit	0
Total		

Low risk; total score 0-3
High risk; total score 4 or more

Acceptable Miss Rate?

HEART Score ~ 1.7% missed MACE rate at 6 weeks

Is that acceptable?

What is the acceptable miss rate in the United States?

< 1%

Than, et al, *Int J Cardiol.* 2013 Jul 1;166(3):752-4.

US HEART score validation

- 1,070 observation unit patients at Wake Forest
- Only 12 patients (1.1%) with MACE
- HEART Score identified 904 (84%) for early discharge with a NPV of 99.4%
- 5 pts with index visit NSTEMIs had low-risk HEART scores
  - Positive serial troponins

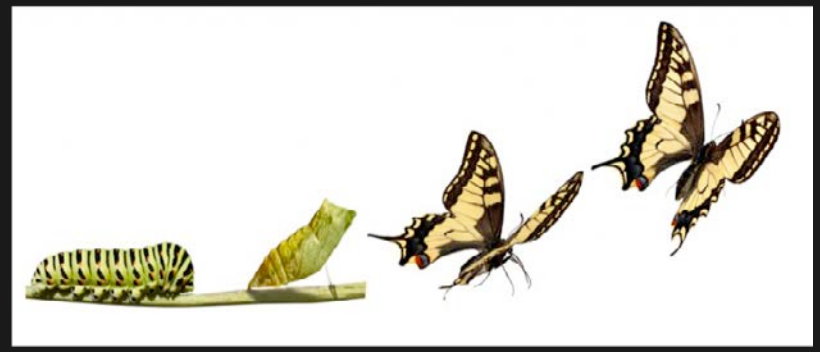
Mahler et. al, Crit Path Cardiol, 2011

The HEART Pathway is born

Addition of serial troponin at 0 and 3 hours to HEAR score

- 100% sensitive for ACS, could have decreased observation stays by 80%
- Improved sensitivity and NPV compared to HEART Score

Mahler et. al, Crit Path Cardiol, 2011

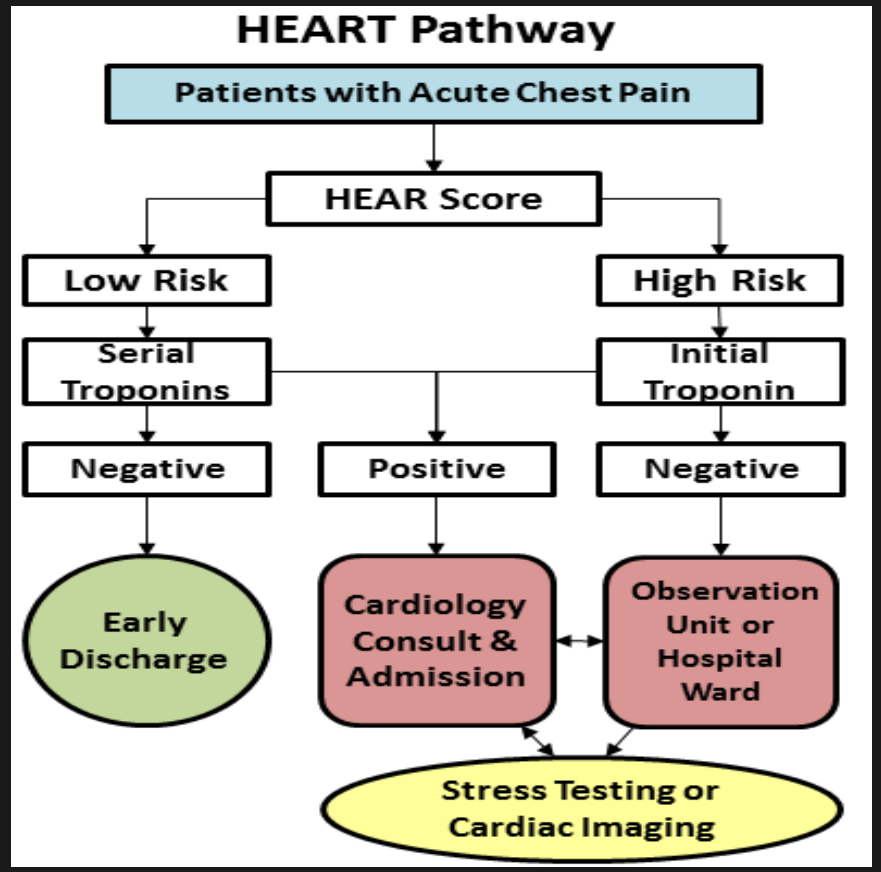


HEART Pathway Care Algorithm

ADP version of the HEART score

- Low risk = HEAR(t) score: 0-3
- Negative serial troponins
- No ischemic ECG changes
- No known CAD
  (prior AMI, revascularization, >70% coronary stenosis)

Improved sensitivity and NPV compared to HEART score



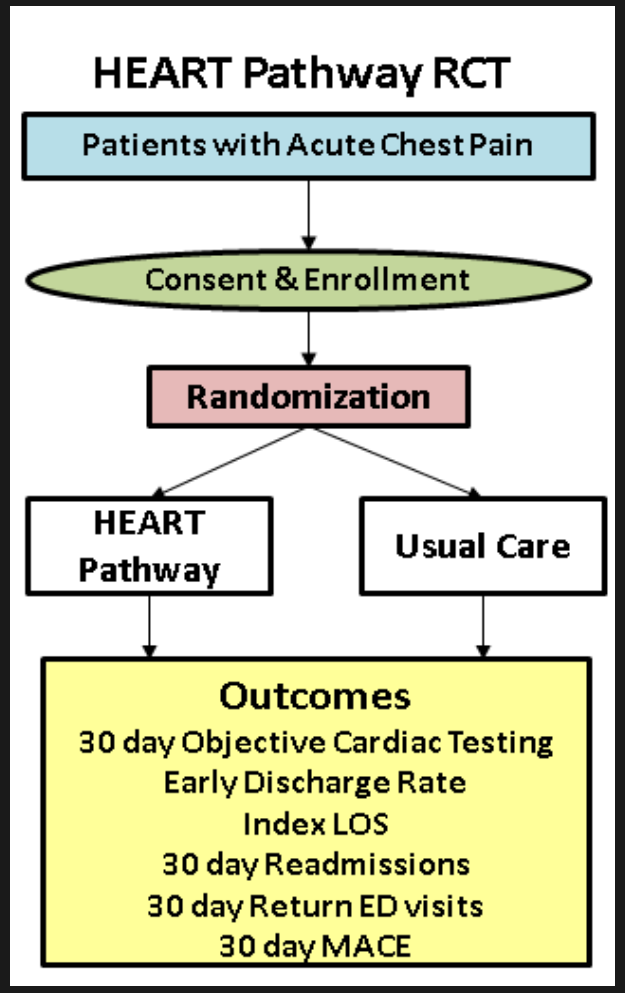
Mahler et. al, Crit Path Cardiol, 2011
Mahler et. al, Int J Cardiol, 2013
Mahler et al, Circ CVQO J, 2015.
Mahler et al, JMIR, 2016

HEART Pathway Validation

- 1,005 patients with possible ACS from 18 US EDs
- Higher-risk cohort (22% ACS events)
- HEART Pathway >99% sensitive for ACS, could have decreased admissions by >20%

Mahler et. al, Int J Cardiol, 2013

HEART Pathway RCT



282 patients

RCT arms:

HEART Pathway

Usual Care: ACC/AHA guidelines

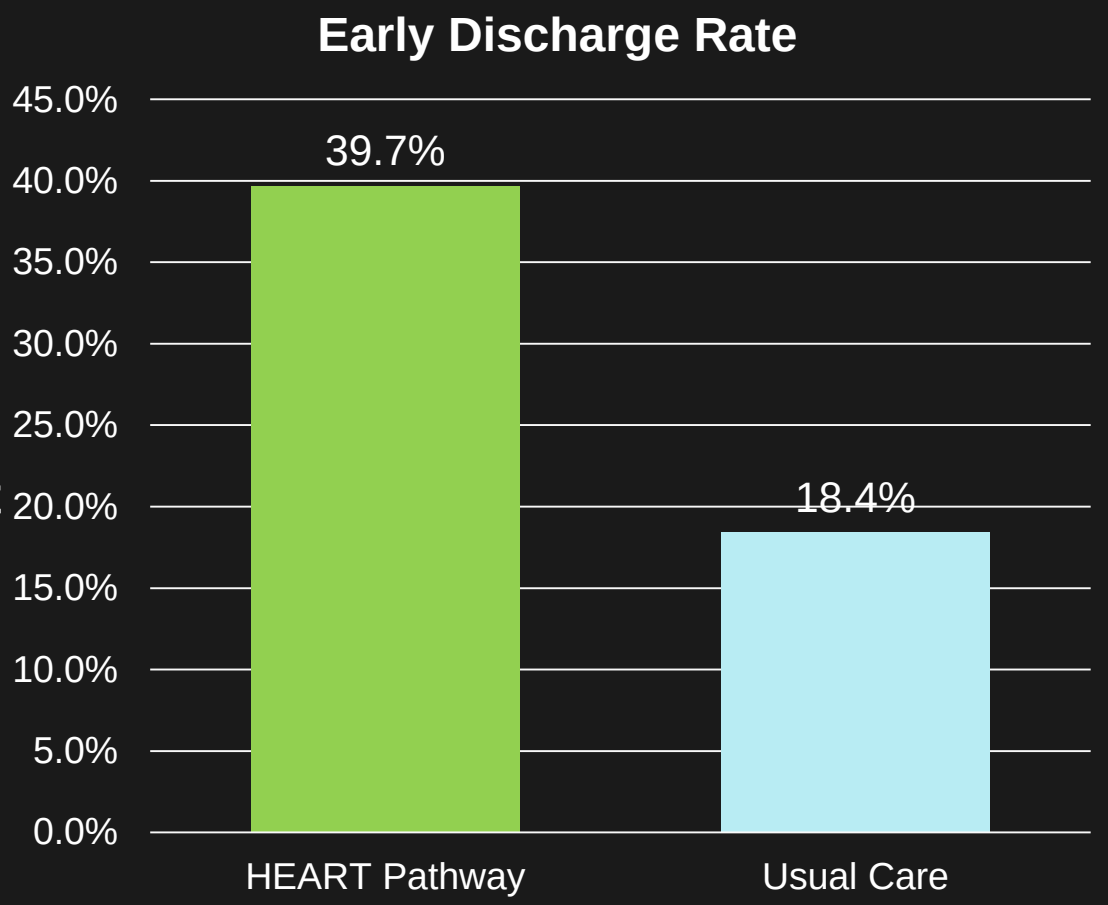
Mahler et al, Circ CVQO J, 2015.
Mahler et al, Acad Emerg Med, 2016.

Early Discharge Rate

HEART Pathway increased the early discharge rate by 21% (p=0.0002).

Decreased median length of stay by 12 hours (p=0.013).

Decreased median total cost over 30 days by $216 (p=0.042)



Safety Events: MACE

MACE = death, acute myocardial infarction, or coronary revascularization

No MACE events among patients low-risk by the HEART Pathway.

No difference between groups (p=1.0)

Cardiac-Related Recurrent Care

Cardiac related non-index hospitalizations

HEART Pathway arm: **3.6**% (5/141)

None in low risk patients

Usual care arm: **2.8**% (4/141)

p = 1.0

Cardiac-related ED visits

HEART Pathway arm: **2.8**% (4/141)

None in low-risk patients

Usual care arm: **4.3**% (6/141)

p = 0.75

Revolving Door?

Interpretation:

The HEART Pathway reduces healthcare utilization outcomes

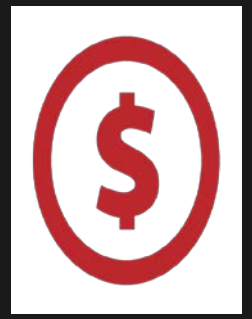
- Objective cardiac testing
- Hospitalizations
- Length of stay
- Cost

These important efficiency gains occurred without any increase in MACE or recurrent cardiac-related care

HEART Pathway Demonstrated Success

3 Emergency Departments within the medical center

Experience in >10,000 patients with chest pain



Improves quality of care while cutting costs

Unmeasured Benefits

- Everyone is on the same page
- Decreased disagreements
- Better workflow
- Provider Efficiency

    Decreased time spent on unnecessary consults, wasted writing notes, and spent on unnecessary testing

MAYO CLINIC

Improving patient-centered care through shared decision making

Erik P. Hess MD MSc
Professor of Emergency Medicine

What is Shared Decision Making?

Involving the patient in making decisions to the extent they desire.

Edwards and Elwyn 2006

What's Next?

Prepared for:

1 Your Chest Pain Diagnosis

Your initial test results are **NEGATIVE for a heart attack**. These included:

- **Blood tests** to look for an enzyme called troponin that is released when the heart muscle is damaged. Additional troponin tests may be done to monitor you for heart attack during your emergency visit.
- **An electrocardiogram** to check whether your heart is getting enough oxygen and blood.

The chest pain you are experiencing today may be a warning sign of a FUTURE heart attack.

2 What You Can Do

Examining your risk will help you and your clinician decide together whether or not you should have additional heart testing.

Additional tests[1] may include:

- **A stress test** which views blood flow to your heart at rest and under stress.
- **A coronary CT angiogram** which takes pictures of the arteries in your heart to check for a blockage in the flow of blood.

3 Your Personal Risk Evaluation

Your risk of having a heart or pre-heart attack within the next 45 days can be determined by comparing you to people with similar factors[2] who also came to the Emergency Department with chest pain.

Of every 100 people like you who came to the Emergency Department with chest pain...

1 had a heart or a pre-heart attack within 45 days of their Emergency Department visit,

99 did not.

4 Would you prefer to have additional heart testing during this emergency visit or decide later during an outpatient appointment?

- ❑ **I would like to have a stress test or coronary CT angiogram during my emergency visit.** I realize that this may increase the cost of my care and/or lengthen my stay.
- ❑ **I would like to be seen by a heart doctor within 24-72 hours** and would like assistance in scheduling this appointment.
- ❑ **I would like to schedule an appointment on my own** to consult with my primary care physician.
- ❑ **I would like my Emergency Department doctor to make this decision for me.**

[1]Stress test options include nuclear stress testing, ultrasound stress testing, or exercise ECG (electrocardiogram) stress testing. Nuclear stress testing and coronary CT angiography include exposure to radiation which has been shown to be related to increased cancer risk over a lifetime. Your doctor can help you explore which option may be best for you.

[2]
- Age
- Gender
- Race
- If chest pain is made worse when manual pressure is applied to the chest area
- If there is a history of coronary artery disease
- If the chest pain causes perspiration
- Findings on electrocardiograms (electronic tracings of the heart)
- Initial cardiac troponin result

What's Next?

Prepared for: _____

1 Your Chest Pain Diagnosis

Your initial test results are **NEGATIVE for a heart attack**. These included:

- **Blood tests** to look for an enzyme called troponin that is released when the heart muscle is damaged. Additional troponin tests may be done to monitor you for heart attack during your emergency visit.
- **An electrocardiogram** to check whether your heart is getting enough oxygen and blood.

The chest pain you are experiencing today may be a warning sign of a FUTURE heart attack.

2 What You Can Do

Examining your risk will help you and your clinician decide together whether or not you should have additional heart testing.

Additional tests[1] may include:

- **A stress test** which views blood flow to your heart at rest and under stress.
- **A coronary CT angiogram** which takes pictures of the arteries in your heart to check for a blockage in the flow of blood.

[1]Stress test options include nuclear stress testing, ultrasound stress testing, or exercise ECG (electrocardiogram) stress testing. Nuclear stress testing and coronary CT angiography include exposure to radiation which has been shown to be related to increased cancer risk over a lifetime. Your doctor can help you explore which option may be best for you.

3 Your Personal Risk Evaluation

Your risk of having a heart or pre-heart attack within the next 45 days can be determined by comparing you to people with similar factors[2] who also came to the Emergency Department with chest pain.

Of every 100 people like you who came to the Emergency Department with chest pain...

1 had a heart or a pre-heart attack within 45 days of their Emergency Department visit,

99 did not.

4 Would you prefer to have additional heart testing during this emergency visit or decide later during an outpatient appointment?

- ❑ **I would like to have a stress test or coronary CT angiogram during my emergency visit.** I realize that this may increase the cost of my care and/or lengthen my stay.
- ❑ **I would like to be seen by a heart doctor within 24-72 hours** and would like assistance in scheduling this appointment.
- ❑ **I would like to schedule an appointment on my own** to consult with my primary care physician.
- ❑ **I would like my Emergency Department doctor to make this decision for me.**

[2]
- Age
- Gender
- Race
- If chest pain is made worse when manual pressure is applied to the chest area
- If there is a history of coronary artery disease
- If the chest pain causes perspiration
- Findings on electrocardiograms (electronic tracings of the heart)
- Initial cardiac troponin result

What's Next?

Prepared for: _____

1 Your Chest Pain Diagnosis

Your initial test results are **NEGATIVE for a heart attack**. These included:

- **Blood tests** to look for an enzyme called troponin that is released when the heart muscle is damaged. Additional troponin tests may be done to monitor you for heart attack during your emergency visit.
- **An electrocardiogram** to check whether your heart is getting enough oxygen and blood.

The chest pain you are experiencing today may be a warning sign of a FUTURE heart attack.

2 What You Can Do

Examining your risk will help you and your clinician decide together whether or not you should have additional heart testing.

Additional tests[1] may include:

- **A stress test** which views blood flow to your heart at rest and under stress.
- **A coronary CT angiogram** which takes pictures of the arteries in your heart to check for a blockage in the flow of blood.

3 Your Personal Risk Evaluation

Your risk of having a heart or pre-heart attack within the next 45 days can be determined by comparing you to people with similar factors[2] who also came to the Emergency Department with chest pain.

Of every 100 people like you who came to the Emergency Department with chest pain...

1 had a heart or a pre-heart attack within 45 days of their Emergency Department visit,

99 did not.

4 Would you prefer to have additional heart testing during this emergency visit or decide later during an outpatient appointment?

- ❑ **I would like to have a stress test or coronary CT angiogram during my emergency visit.** I realize that this may increase the cost of my care and/or lengthen my stay.
- ❑ **I would like to be seen by a heart doctor within 24-72 hours** and would like assistance in scheduling this appointment.
- ❑ **I would like to schedule an appointment on my own** to consult with my primary care physician.
- ❑ **I would like my Emergency Department doctor to make this decision for me.**

[1]Stress test options include nuclear stress testing, ultrasound stress testing, or exercise ECG (electrocardiogram) stress testing. Nuclear stress testing and coronary CT angiography include exposure to radiation which has been shown to be related to increased cancer risk over a lifetime. Your doctor can help you explore which option may be best for you.

[2]
- Age
- Gender
- Race
- If chest pain is made worse when manual pressure is applied to the chest area
- If there is a history of coronary artery disease
- If the chest pain causes perspiration
- Findings on electrocardiograms (electronic tracings of the heart)
- Initial cardiac troponin result

What's Next?

Prepared for: _____

1 Your Chest Pain Diagnosis

Your initial test results are **NEGATIVE for a heart attack**. These included:

- **Blood tests** to look for an enzyme called troponin that is released when the heart muscle is damaged. Additional troponin tests may be done to monitor you for heart attack during your emergency visit.
- **An electrocardiogram** to check whether your heart is getting enough oxygen and blood.

The chest pain you are experiencing today may be a warning sign of a FUTURE heart attack.

2 What You Can Do

Examining your risk will help you and your clinician decide together whether or not you should have additional heart testing.

Additional tests[1] may include:

- **A stress test** which views blood flow to your heart at rest and under stress.
- **A coronary CT angiogram** which takes pictures of the arteries in your heart to check for a blockage in the flow of blood.

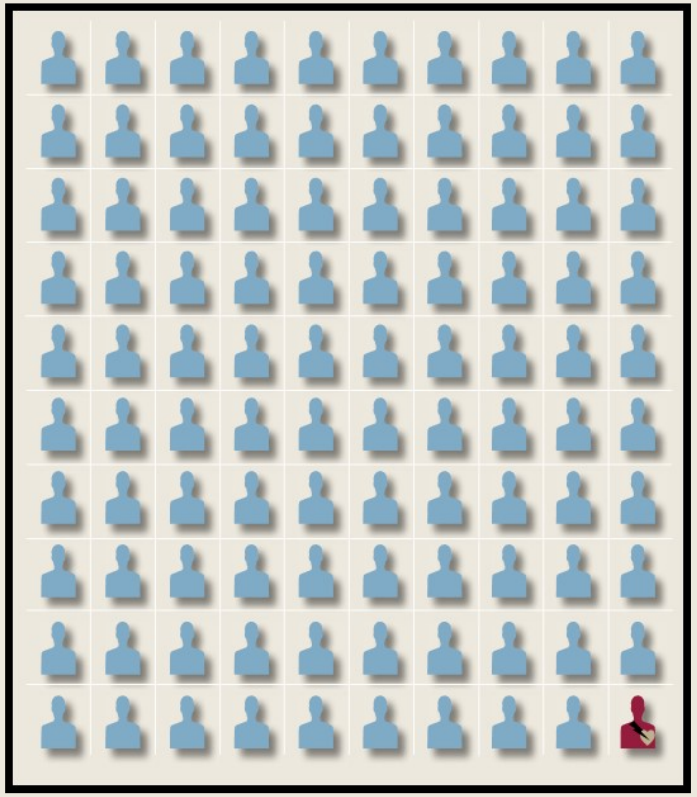
3 Your Personal Risk Evaluation

Your risk of having a heart or pre-heart attack within the next 45 days can be determined by comparing you to people with similar factors[2] who also came to the Emergency Department with chest pain.

Of every 100 people like you who came to the Emergency Department with chest pain...

1 had a heart or a pre-heart attack within 45 days of their Emergency Department visit,

99 did not.



4 Would you prefer to have additional heart testing during this emergency visit or decide later during an outpatient appointment?

- ❑ **I would like to have a stress test or coronary CT angiogram during my emergency visit.** I realize that this may increase the cost of my care and/or lengthen my stay.
- ❑ **I would like to be seen by a heart doctor within 24-72 hours** and would like assistance in scheduling this appointment.
- ❑ **I would like to schedule an appointment on my own** to consult with my primary care physician.
- ❑ **I would like my Emergency Department doctor to make this decision for me.**

[1] Stress test options include nuclear stress testing, ultrasound stress testing, or exercise ECG (electrocardiogram) stress testing. Nuclear stress testing and coronary CT angiography include exposure to radiation which has been shown to be related to increased cancer risk over a lifetime. Your doctor can help you explore which option may be best for you.

[2]
- Age
- Gender
- Race
- If chest pain is made worse when manual pressure is applied to the chest area
- If there is a history of coronary artery disease
- If the chest pain causes perspiration
- Findings on electrocardiograms (electronic tracings of the heart)
- Initial cardiac troponin result

What's Next?

Prepared for: _____

1 Your Chest Pain Diagnosis

Your initial test results are **NEGATIVE for a heart attack**. These included:

- **Blood tests** to look for an enzyme called troponin that is released when the heart muscle is damaged. Additional troponin tests may be done to monitor you for heart attack during your emergency visit.
- **An electrocardiogram** to check whether your heart is getting enough oxygen and blood.

The chest pain you are experiencing today may be a warning sign of a FUTURE heart attack.

2 What You Can Do

Examining your risk will help you and your clinician decide together whether or not you should have additional heart testing.

Additional tests[1] may include:

- **A stress test** which views blood flow to your heart at rest and under stress.
- **A coronary CT angiogram** which takes pictures of the arteries in your heart to check for a blockage in the flow of blood.

3 Your Personal Risk Evaluation

Your risk of having a heart or pre-heart attack within the next 45 days can be determined by comparing you to people with similar factors[2] who also came to the Emergency Department with chest pain.

4 Would you prefer to have additional heart testing during this emergency visit or decide later during an outpatient appointment?

- ❑ **I would like to have a stress test or coronary CT angiogram during my emergency visit.** I realize that this may increase the cost of my care and/or lengthen my stay.
- ❑ **I would like to be seen by a heart doctor within 24-72 hours** and would like assistance in scheduling this appointment.
- ❑ **I would like to schedule an appointment on my own** to consult with my primary care physician.
- ❑ **I would like my Emergency Department doctor to make this decision for me.**

Of every 100 people like you who came to the Emergency Department with chest pain...

1 had a heart or a pre-heart attack within 45 days of their Emergency Department visit,

99 did not.

[1]Stress test options include nuclear stress testing, ultrasound stress testing, or exercise ECG (electrocardiogram) stress testing. Nuclear stress testing and coronary CT angiography include exposure to radiation which has been shown to be related to increased cancer risk over a lifetime. Your doctor can help you explore which option may be best for you.

[2]
- Age
- Gender
- Race
- If chest pain is made worse when manual pressure is applied to the chest area
- If there is a history of coronary artery disease
- If the chest pain causes perspiration
- Findings on electrocardiograms (electronic tracings of the heart)
- Initial cardiac troponin result

Objective

Test the effectiveness of Chest Pain Choice in a pragmatic multicenter RCT

Methods

Design

Patient level RCT

Allocation concealed by password-protected, web-based randomization scheme

Dynamic randomization

1:1 ratio


Rochester,
Minnesota
Philadelphia,
Pennsylvania
Indianapolis,
Indiana
Sacramento,
California
Jacksonville,
Florida

Eligibility criteria

- **Inclusion**
  - Adults with chest pain considered for EDOU admission for stress testing or coronary CTA
- **Exclusion**
  - Ischemic ECG
  - Elevated troponin
  - Known CAD
  - Cocaine use within 72 hours
  - Unable to provide informed consent or use DA

Outcome measures

- Decision quality
  - Patient knowledge**
  - Degree of patient participation (OPTION scale)
  - Acceptability
- CV endpoints
  - Safety: 30-day MACE
  - Resource use
    - Admitted to EDOU for stress testing or coronary CT
    - 30-day rate of stress testing/coronary CT

Results

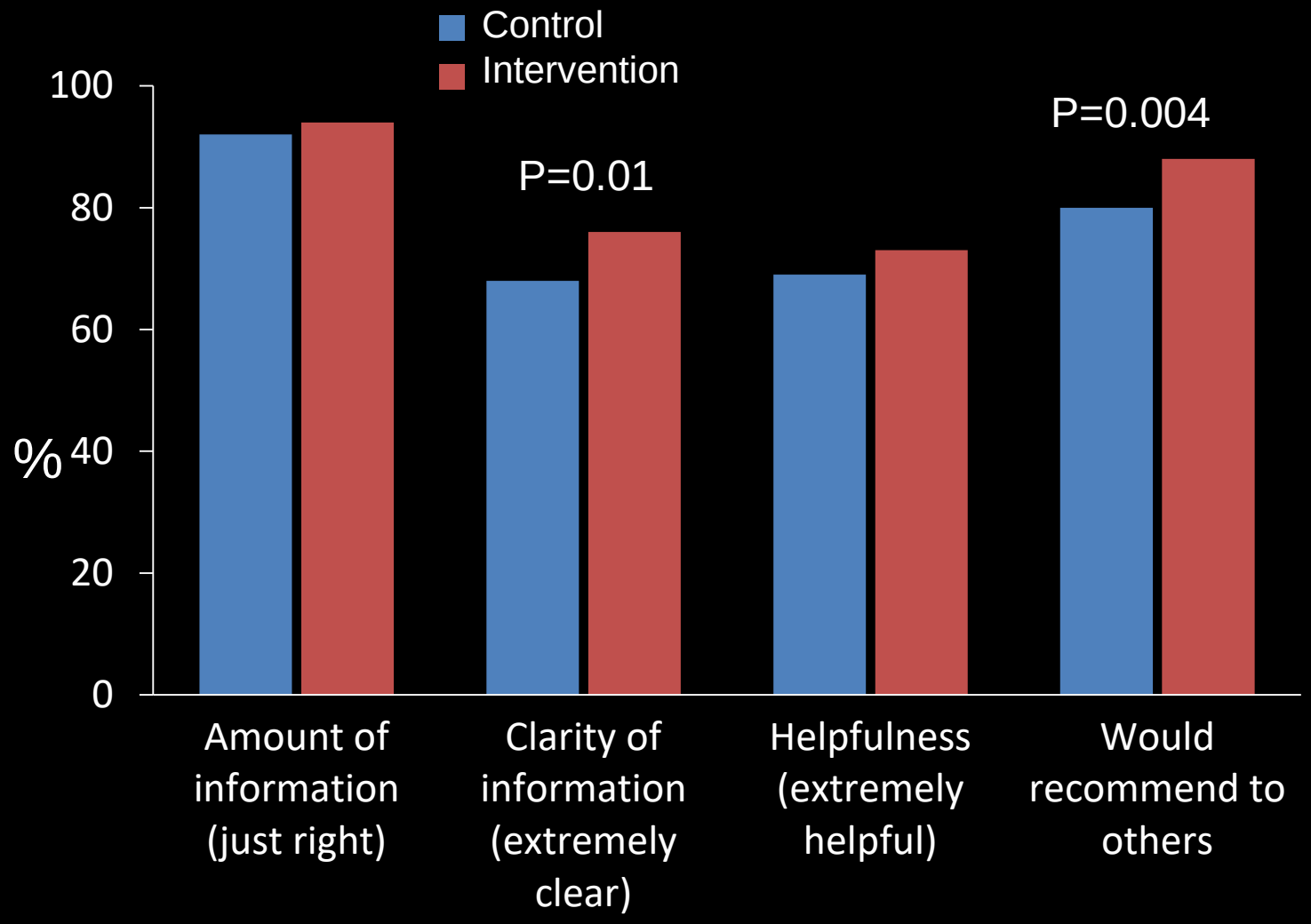
Baseline characteristics

Variable	Control (n=447)	Intervention (n=451)	P-value
Mean age	50.6	50.0	0.57
Female	58%	56.7	0.41
HTN	55%	1.0	0.70
Dislipidemia	69%	56.9	0.07
Family history of premature CAD	59%	25.4	0.62
Mean PTP of ACS	3.8%	3.6	0.46

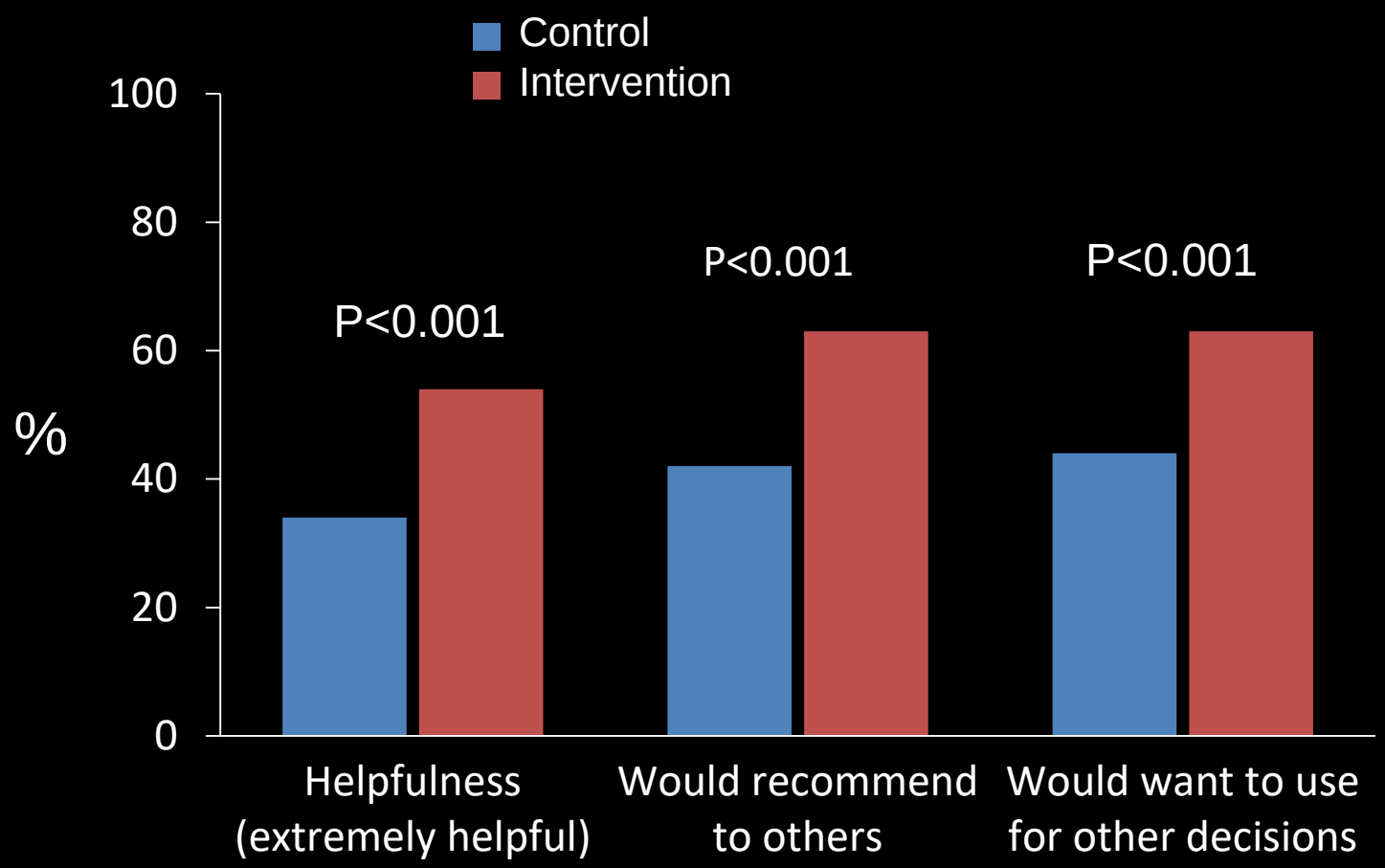
Knowledge and Engagement

Variable	Control (n=447)	Intervention (n=451)	P-value
Knowledge [Mean (SD)]	3.56 (1.50)	4.23 (1.54)	<0.001
Engagement (Option scale)	8	18	<0.001

Decision aid acceptability (patient)



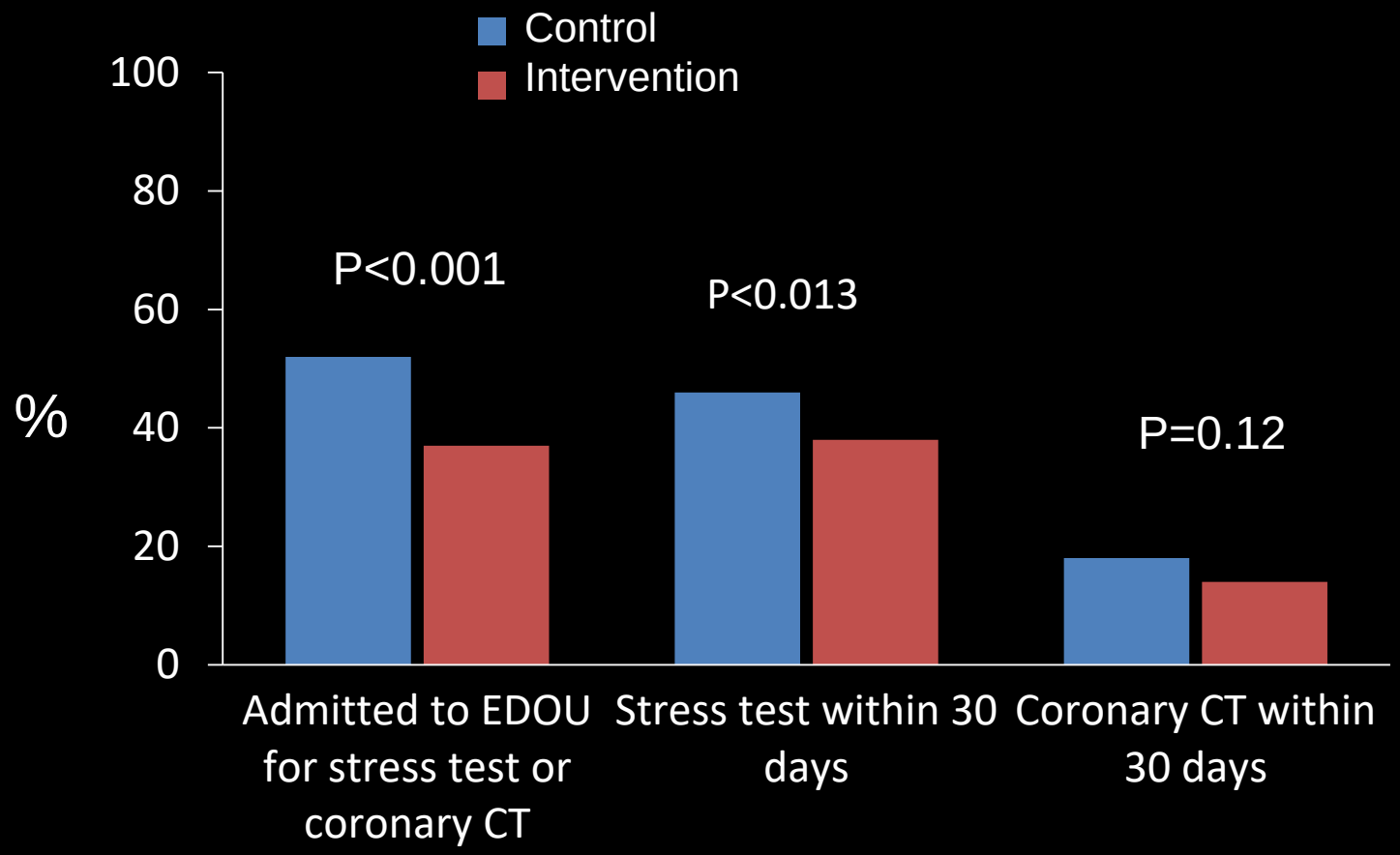
Decision aid acceptability (clinician)



Safety

Variable	Control (n=451)	Intervention (n=447)	P-value
AMI	1 (0%)	4 (1%)	1.0
Revascularization	4 (1%)	7 (2%)	0.37
Death	0 (0%)	0 (0%)	1.0
MACE within 30 days of discharge	0 (0%)	1 (0%)	1.0

Resource Use



Shared decision making in Chest Pain

(n=898)

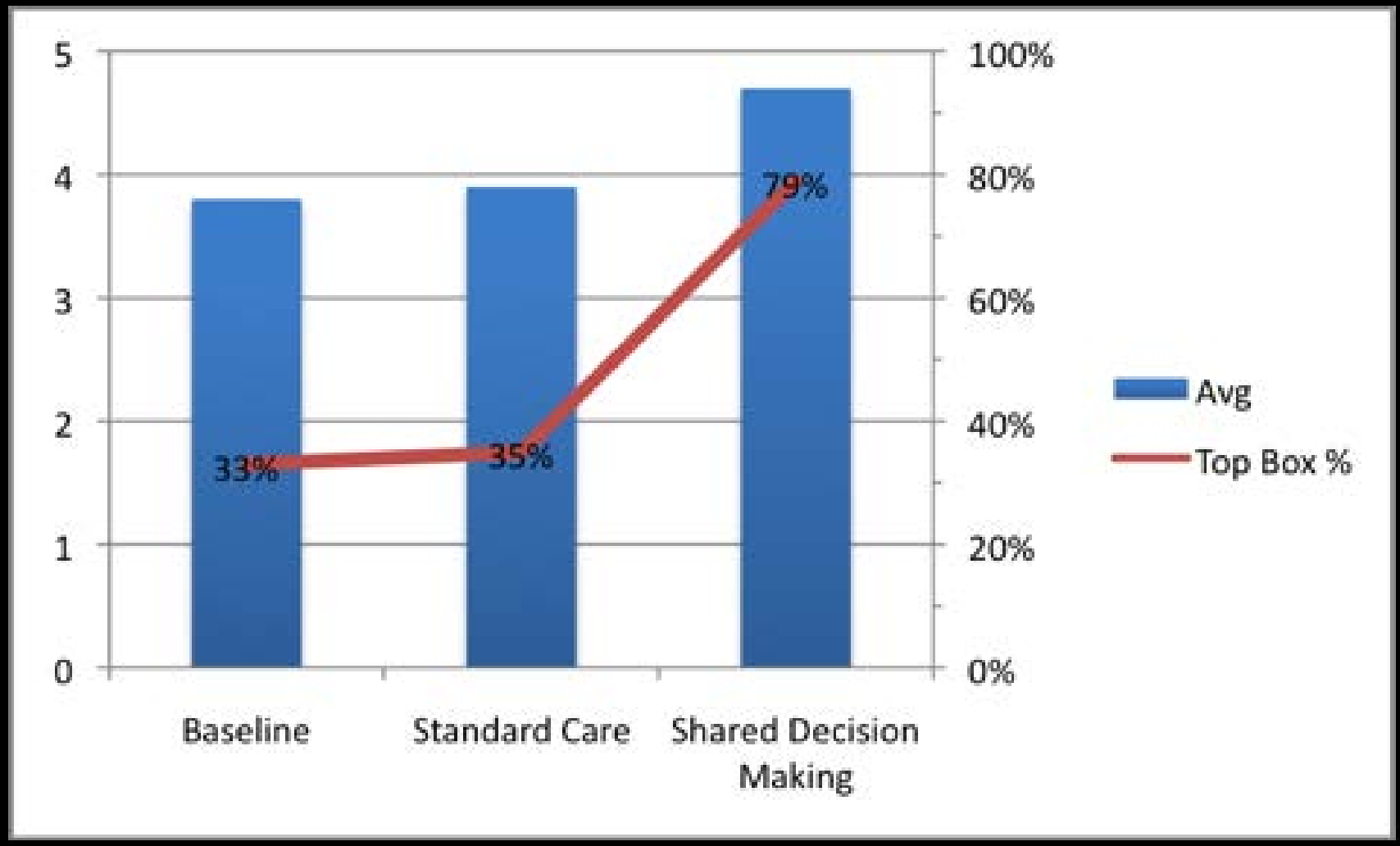
Outcome	Change
Patient knowledge	↑
Patient engagement	↑
Admitted for stress testing	↓ (15%)
Stress testing within 30 days	↓ (7%)
Provider experience	↑
Outpatient follow-up	↑
Safety	↔

BMJ 2016

What is the effect of SDM on ED clinician's perceived compassion?

Bellamkonda, Hess, Hess et al., Annals Emerg Med 2016

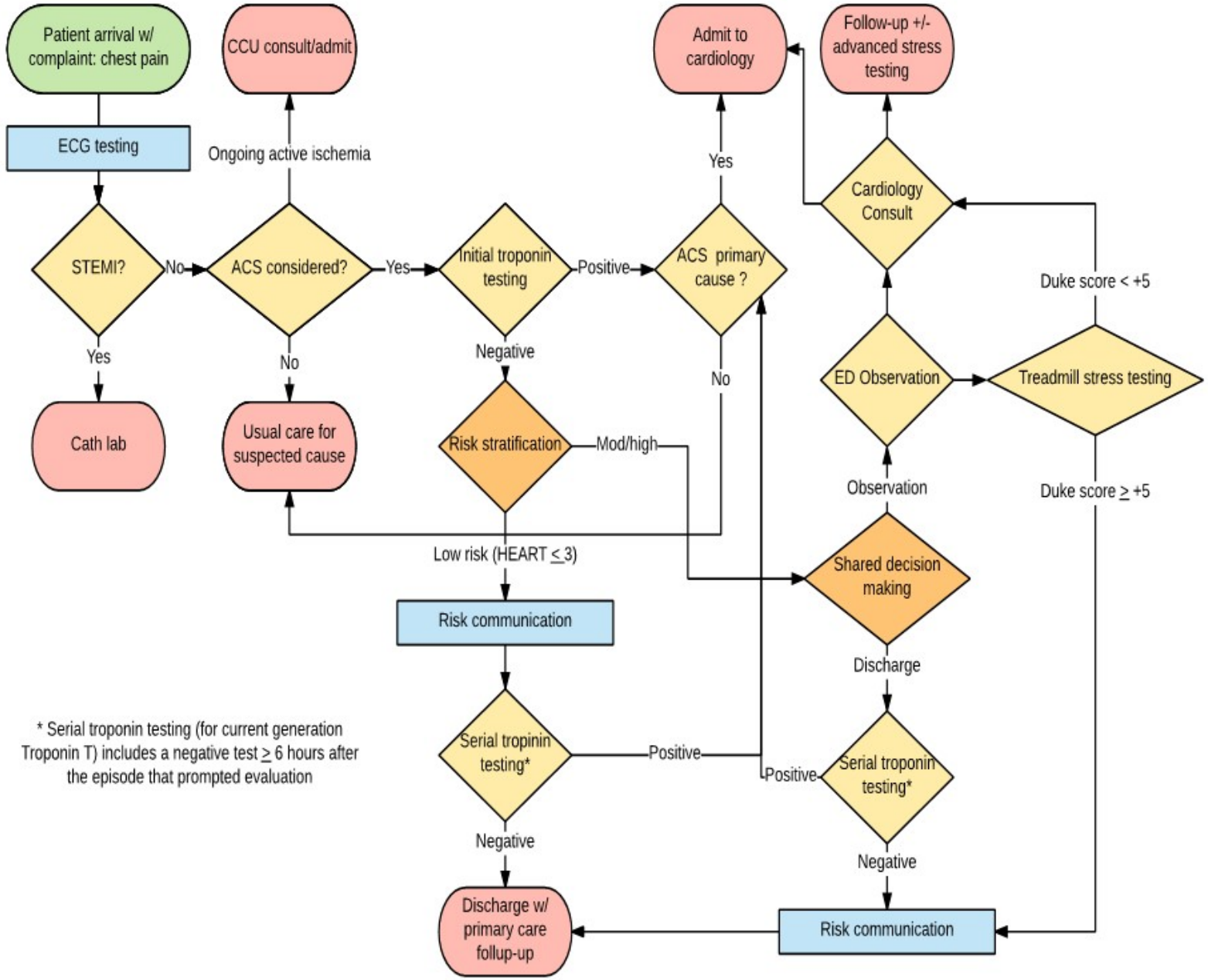
Point of service ratings of ED providers' concern and sensitivity



Patient Centered Chest Pain Pathway

Clinical scenario: "I developed left-sided chest pain at home while playing outside with my kids. It scared me – my dad died of a sudden cardiac death last year, when he was just 49 years old! I called my wife at work, and we decided to go to the emergency department to get checked out, leaving our kids with my wife's coworkers. My initial tests are negative – the ECG and blood work show no signs of a heart attack. My doctor tells me I am "low risk" but recommends I stay overnight for monitoring and further testing "just to be sure." But I need to go back to my kids! If I am "low risk," then why am I staying overnight? What is "low risk?" Based on my doctor's recommendation to stay overnight, my risk feels like 50/50."

– Michel Demers, patient representative and co-author, the Chest Pain Choice multicenter randomized trial.[1]


Patient arrival w/ complaint: chest pain
ECG testing
STEMI?
Yes
Cath lab
No
ACS considered?
No
Usual care for suspected cause
Yes
CCU consult/admit
Ongoing active ischemia
Initial troponin testing
Negative
Risk stratification
Mod/high
Low risk (HEART ≤ 3)
Positive
ACS primary cause ?
No
Yes
Admit to cardiology
Risk communication
Serial tropinin testing*
Positive
Negative
Discharge w/ primary care follup-up
Shared decision making
Discharge
Serial troponin testing*
Positive
Negative
Risk communication
Observation
ED Observation
Duke score < +5
Treadmill stress testing
Duke score ≥ +5
Cardiology Consult
Follow-up +/- advanced stress testing
* Serial troponin testing (for current generation Troponin T) includes a negative test ≥ 6 hours after the episode that prompted evaluation

E·QUAL | EMERGENCY QUALITY NETWORK

TCPi | Transforming Clinical Practices Initiative

American College of Emergency Physicians®

ADVANCING EMERGENCY CARE

E·QUAL | EMERGENCY QUALITY NETWORK

TCPi | Transforming Clinical Practices Initiative

American College of Emergency Physicians®
ADVANCING EMERGENCY CARE

What's Next for Sepsis Wave II?

- E-QUAL Portal

Activate your portal account by the end of June

- Questions? Contact the E-QUAL team at equal@acep.org