The Gray Zone:
Inside the mind of a triage hospitalist

Christian Silvio Greco, DO

May 10, 2019

Clinical Challenges in Hospital Medicine

Baltimore, MD

Disclosures

- None (sadly)

Purpose of this lecture

- *Delve* into the data behind a few commonly used scoring systems

- This lecture is NOT designed to convince practitioners to use these tools; rather, simply to discuss the data behind the tools often referenced and utilized during the inpatient vs. outpatient decision making process

Scoring tools

1. HEART Score (HEART Pathway)
2. CURB-65
3. San Francisco Syncope Score
4. PEDIS score

Complications of inpatient admission

Fall

- 5 % of inpatients with a recent ischemic stroke will fall as an inpatient
  - Schmid, Arlene A., et al. "Prevalence, predictors, and outcomes of poststroke falls in acute hospital setting." (2010).
- 10 % of older adults admitted to a geriatric psychiatric unit will fall
  - de Carle, A. John, and Robert Kohn. "Risk factors for falling in a psychogeriatric unit." *International journal of geriatric psychiatry* 16.8 (2001): 762-767.
- Hospitalized patients with cancer are also at especially high fall risk
  - Hendrich, Ann, et al. "Hospital falls: development of a predictive model for clinical practice." *Applied Nursing Research* 8.3 (1995): 129-139.
- 5 % of hospital may result in a serious injury
  - Schwendimann, René, et al. "Characteristics of hospital inpatient falls across clinical departments." *Gerontology* 54.6 (2008): 342-348.
- Persons experiencing a hip fracture during hospitalization have a greater risk of institutionalization and death
  - Murray, Geoffrey R., Ian D. Cameron, and Robert G. Cumming. "The consequences of falls in acute and subacute hospitals in Australia that cause proximal femoral fractures." *Journal of the American Geriatrics Society* 55.4 (2007): 577-582.
  - Neuman, Mark D., et al. "Survival and functional outcomes after hip fracture among nursing home residents." *JAMA internal medicine* 174.8 (2014): 1273-1280.

Infection

- VAP per 1000 ventilator-days decreased from 3.1 to 0.9… but risk still present
  - Edwards, Jonathan R., et al. "National Healthcare Safety Network (NHSN) report, data summary for 2006, issued June 2007." *American journal of infection control* 35.5 (2007): 290-301.
- The rate of nosocomial *C. difficile*–associated diarrhea in the United States doubled from 31 per 100,000 to 61 per 100,000 between 1996 and 2003
  - McDonald, L. Clifford, Maria Owings, and Daniel B. Jernigan. "Clostridium difficile infection in patients discharged from US short-stay hospitals, 1996–2003." *Emerging infectious diseases* 12.3 (2006): 409.
- *C. difficile* carriage occurs in 8 to 10 percent of adults residing in hospitals or long-term care facilities
  - McFarland, Lynne V., et al. "Nosocomial acquisition of Clostridium difficile infection." *New England journal of medicine* 320.4 (1989): 204-210.
  - Zacharioudakis, Ioannis M., et al. "Colonization with toxinogenic C. difficile upon hospital admission, and risk of infection: a systematic review and meta-analysis." *The American journal of gastroenterology* 110.3 (2015): 381.

DVT

- THA/ TKA population: DVT/ PE & VTE can occur in as high as 1%
  - Shahi, Alisina, et al. "The incidence and economic burden of in-hospital venous thromboembolism in the United States." *The Journal of arthroplasty* 32.4 (2017): 1063-1066.

Case #1: Mr. Cuore

- 66 yo M presented to the ED with CC of chest pain. PMHx: HTN, DM2, GERD, tobacco use (30 pyh), OSA and Obesity.
- The patient's chest pain was gradual in onset and 8/10. It was located in the center of his chest. It occurred while tinkering with his car in his garage not long after enjoying a delicious pasta putanesca made by his beautiful Italian wife. He paired this pasta with a 2013 Vino Nobile di Montipulciano (DOCG, of course).
- His pain is not worse with exertion and not relieved by rest. His wife, ever the protector, called EMS who arrived and promptly administered sublingual nitroglycerin which decreased his pain to a 2/10 and then took him to the hospital.
- The ED physicians called the admitting hospitalist after 3.5 hours after presentation to discuss the case. He has received ASA 324 mg PO x1 and had ½ inch of nitroglycerin paste put on his chest. His pain has completely resolved. His EKG showed non-specific ST wave changes. His troponin I is 0.05. The ED physician states that the patient has a HEART SCORE of 4 and he would like the patient to be admitted to the hospital for observation given his 20% risk of MACE.

Heart Score

- Backus et al (2008)
  - Retrospective cohort study of 122 patients with chest pain in an emergency department setting.
  - The study included any patients admitted to the emergency department due to chest pain (irrespective of age, pre-hospital assumptions, and previous medical treatments).
  - *It excluded patients with chest pain and significant ST segment elevations.*
  - Primary Endpoints (MACE)
    1. Acute myocardial infarction (AMI)
    2. Percutaneous coronary intervention (PCI)
    3. Coronary artery bypass graft (CABG)
    4. Death
- Scoring system
- HEART Scores Results
  - **0-3 points confer a risk of 2.5% (for any endpoint)**
    - discharged from the ED.
  - **4-6 points confer a risk of 20.3%**
    - admission for clinical observation is necessary
  - **≥7 points has a risk of 72.7%**
    - invasive strategies.

HEART Score (Scoring system)

History	**Slightly suspicious**		0
	Moderately suspicious		+1
	Highly suspicious		+2
EKG 1 point: No ST deviation but LBBB, LVH, repolarization changes (e.g. digoxin); 2 points: ST deviation not due to LBBB, LVH, or digoxin	**Normal**		0
	Non-specific repolarization disturbance		+1
	Significant ST deviation		+2
Age	**<45**	0	
	45-64	+1	
	≥65	+2	
Risk factors Risk factors: HTN, hypercholesterolemia, DM, obesity (BMI >30 kg/m^2), smoking (current, or smoking cessation ≤3 mo), positive family history (parent or sibling with CVD before age 65); atherosclerotic disease: prior MI, PCI/CABG, CVA/TIA, or peripheral arterial disease	**No known risk factors**		0
	1-2 risk factors		+1
	≥3 risk factors or history of atherosclerotic disease		+2
Initial troponin Use local assays and corresponding cutoffs	**≤normal limit**		0
	1–3× normal limit		+1
	>3× normal limit		+2

www.mdcalc.com

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HEART SCORE

- HEART SCORE validation
  - Backus et al (2010)
    - retrospective multicenter validation study with 880 patients presenting with chest pain were evaluated (*same* primary endpoints)
      - 0-3 (303 patients)… 3 cases (0.99%) resulted in a MACE
      - 4-6 (413 patients)… 48 cases (11.6%) resulted in a MACE
      - 7-10 (164 patients)… 107 cases (65.2%) resulted in a MACE
  - Backus et al 2013
    - Prospective multicenter study 2,440 (10 emergency departments in the Netherlands).
    - (*same* primary endpoints BUT within 6 weeks)
      - 0-3 (870 patients)… 15 cases (1.7 %) resulted in a MACE
      - 4-6 (1101 patients)… 183 cases (16.6%) resulted in a MACE
      - 7-10 (469 patients)… 235 cases (50.1%) resulted in a MACE

HEART SCORE

Annals of Internal Medicine®

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ORIGINAL RESEARCH | 16 MAY 2017

Effect of Using the HEART Score in Patients With Chest Pain in the Emergency Department: A Stepped-Wedge, Cluster Randomized Trial

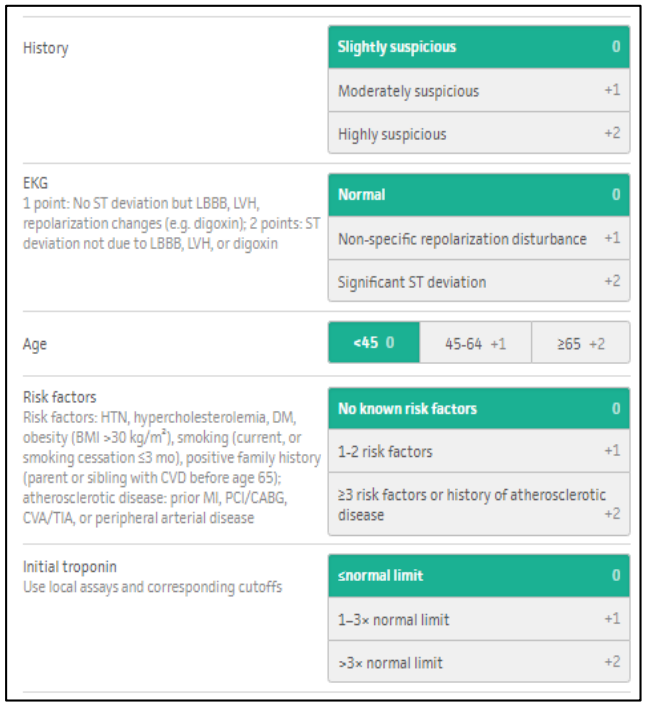
Judith M. Poldervaart, MD, PhD; Johannes B. Reitsma, MD, PhD; Barbra E. Backus, MD, PhD; Hendrik Koffijberg, PhD; Rolf F. Veldkamp, MD, PhD; Monique E. ten Haaf, MD; Yolande Appelman, MD, PhD; Herman F.J. Mannaerts, MD, PhD; Jan-Melle van Dantzig, MD, PhD; Madelon van den Heuvel, MD; Mohamed el Farissi, MD; Bernard J.W.M. Rensing, MD, PhD; Nicolette M.S.K.J. Ernst, MD, PhD; Ineke M.C. Dekker, MD; Frank R. den Hartog, MD; Thomas Oosterhof, MD, PhD; Ghizelda R. Lagerweij; Eugene M. Buijs, MD, PhD; Maarten W.J. van Hessen, MD, PhD; Marcel A.J. Landman, MD; Roland R.J. van Kimmenade, MD, PhD; Luc Cozijnsen, MD; Jeroen J.J. Bucx, MD, PhD; Clara E.E. van Ofwegen-Hanekamp, MD, PhD; Maarten-Jan Cramer, MD, PhD; A. Jacob Six, MD, PhD; Pieter A. Doevendans, MD, PhD; Arno W. Hoes, MD, PhD

- Poldervaart et al (2017)
  - stepped-wedge cluster randomized trial 3,648 patients were included
    - Directly compared *usual care* vs HEART SCORE decision making to the occurrence of MACE and utilization of the health care system
- Every six weeks, one hospital was randomly assigned to use the HEART Score to assess patients with chest pain.
  - 1,827 receiving usual care
  - 1,821 receiving HEART care
    - The 6 week MACE incidence while using the HEART Score was 1.3% lower than with usual care
    - In low-risk patients (score 0-3) the incidence of MACEs was 2.0%
      - FALSE NEGATIVE (previously 1%.. Average 1-2%)
    - No statistically significant differences in any of the following
      - early discharge
      - readmissions
      - recurrent emergency department visits
      - outpatient visits
      - visits to general practitioners.
      - Non-adherence occurred in 18% of the low risk patients, which is similar to non-adherence rates found by Mahler and colleagues

HEART SCORE

- Poldervaart et al (2017)
  - HEART SCORE vs TIMI vs GRACE scores
  - HEART SCORE more sensitive at capturing patients with 0.8% incidence of MACE in the low risk group.
- Nieuwets et al (2016)
  - HEART SCORE vs TIMI
  - The HEART Score identified more patients as low risk compared with the TIMI Score (this study enumerated cost savings)

HEART SCORE



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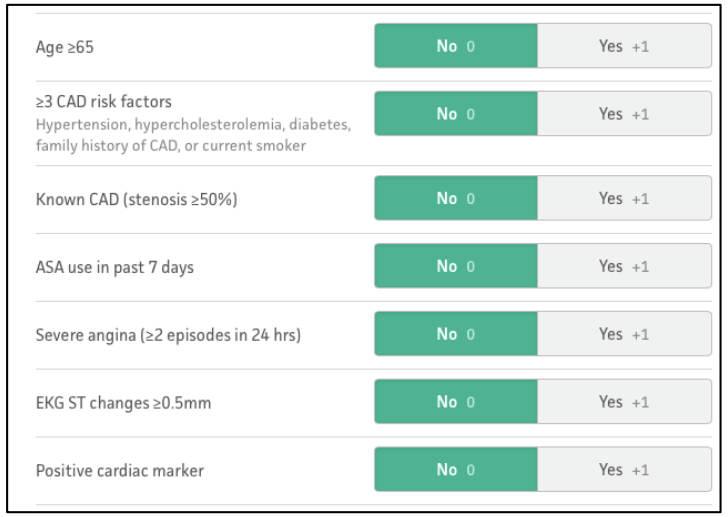
GRACE ACS Risk and Mortality Calculator

Age		years
Heart rate/pulse	Norm: 60 - 100	beats/min
Systolic BP	Norm: 100 - 120	mm Hg
Creatinine	Norm: 0.7 - 1.3	mg/dL ⇋
Cardiac arrest at admission	No	Yes
ST segment deviation on EKG?	No	Yes
Abnormal cardiac enzymes	No	Yes
Killip class (signs/symptoms)	No CHF	
	Rales and/or JVD	
	Pulmonary edema	
	Cardiogenic shock	

TIMI Risk Score



Age ≥65	**No** 0	Yes +1
≥3 CAD risk factors Hypertension, hypercholesterolemia, diabetes, family history of CAD, or current smoker	**No** 0	Yes +1
Known CAD (stenosis ≥50%)	**No** 0	Yes +1
ASA use in past 7 days	**No** 0	Yes +1
Severe angina (≥2 episodes in 24 hrs)	**No** 0	Yes +1
EKG ST changes ≥0.5mm	**No** 0	Yes +1
Positive cardiac marker	**No** 0	Yes +1

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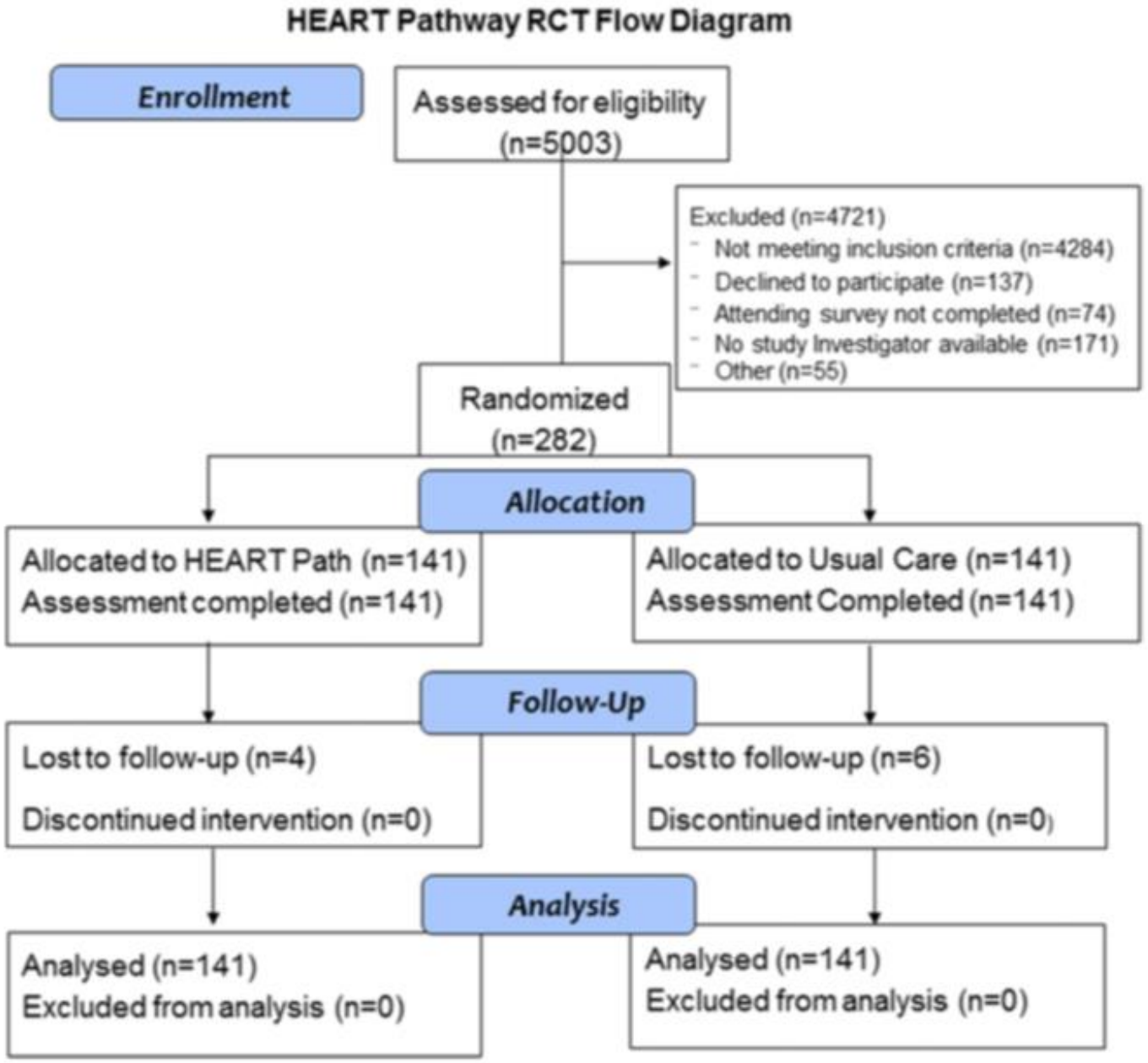
  - The HEART Score identified more patients as low risk compared with the TIMI Score (this study enumerated cost savings).

HEART Pathway

The HEART Pathway Randomized Trial
Identifying Emergency Department Patients With Acute Chest Pain for Early Discharge

Simon A. Mahler, MD, MS; Robert F. Riley, MD; Brian C. Hiestand, MD, MPH; Gregory B. Russell, MS; James W. Hoekstra, MD; Cedric W. Lefebvre, MD; Bret A. Nicks, MD; David M. Cline, MD; Kim L. Askew, MD; Stephanie B. Elliott, BS; David M. Herrington MD, MHS; Gregory L. Burke, MD; Chadwick D. Miller, MD, MS

- Mahler 2015
  - RCT with 282 participants
    - decision aid algorithm designed to identify ED patients with acute chest pain for *early* discharge
  - HEART Pathway & Serial trop vs Usual Care (ACA recs)
    - Decreased objective cardiac testing at 30 days
      - 12.1% (68.8% versus 56.7%; *P*=0.048)
    - Decreased LOS by 12 hours
      - (9.9 versus 21.9 hours; *P*=0.013)
    - Increased early discharges
      - 21.3% (39.7% versus 18.4%; *P*<0.001).
    - No patients identified for early discharge had major adverse cardiac events within 30 days.


HEART Pathway RCT Flow Diagram
Enrollment
Assessed for eligibility (n=5003)
Excluded (n=4721)
Not meeting inclusion criteria (n=4284)
Declined to participate (n=137)
Attending survey not completed (n=74)
No study Investigator available (n=171)
Other (n=55)
Randomized (n=282)
Allocation
Allocated to HEART Path (n=141)
Assessment completed (n=141)
Allocated to Usual Care (n=141)
Assessment Completed (n=141)
Follow-Up
Lost to follow-up (n=4)
Discontinued intervention (n=0)
Lost to follow-up (n=6)
Discontinued intervention (n=0)
Analysis
Analysed (n=141)
Excluded from analysis (n=0)
Analysed (n=141)
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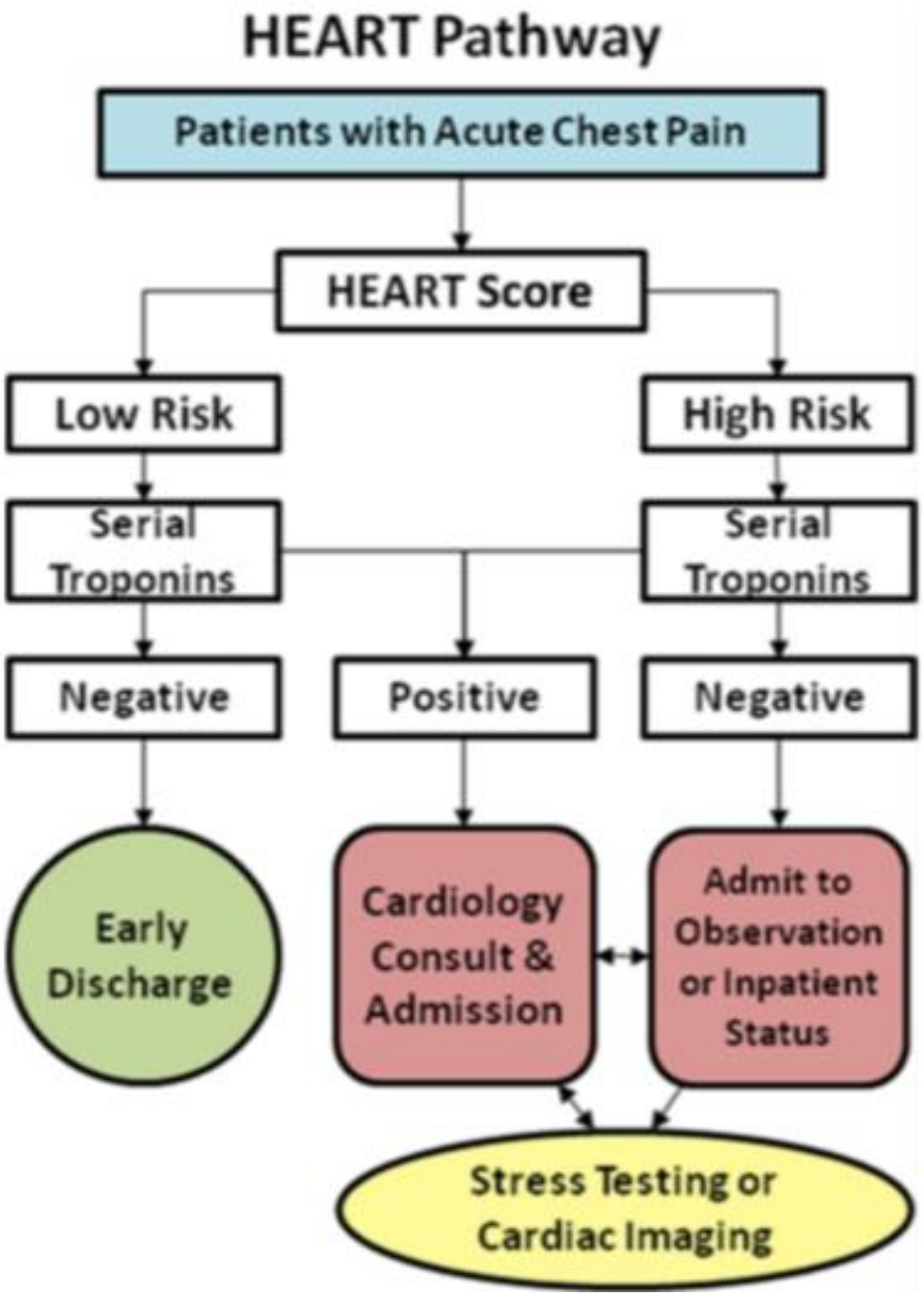
HEART Pathway
Patients with Acute Chest Pain
HEART Score
Low Risk
High Risk
Serial Troponins
Serial Troponins
Negative
Positive
Negative
Early Discharge
Cardiology Consult & Admission
Admit to Observation or Inpatient Status
Stress Testing or Cardiac Imaging

Mahler 2015

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Major Adverse Cardiac Events
(MACE)

1. Acute myocardial infarction
2. Percutaneous coronary intervention
3. Coronary artery bypass graft
4. Death (…not so good)

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HEART Pathway

- Mahler 2017
  - cardiac troponin (cTn) vs high sensitivity troponin (hs-cTn)
    - The HEART Pathway using hs-cTnT missed one MACE


American Journal of Emergency Medicine 35 (2017) 77–81

Contents lists available at ScienceDirect

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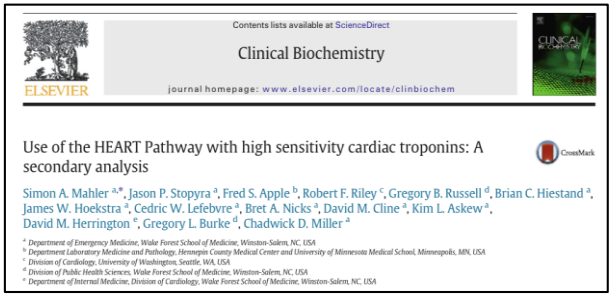
Original Contribution

Cost analysis of the *H*istory, *E*CG, *A*ge, *R*isk factors, and initial *T*roponin (HEART) Pathway randomized control trial☆,☆☆,★

Robert F. Riley, MD, MS [a,*], Chadwick D. Miller, MD, MS [b], Gregory B. Russell, MS [c], Erin N. Harper, MS [b], Brian C. Hiestand, MD [b], James W. Hoekstra, MD [b], Cedric W. Lefebvre, MD [b], Bret A. Nicks, MD [b], David M. Cline, MD [b], Kim L. Askew, MD [b], Simon A. Mahler, MD, MS [b]

[a] Division of Cardiology, University of Washington, Seattle, WA
[b] Department of Emergency Medicine, Wake Forest Baptist Health, Winston-Salem, NC
[c] Department of Biostatistical Sciences, Wake Forest University, Winston-Salem, NC

- Riley et al 2017
  - Cost of HEART Pathway vs Usual care
  - There was a significant reduction in cost for the HEART Pathway group at 30 days
    - median cost savings of $216 per individual


Contents lists available at ScienceDirect

Clinical Biochemistry

journal homepage: www.elsevier.com/locate/clinbiochem

Use of the HEART Pathway with high sensitivity cardiac troponins: A secondary analysis

Simon A. Mahler [a,*], Jason P. Stopyra [a], Fred S. Apple [b], Robert F. Riley [c], Gregory B. Russell [d], Brian C. Hiestand [a], James W. Hoekstra [a], Cedric W. Lefebvre [a], Bret A. Nicks [a], David M. Cline [a], Kim L. Askew [a], David M. Herrington [e], Gregory L. Burke [d], Chadwick D. Miller [a]

[a] Department of Emergency Medicine, Wake Forest School of Medicine, Winston-Salem, NC, USA
[b] Department Laboratory Medicine and Pathology, Hennepin County Medical Center and University of Minnesota Medical School, Minneapolis, MN, USA
[c] Division of Cardiology, University of Washington, Seattle, WA, USA
[d] Division of Public Health Sciences, Wake Forest School of Medicine, Winston-Salem, NC, USA
[e] Department of Internal Medicine, Division of Cardiology, Wake Forest School of Medicine, Winston-Salem, NC, USA

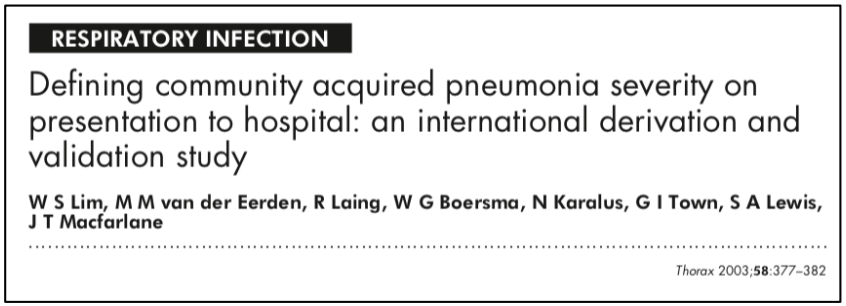
HEART SCORE Recap

- Scoring system
  - Equality
- Adequate assessment of pain
- Ruling in vs. ruling out
- Practicality

Case #2: Mrs. Polmonite

- 66 yo F presented to the ED with CC of cough with fever and yellow sputum production.
  - PMHx: COPD, tobacco use (10 cigarettes/ day; 20 pyh), HTN and Gout.
- The patient has been increasingly weak and fatigued. She has a hacking cough and yellow sputum production. She has had decreased appetite, malaise and occasional shaking chills. She is active: walking 1-2 miles >5x week with her husband and playing doubles tennis weekly with a group of friends. She was making pizzelles with her 3 grandchildren last weekend and says that one of them had a head cold.
  - Temp: 101.0*F; BP: 122/20; HR: 82; RR: 14; SpO2 92% RA
  - CXR: LLL opacity; Procalcitonin: 1.5
  - BMP: NA 146/ K 4.0/ Cl 106/ BC 22/ BUN 24/ Cr 0.7
- The ED physicians called the admitting hospitalist after 1.5 hours after presentation to discuss the case. The patient has received nebulizer treatments, empiric antibiotic coverage wit . The ED physician states that the patient has a CURB-65 SCORE of 2 and she would like the patient to be admitted to the hospital for observation.

CURB-65



RESPIRATORY INFECTION

Defining community acquired pneumonia severity on presentation to hospital: an international derivation and validation study

W S Lim, M M van der Eerden, R Laing, W G Boersma, N Karalus, G I Town, S A Lewis, J T Macfarlane

Thorax 2003;**58**:377–382

- Lim, 2003
  - Retrospective review of three prospective studies of CAP in in Europe which included 1068 patients.
  - A five-point score was developed to stratify patients into different treatment group based on mortality risk.
    1. Confusion
    2. Urea (>20)
    3. Respiratory rate (>30)
    4. Systolic blood pressure(systolic <90)
    5. Age >65

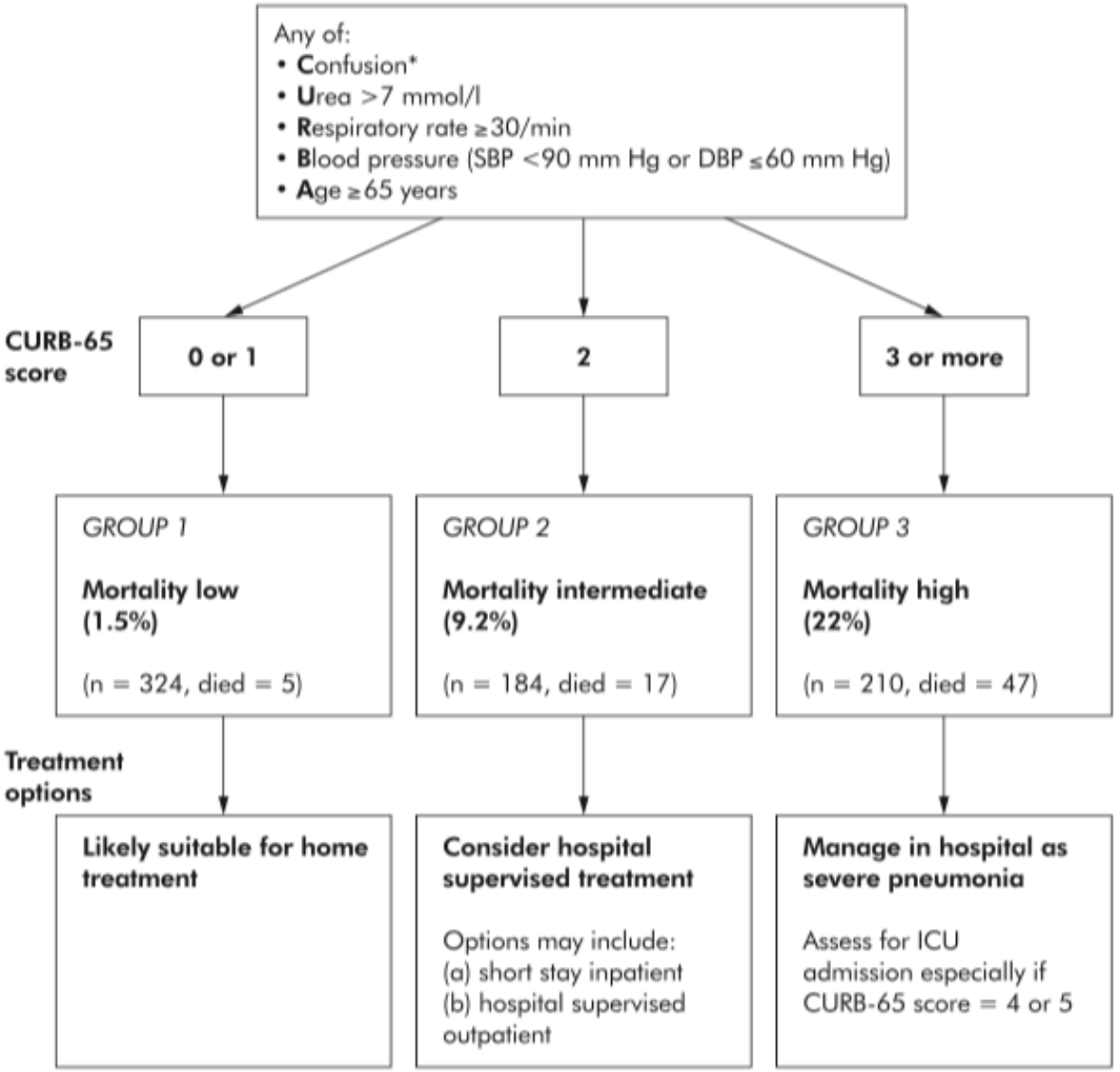
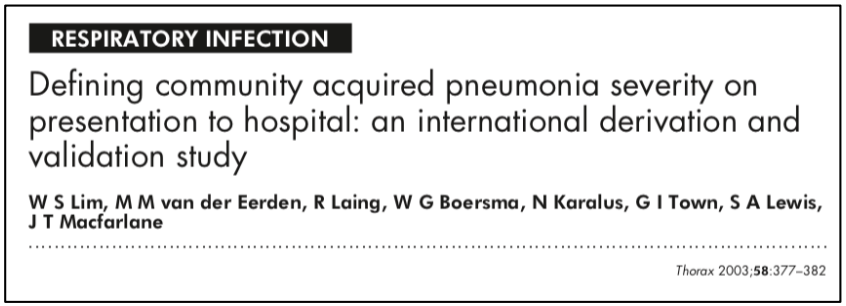


Figure 2 Severity assessment in a hospital setting: the CURB-65 score. One step strategy for stratifying patients with CAP into risk groups according to risk of mortality at 30 days when the results of blood urea are available.

CURB-65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    1. Confusion
    2. Urea (>20)
    3. Respiratory rate (>30)
    4. Systolic blood pressure(systolic <90)
    5. Age >65
- Results based on risk of 30 day mortality
  - Low risk (score 0-1): 1.5%
  - Moderate risk (score 2): 9.2%
  - High risk (score $\geq$3): 22%

CURB-65

Eur Respir J 2006; 27: 151–157
DOI: 10.1183/09031936.06.00062505

Validation of a predictive rule for the management of community-acquired pneumonia

A. Capelastegui*, P.P. España*, J.M. Quintana#, I. Areitio", I. Gorordo*, M. Egurrola* and A. Bilbao+

- Capelastegui et al, 2006
  - Retrospective review of a prospective, consecutive cohort of 1776 (1,100 inpatients and 676 outpatients).
- Simplified the CURB-65 score to the CRB-65 scoring system by evaluating patients without the use of laboratory data.
- This study *not only validated the work of Dr. Lim in 2003* but also suggested the lack of need of BUN for evaluation of patients with pneumonia to achieve the same negative predictive values.

TABLE 2 Mortality, use of mechanical ventilation, and hospital admission according to CURB-65 and CRB-65 (Confusion, Urea, Respiratory rate, Blood pressure, and age ⩾65 yrs) score

	Patients n	30-day mortality	Mechanical ventilation#	Admission to hospital
CURB-65 score				
0	629	0 (0)	0 (0)	153 (24.3)
1	377	4 (1.1)	2 (0.5)	247 (65.5)
2	474	36 (7.6)	9 (1.9)	406 (85.7)
3	224	47 (21)	4 (2)	222 (99.1)
4	62	26 (41.9)	2 (4.2)	62 (100)
5	10	6 (60)	1 (11.1)	10 (100)
Total	1776	119 (6.7)	18 (1)	1100 (61.9)
p-value		<0.001	<0.001	<0.001
CRB-65 score				
0	716	0 (0)	1 (0.1)	201 (28.1)
1	686	28 (4.1)	8 (1.2)	529 (77.1)
2	294	55 (18.7)	6 (2.2)	290 (98.6)
3	69	30 (43.5)	2 (3.9)	69 (100)
4	11	6 (54.6)	1 (10)	11 (100)
Total	1776	119 (6.7)	18 (1)	1100 (61.9)
p-value		<0.001	<0.001	<0.001

Data presented as n (%) and included all patients (both inpatients and outpatients). #: deaths from pneumonia as an expected terminal event of a chronic disabling illness excluded.

CURB-65

Eur Respir J 2006; 27: 151–157
DOI: 10.1183/09031936.06.00062505

Validation of a predictive rule for the management of community-acquired pneumonia

A. Capelastegui*, P.P. España*, J.M. Quintana#, I. Areitio", I. Gorordo*, M. Egurrola* and A. Bilbao+

- Capelastegui et al, 2006
  - Retrospective review of a prospective, consecutive cohort of 1776 (1,100 inpatients and 676 outpatients).
- Simplified the CURB-65 score to the CRB-65 scoring system by evaluating patients without the use of laboratory data.
- This study not only validated the work of Dr. Lim in 2003 but also suggested the lack of need of BUN for evaluation of patients with pneumonia to achieve the same negative predictive values.
- BUT…CURB-65 was more sensitive for negative outcomes

CURB-65


The American Journal of Medicine (2005) 118, 384-392

THE AMERICAN JOURNAL of MEDICINE®

CLINICAL RESEARCH STUDY

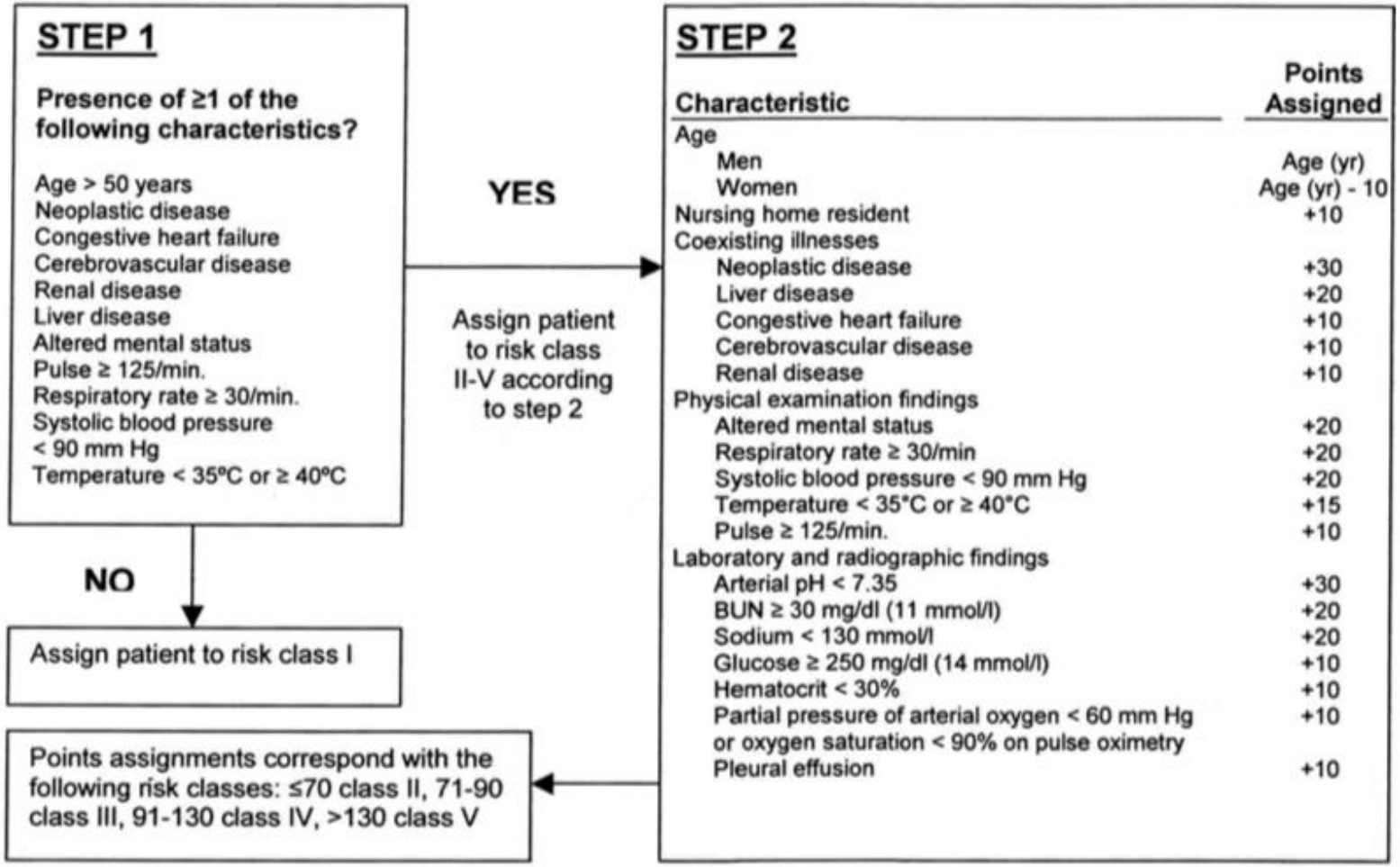
Prospective comparison of three validated prediction rules for prognosis in community-acquired pneumonia

Drahomir Aujesky, MD, MSc,[a,d] Thomas E. Auble, PhD,[b] Donald M. Yealy, MD,[b] Roslyn A. Stone, PhD,[c,d] D. Scott Obrosky, MSc,[a,d] Thomas P. Meehan, MD, MPH,[e,f] Louis G. Graff, MD,[e,g,h] Jonathan M. Fine, MD,[i] Michael J. Fine, MD, MSc[a,d]

- Aujesky 2005
  - Multicenter prospective study of 3181 patients with community-acquired pneumonia
  - Comparison of CURB 65 vs. CURB vs Pneumonia severity index
  - Assessed ability of these scoring systems to predict mortality 30 days after initial presentation
- Patients that fell in to low risk low risk classification based on score:
  - **PSI** (risk classes I-III) 68% [2152/3181])
  - CURB score <1 (51% [1635/3181])
  - CURB-65 score <2 (61% [1952/3181])
- Negative Predictive value of these scoring systems
  - PSI (1.4% [31/2152])
  - CURB (1.7% [28/1635])
  - CURB-65 (1.7% [33/1952])
    - PSI had a slightly higher sensitivity and a (somewhat) higher negative predictive value for mortality than either CURB score

Pneumonia Severity Index (PSI)

Panel A. Risk Class Assignment based on the Pneumonia Severity Index



Aujesky 2005

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- Aujesky 2005
  - 3181 patients with community-acquired pneumonia from 32 hospital emergency departments (January-December 2001)
  - Comparison of CURB 65 vs. CURB vs Pneumonia severity index
  - Assessed ability to predict mortality 30 days after initial presentation
- Patients that fell in to low risk low risk classification based on score:
  - PSI (risk classes I-III) 68% [2152/3181])
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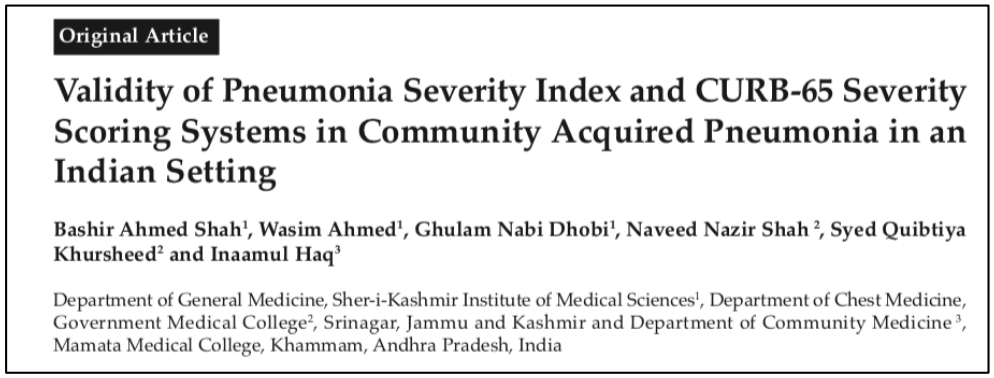
CURB-65



Original Article

Validity of Pneumonia Severity Index and CURB-65 Severity Scoring Systems in Community Acquired Pneumonia in an Indian Setting

Bashir Ahmed Shah[1], Wasim Ahmed[1], Ghulam Nabi Dhobi[1], Naveed Nazir Shah [2], Syed Quibtiya Khursheed[2] and Inaamul Haq[3]

Department of General Medicine, Sher-i-Kashmir Institute of Medical Sciences[1], Department of Chest Medicine, Government Medical College[2], Srinagar, Jammu and Kashmir and Department of Community Medicine [3], Mamata Medical College, Khammam, Andhra Pradesh, India

- Shah 2008
  - prospective study including 150 patients in India.
  - Evaluated patients in a single hospital setting and compared outcomes between the PSI and the CURB 65
  - CURB-65 class ≥3 had a higher specificity (74.6%) than PSI class ≥IV (52.2%) when used to predict death

CURB-65

Severity assessment criteria recommended by the British Thoracic Society (BTS) for community-acquired pneumonia (CAP) and older patients. Should SOAR (systolic blood pressure, oxygenation, age and respiratory rate) criteria be used in older people? A compilation study of two prospective cohorts

Phyo K. Myint[1,2,3], Ajay V. Kamath[4], Sarah L. Vowler[5], David N. Maisey[1], Brian D. W. Harrison[2,4]

- Myint, et al 2006
  - Multicenter compilation study of two prospective observational cohorts that studied 1068 patients
  - 30 day mortality was the major outcome measure
- Results
  - Validated the previous work of Lim/ Aujeski/Capelastegui
  - Noted the significant PPV and NPV of the SOAR criteria
  - Using SOAR criteria derived in this cohort appeared to be *as useful* as CURB, CURB-65 and CRB-65, and it *may* be potentially useful in situation where a pre-existing high urea level or background confusion is present.

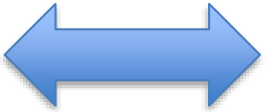
CURB-65

Table 3. Sensitivity, specificity, positive and negative predictive values and corresponding 95% confidence interval for new criteria SOAR (systolic blood pressure, oxygenation, age and respiratory rate) in 134 patients in predicting mortality

Score	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
≥0	100.0 (83.9–100.0)	0.0 (0.0–3.2)	15.7 (10.0–23.0)	NA
≥1	100.0 (83.9–100.0)	15.9 (9.7–24.0)	18.1 (11.6–26.3)	100.0 (81.5–100.0)
≥2	**81.0 (58.1–94.6)**	**59.3 (49.6–68.4)**	**27.0 (16.6–39.7)**	**94.4 (86.2–98.4)**
≥3	47.6 (25.7–70.2)	85.8 (78.0, 91.7)	38.5 (20.2–59.4)	89.8 (82.5–94.8)
≥4	14.3 (3.0–36.3)	100.0 (96.8–100.0)	100.0 (29.2–100.0)	86.3 (79.2–91.6)

CURB-65

1. Confusion
2. Urea >20
3. RR >30
4. SBP <90
5. Age >65



SOAR

1. SBP <90
2. Oxygenation Pa02:Fi02 ratio <250
3. Age >65
4. Respiratory rate >30

CURB-65

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CURB 65 Scoring system

Confusion	**No 0**	Yes +1
BUN > 19 mg/dL (> 7 mmol/L)	**No 0**	Yes +1
Respiratory Rate ≥ 30	**No 0**	Yes +1
Systolic BP < 90 mmHg or Diastolic BP ≤ 60 mmHg	**No 0**	Yes +1
Age ≥ 65	**No 0**	Yes +1

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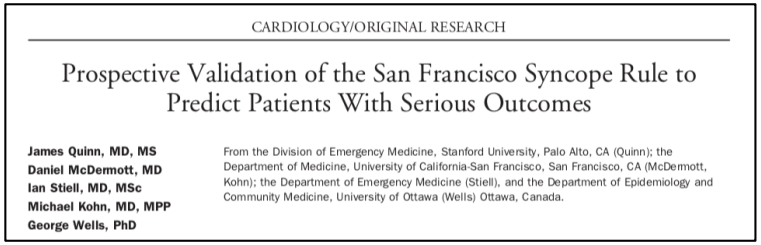
CURB 65 recap

- Scoring system equality
  - SOAR?
- Availability of data
- IP vs OP use

Case #3: Mr. Svenire

- 58yo M presented to the ED with CC of passing out earlier today.
  - PMHx: HTN, LVH and HFpEF and Gout.
- The patient states that he had a busy couple mornings prepping for his yearly sausage making party. He was so busy that he skipped his morning meal. He has been driving all over town for supplies. After loading all the groceries in to the house he sat down to rest a bit and mix all the spices.
- The next thing he knows his wife is shaking him and waking him up off the floor. He says it couldn't have been more that a few seconds after he passed out that she came in because she heard a "thump" on the floor. He immediately regained consciousness and had no confusion. He "feels a bit winded and beat" but is otherwise asymptomatic.
  - Temp: 98.0*F; BP: 138/80; HR: 82; RR: 14; SpO2 92% RA
  - EKG: NSR & LVH; BMP & CBC WNL
  - No evidence of CHF on exam
- The ED physicians called the admitting hospitalist after 2 hours after presentation to discuss the case. The patient has received 1 L NSS and appear to be NSR without events on telemetry. The ED physician states that the patient has a (+) San Francisco Syncope Score and she would like the patient to be admitted to the hospital for observation.

San Francisco Syncope Score



CARDIOLOGY/ORIGINAL RESEARCH

Prospective Validation of the San Francisco Syncope Rule to Predict Patients With Serious Outcomes

James Quinn, MD, MS
Daniel McDermott, MD
Ian Stiell, MD, MSc
Michael Kohn, MD, MPP
George Wells, PhD

From the Division of Emergency Medicine, Stanford University, Palo Alto, CA (Quinn); the Department of Medicine, University of California-San Francisco, San Francisco, CA (McDermott, Kohn); the Department of Emergency Medicine (Stiell), and the Department of Epidemiology and Community Medicine, University of Ottawa (Wells) Ottawa, Canada.

- Quinn et al 2006
  - Prospective cohort study which included 791 that was used to validate the San Francisco Syncope Rule (**CHESS**)
    - History of CHF, HCT <30%, abnormal ECG result [new changes or non–sinus rhythm], complaint of Shortness of breath,SBP <90 mm Hg at presentation
- Dichotomous scoring system that evaluates patients presenting with syncope defined as transient loss of consciousness with return to baseline neurologic function
- Short term serious outcomes measured
  - **Death, MI, arrhythmia, PE, Stroke, SAH, significant hemorrhage or anemia requiring transfusion.**
- Results
  - Rule positive: 52 serious outcomes out of 342
    - Fifty-three visits (6.7%) resulted in patients having serious outcomes that were undeclared during their ED visit.
    - The rule was 98% sensitive (95% confidence interval [CI] 89% to 100%) and 56% specific (95% CI 52% to 60%) to predict these events.
  - Rule negative: 1 serious outcome out of 371
    - Cardiac arrest in public at a pharmacy 2 weeks later (after evaluation by cardiology with PCI)
  - In this cohort, the San Francisco Syncope Rule classified 52% of the patients as high risk, potentially decreasing overall admissions by 7%.
  - If the rule had been applied only to the 453 patients admitted, it might have decreased admissions by 24%
  - Physician discretion was used as the primary criterion for admission to ED

San Francisco Syncope Score

Congestive heart failure history	No	Yes
Hematocrit <30%	No	Yes
EKG abnormal (EKG changed, or any non-sinus rhythm on EKG or monitoring)	No	Yes
Shortness of breath symptoms	No	Yes
Systolic BP <90 mmHg at triage	No	Yes

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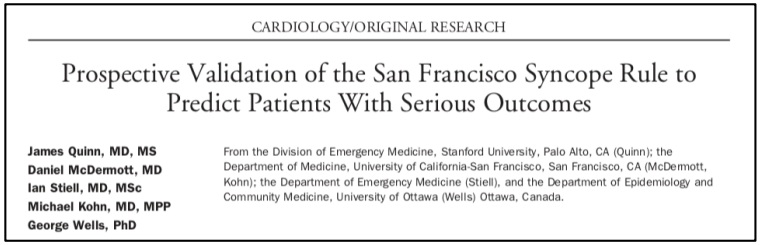
San Francisco Syncope Score



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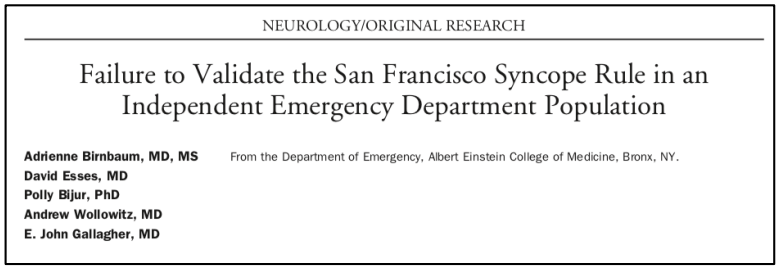

NEUROLOGY/ORIGINAL RESEARCH

Failure to Validate the San Francisco Syncope Rule in an Independent Emergency Department Population

Adrienne Birnbaum, MD, MS
David Esses, MD
Polly Bijur, PhD
Andrew Wollowitz, MD
E. John Gallagher, MD

From the Department of Emergency, Albert Einstein College of Medicine, Bronx, NY.

- Birnbaum et al, 2008
  - Single setting, prospective, observational cohort designed study 713 (of 743) patients
  - Primary outcomes within 7 days of the indexed ED visit
  - Serious outcome predicted by rule: 74% (45/61)
  - Serious outcome missed by rule: 26% (16/61)
    - "Missed" = missed by the scoring system, not the physician
  - Serious outcomes included the following:
    - 3 strokes
    - 1 subarachnoid hemorrhage
    - One patient required a blood transfusion for acute bleeding
    - 2 patients returned to the ED within 7 days and were admitted for related medical problems
    - 1 death
      - ventricular fibrillation/cardiac arrest, which occurred in a pharmacy soon after hospital discharge.
    - 8 arrhythmias
      - sinus pause requiring pacemaker placement
      - 2 cases of Mobitz II second-degree atrioventricular block requiring pacemakers
      - junctional bradycardia with pulse rate of 30 beats/min treated with a pacemaker
      - 2 cases of bradycardia requiring medication adjustment
      - 1 case of nonsustained ventricular tachycardia
      - 1 case of alternating periods of junctional arrhythmia and slow atrial fibrillation with pauses treated with a pacemaker

San Francisco Syncope Score


RESEARCH CMAJ

San Francisco Syncope Rule to predict short-term serious outcomes: a systematic review

Ramon T. Saccilotto MD, Christian H. Nickel MD, Heiner C. Bucher MD MPH, Ewout W. Steyerberg MSc PhD, Roland Bingisser MD, Michael T. Koller MD MSc

See related commentary by Parry at www.cmaj.ca/lookup/doi/10.1503/cmaj.111529

- Saccilotto et al, 2011
  - *Systemic review* of 12 studies with a total of 5316 patients
    - 596 (11%) experienced a serious outcome.
- The prevalence of serious outcomes across the studies varied between 5% and 26%.
- Pooled estimate:
  - **sensitivity**: **87%** (95% confidence interval [CI] 0.79–0.93)
  - **specificity** was **52%** (95% CI 0.43–0.62)…. half
    - There was substantial between-study heterogeneity (resulting in a 95% prediction interval for sensitivity of 0.55–0.98).
- Probability of a serious outcome given a negative score:
  - 5% or lower… but 2% or lower when the rule was applied only to patients for whom no cause of syncope was identified after initial evaluation in the ED.
- The most common cause of false-negative classification for a serious outcome was cardiac arrhythmia.

Table 2: Outcomes with false-negative classification by the San Francisco Syncope Rule

Study	No. of patients missed	Serious outcome in missed cases* (no. of patients)
Quinn et al.[3]	3	Troponin elevation < 2 μg/L (2), readmission without cause found (1)
Fischer et al.[25]	24	Stroke (6), hemorrhage requiring transfusion (5), symptomatic ventricular arrhythmia (3), intracranial hemorrhage (4), implantation of pacemaker (2), symptomatic bradyarrhythmia (1), hypoglycemia (1), central cord syndrome (1), not stated (1)
Stracner et al.[26]	6	Myocardial infarction (1), subarachnoid hemorrhage (1), arrhythmia (4)
Quinn et al.[4]	1	Negative result on cardiac evaluation (1)
Reed et al.[1]	0	No serious outcomes missed
Sun et al.[27]	6	Arrhythmia (1), ventricular tachycardia (1), supraventricular tachycardia (1), hypertrophic obstructive cardiomyopathy (1), stroke (1), cerebral hemorrhage (1)
Cosgriff et al.[28]	1	Sick sinus syndrome with implantation of pacemaker (1)
Birnbaum et al.[29]	16	Death (1), arrhythmia (8), stroke (3), subarachnoid hemorrhage (1), significant hemorrhage (1), return for admission to hospital (2)
Schladenhaufen et al.[30]	23	Arrhythmia (17) with implantation of pacemaker or defibrillator (11), return for admission to hospital (6), myocardial infarction (1), cerebral vascular accident (1)†
Thiruganasambandamoorthy et al.[31]	5	Arrhythmia (3), intervention (1), return for admission to hospital (1)
Diapola et al.[32]	5	Implantation of pacemaker (3), readmission to hospital (2)
Reed et al.[16]	6	Not stated

*As described in source article.
†Two patients experienced more than one serious outcome.

*variation in definition of arrhythmias

San Francisco Syncope Score recap

- Not able to be validated in several different single center studies
- Subjective criteria (SOB)
- High sensitivity but low (52% specificity)
- Cost savings: all admit criteria was related to physician discretion
- *Best if used when no suspected cause is known

Case #3: Mrs. Peidi

- 75 F presented to her PCP Dr. Donzella with CC of redness on the top of her foot.
  - PMHx: HTN, IDDM2 with subsequent neuropathy, PAD, tobacco abuse (40 PYH) and hypothyroidism.
- The patient states that she has had a rather uneventful week until she began to feel increasingly week and fatigued two days ago. She and her husband went about their usual routines cleaning the house in preparation for the weekly huge Italian Sunday dinner (which means she is cooking like crazy while sits on the couch and watches football). After dinner she had some shaking chills that persisted overnight. she noticed the foot early in the AM. She feels no pain.
  - Temp: 100.8*F; BP: 115/80; HR: 87; RR: 14; SpO2 92% RA
  - 2cm open/ draining DM foot ulcer that looks “superficial” with some associated erythema/ induration
- The Dr. Donzella calls me from his office for a direct admit to the hospital and states this lady has a PEDIS score of 7 and he would like to have her admitted to the hospital for evaluation by a multidisciplinary team.

Diabetic Foot Ulcers

RESEARCH ARTICLE

Reliability and Validity of the Perfusion, Extent, Depth, Infection and Sensation (PEDIS) Classification System and Score in Patients with Diabetic Foot Ulcer

Fengning Chuan, Kang Tang, Peng Jiang, Bo Zhou*, Xiaoqun He

Department of Endocrinology, the First Affiliated Hospital of Chongqing Medical University, Chongqing, China

* zhoubo915@126.com

- Chuan et al, 2015
  - Retrospective, single center, cohort study with 364 patients
- Diabetic foot ulcers
  - full-thickness wound, skin necrosis or gangrene below the ankle induced by peripheral neuropathy or peripheral arterial disease in patients with diabetes
- PEDIS classification system
  - Perfusion Extent: 0 (no PAD; +1 (PAD); +2 (PAD with critical limb ischemia)
  - Extent: 0 (skin intact); +1 (<1cm); +2 (1-3cm); +3 (>3)
  - Depth: 0 (skin intact); +1 (superficial); +2 (fas/mm/tendon); +3 (bone)
  - Infection: 0 (none); +1 (surface); +2 (abscess/ fasciitis/SA); +3 (SIRS)
  - Sensation: 0 (sensation intact); +1 (loss of sensation)
- Dichotomous scoring system of High vs Low risk
  - Score $\geq$7 were 82% specific for nonhealing ulcer, need for amputation or death at 6 months

PEDIS Scoring Sytem

Perfusion	**No peripheral arterial disease**	**0**
	Peripheral arterial disease, no critical limb ischemia	+1
	Critical limb ischemia	+2
Extent	**Skin intact**	**0**
	<1 cm^2	+1
	1–3 cm^2	+2
	>3 cm^2	+3
Depth Evaluate using sterile blunt nasal probe and imaging tests	**Skin intact**	**0**
	Superficial	+1
	Fascia, muscle, tendon	+2
	Bone or joint	+3
Infection	**None**	**0**
	Surface	+1
	Abscess, fasciitis, and/or septic arthritis	+2
	Systemic inflammatory response syndrome	+3
Sensation	**Sensation intact**	**0**
	Loss of sensation	+1

www.medcalc.com

PEDIS recap

- Easy OP scoring system to know when to *activate* the multidisciplinary team

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