

Risk Evaluation in Acute Heart Failure

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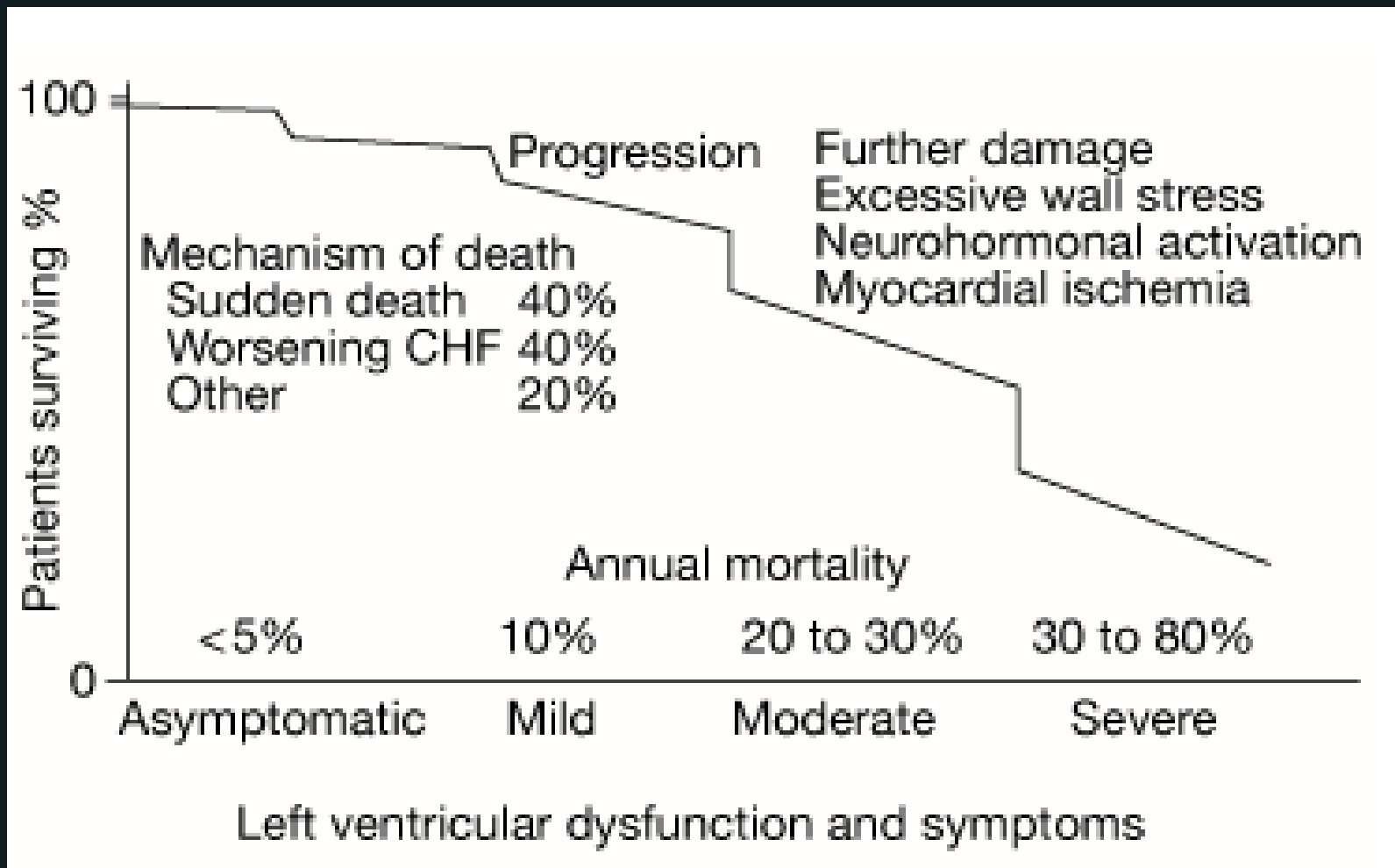
Relevant Disclosures

- None

Objectives

- To discuss key issues surrounding “prognosis” in acute HF
- To compare and contrast existing acute HF risk stratification tools
- To present a streamlined approach to risk stratification and disposition of patients with acute HF

Why Do We Know About HF?



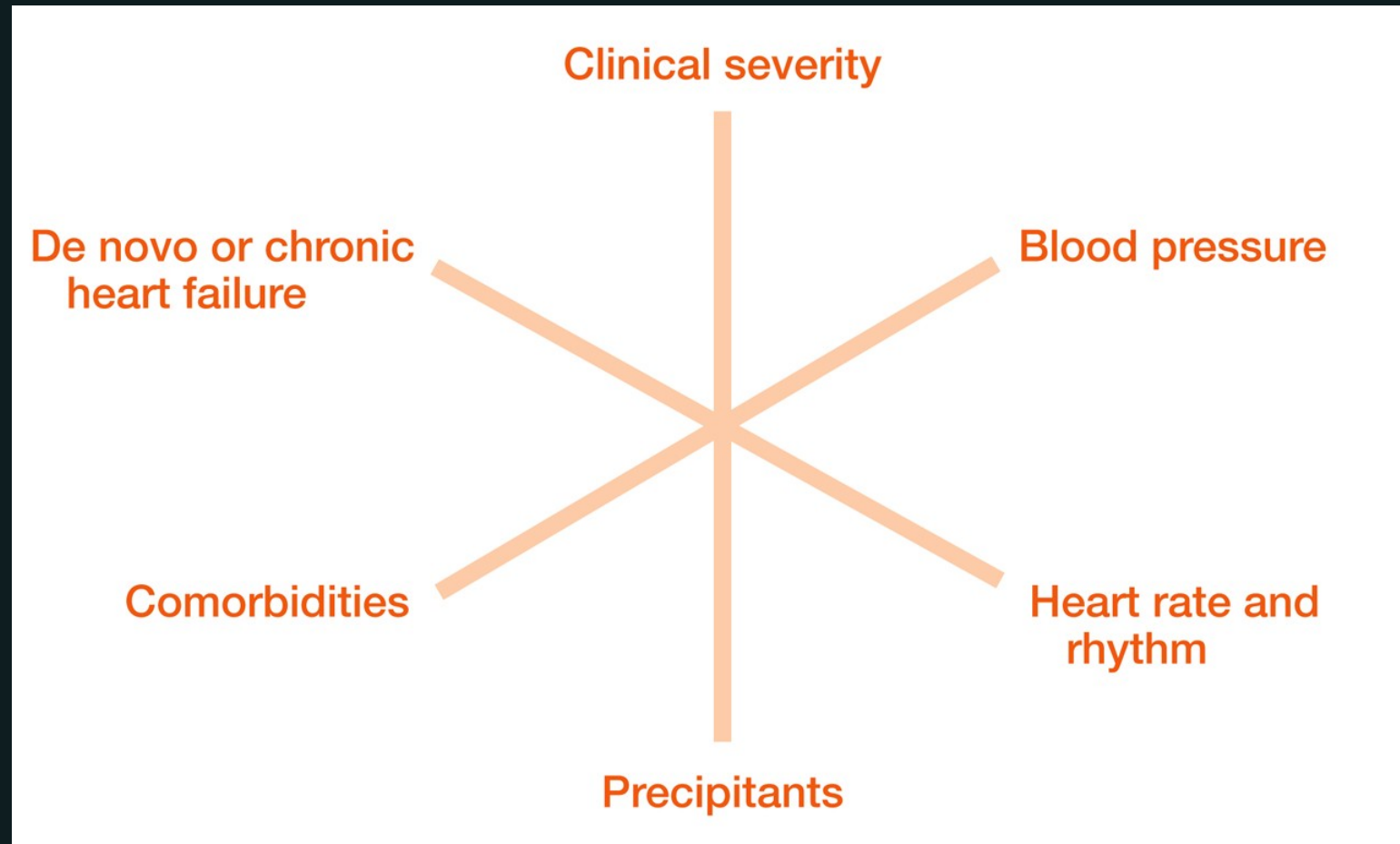
Goals of Risk Evaluation?

- Get the right treatment to the right patient at the right time
- Avoid bad outcomes!

A Proposed Model for Initial Assessment and Management of Acute Heart Failure Syndromes

Mihai Gheorghiade, MD

Eugene Braunwald, MD



Goals of Risk Evaluation?

- Get the right treatment to the right patient at the right time
- Avoid bad outcomes!

What Outcomes?

- Major adverse cardiac event
 - Death
 - AMI
 - Urgent revascularization
- In-hospital complications
 - Worsening symptoms
 - Cardiorenal injury
 - Unstable rhythm or labile BP
- Readmission
 - Days out of hospital and alive

Attributable Time Frame

- Pre-hospital (?)
- In-hospital
- Post-discharge
 - 3 to 7 days
 - 30 days
 - 90 days
 - 180 days
 - 1 year

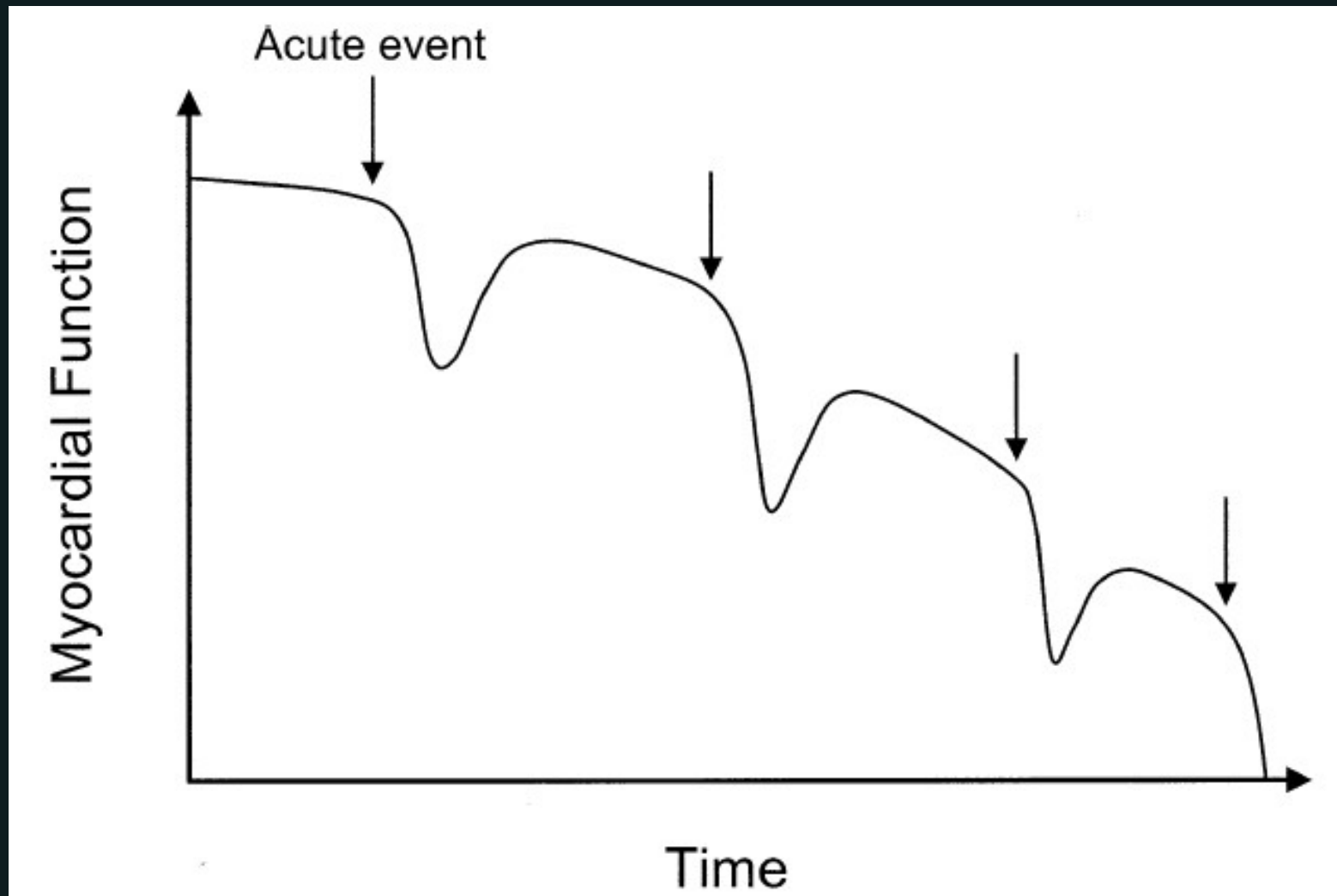
Acute Heart Failure Syndromes: Emergency Department Presentation, Treatment, and Disposition: Current Approaches and Future Aims

A Scientific Statement From the American Heart Association

Neal L. Weintraub, MD, Chair; Sean P. Collins, MD, MSc, Co-Chair; Peter S. Pang, MD; Phillip D. Levy, MD, MPH; Allen S. Anderson, MD; Cynthia Arslanian-Engoren, PhD, RN, FAHA; W. Brian Gibler, MD, FAHA; James K. McCord, MD; Mark B. Parshall, PhD, RN; Gary S. Francis, MD, FAHA; Mihai Gheorghiade, MD; on behalf of the American Heart Association Council on Clinical Cardiology and Council on Cardiopulmonary, Critical Care, Perioperative and Resuscitation

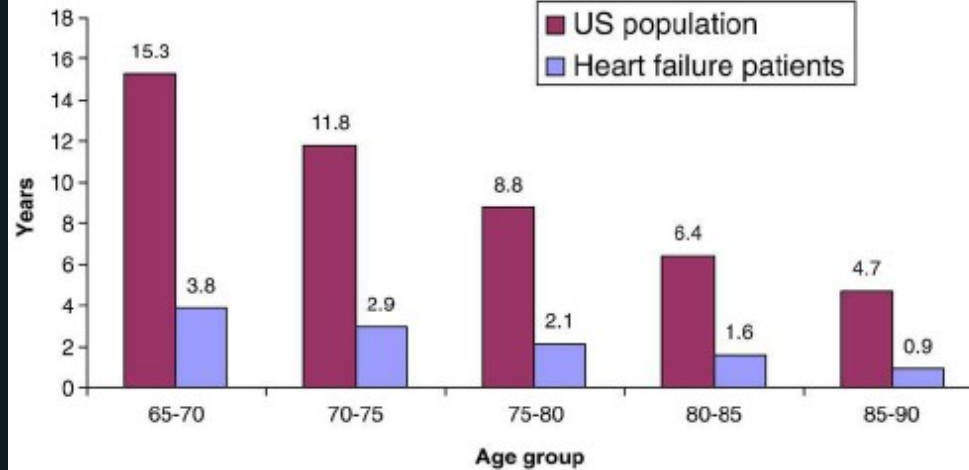
	ACS	AHFS
Incidence	1 million/y	1 million/y
Mortality		
Prehospital	High	?
In-hospital	3%–4%	3%–4%
60–90 d	2%	10%
Targets of therapy	Clearly defined-thrombolysis	Unclear
Clinical trial results	Beneficial	Minimal, no benefit, harmful
ACC/AHA Guidelines	Level A	Minimal level A/B, mostly C

Acute HF Survival Trajectory

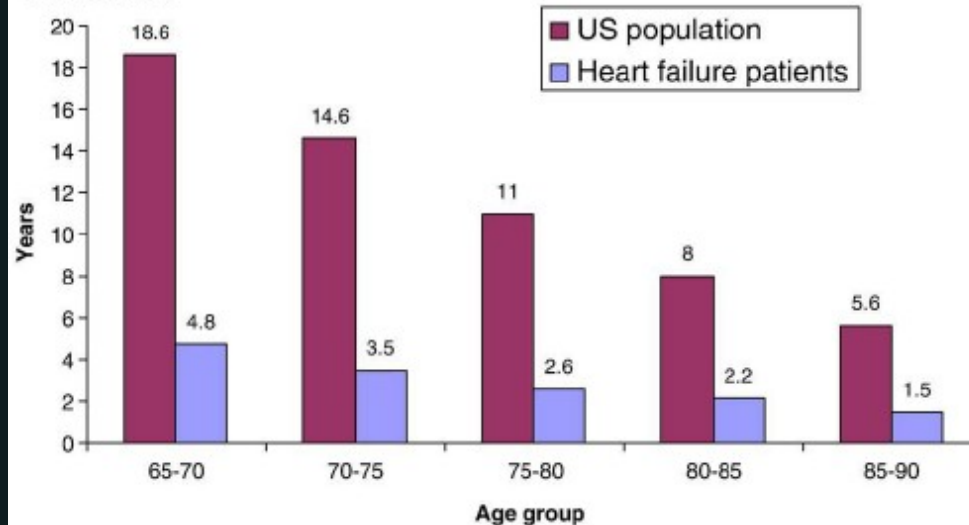


Median Survival

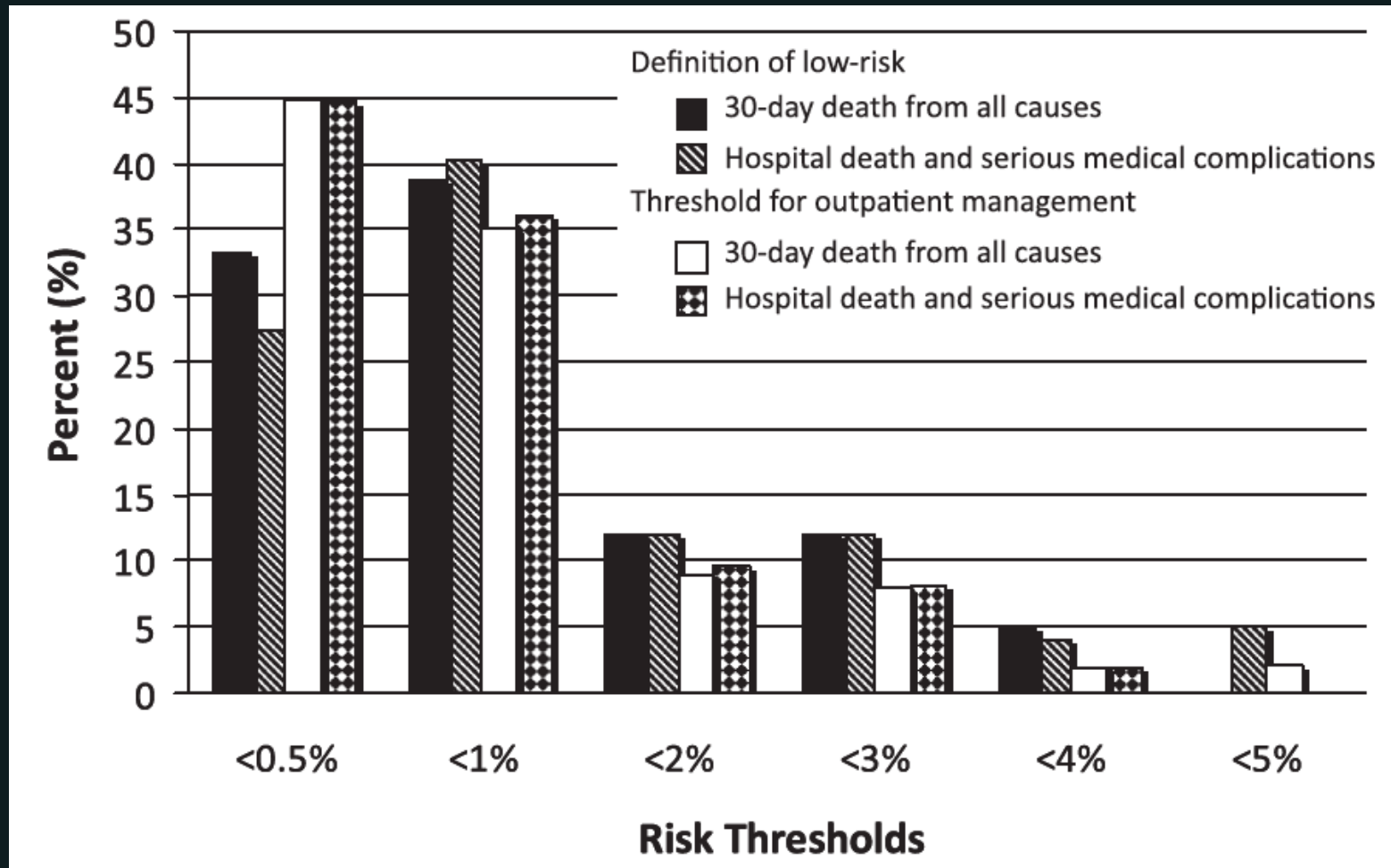
A. Male



B. Female



Who Do Emergency Physicians Consider “Safe” for Discharge?



Net Result?

- ~ 80% admitted to the hospital
 - Many to monitored beds

Driven By...

- Clinical inertia and apathy
 - Path of least resistance
- Fear
 - Incomplete understanding of risk

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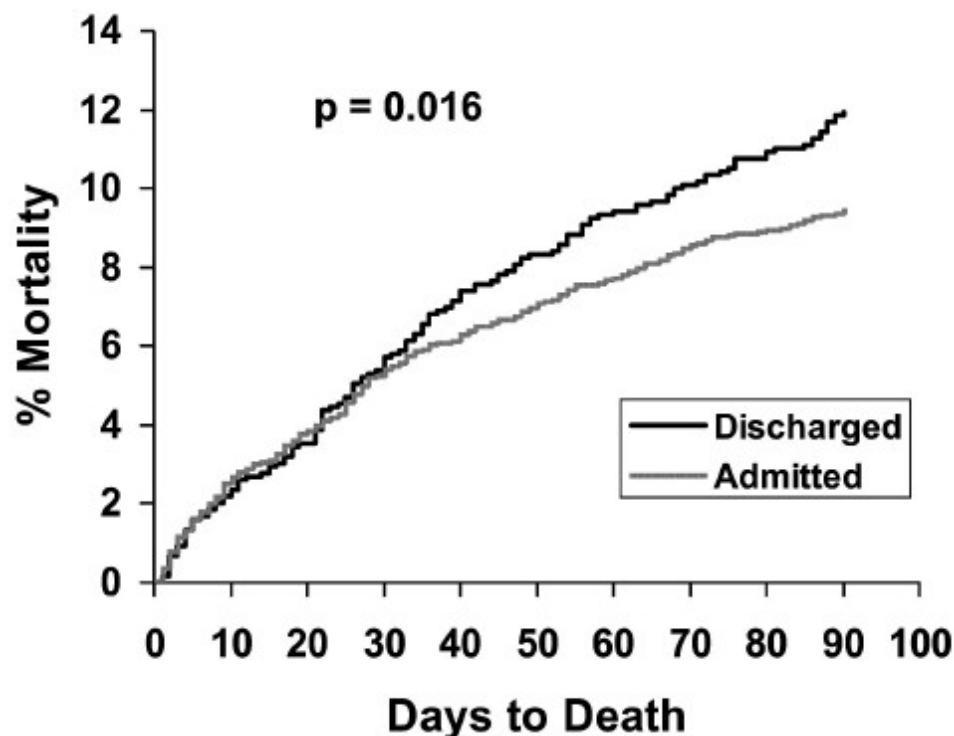
Can We Improve Decision Making?

- Definitive criteria lacking with limited direction as to who should go where
 - Home
 - Observation unit
 - Full inpatient admission
 - Monitored setting
 - Telemetry
 - CCU or ICU
 - NIPPV, ETI, ACS, IV vasoactive meds

Early Deaths in Patients With Heart Failure Discharged From the Emergency Department

A Population-Based Analysis

Douglas S. Lee, MD, PhD; Michael J. Schull, MD, MSc; David A. Alter, MD, PhD; Peter C. Austin, PhD; Andreas Laupacis, MD, MSc; Alice Chong, BSc; Jack V. Tu, MD, PhD; Thérèse A. Stukel, PhD



30-Day Mortality Predictors	Wald χ^2	Adjusted OR (95% CI)	P
Age, per 10 y*	63.2	1.45 (1.32–1.59)	<0.001
Male sex*	15.3	1.41 (1.19–1.67)	<0.001
Mode of arrival			
Paramedic vs ambulatory*	151.1	3.17 (2.64–3.81)	<0.001
Triage code			
High vs low acuity	11.4	0.63 (0.49–0.83)	<0.001
Medium vs low acuity	5.0	0.77 (0.61–0.97)	0.025
No. previous HF admissions			
1 vs 0	0.2	1.06 (0.82–1.37)	0.632
≥ 2 vs 0*	7.7	1.64 (1.14–2.31)	0.006
Valvular and rheumatic heart disease	4.2	1.37 (1.00–1.84)	0.041
Peripheral vascular disease	4.2	1.41 (1.00–1.93)	0.041
Dementia*	21.6	1.96 (1.47–2.60)	<0.001
Respiratory disease	7.3	1.33 (1.08–1.63)	0.007
Renal disease	3.5	1.27 (0.99–1.63)	0.060
Metastatic cancer*	40.6	4.60 (2.81–7.23)	<0.001
Length of stay in ED, per 5 h*	20.9	1.10 (1.05–1.14)	<0.001

*Also a predictor of 7-day mortality.

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Society of Chest Pain Centers Recommendations for the Evaluation and Management of the Observation Stay Acute Heart Failure Patient

Inclusion criteria	Recommended	Suggested
Blood pressure	SBP>100 mm Hg	SBP>120 mm Hg
Respiratory rate	< 32 breaths/min	NR
Renal function	BUN<40 mg/dL Creatinine<3.0 mg/dL	NR
ECG findings	No ischemic changes	NR
Natriuretic peptides	NR	BNP<1000 pg/mL; NT-proBNP<5000 pg/mL
Response to initial therapy	NR	Dyspnea improvement, adequate urine output, blood pressure controlled
Exclusion Criteria	Recommended	Suggested
ECG findings	Ischemic ECG changes	NR
Vasoactive medications	No active titration	NR
Social support	NR	Adequate prior to OU admission

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Executive Summary: HFSA 2010 Comprehensive Heart Failure Practice Guideline

HEART FAILURE SOCIETY OF AMERICA

- **Hospitalization recommended with:**
 - Hypotension, worsening renal function, altered mental status
 - Dyspnea at rest
 - Hemodynamically significant arrhythmia
 - Acute coronary syndromes

Executive Summary: HFSA 2010 Comprehensive Heart Failure Practice Guideline

HEART FAILURE SOCIETY OF AMERICA

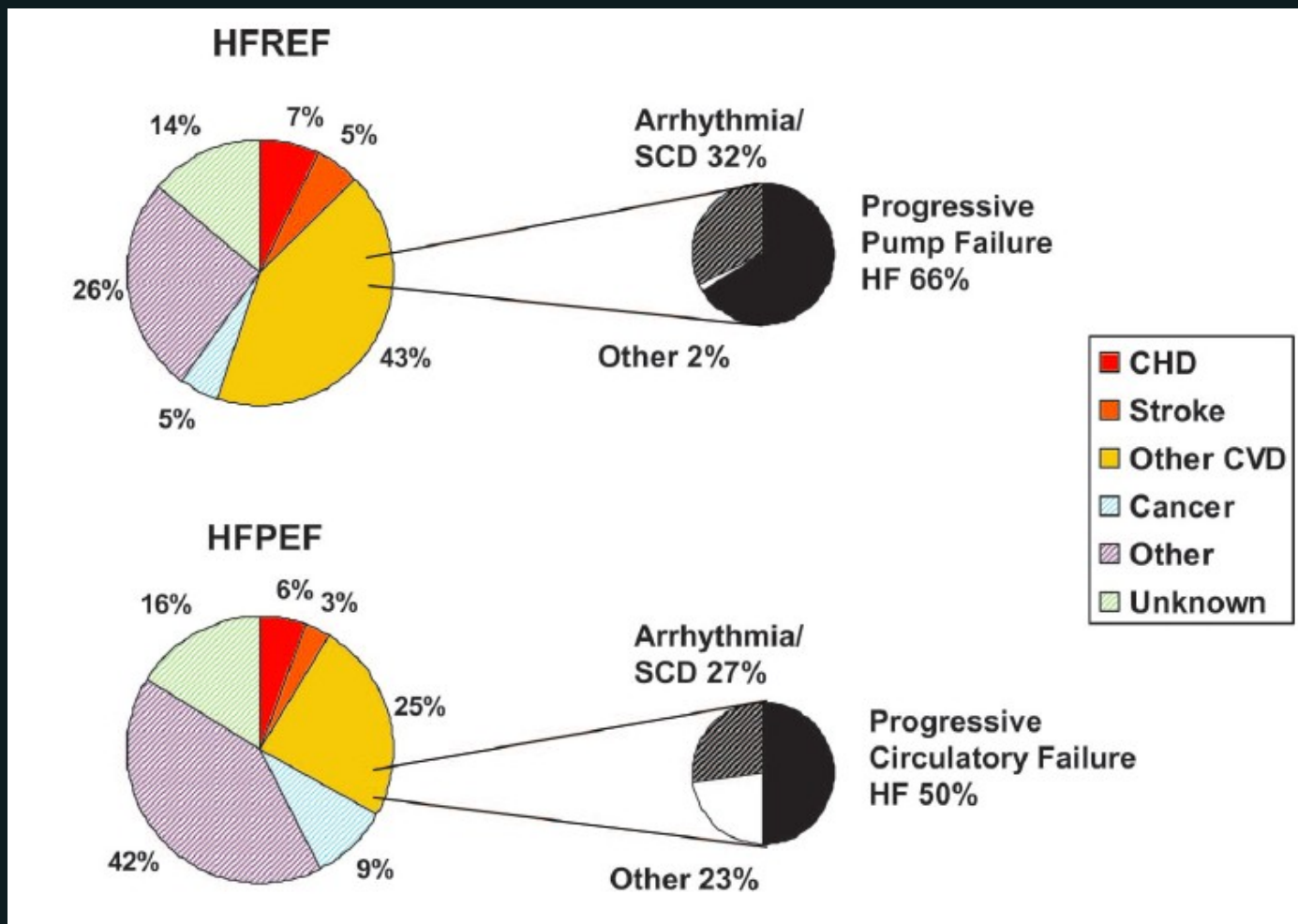
- **Consider hospitalization with:**
 - Worsening congestion
 - Pulmonary or systemic
 - Major electrolyte disturbance
 - Associated comorbidity (CVA, DKA, PE, PNA)
 - Repeated ICD firing
 - De novo HF
 - High risk of ACS

Can We Improve Decision Making?

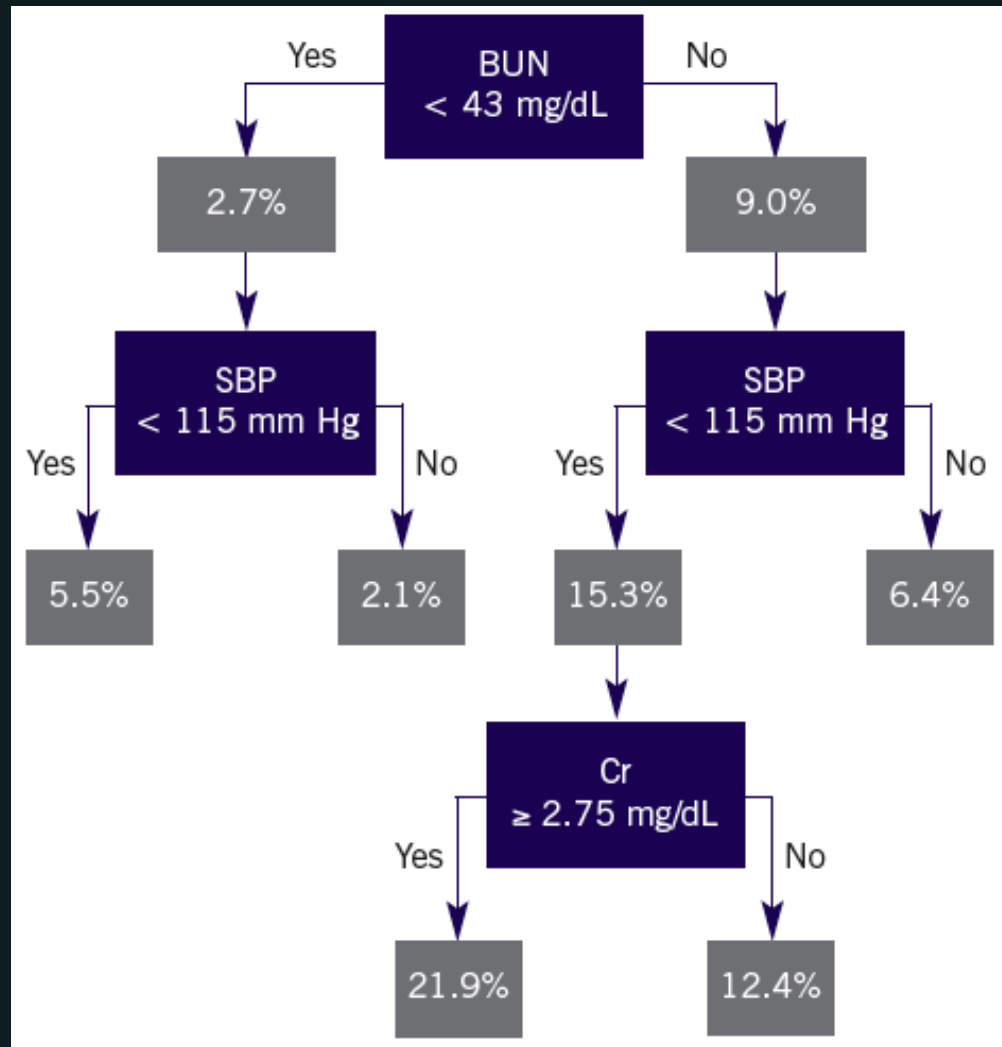
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A Systematic Assessment of Causes of Death After Heart Failure Onset in the Community

Impact of Age at Death, Time Period, and Left Ventricular Systolic Dysfunction



ADHERE In-Hospital Mortality Model



EFFECT Mortality Model

Enhanced Feedback for Effective Cardiac Treatment

Variable	Points Assigned
Age, years	+Age
Respiratory rate, breaths/min*	+Rate
Systolic blood pressure, mmHg	
≥ 180	-60
160-179	-55
140-159	-50
120-139	-45
100-119	-40
90-99	-35
<90	-30
Urea Nitrogen, mg/dL†	+Level
Sodium <136 mEq/L	+10
Cerebrovascular disease	+10
Dementia	+20
Chronic obstructive pulmonary disease	+10
Hepatic cirrhosis	+25
Cancer	+15

Total point score corresponds to the following risk group: ≤ 60 =Very low risk, 61-90 =Low risk, 91-120 =Intermediate risk, 121-150 =High risk and > 150 =Very high risk

*Values ≥ 45 are assigned 45 points and values ≤ 20 are assigned 20 points.

†Values ≥ 60 points are assigned 60 points

GWTG-HF Mortality Score

Get With the Guidelines – Heart Failure

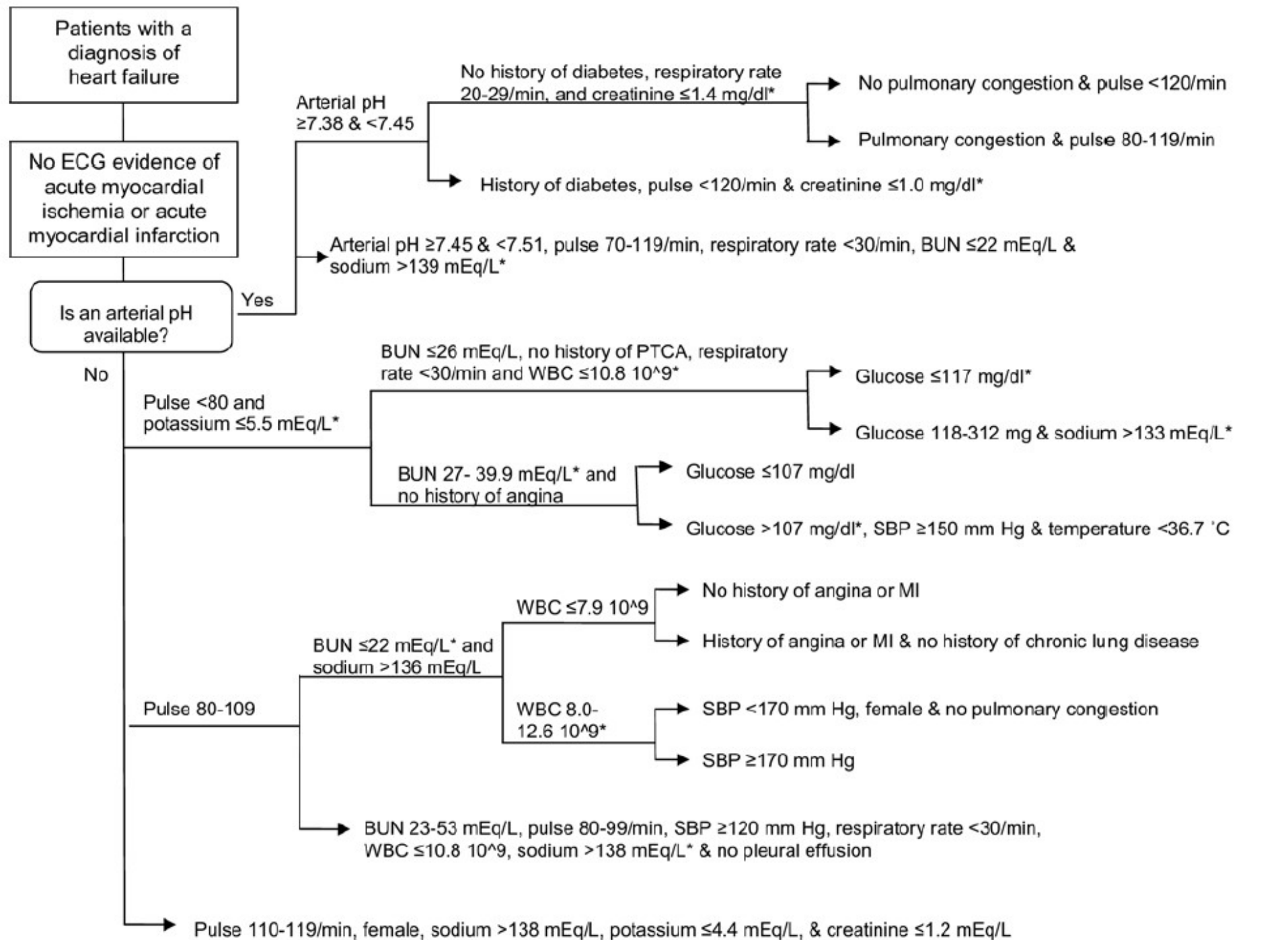
Systolic BP	Points	BUN	Points	Sodium	Points	Age	Points
50-59	28	≤9	0	≤130	4	≤19	0
60-69	26	10-19	2	131	3	20-29	3
70-79	24	20-29	4	132	3	30-39	6
80-89	23	30-39	6	133	3	40-49	8
90-99	21	40-49	8	134	2	50-59	11
100-109	19	50-59	9	135	2	60-69	14
110-119	17	60-69	11	136	2	70-79	17
120-129	15	70-79	13	137	1	80-89	19
130-139	13	80-89	15	138	1	90-99	22
140-149	11	90-99	17	≥139	0	100-109	25
150-159	9	100-109	19			≥110	28
160-169	8	110-119	21				
170-179	6	120-129	23				
180-189	4	130-139	25				
190-199	2	140-149	27				
≥200	0	≥150	28				

Heart Rate	Points	Black Race	Points	COPD	Points	Total Score	Probability of Death
≤79	0	Yes	0	Yes	2	0-33	<1%
80-84	1	No	3	No	0	34-50	1-5%
85-89	3					51-57	>5-10%
90-94	4					58-61	>10-15%
95-99	5					62-65	>15-20%
100-104	6					66-70	>20-30%
≥105	8					71-74	>30-40%
						75-78	>40-50%
						≥79	>50%

OPTIMIZE-HF In-Hospital Mortality Model

Variable	Wald Chi-Square	Odds Ratio	95% CI	p Value
SCr: per 0.3-mg/dl increase up to 3.5 mg/dl	335.5	1.18	1.16-1.20	<0.0001
SBP: per 10-mm Hg increase up to 160	107.0	0.83	0.80-0.86	<0.0001
Age: per 10-yr increase	108.5	1.34	1.26-1.41	<0.0001
Heart rate: per 10 beats/min increase between 65 and 110 beats/min	55.1	1.18	1.13-1.24	<0.0001
Sodium: per 3-mEq/l decrease below 140 mEq/l	39.1	1.15	1.10-1.20	<0.0001
Sodium: per 3-mEq/l decrease above 140 mEq/l	6.63	0.87	0.78-0.97	0.0100
HF as primary cause of admission	10.7	0.72	0.60-0.88	0.0011
Liver disease	11.5	2.33	1.43-3.80	0.0007
Prior cerebrovascular accident/transient ischemic attack	18.6	1.37	1.19-1.58	<0.0001
Peripheral vascular disease	12.9	1.32	1.13-1.54	0.0003
Diastolic blood pressure: per 10-mm Hg increase up to 100 mm Hg	12.9	0.90	0.85-0.95	0.0003
Hyperlipidemia	11.1	0.80	0.71-0.91	0.0009
Smoker within past year	12.5	0.70	0.58-0.85	0.0004
No known HF before this admission	10.5	0.65	0.51-0.85	0.0012
African American	11.1	0.71	0.57-0.87	0.0009
LVSD	14.0	1.28	1.13-1.46	0.0002
Chronic obstructive pulmonary disease	6.32	1.19	1.04-1.35	0.0120
ACE inhibitor at admission	7.67	0.84	0.75-0.95	0.0056
Beta-blocker at admission	17.3	0.77	0.68-0.87	<0.0001

C-statistic for model = 0.77



Prediction of Heart Failure Mortality in Emergent Care

A Cohort Study

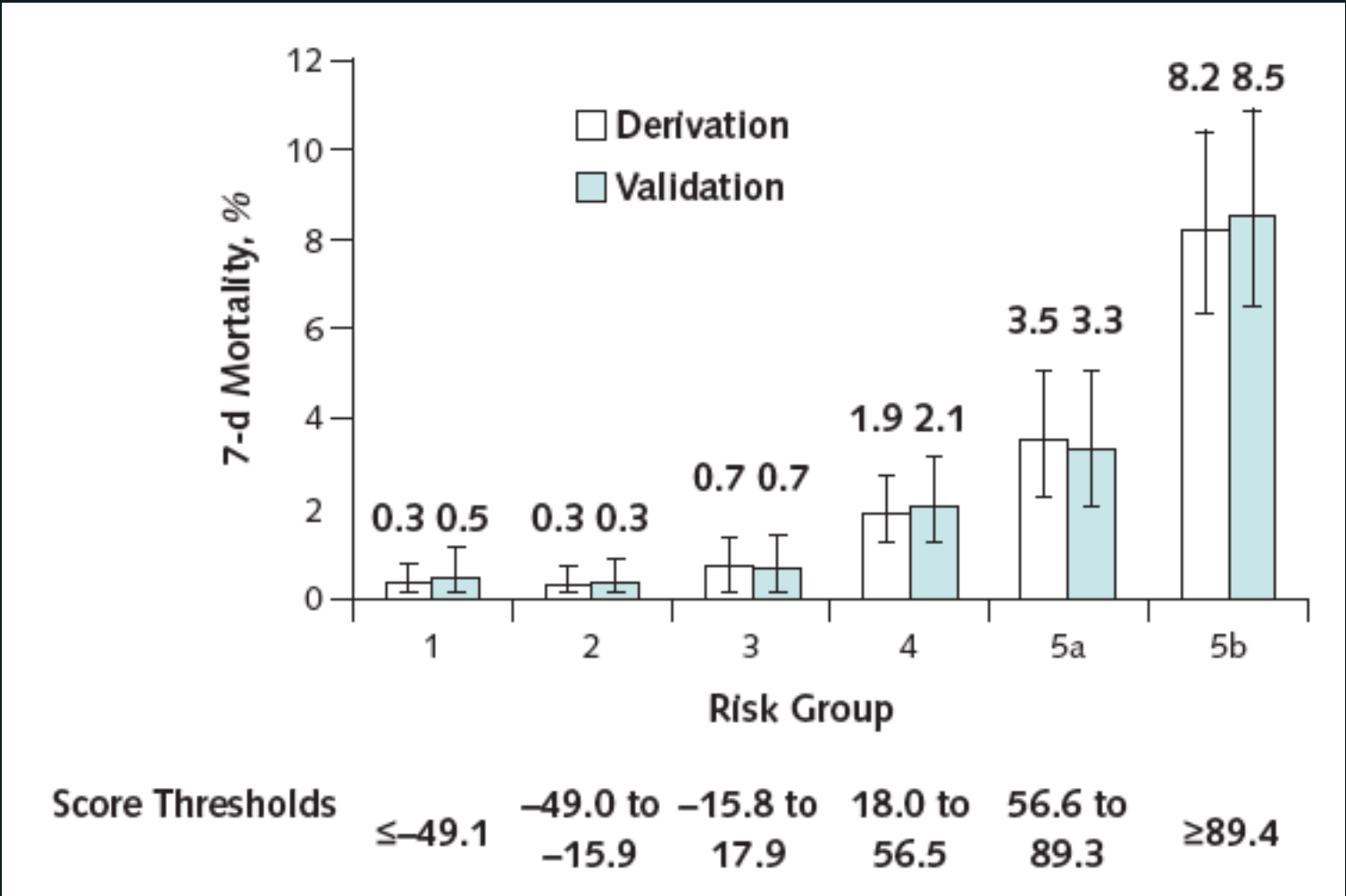
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Variable	Units	Additive or Multiplicative Component
Age	y	$2 \times \text{age}$
Transported by EMS	If "yes"	+60
SBP	mm Hg*	$-1 \times \text{SBP}$
Heart rate	beats/min†	$1 \times \text{heart rate}$
Oxygen saturation	%‡	$-2 \times \text{oxygen saturation}$
Creatinine	mg/dL§	$20 \times \text{creatinine}$
Potassium	4.0 to 4.5 mmol/L	0
	≥4.6 mmol/L	+30
	≤3.9 mmol/L	+5
Troponin	>ULN	+60
Active cancer	If "yes"	+45
Metolazone at home	If "yes"	+60
Adjustment factor		+12
Total		EHMRG score¶

Prediction of Heart Failure Mortality in Emergent Care

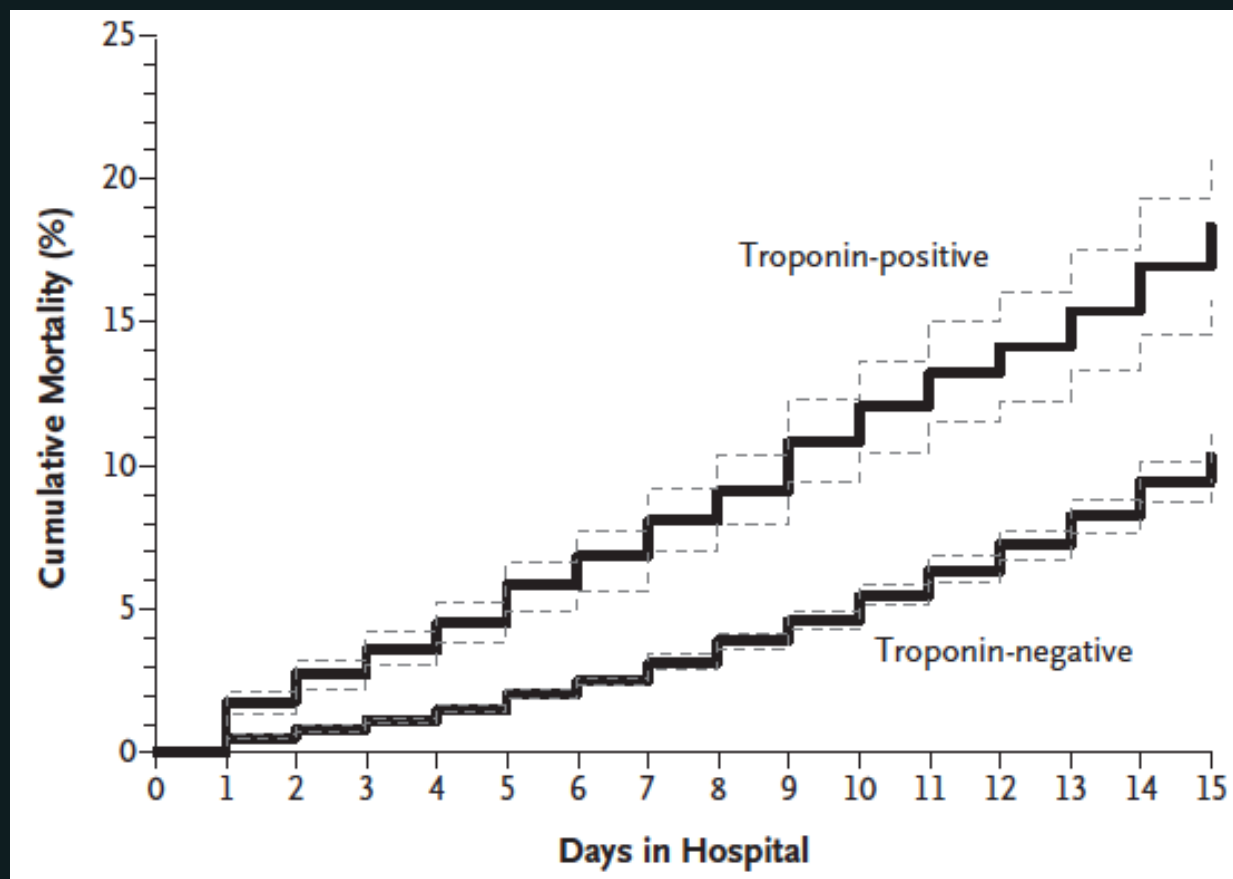
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Cardiac Troponin and Outcome in Acute Heart Failure

W. Frank Peacock IV, M.D., Teresa De Marco, M.D., Gregg C. Fonarow, M.D.,
Deborah Diercks, M.D., Janet Wynne, M.S., Fred S. Apple, Ph.D.,
and Alan H.B. Wu, for the ADHERE Investigators



Impact of Serial Troponin Release on Outcomes in Patients With Acute Heart Failure

Analysis From the PROTECT Pilot Study

Christopher M. O'Connor, MD; Mona Fiuzat, PharmD; Carlo Lombardi, MD; Kenji Fujita, MD; Gang Jia, PhD; Beth A. Davison, PhD; John Cleland, MD; Daniel Bloomfield, MD; Howard C. Dittrich, MD; Paul DeLucca, MD; Michael M. Givertz, MD; George Mansoor, MD; Piotr Ponikowski, MD; John R. Teerlink, MD; Adriaan A. Voors, MD; Barry M. Massie, MD; Gad Cotter, MD; Marco Metra, MD

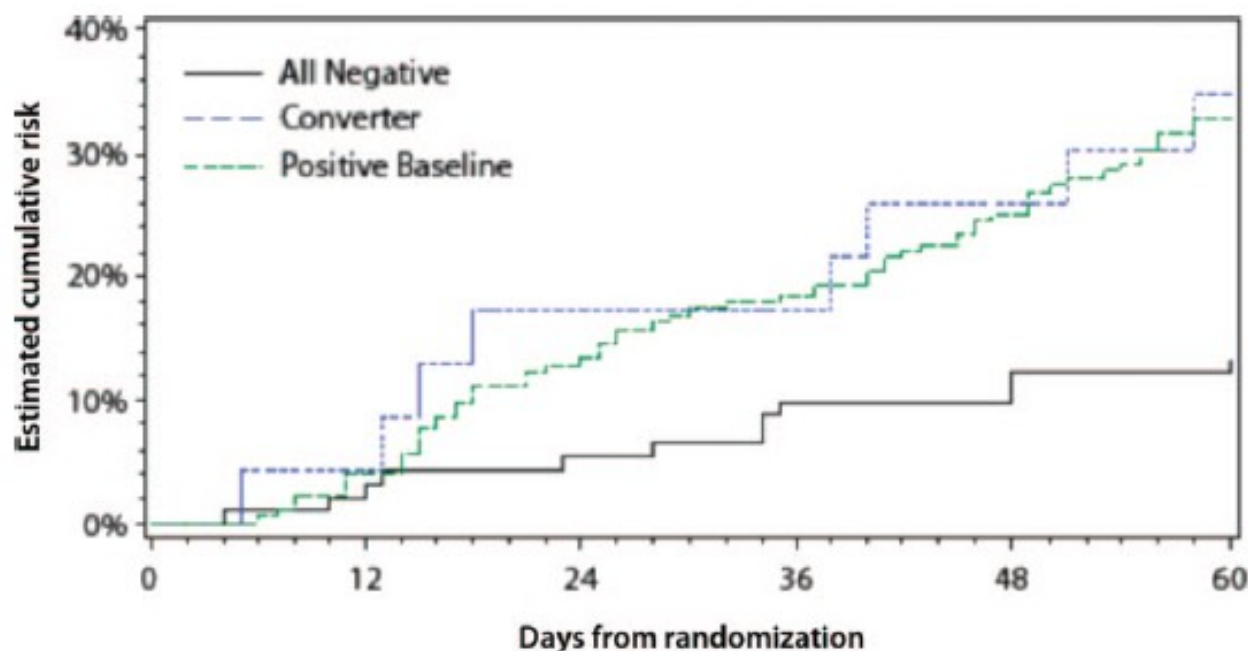
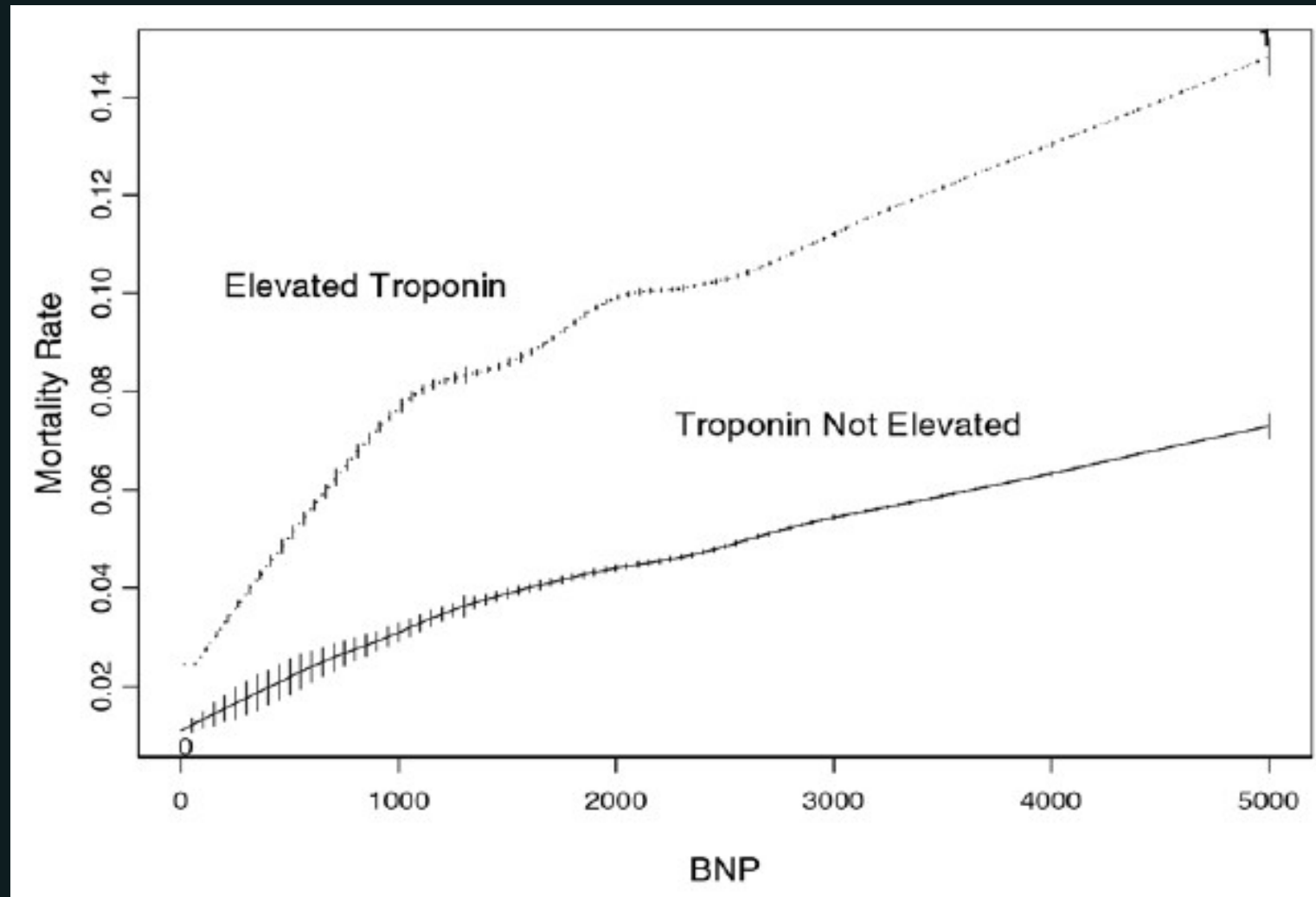
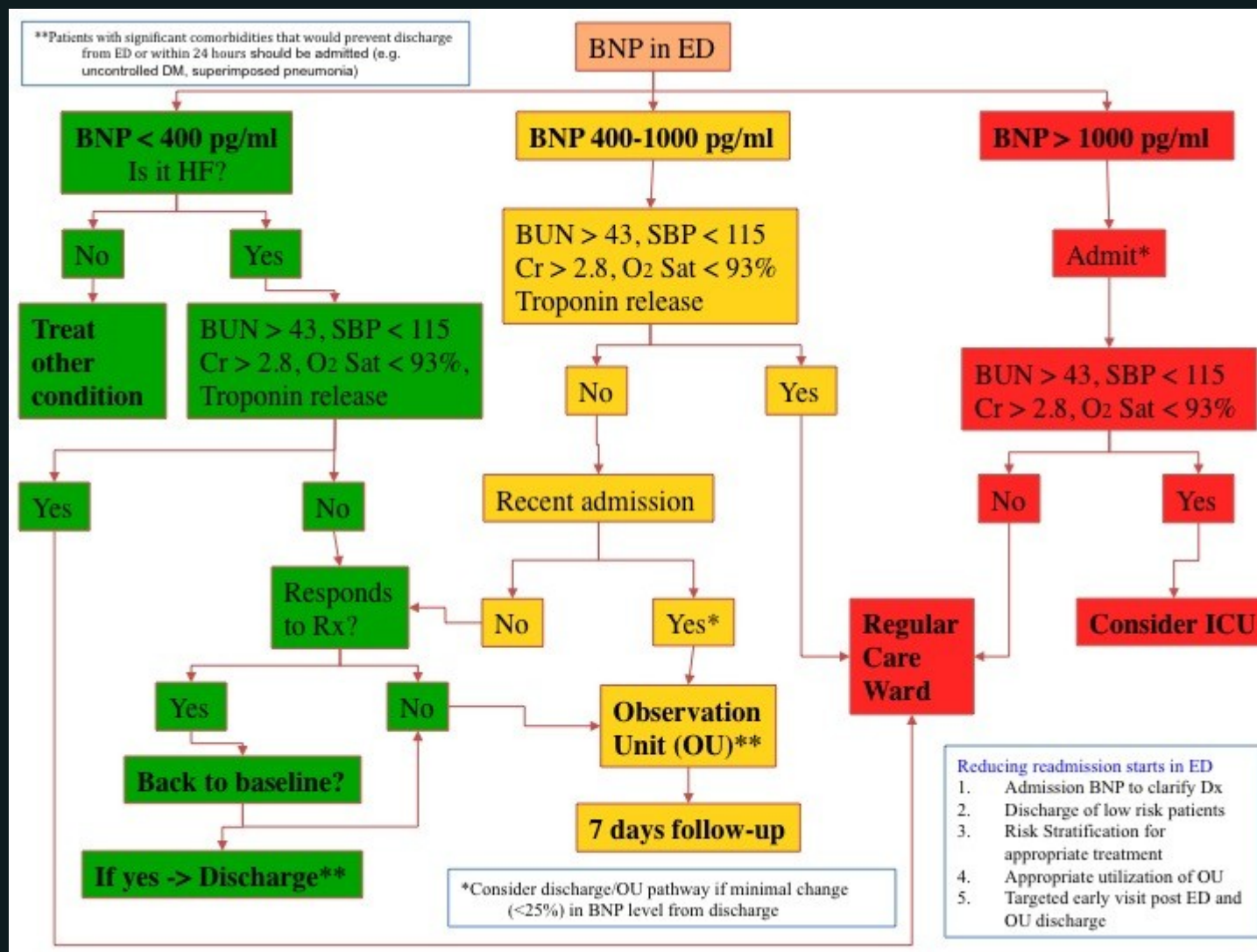


Figure 1. Day 60 cardiovascular (CV)/renal hospitalization or death.

BNP and Troponin: Additive Short-Term Prognostic Value



A Potential Approach?



Take Home Points

- Despite years of research, post-discharge outcomes for AHF remain poor
- Relatively easy to define high-risk
 - BP, HR, oxygenation, renal function, biomarkers of cardiac stress/injury
- Limited in our ability to identify those who are truly low-risk