

Zwolle Risk Score

Matthew Bunte, MD, MS, RPVI, FSVM, FSCAI, FACC

Director, Saint Luke's East STEMI Program

Division of Cardiovascular Medicine

Saint Luke's Physician Group



Disclosures

- None



Objectives

- Review of ST-elevation MI (STEMI) patient risk assessment
- Zwolle risk score for early STEMI discharge
- Saint Luke's East Early DC Program (SLEDP) experience



US STEMI Care

- >250,000 US adults annually
- Average \$20,000/admission
- High-risk condition, 25%+ mortality before arrival
- Timely primary PCI critical to acutely reduce risk
- Post-PCI care needs can be variable





High-risk STEMI

- Cardiac arrest
- Pulmonary edema
- Ventricular arrhythmia
- Mechanical circulatory support (e.g., ECMO, Impella, IABP)

In-hospital death: >5%



Intermediate-risk STEMI

- Late presentation
- Multivessel disease
- Acute heart failure
- Hypotension +/- pressors
- Elderly, comorbidities

In-hospital death: 2-5%



Low-risk STEMI

- Prompt revascularization
- Single-vessel disease
- Complete revascularization
- Radial access
- No heart failure
- Stable post-PCI vital signs

In-hospital death: <2%



**Doctor, how
much damage
was done to my
heart?**



**Nurse, when
can I go home?**

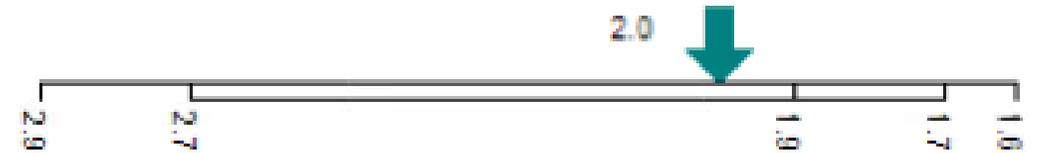


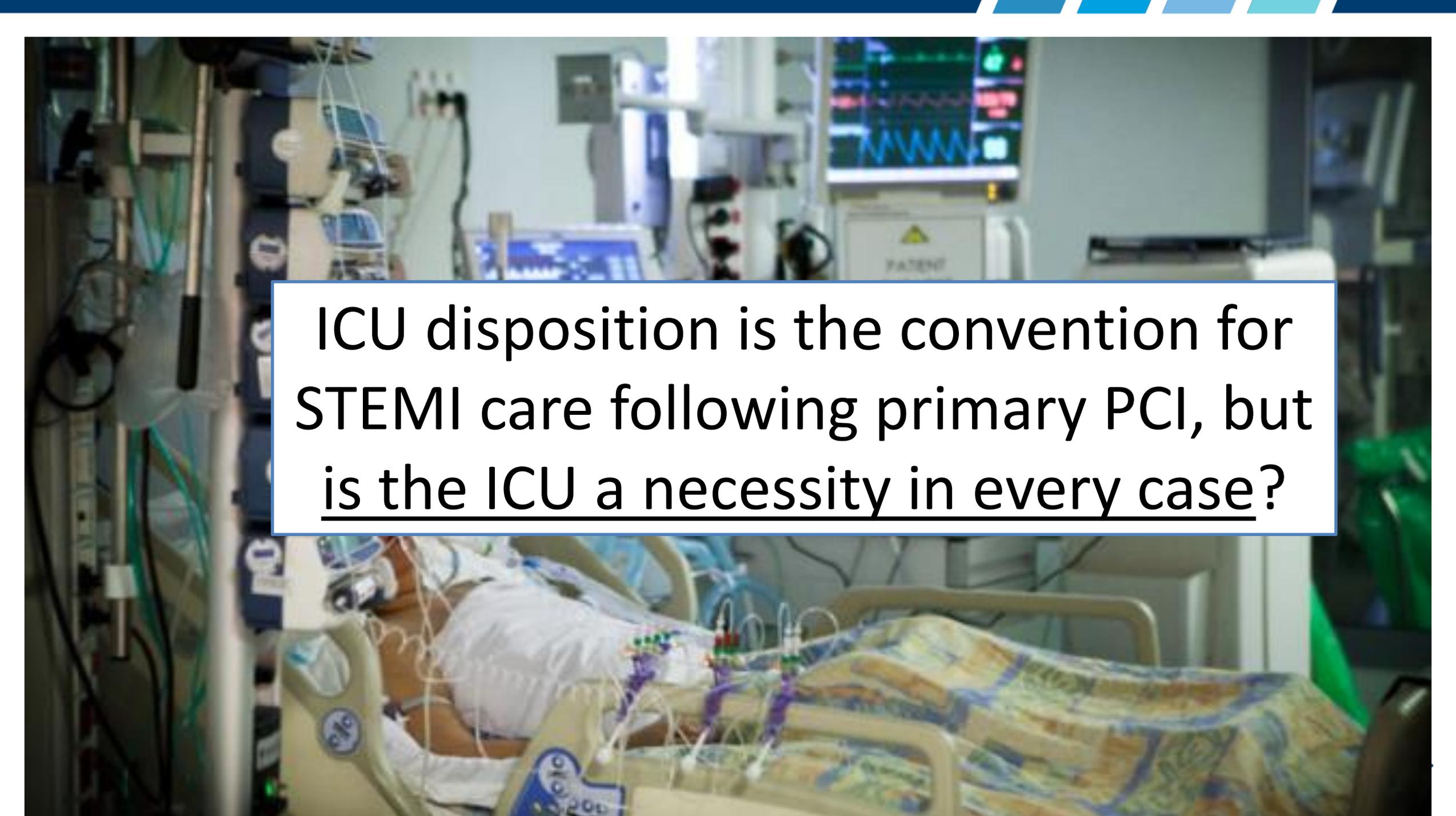
NCDR Cath PCI – Saint Luke’s East LOS (Q4 2017)

Median post-procedure length of stay (in days) for PCI patients with STEMI

My Hospital	US Hospitals 50th Pctl	US Hospitals 90th Pctl
2.0	1.9	1.6

Your hospital’s median post-procedure length of stay (in days) for PCI patients with STEMI. [Detail Line:2111]



A photograph of an intensive care unit (ICU) patient in a hospital bed. The patient is lying in a bed with a patterned blanket, surrounded by various medical devices and monitors. A central text box is overlaid on the image, containing a question about ICU disposition for STEMI patients after primary PCI.

ICU disposition is the convention for STEMI care following primary PCI, but is the ICU a necessity in every case?

Post-PCI STEMI Goals of Care



Prompt attention to potential post-MI complications



Frequent vital sign and access site assessment



Titration of medications (e.g., beta-blockers, antihypertensives)



Post-MI education



Consequences of Post-STEMI ICU Care

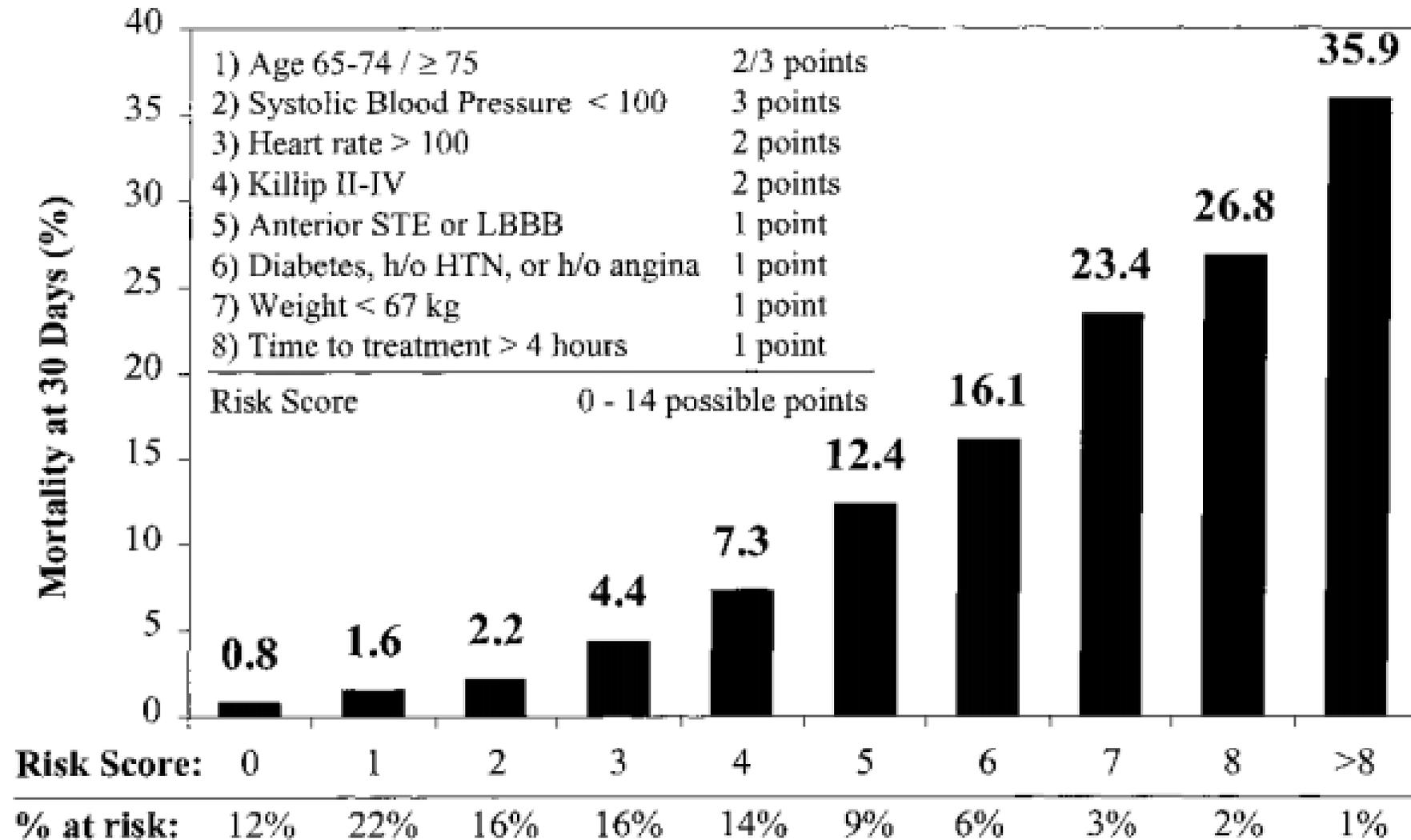
- Increased length of stay
- Exposure to nosocomial infection
- Increased care costs
- Reduced patient satisfaction
- Opportunity cost of occupied ICU bed



Can successful post-STEMI care be achieved in an intermediate-care setting (e.g., CVRU)?



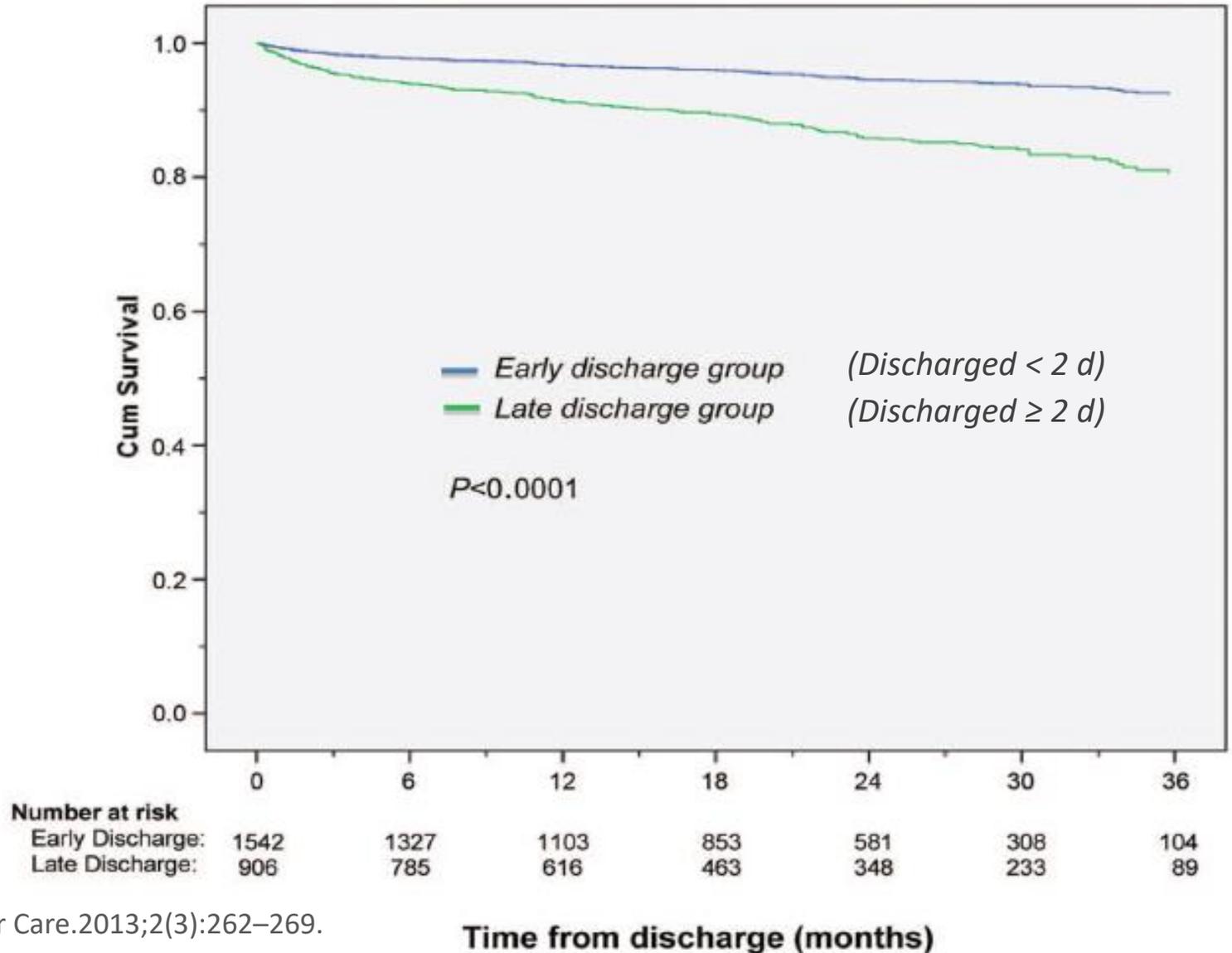
TIMI Risk Score



Early Post-STEMI Discharge (2008-2011)

Predictors of Early DC

- Radial access
- Admission free of:
 - Cardiogenic shock
 - Cardiac arrest
 - Anterior MI
 - Multivessel disease
 - Left main stenosis
 - Vascular disease



Role of Early Discharge: Cost savings

- Early economic models performed on patients receiving thrombolysis (GUSTO-I, 1996)
- Extending the hospital stay for an additional day (beyond 3d) among low-risk STEMI patients provides less value (i.e., \$105,629 per year of life saved)
- Care must be individualized (risk assessment, patient education, medication titration, etc)

Newby LK, et al. N Engl J Med. 2000;342:749 –55.



Guideline recs for post-PPCI STEMI LOS

Journal of the American College of Cardiology
© 2013 by the American College of Cardiology Foundation and the American Heart Association, Inc.
Published by Elsevier Inc.

Vol. 61, No. 4, 2013
ISSN 0735-1097/\$36.00
<http://dx.doi.org/10.1016/j.jacc.2012.11.019>

PRACTICE GUIDELINE

2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction

A Report of the American College of Cardiology Foundation/
American Heart Association Task Force on Practice Guidelines

- More contemporary guidelines
- More guidance offered for low-risk STEMI discharge (day 2 or 3)
- Encourages early risk stratification (PAMI-II or Zwolle risk scores)
- Declares unique challenges of early dc

European Heart Journal (2018) 39:119-177.

- Guides pre-hospital and in-lab reperfusion care
- Encourages early risk stratification
- Acknowledges some low-risk patients are amendable to early dc
- No specifics for early discharge risk stratification tool

ESC GUIDELINES

JACC.2013.61(4):e78-140.

JACC.2013.61(4):e78-140.

2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation

The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC)

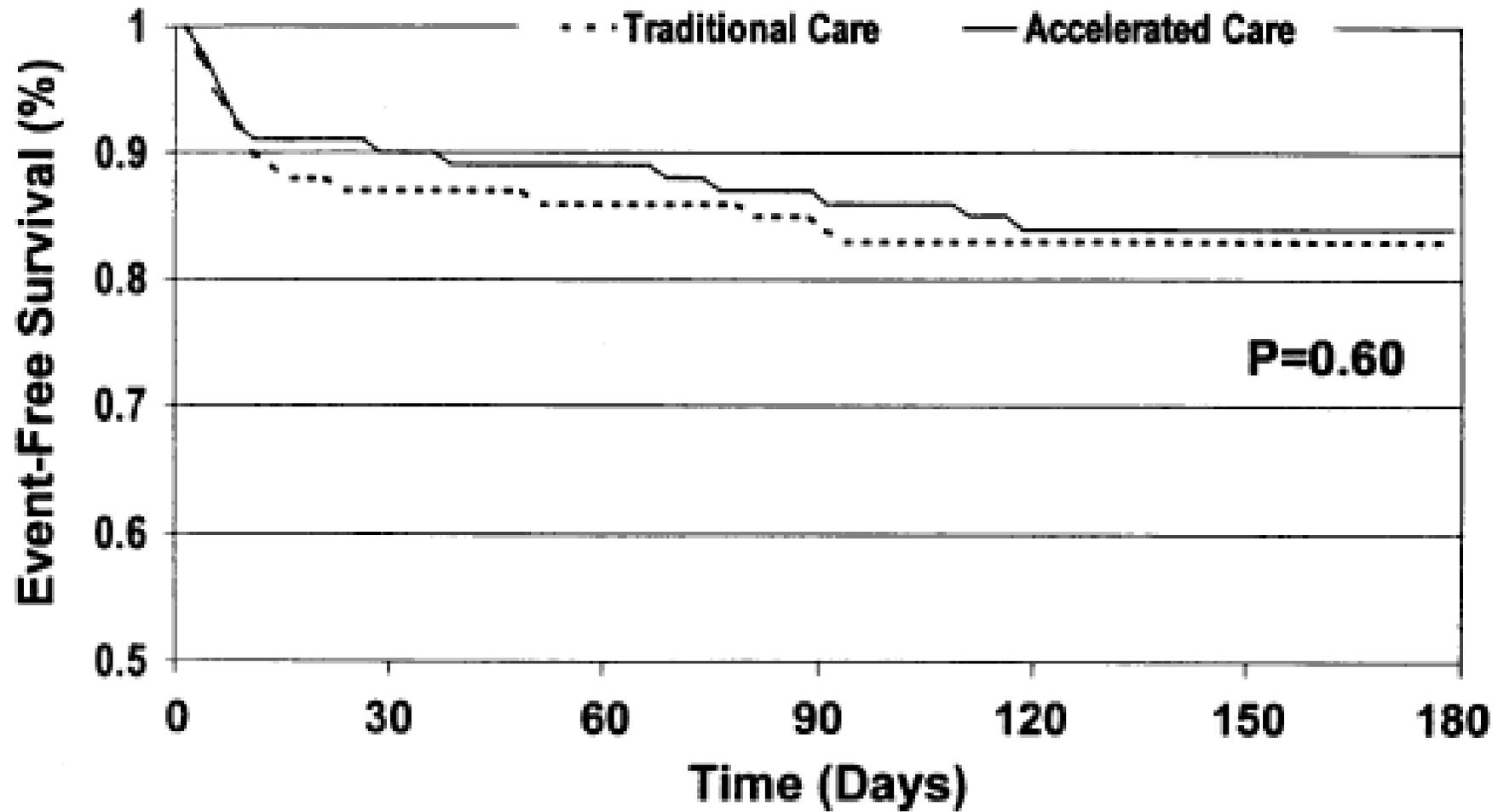
Primary Angioplasty in Low Risk Patients with AMI (PAMI II)

- Hypothesis: Hosp dc 3 d after PTCA in low-risk patients is safe, cost-effective
- Low-risk (def): age \leq 70, EF $>$ 45%, 1-2v CAD, primary PTCA success, no arrhythmia
- Patients randomized to:
 - **Accelerated care:** non-ICU care, full-dose heparin (48hrs) followed by half-dose heparin (12 hrs) and d/c after 3 d without noninvasive testing
 - **Traditional care:** to ICU, heparin (72hrs), non-invasive testing

	Accelerated Care (n = 237)	Traditional Care (n = 234)	p Value
Age (yr)	55 \pm 10	56 \pm 10	0.21
Male	77.6%	75.2%	0.54
Previous MI	11.2%	10.4%	0.79
Hypertension	37.7%	37.6%	1.0
Diabetes, insulin-dependent	2.2%	3.9%	0.27
Thrombolytic eligible	75.7%	80.9%	0.18
Diseased vessels			
1	75.6%	74.8%	0.83
2	23.1%	23.1%	
3*	1.3%	2.1%	
Post-PTCA TIMI flow grade			
0-1*	0.4%	0.4%	0.54
2	1.3%	1.7%	
3	98.3%	97.8%	
Post-PTCA % stenosis	20 \pm 13	20 \pm 12	0.71



PAMI II



Zwolle Risk Score

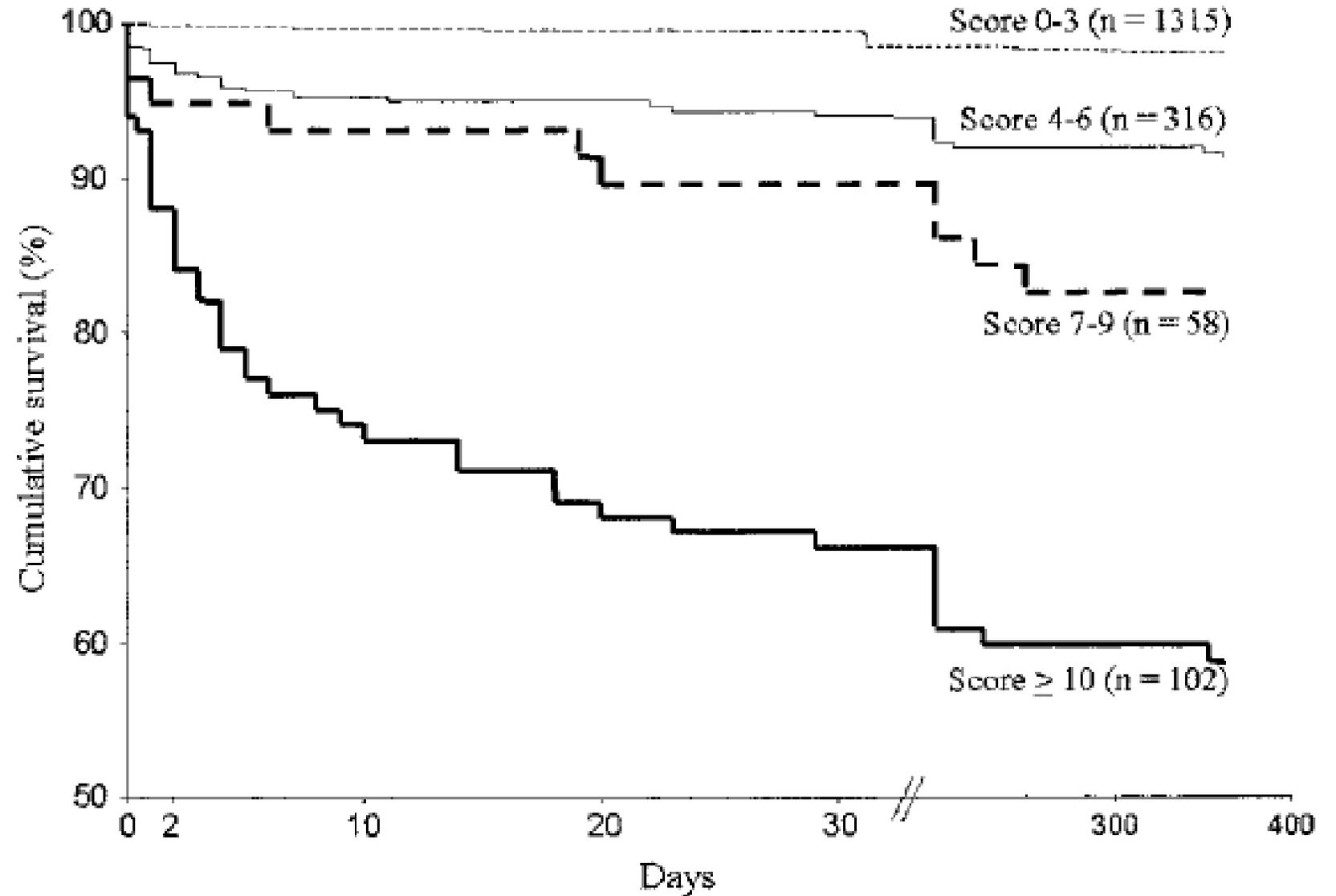
- Risk scores for early d/c developed in patients with medical therapy, +/- thrombolysis, without considering **procedural variables**
- Prognostic score built according to 30-d mortality rates
- STEMI patients (n=1791), enrolled 1994-2001
 - All patients received asa (500 mg) + heparin (10000 IU) IV pre PTCA/PCI
 - Post-PCI patients (52.2%) received warfarin x 3 mo (pre-1996) or 1-mo DAPT (ticlopidine or clopidogrel, after 1996)



- Low-risk Zwolle score: ≤ 3
- Low-risk patients
 - 0.2% risk VT/VF at 48hrs
 - 0.5% 30-d mortality
 - Can be safely discharged 48-72 hours of admission

<u>Killip Class</u>	<u>Points</u>
1	0
2	4
3-4	9
<u>TIMI Flow Post</u>	
3	0
2	1
0-1	2
<u>Age</u>	
< 60	0
≥ 60	2
<u>3-Vessel Disease</u>	
No	0
Yes	1
<u>Anterior Infarction</u>	
No	0
Yes	1
<u>Ischemic Time</u>	
≤ 4 hours	0
> 4 hours	1
Total Score	16

Survival by Zwolle Score



Practical Pathways of STEMI Care

- Much of STEMI risk mitigated by prompt revascularization/PCI
- Following primary PCI, validated risk models predict which patients are safe for early discharge
- Appropriate early discharge may benefit patients without adverse effects
- Unique requirements of CVRU staff on education, med titration, and early arrangements for follow-up care (i.e., cardiac rehab, clinic appts)



SLE Early Discharge Program (SLEDP) for STEMI

- Pilot launched Dec 2018
- Program identifies SLE-based STEMI patients deemed low-risk for complications and appropriate for early discharge
- Patients referred from lab directly to an intermediate-care, CV recovery unit (CVRU)



SLEDP Criteria

- Low-risk Zwolle score (≤ 3)
- Radial access with successful patent hemostasis OR femoral hemostasis in lab
- Uncomplicated, single-vessel primary PCI
- Complete coronary revascularization
- TIMI III flow
- Stable VS (SBP > 90 mmHg, HR < 100 bpm, >90% RA, a/o x3)
- No arrhythmia in lab
- LV end-diastolic pressure < 25 mmHg
- Non-use of GpIIb/IIIa, cangrelor, tPA
- MD/IC discretion for enrollment



Zwolle risk score: Safe early (48-72 hr) discharge

Killip class: *** (1 [0]; 2 [4]; 3-4 [9])

TIMI grade post PPCI: *** (3 [0]; 2 [1]; 0-1 [2])

Age score: *** (< 60 years [0]; ≥/ = 60 years [2])

3-v CAD present: *** (no [0], yes [1])

Anterior infarction: *** (no [0], yes [1])

Ischemia time > 4hrs: *** (no [0], yes [1])

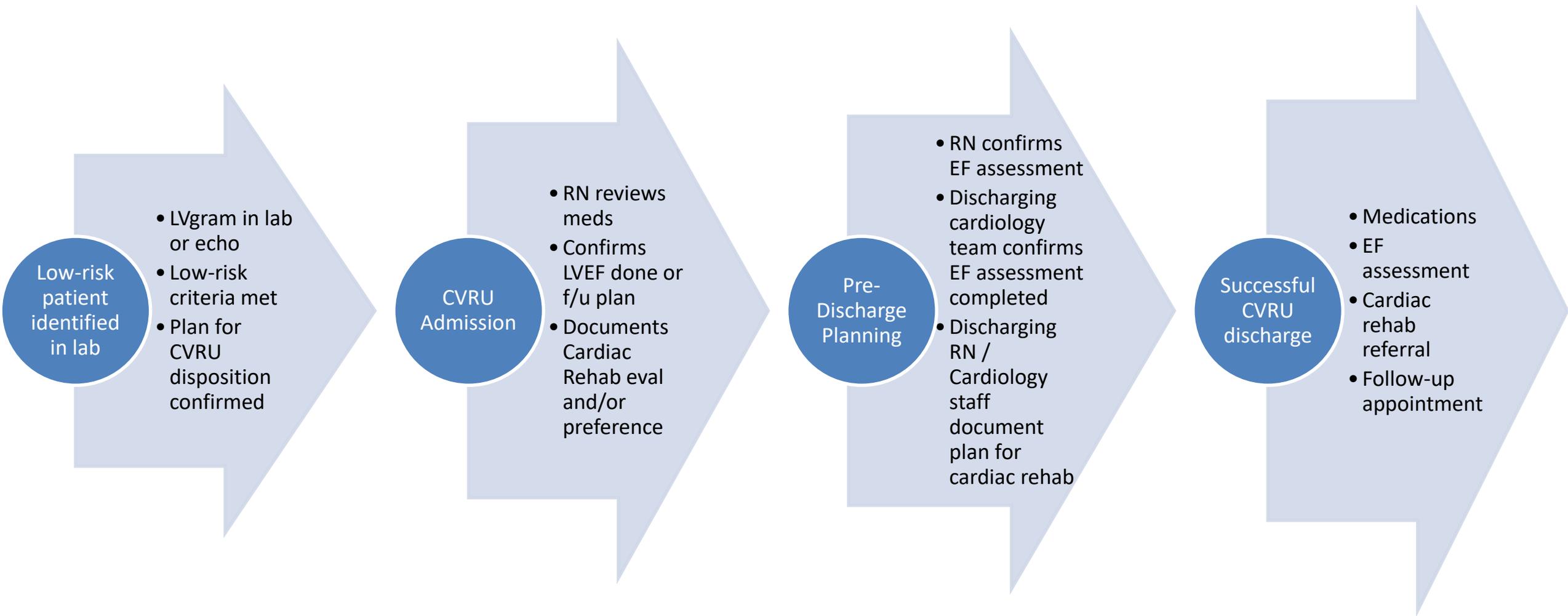
Zwolle risk score: *** (low risk: score 0-3; non-low risk: score >3)



CVRU Education & Follow-up Protocol

- **CVRU staff competencies:** education & action plan clear
- **LVEF assessment:** completed in hospital, often in lab (LVgram), or arranged for evaluation within 14d post-discharge
- **Cardiac rehab:** referral order sent; patient education, patient preference for location of CR, reason for patient decline of CR all documented
- **Two-midnight rule:** estimated LOS documented on admission, documentation of why patient eligible for early discharge prior to 2nd midnight, as needed



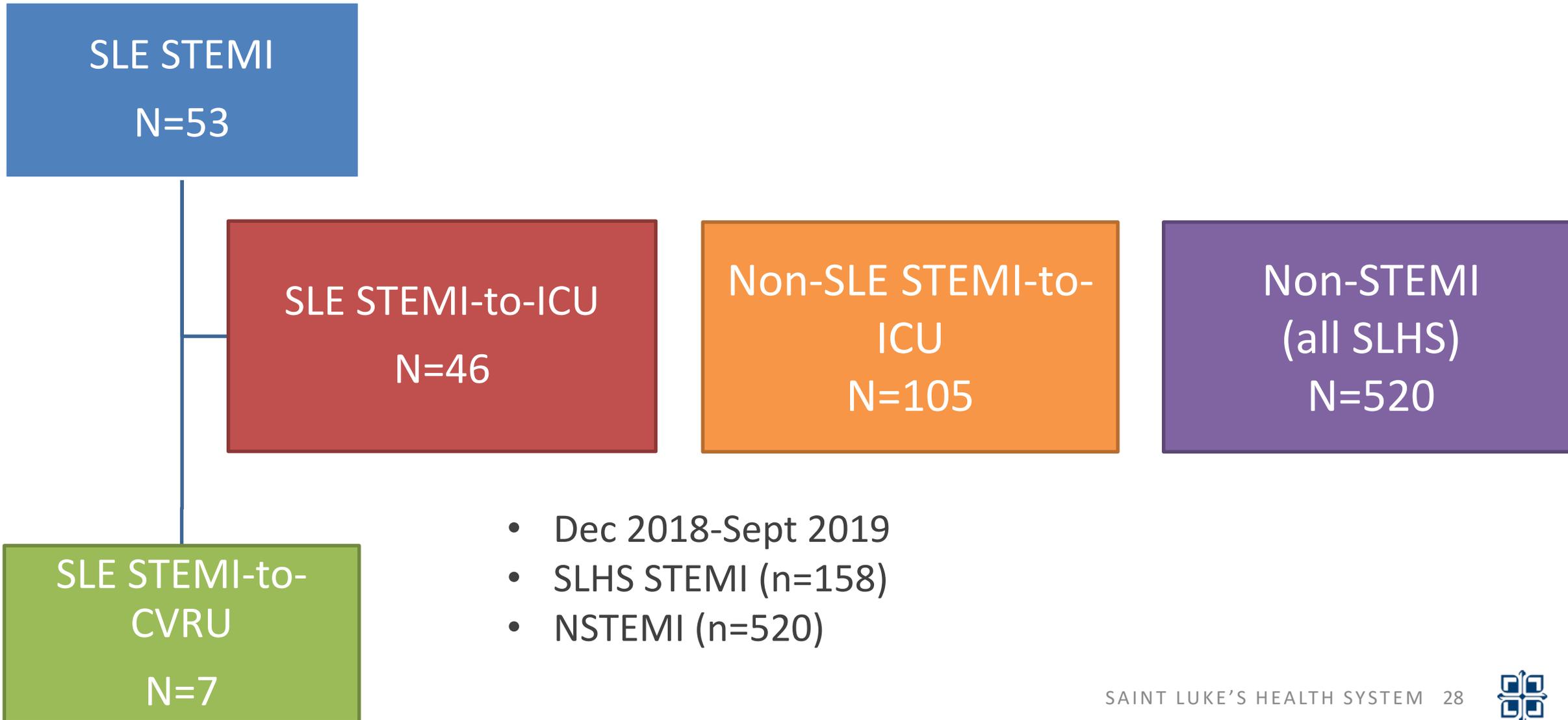


Methods: SLEDP Outcomes

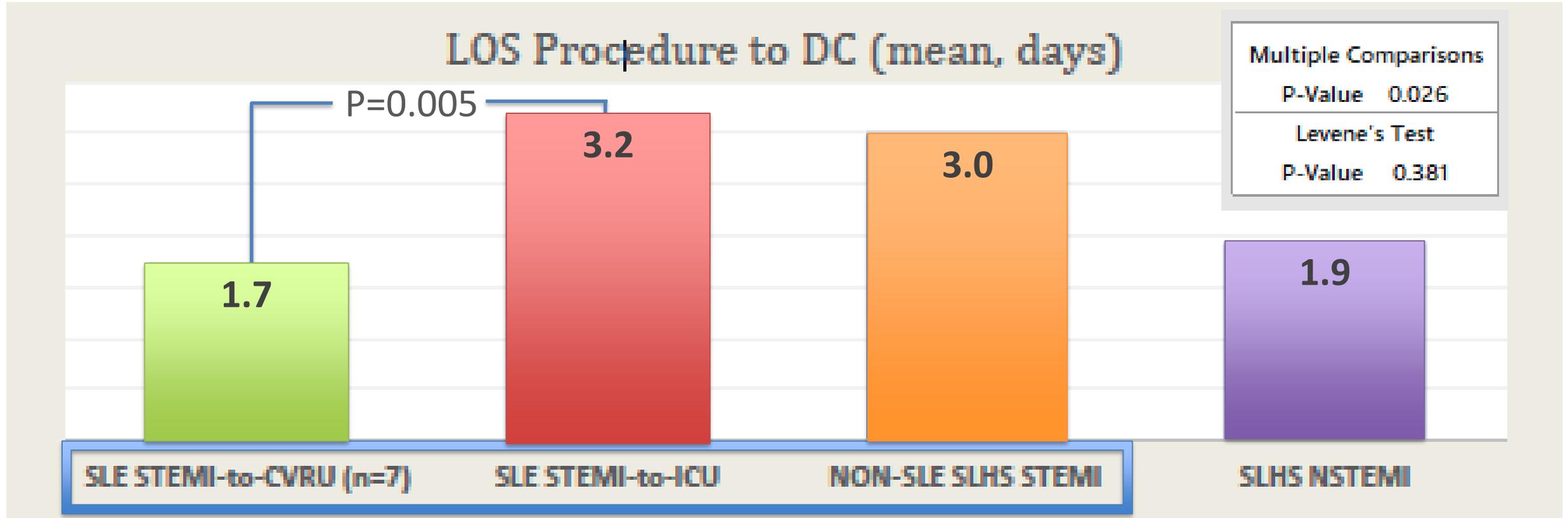
- Retrospective analysis of prospectively collected data on all STEMI (n=158) & NSTEMI (n=520) from Dec 2018-Sept 2019
- Primary Outcome: Length of stay (LOS) PCI-to-discharge (days)
- Secondary Outcomes:
 - Major bleeding
 - Stroke
 - In-hospital Mortality



Saint Luke's East: Early Discharge Program (SLEDP)



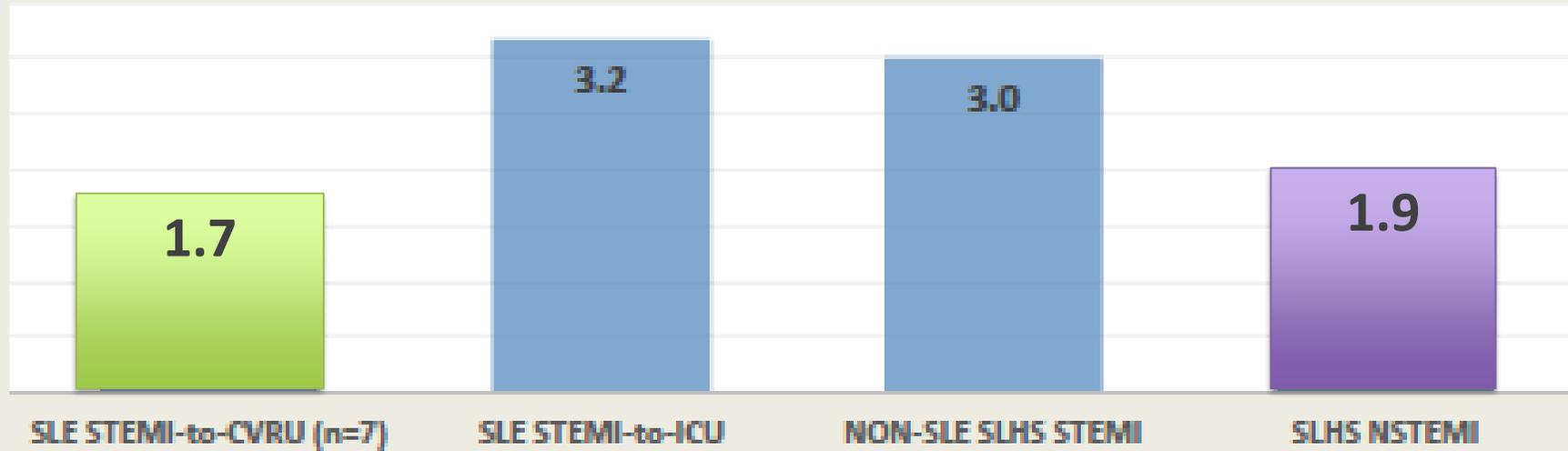
Acute MI Length of Stay (LOS) Following PCI



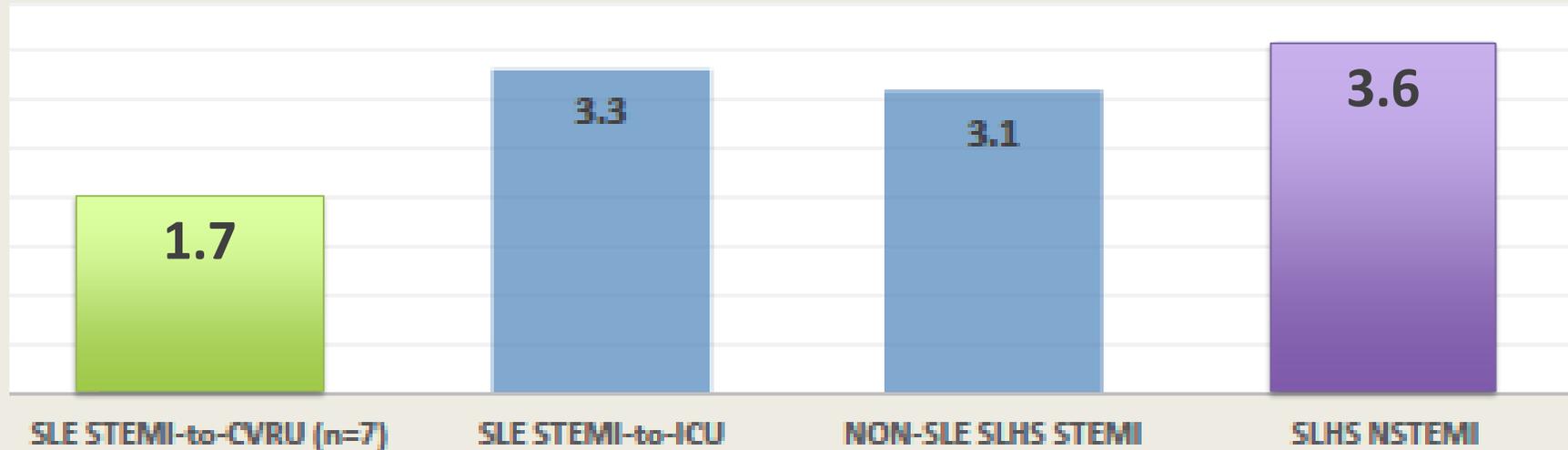
- Average post-PCI LOS reduced by **1.44 d (95% CI 0.43-2.45)**



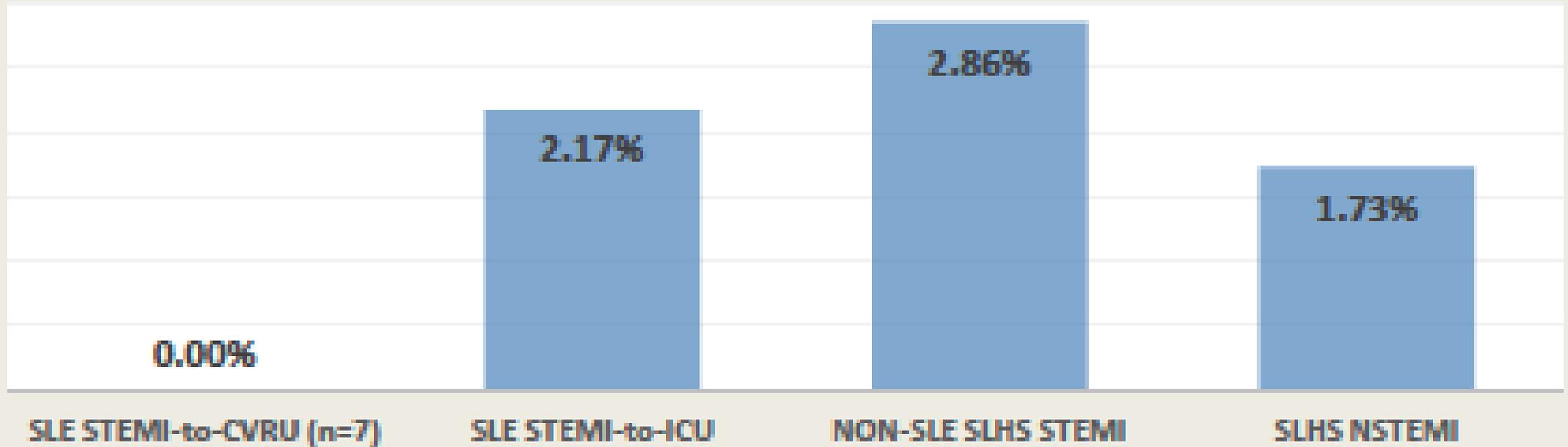
LOS Procedure to DC (mean, days)



LOS Arrival to DC (mean, days)



Major Bleeding (%)

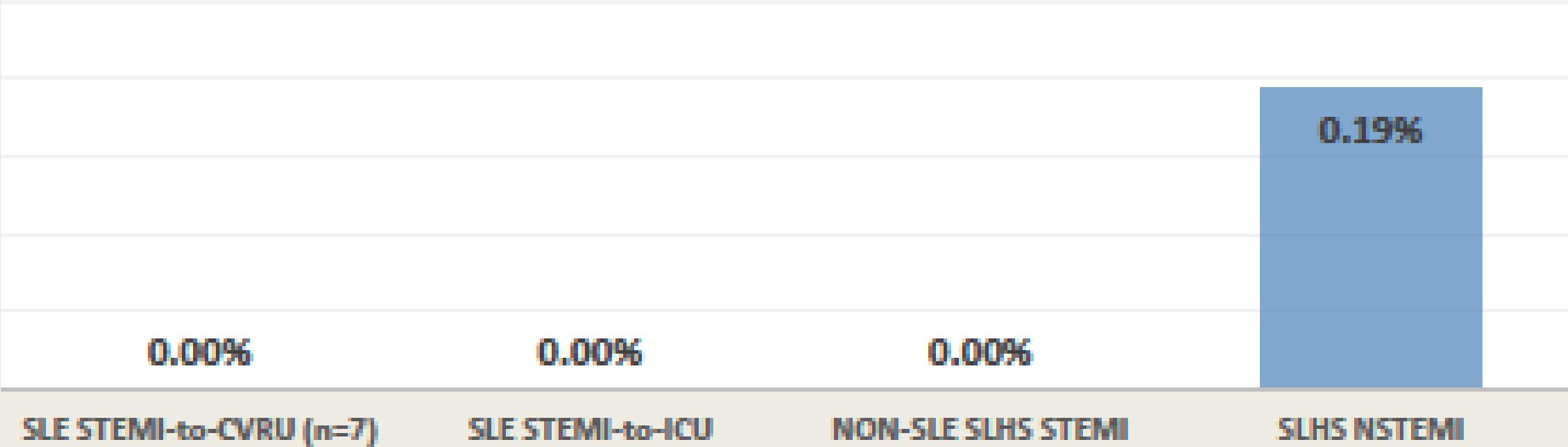


Major Bleeding (definition)

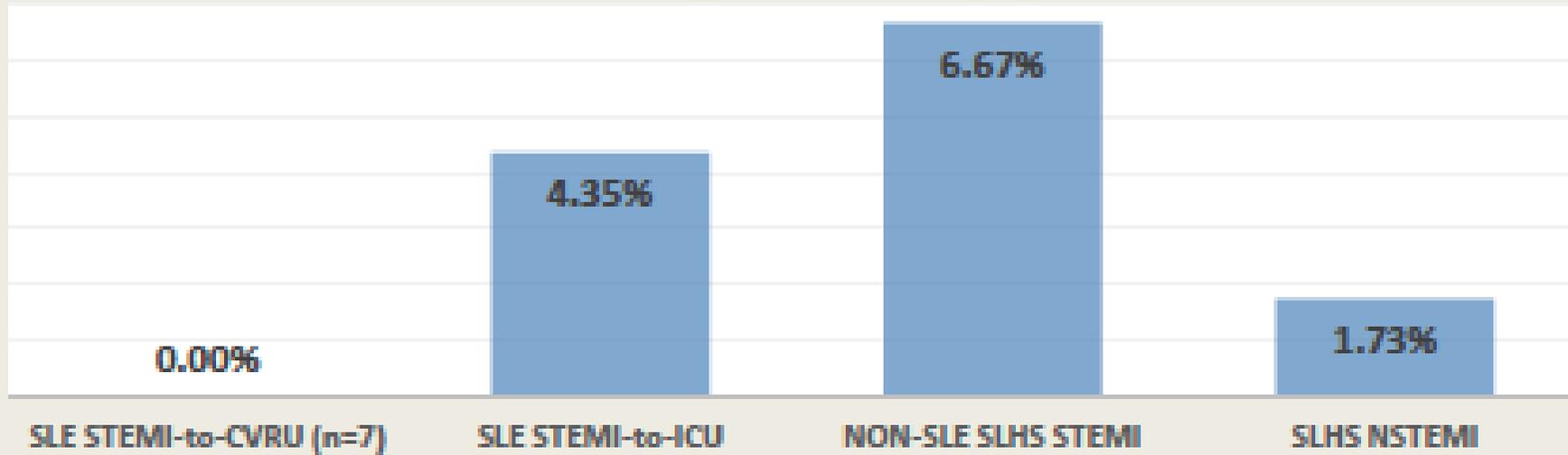
1. Hemoglobin drop of ≥ 3 g/dL;
2. Transfusion of whole blood or packed red blood cells;
3. Procedural intervention/surgery at the bleeding site to reverse/stop or correct the bleeding



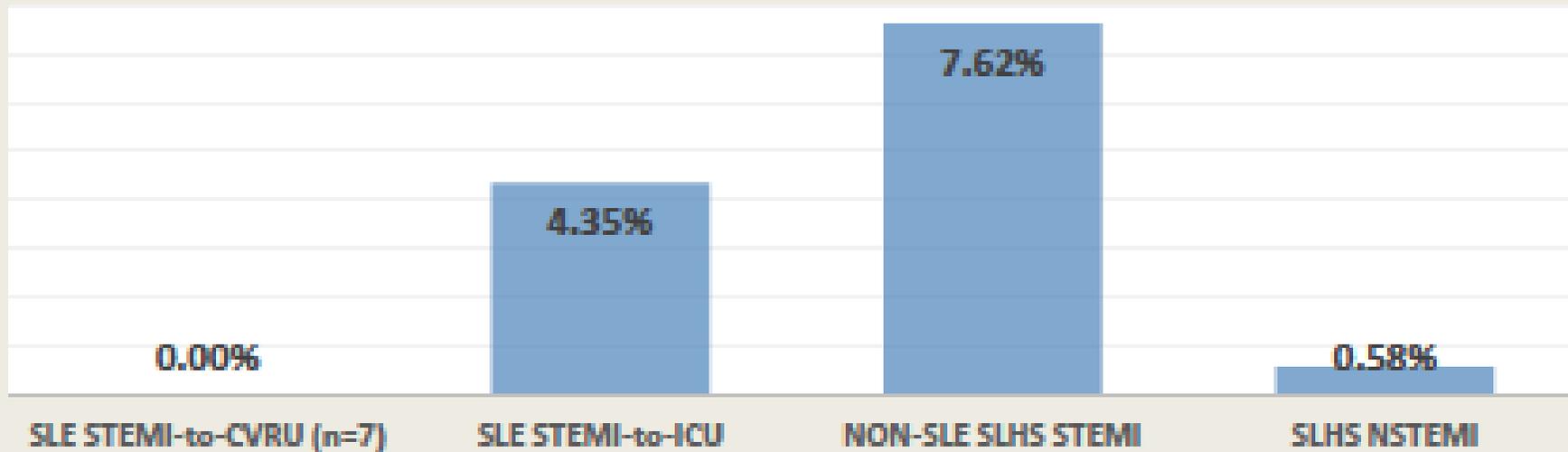
Ischemic Stroke (%)



Cardiogenic Shock (%)



In-Hospital Mortality (%)



Next Steps

- Additional enrollments needed for program validation
- Evaluate readmission rates
- Evaluate direct and in-direct economic impact of program
- Prospectively assess patient satisfaction
- Expand program with use of EMR-based Zwolle risk calculator with careful study of patient selection and results



Conclusions

- Zwolle risk scoring successfully identified patients appropriate for SLE Early DC Program (SLEDP)
- SLEDP reduced LOS by 1.44 d without increase in adverse in-hospital events
- Potential to improve patient satisfaction, reduce adverse events, and opportunity for health cost savings

