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Does the PA catheter improve survival in cardiogenic shock?

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Association for
Acute CardioVascular Care



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of Cardiology



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Conflicts of interest

None to declare

A historical perspective of the PA catheter (PAC)



1972: Dr. Swan & Dr Ganz
(R Bradley, UK)

PAC \leq 24 h in critically ill patients: worse survival

September 18, 1996

The Effectiveness of Right Heart Catheterization in the Initial Care of Critically Ill Patients

Alfred F. Connors Jr, MD; Theodore Speroff, PhD; Neal V. Dawson, MD; [et al](#)

» [Author Affiliations](#)

JAMA. 1996;276(11):889-897. doi:10.1001/jama.1996.03540110043030

Case-matched, risk-adjusted study (N = 5735)

↑ 30-day mortality if PAC use \leq 24 h after ICU admission

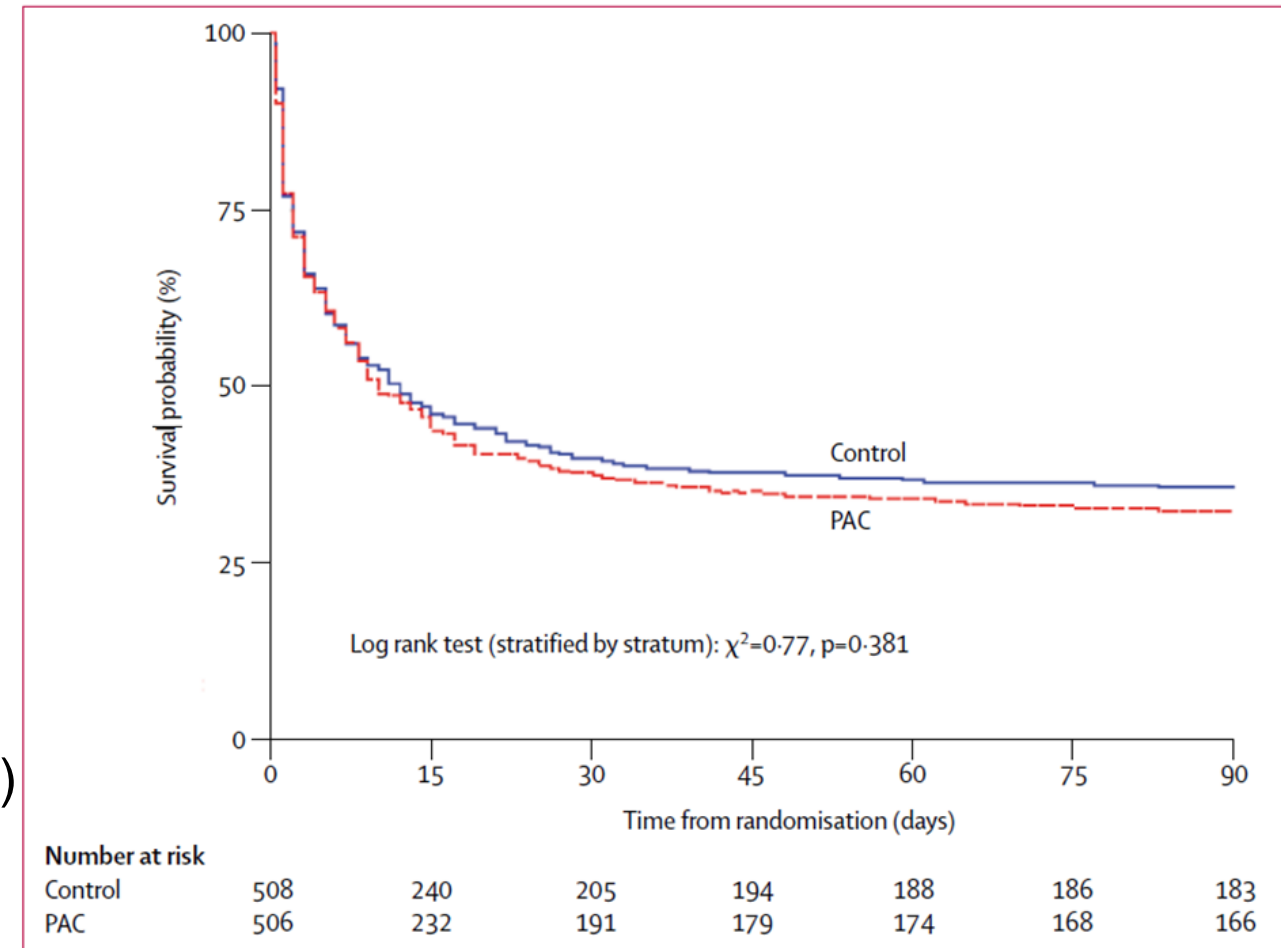
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PAC-Man trial – Harvey et al. The Lancet 2005

Population: N = 1041

- multicenter RCT, UK
- patients admitted to general ICU
- high APACHEII score at admission
- 11% ADHF
- PAC to guide vasoactive drug therapy
- no standardized protocol
- no data on how measurements were used

Primary endpoint: in-hospital mortality (68 vs 66%)

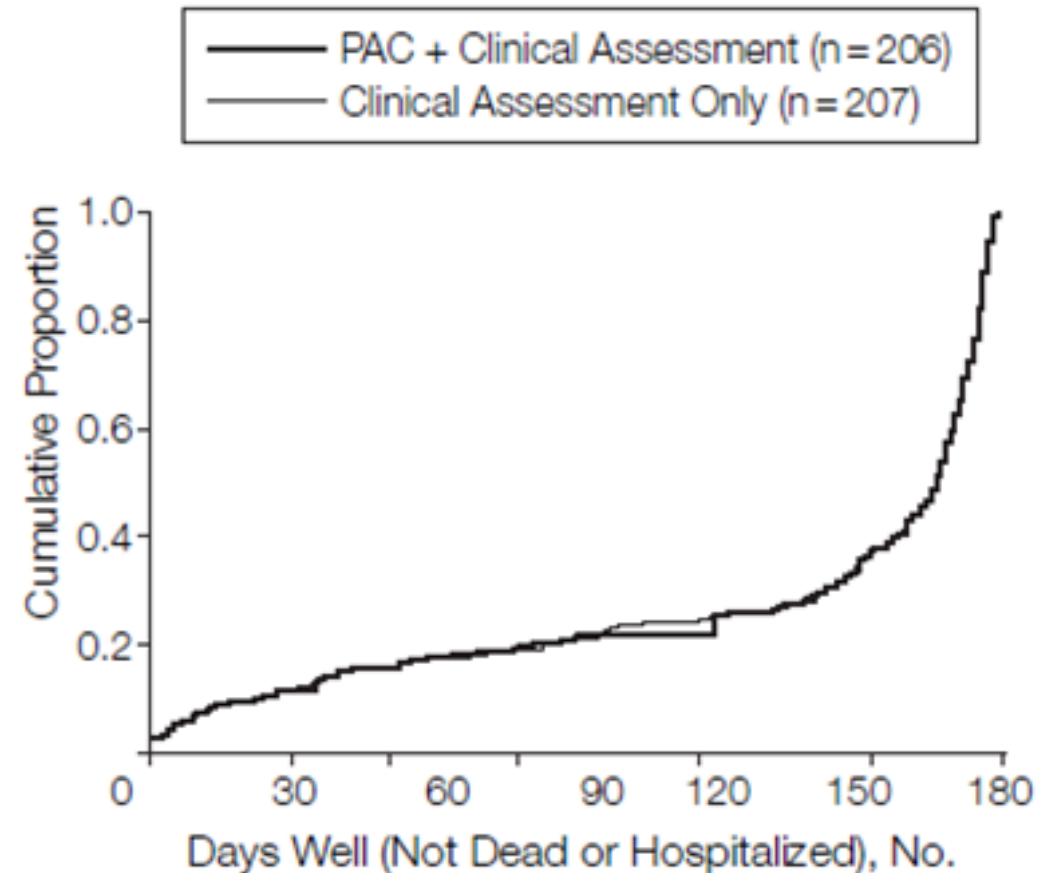


ESCAPE trial – Stevenson et al. JAMA 2005

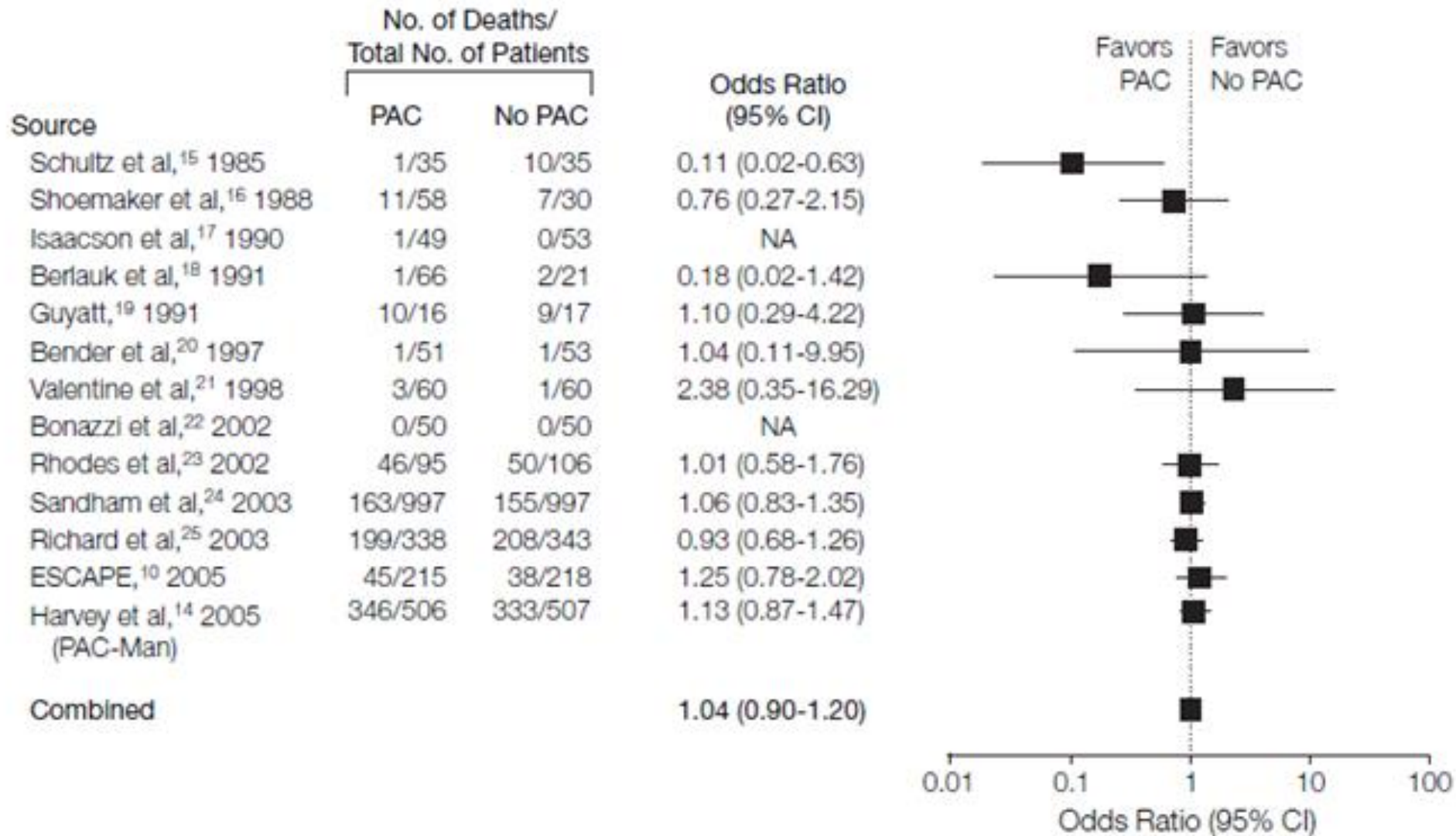
Population: N = 433

- multicenter RCT, US and Canada
- patients admitted with acute on chronic heart failure
 - LVEF \leq 30%, SBP \leq 125 mm Hg
 - 1 sign + 1 symptom of congestion
 - treated with GDMT \geq 3 months
 - almost no cardiogenic shock (<1%)
- main reason: to guide decongestion
- therapy according to physician
- no data on how measurements were used

Primary endpoint: days alive out of the hospital

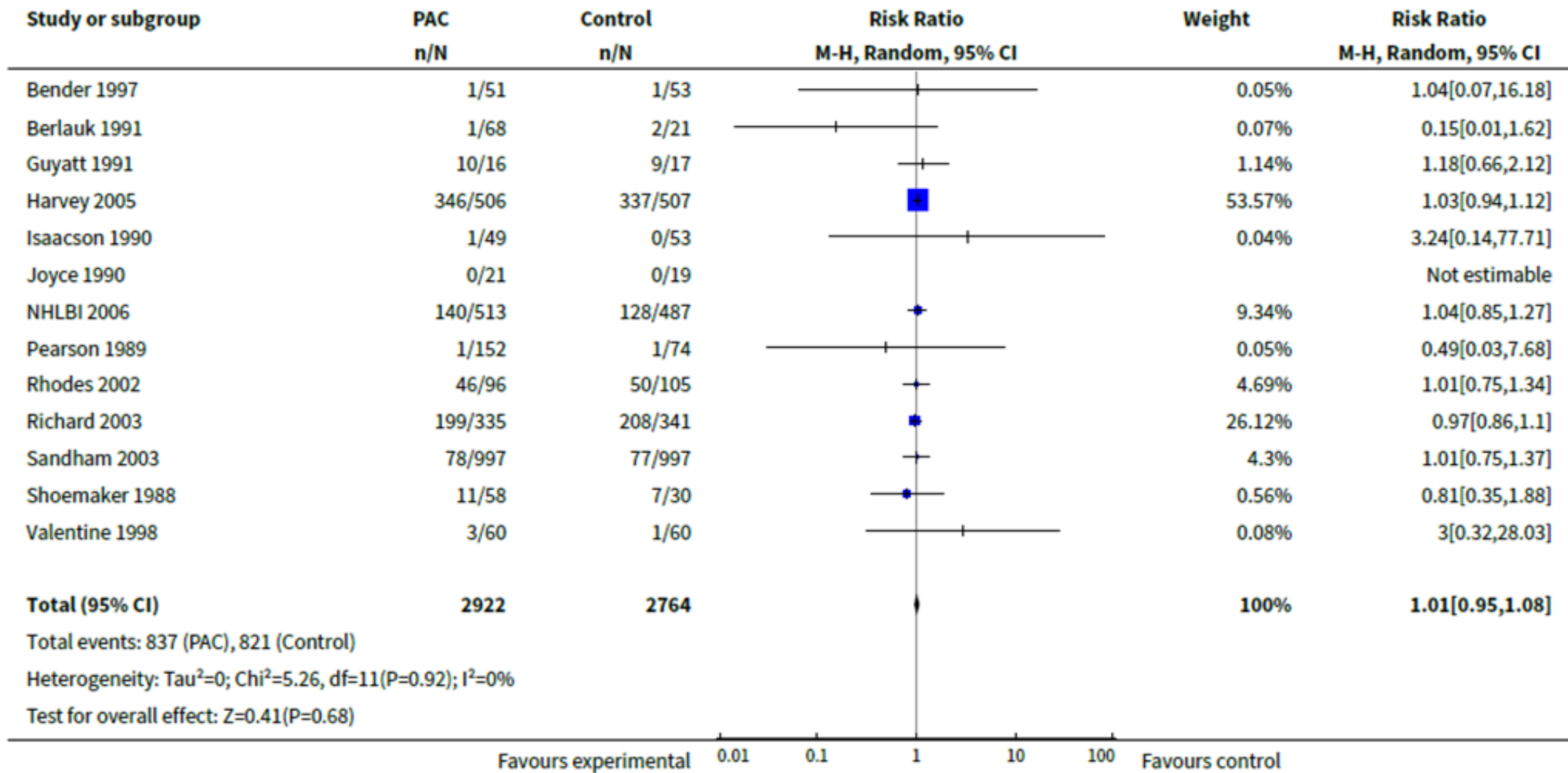


PAC in the critically ill population



Shah et al. Meta-analysis JAMA 2005

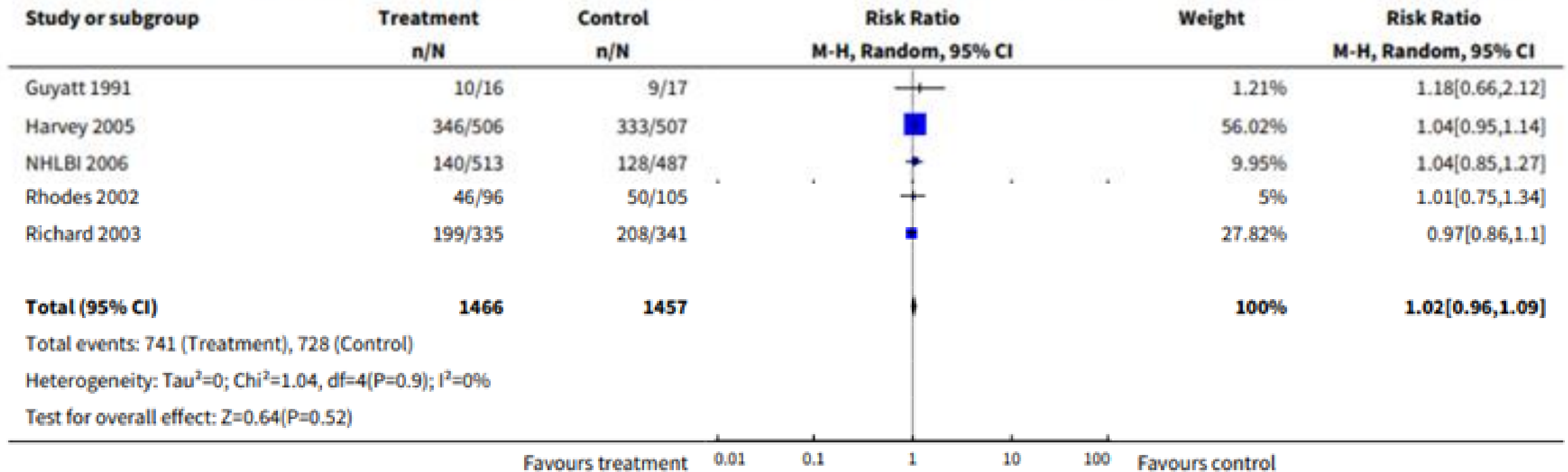
PAC in the critically ill and high-risk surgery population



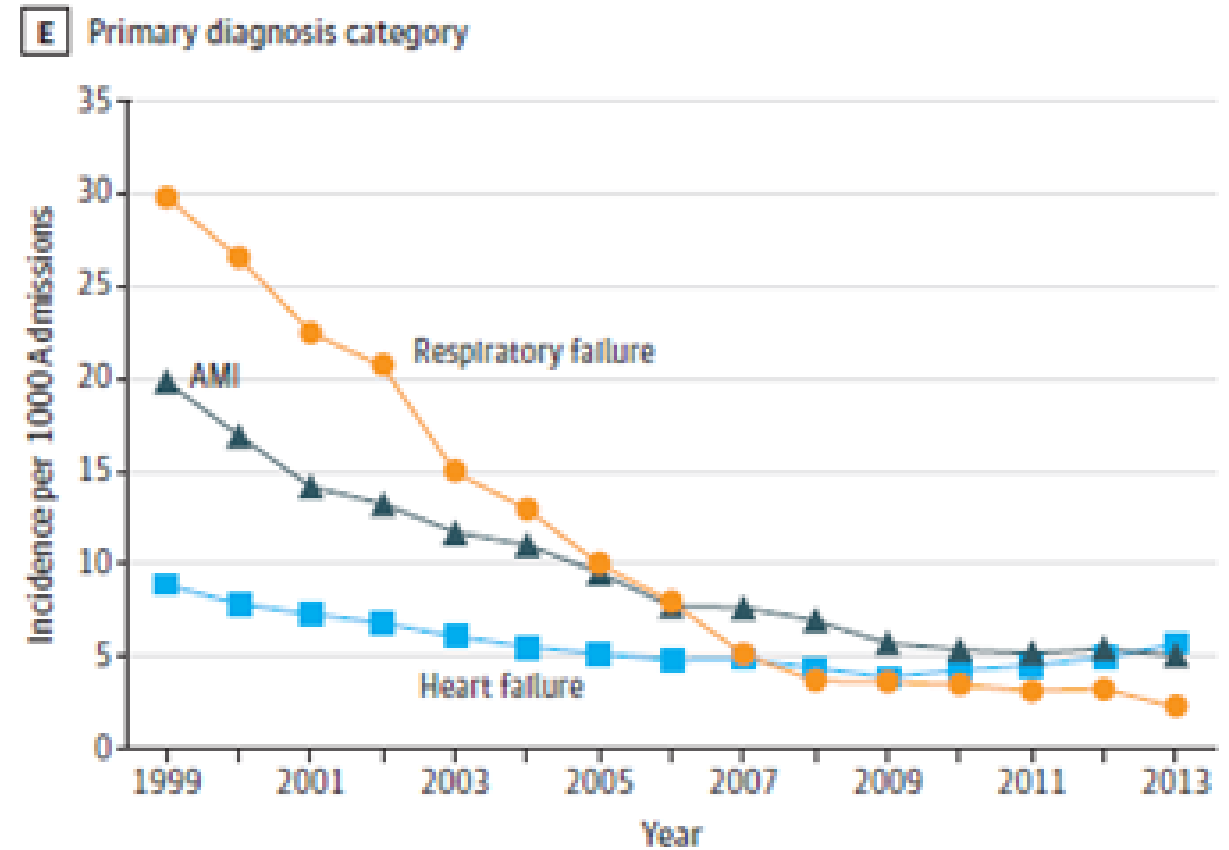
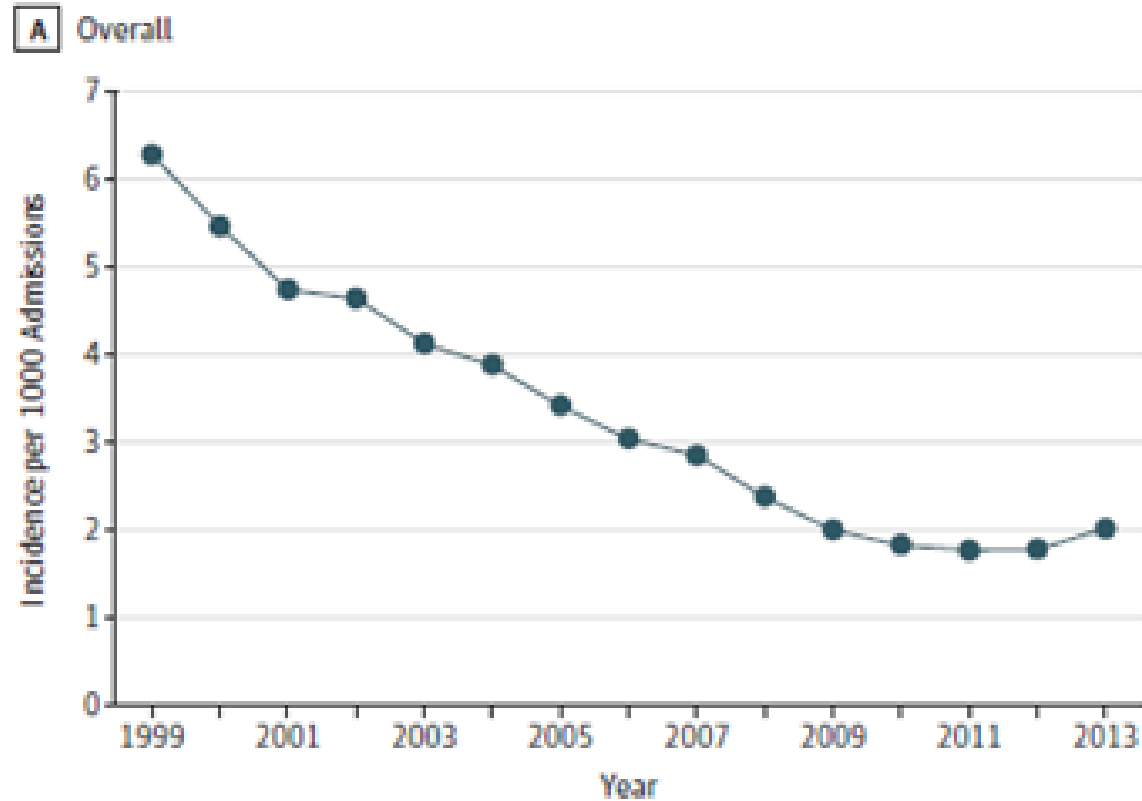
Rajaram et al. *Cochrane Database of Systematic Reviews* 2013

PAC in the critically ill population

Analysis 2.1. Comparison 2 PAC versus no PAC, Outcome 1 All types mortality (general intensive care patients).



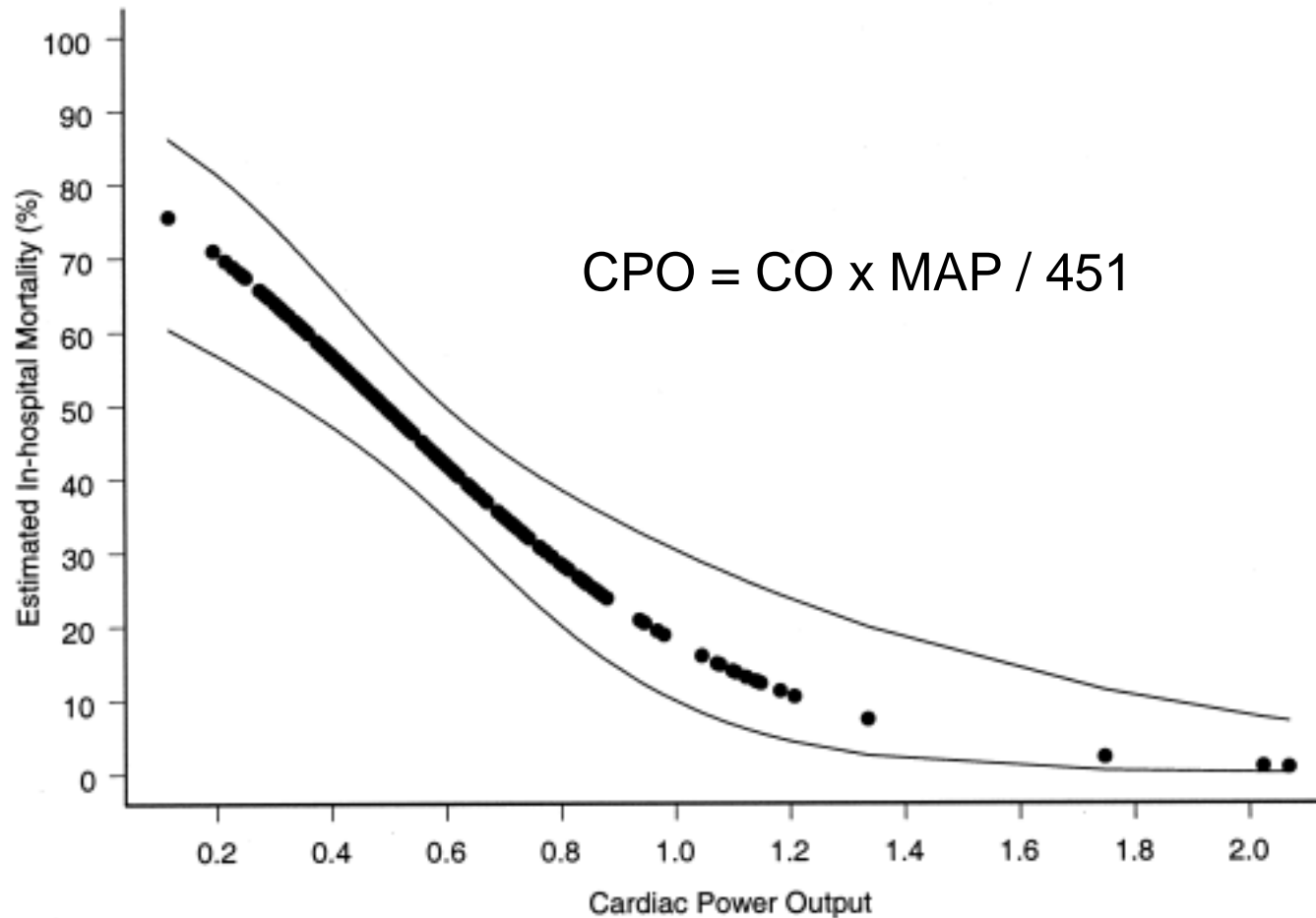
Trends in PAC use



National Trends in Use and Outcomes of Pulmonary Artery Catheters Among Medicare Beneficiaries, 1999-2013 - JAMA Cardiology 2017

Cardiac power output: hemodynamic variable measured by PAC

strongest independent correlation with survival in cardiogenic shock



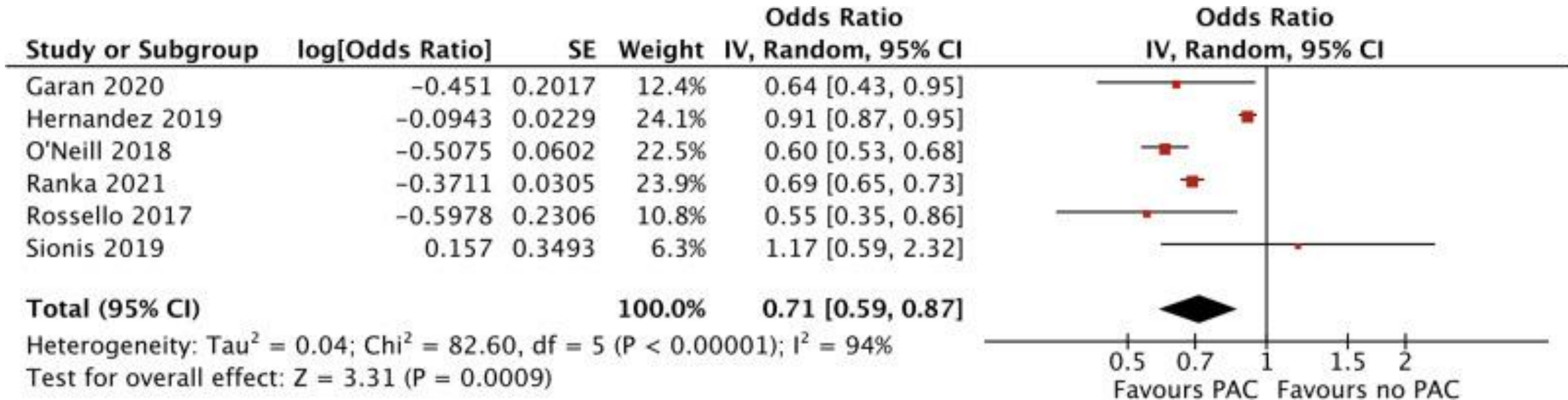
Post-hoc analysis from the SHOCK trial registry

Fincke et al. JACC 2004

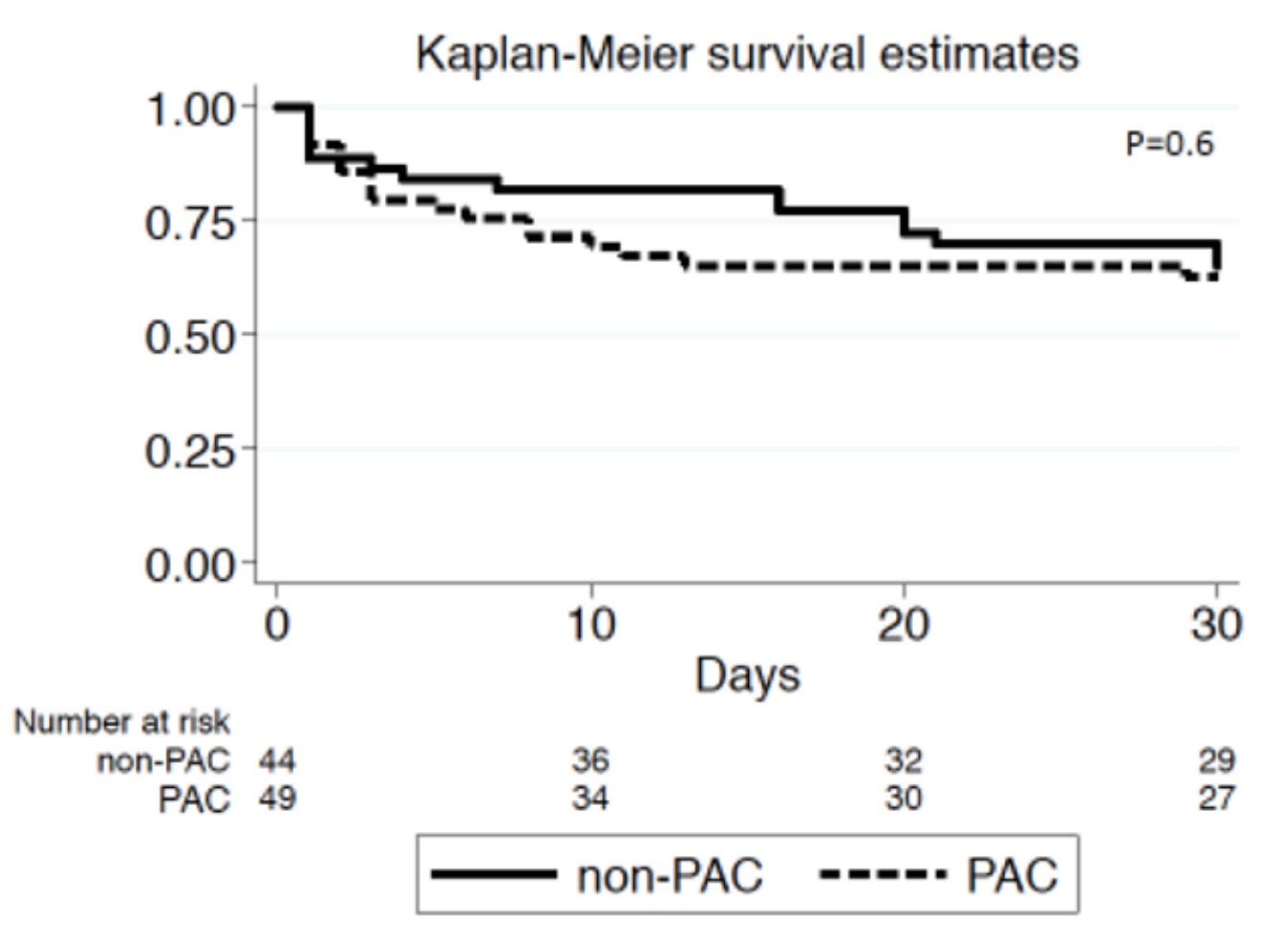
Prognostic implications of pulmonary artery catheter monitoring in patients with **cardiogenic shock**: A systematic review and meta-analysis of **observational studies**



Maurizio Bertaina et al. 2022



Current use and impact of PAC in cardiogenic shock in Europe



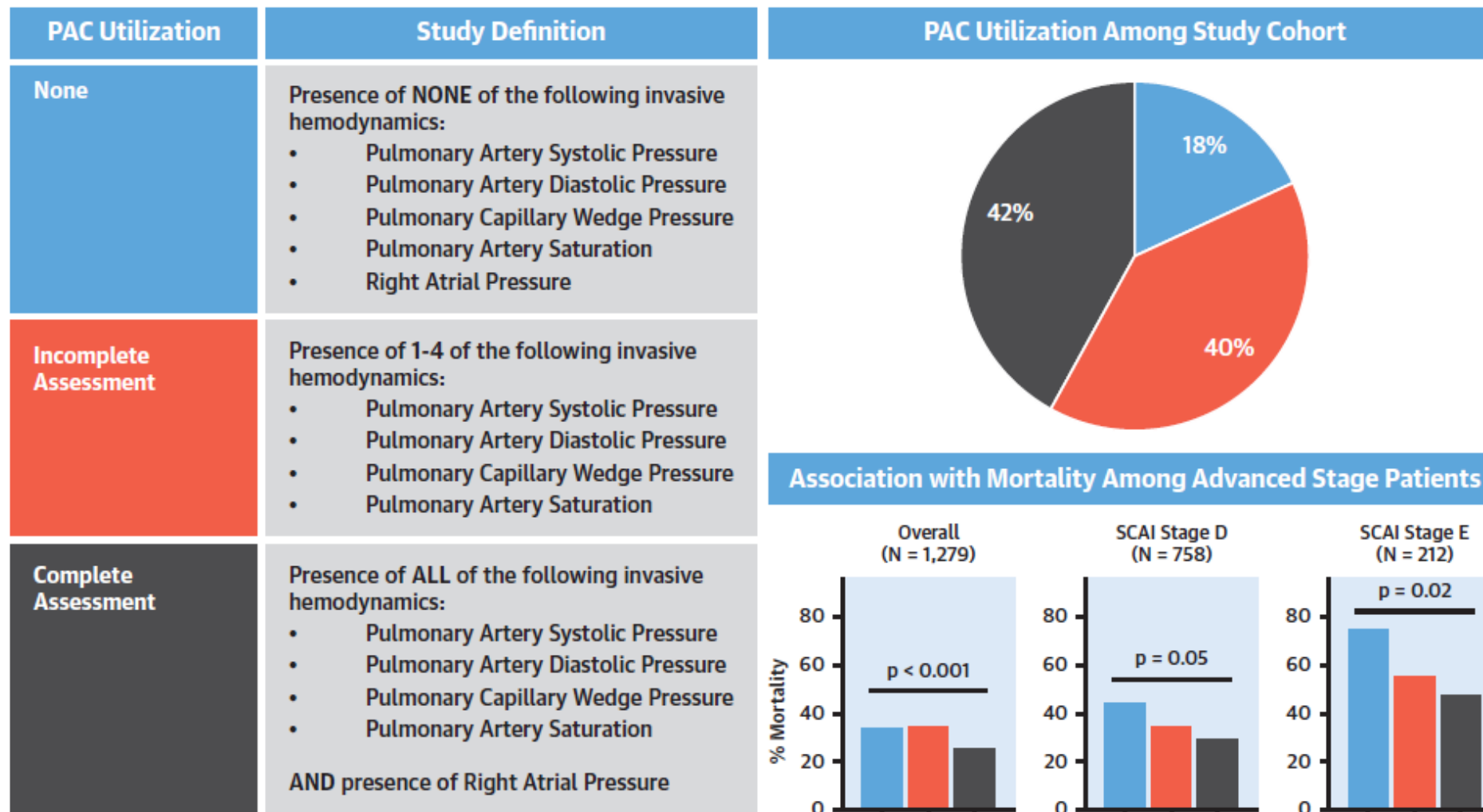
Cardshock study (N = 219)

- PAC use in 37.4%
- >70% AMI-CS
- PAC group:
higher APACHEII-score
more aggressive treatment
no severe complications

Sionis et al. Journal of Intensive Care Medicine 2021

Complete PAC assessment – lower in-hospital mortality?

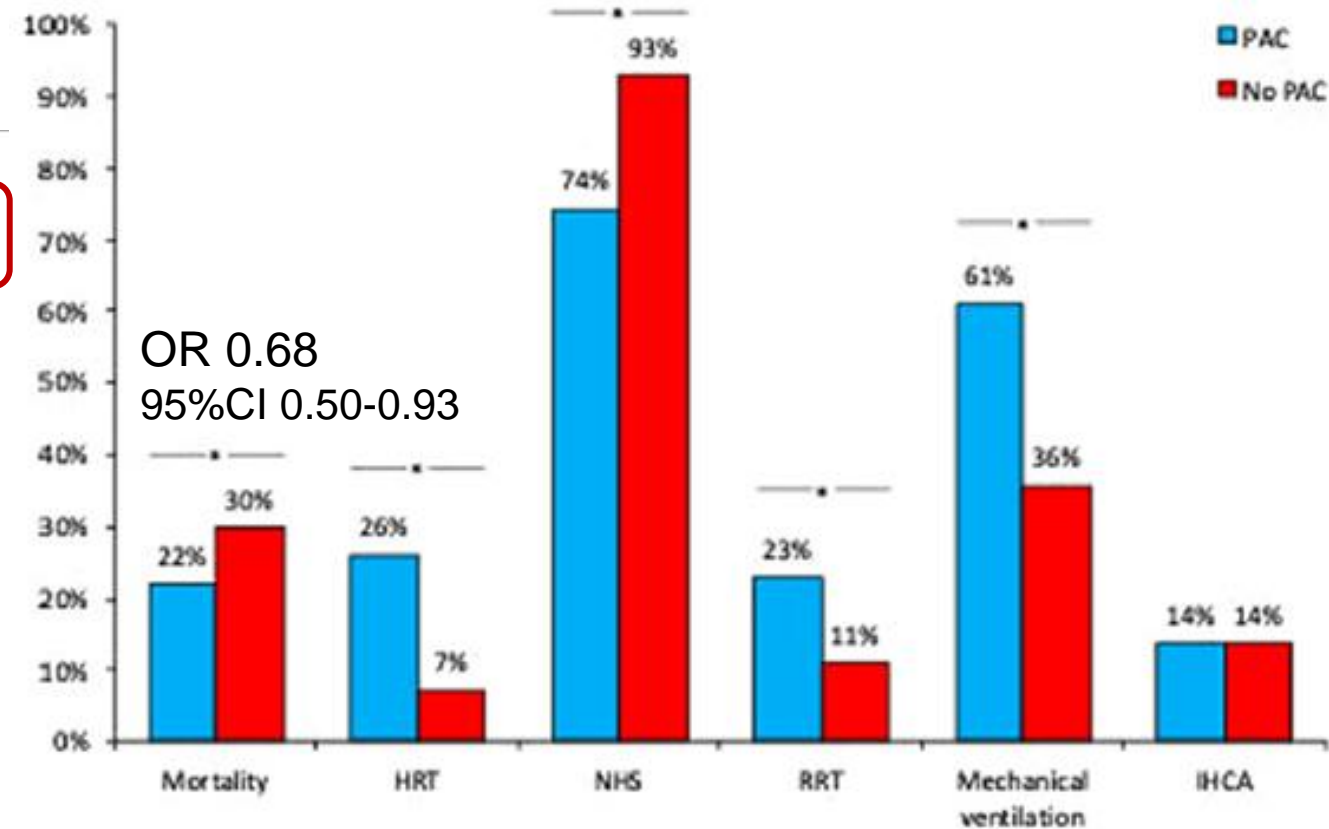
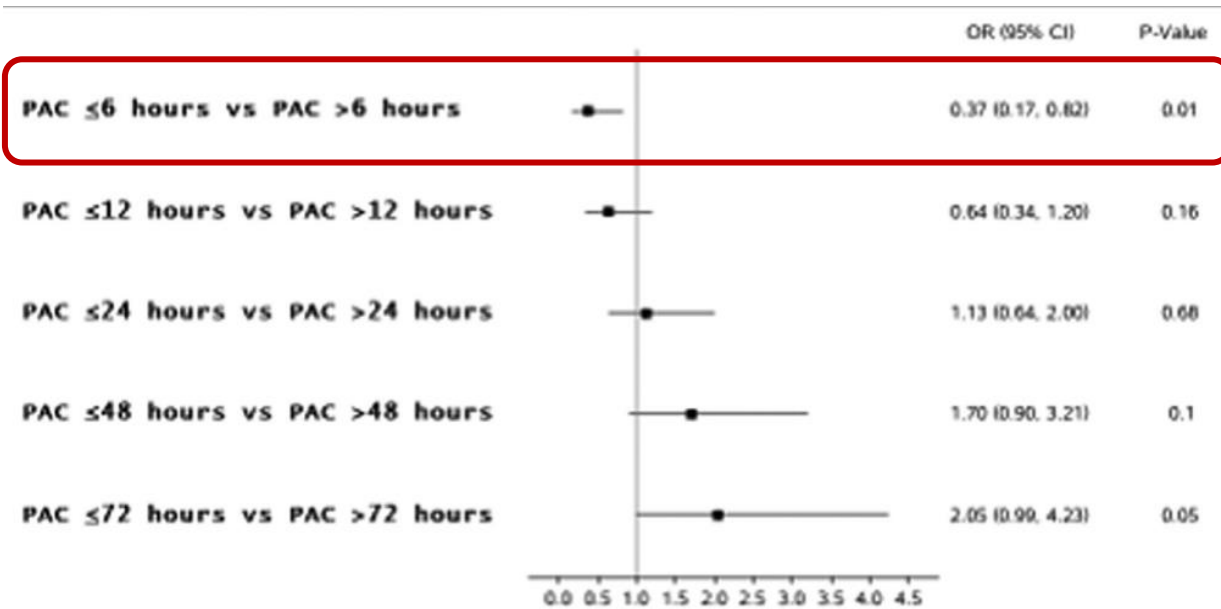
CENTRAL ILLUSTRATION Frequency of Mortality Among PAC Use Overall and by SCAI Stage



Garan, A.R. et al. J Am Coll Cardiol HF. 2020;8(11):903-13.

PAC in HF-CS: the earlier, the better?

Retrospective multicenter study (N = 1055)
Cardiogenic Shock Working Group Registry



Kanwar et al. Journal of Cardiac Failure 2023

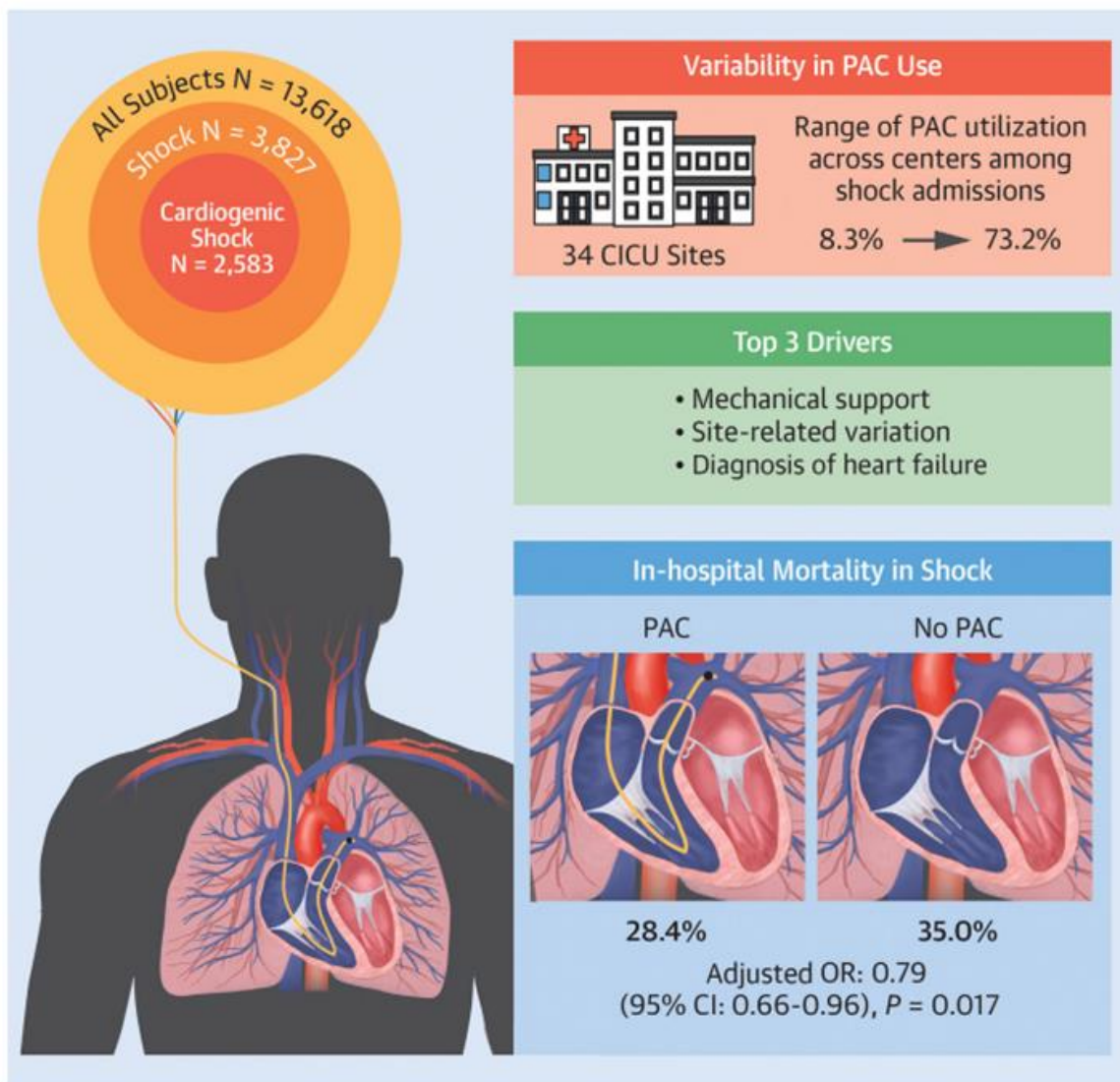
PAC use – lower in-hospital mortality?

Retrospective multicenter study
Critical Care Cardiology Trials Network North America

Variable site practice:
PAC use 1.1% - 34.9% per site

PAC: previous HF, LVEF<20%, valvular or congenital heart disease, pulmonary hypertension
Less PAC in advanced age, multiple comorbidities

CENTRAL ILLUSTRATION Pulmonary Artery Catheter Use in CICUs and Association With Mortality



Kadosh BS, et al. J Am Coll Cardiol HF. 2023;11(8):903-914.

CICU = cardiac intensive care unit; PAC = pulmonary artery catheter.

What do the guidelines say?



No clear recommendation on PA catheter
in cardiogenic shock

2021 ESC guidelines on Heart Failure

2b	B-NR	4. In patients presenting with cardiogenic shock, placement of a PA line may be considered to define hemodynamic subsets and appropriate management strategies. ²³⁻²⁷
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2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure



Under development:
“Consensus Statement on shock diagnosis
and haemodynamic monitoring in the ICU”

The future... RCT in HF-CS

NIH U.S. National Library of Medicine

ClinicalTrials.gov

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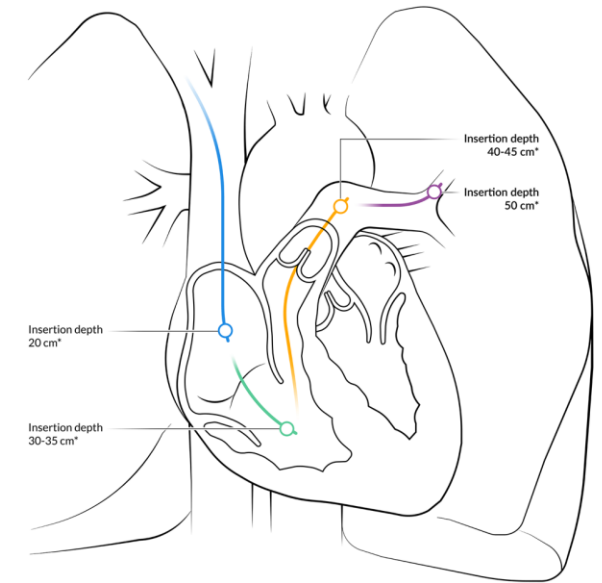
[Home](#) > [Search Results](#) > Study Record Detail

Pulmonary Artery Catheter in Cardiogenic Shock Trial (PACCS)

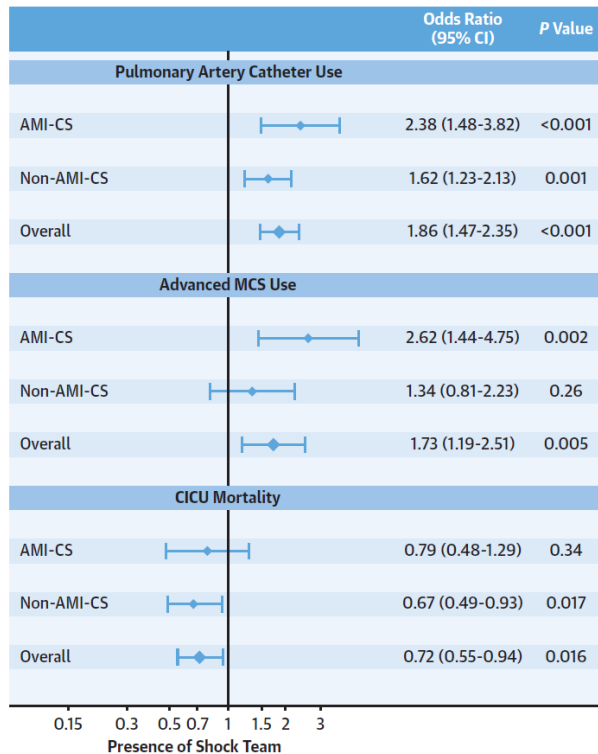
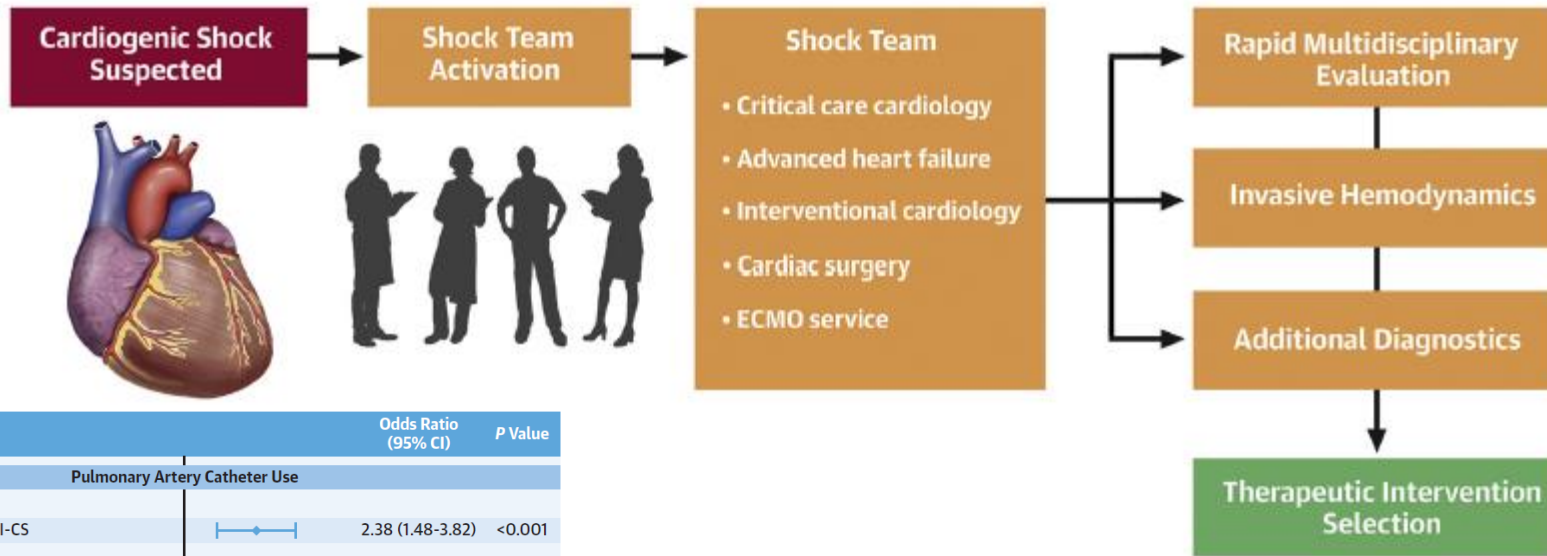
- RCT
- PAC ≤ 6h of randomization vs no or delayed PAC (>48h)
- Heart Failure related-CS (de novo or acute on chronic) (excl AMI)
- Primary outcome: in-hospital mortality

Equipose based on current observational data?

16% PAC in US in CS
>95% at individual sites



Shock teams / protocols might improve survival – PAC - guided?



Clinical Course and Outcomes	Shock Team (n = 546)	No Shock Team (n = 696)	P Value
Time from CICU admission to PAC, days	0.3 (0.08-1.00)	0.66 (0.15-1.58)	0.019
Median number of inotropes administered	1 (1-2)	2 (1-2)	0.008
Mechanical ventilation	223 (40.8)	363 (52.2)	<0.001
New renal replacement therapy	58 (10.6)	131 (18.8)	<0.001
Duration of CICU stay, days	4.0 (2.0-7.5)	5.1 (2.4-10.5)	<0.001
CICU mortality	126 (23.1)	200 (28.7)	0.025
MCS			
Treated with any MCS	192 (35.2)	299 (43.0)	0.005
MCS before transfer	47 (24.5)	88 (29.6)	0.22
MCS during first 24 hours	115 (59.9)	154 (51.9)	–
MCS after 24 hours	30 (15.6)	55 (18.5)	–

Papalos, A.I. et al. *J Am Coll Cardiol.* 2021;78(13):1309-1317.

<u>Shock team characteristics (n=10)</u>	
Members of the shock team include representation from:	
Critical care cardiology	10/10 (100%)
Cardiac surgery	10/10 (100%)
Interventional cardiology	9/10 (90%)
Advanced heart failure	8/10 (80%)
Extracorporeal membrane oxygenation service	7/10 (70%)
Is there a centralized way to active the shock team?	10/10 (100%)
Is the shock team a 24/7 service?	10/10 (100%)
Is a there a shock team member in-hospital 24/7?	6/10 (60%)
What proportion of patients receive pulmonary artery catheters prior to shock team activation?	
<1/3 rd	4/10 (40%)
1/3 rd - 2/3 rd	6/10 (60%)
>2/3 rd	0/10 (%)
What proportion of patients receive pulmonary artery catheters after shock team activation?	
<1/3 rd	0/10 (0%)
1/3 rd - 2/3 rd	3/10 (30%)
>2/3 rd	7/10 (70%)
Are specific hemodynamic algorithms used to guide management?	4/10 (40%)
Are there regularly scheduled shock team meetings to review cases as part of ongoing quality improvement efforts?	5/10 (50%)

Take home messages

- Routine use of PAC in cardiogenic shock: no benefit on survival
- ↑ use in cardiogenic shock
- Assessment of PAC variables should be complete (exclude errors and pitfalls)
- Guidance in use of fluids / vasoactive drugs / MCS, eg in mixed or biventricular shock
- Monitoring tool, complimentary to other HD monitoring (echo) >< treatment
- Awaiting further RCT's!

It is never the tool that decides.
It's the hands -and the heart- of the one who wields it.”

— Kevin Sands

Thank you!

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