

# Updates in Cardiogenic Shock

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With every heart we heal, we remember you.....



Michael Julian Collins (March 1981 – March 2023)

Son, husband, father, friend, shock-doc and 'cannulator-in-chief'

# Cardiogenic Shock Summit 2022

- Focus on early recognition (and transfer)
- Focus on assessment of shock severity
- Approach to shock management



But Manreet, you  
always tell us to  
hurry up...  
and then wait!

# Western PA Shock Summit 2023 – *what's new?*

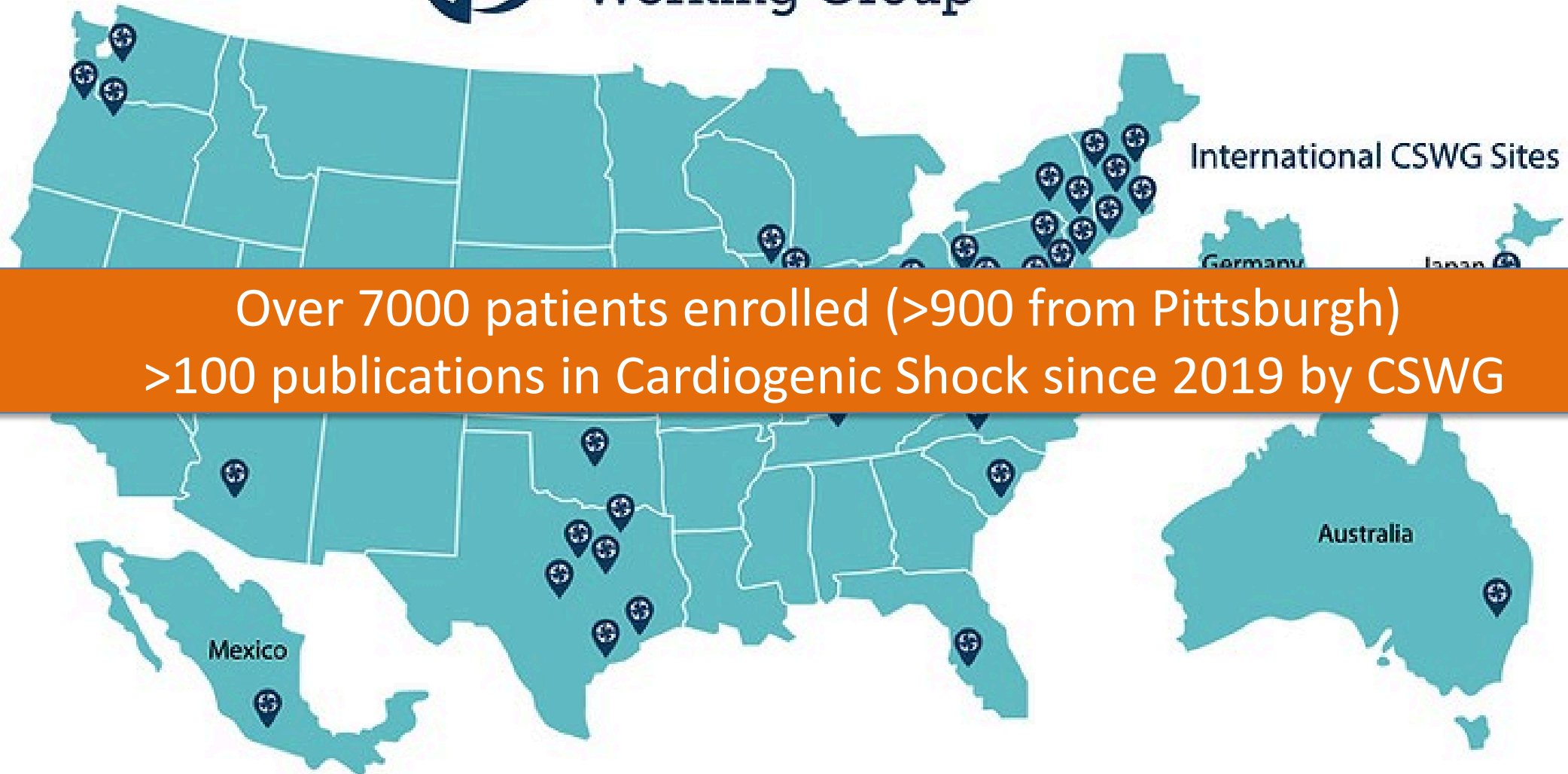
1. A more organized approach to cardiogenic shock (art of CS)
2. A renewed commitment to generating the science of CS
3. Learning to appreciate the role RV (beyond LV) in CS
4. New trials in CS
5. Cardiogenic shock does not care about an insurer!

# My disclosures

- Consultant for Abiomed, Abbott, CorWave
- Steering Committee Member for Cardiogenic Shock Working Group



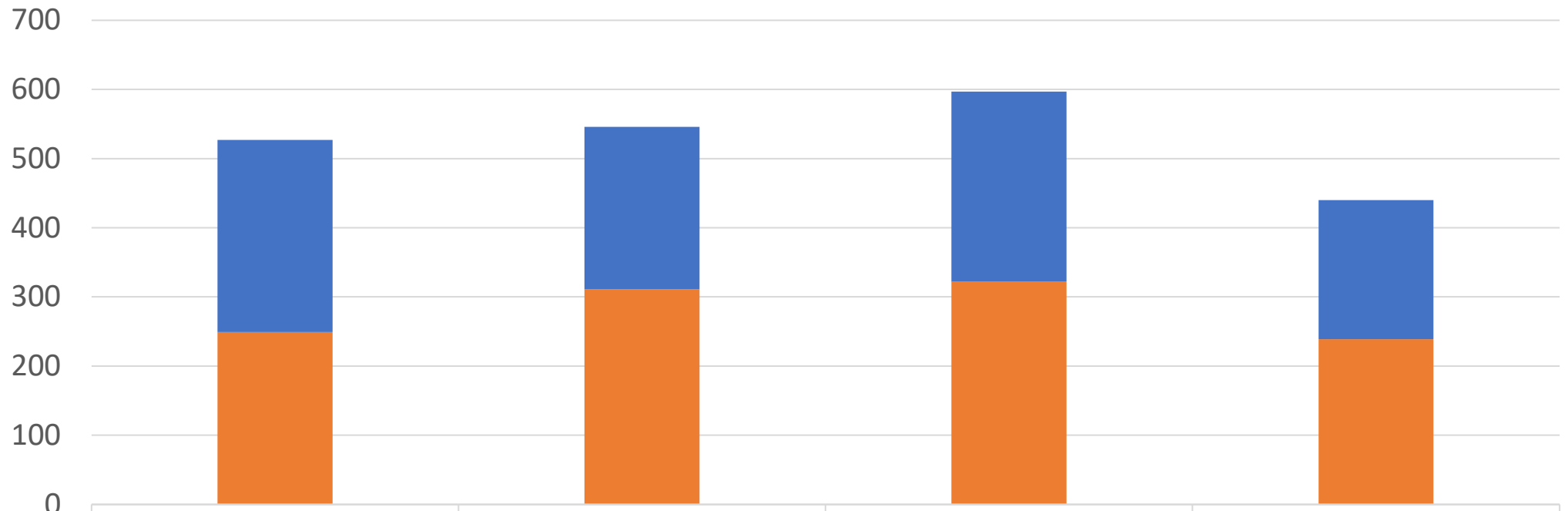
## The Cardiogenic Shock Working Group



Over 7000 patients enrolled (>900 from Pittsburgh)  
>100 publications in Cardiogenic Shock since 2019 by CSWG

# Admission Source:

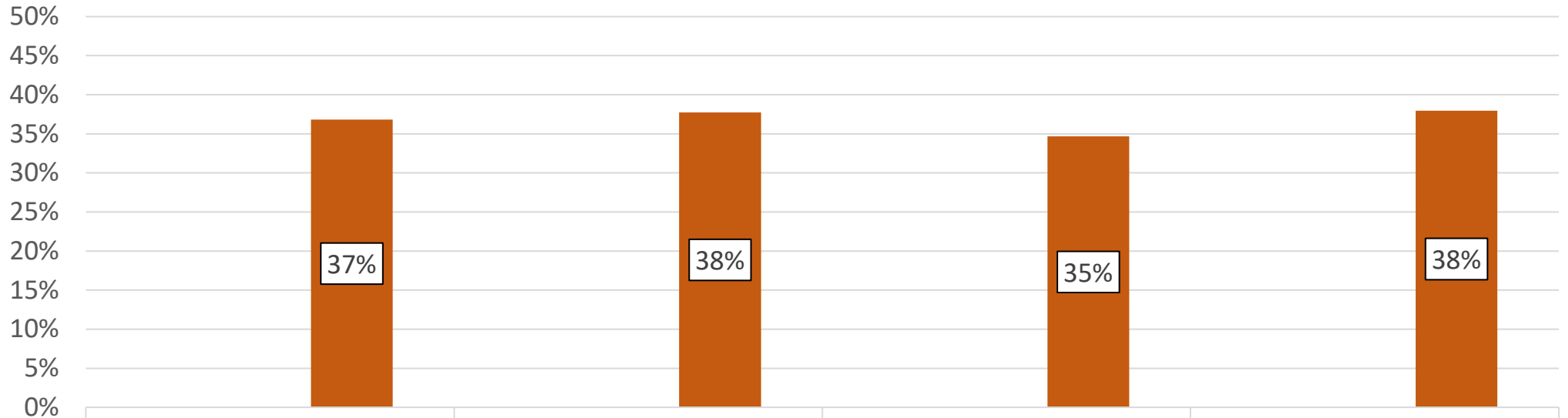
## AGH Patients With Final Discharge ICD-10 Code R57.0 (Cardiogenic Shock)



	2020	2021	2022	2023* Partial Year
Transfer to AGH	278	235	275	201
Admission via AGH ER	249	311	322	239
<b>Total</b>	<b>527</b>	<b>546</b>	<b>597</b>	<b>440</b>

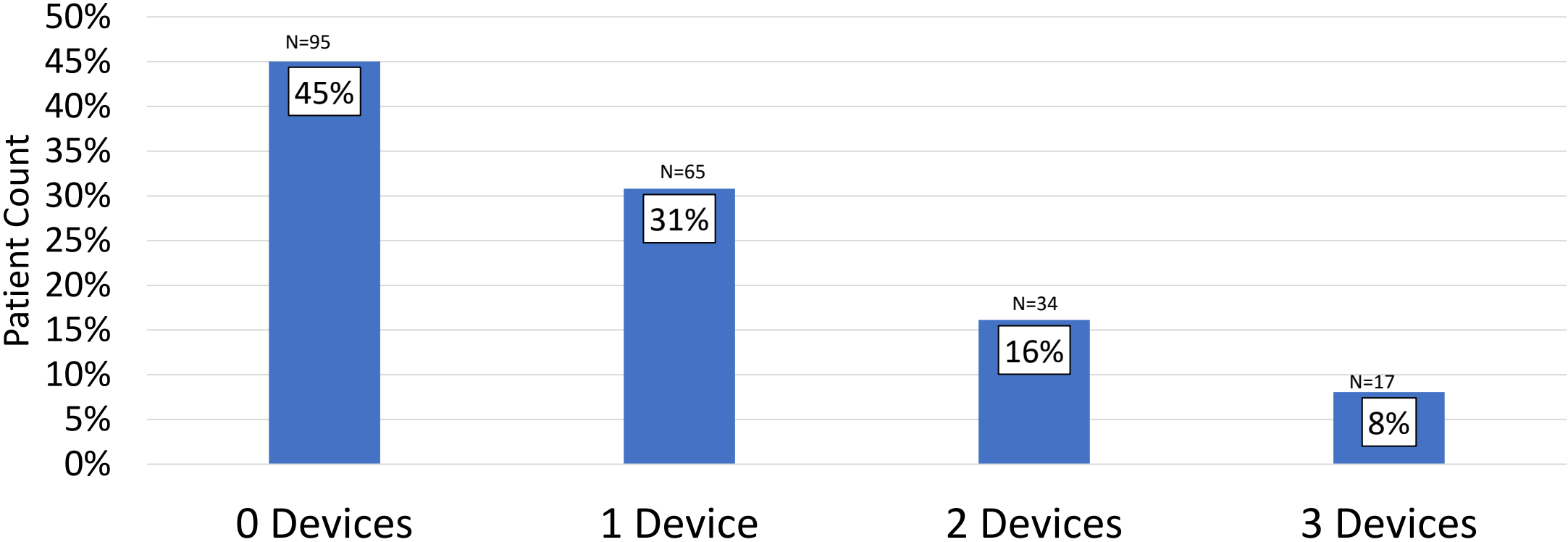


# Index Admission: Died or Discharged to Hospice



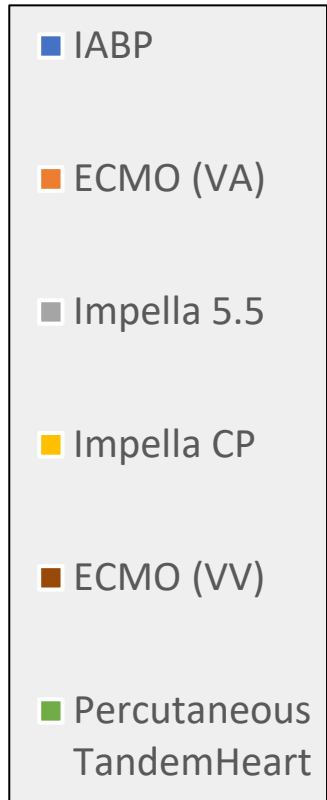
	2020	2021	2022	2023* Partial Year
DC'd Allive	333	340	390	273
Died or DC'd to Hospice	194	206	207	167
<span style="color: #C85130;">■</span> % Died or DC'd to Hospice	37%	38%	35%	38%
Total	527	546	597	440

# AGH: Number of Devices per Patient\*

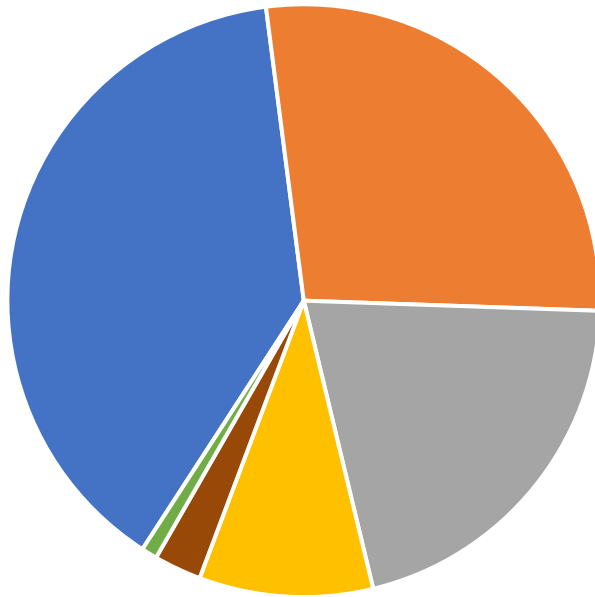


\*from 7/2022 to 6/2023

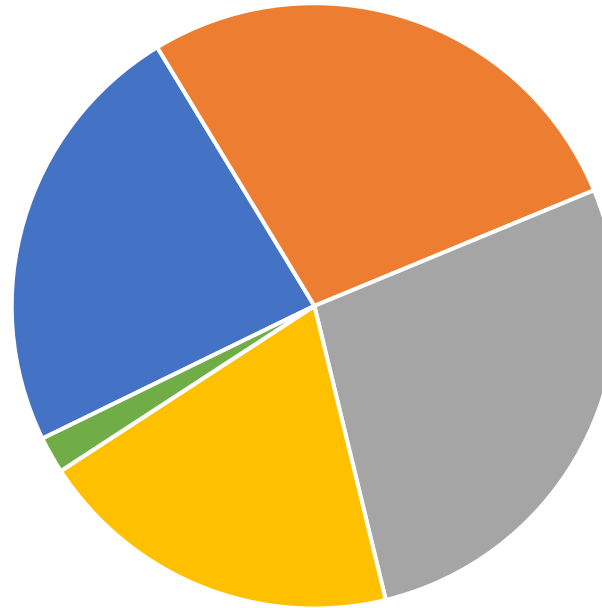
# AGH: Device Type by Order of Usage\*



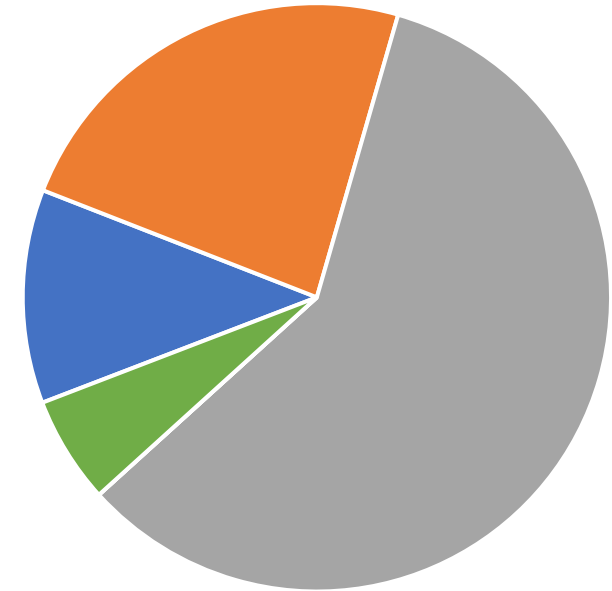
First Device



Second Device



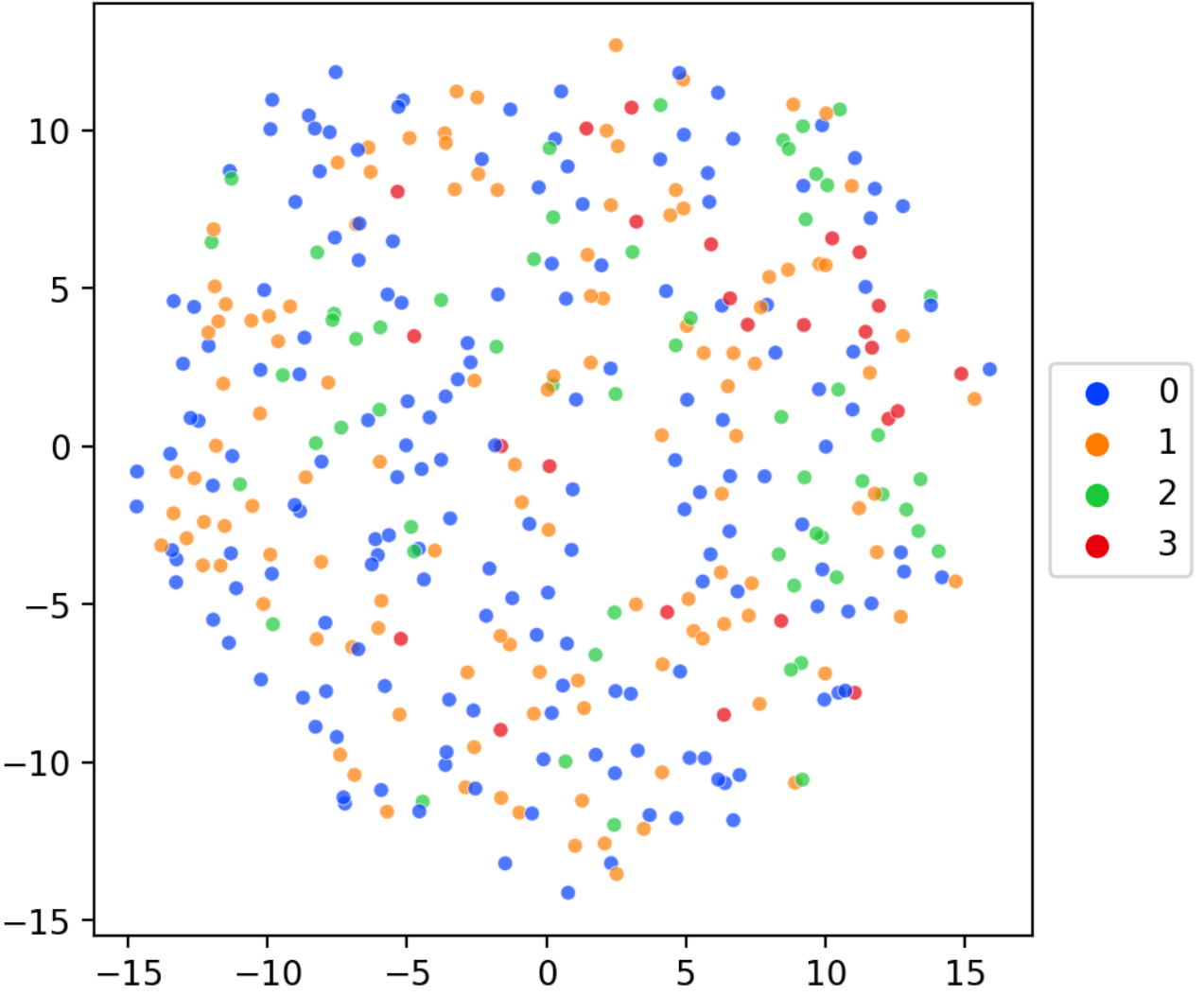
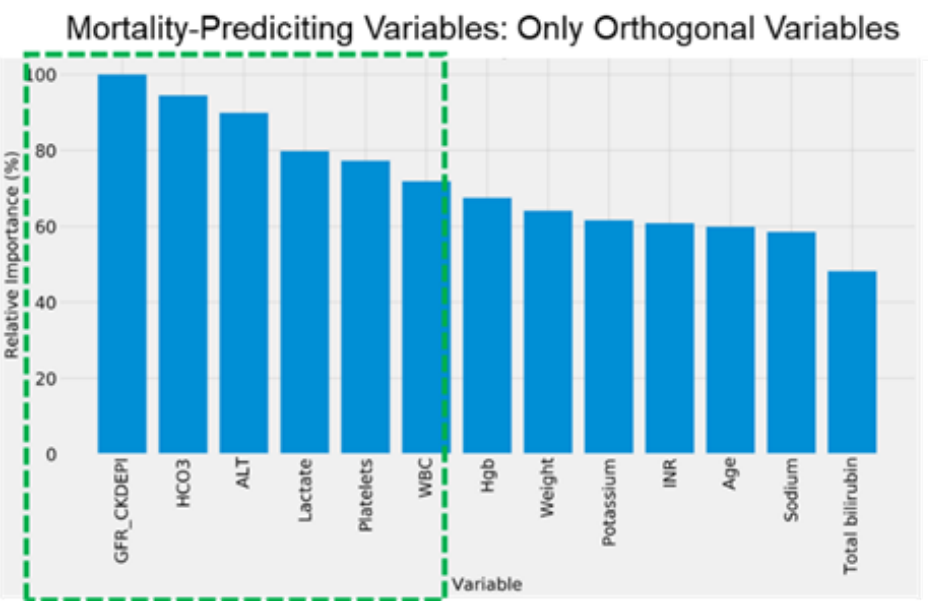
Third Device



\*from 7/2022 to 6/2023

# Choice of initial temporary MCS in CS patients

C



# Complete Hemodynamic Profiling With Pulmonary Artery Catheters in Cardiogenic Shock Is Associated With Lower In-Hospital Mortality



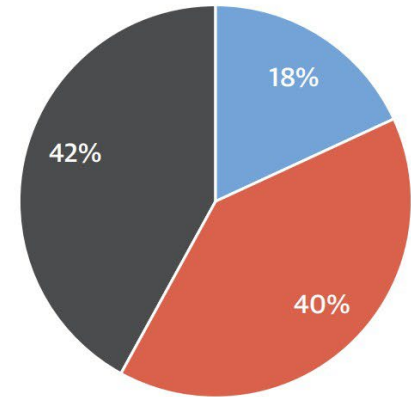
## PAC Use is Associated with Improved Outcomes Especially in Stage D-E Shock and in HF-CS

A. Reshad Garan, MD, MS,<sup>a,\*</sup> Manreet Kanwar, MD,<sup>b,\*</sup> Katherine L. Thayer, MPH,<sup>c</sup> Evan Whitehead, MD,<sup>d</sup> Elric Zweck, MSc,<sup>e,g</sup> Jaime Hernandez-Montfort, MD, MPH,<sup>f</sup> Claudius Mahr, DO,<sup>g</sup> Jillian L. Haywood, MS,<sup>c</sup> Neil M. Harwani, MS,<sup>c</sup> Detlef Wencker, MD,<sup>h</sup> Shashank S. Sinha, MD, MSc,<sup>i</sup> Esther Vorovich, MD,<sup>j</sup> Jacob Abraham, MD,<sup>k</sup> William O'Neill, MD,<sup>l</sup> Daniel Burkhoff, MD, PhD,<sup>m</sup> Navin K. Kapur, MD<sup>c</sup>

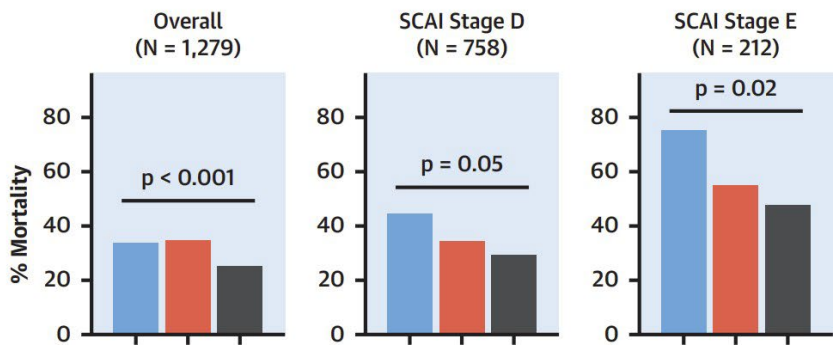
JACC: HEART FAILURE VOL. 8, NO. 11, 2020  
NOVEMBER 2020:903-13

PAC Utilization	Study Definition
None	Presence of <b>NONE</b> of the following invasive hemodynamics: <ul style="list-style-type: none"> <li>• Pulmonary Artery Systolic Pressure</li> <li>• Pulmonary Artery Diastolic Pressure</li> <li>• Pulmonary Capillary Wedge Pressure</li> <li>• Pulmonary Artery Saturation</li> <li>• Right Atrial Pressure</li> </ul>
Incomplete Assessment	Presence of <b>1-4</b> of the following invasive hemodynamics: <ul style="list-style-type: none"> <li>• Pulmonary Artery Systolic Pressure</li> <li>• Pulmonary Artery Diastolic Pressure</li> <li>• Pulmonary Capillary Wedge Pressure</li> <li>• Pulmonary Artery Saturation</li> </ul>
Complete Assessment	Presence of <b>ALL</b> of the following invasive hemodynamics: <ul style="list-style-type: none"> <li>• Pulmonary Artery Systolic Pressure</li> <li>• Pulmonary Artery Diastolic Pressure</li> <li>• Pulmonary Capillary Wedge Pressure</li> <li>• Pulmonary Artery Saturation</li> </ul> AND presence of Right Atrial Pressure

### PAC Utilization Among Study Cohort



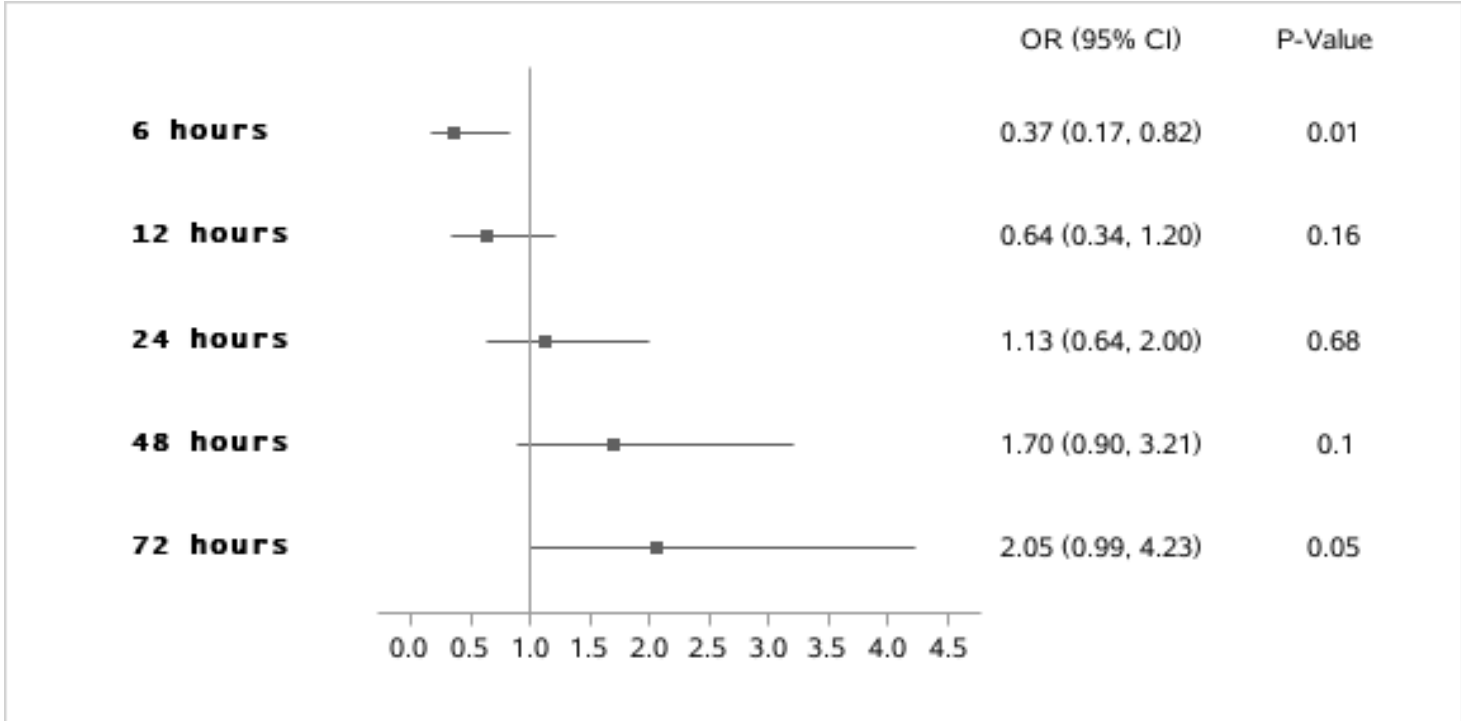
### Association with Mortality Among Advanced Stage Patients



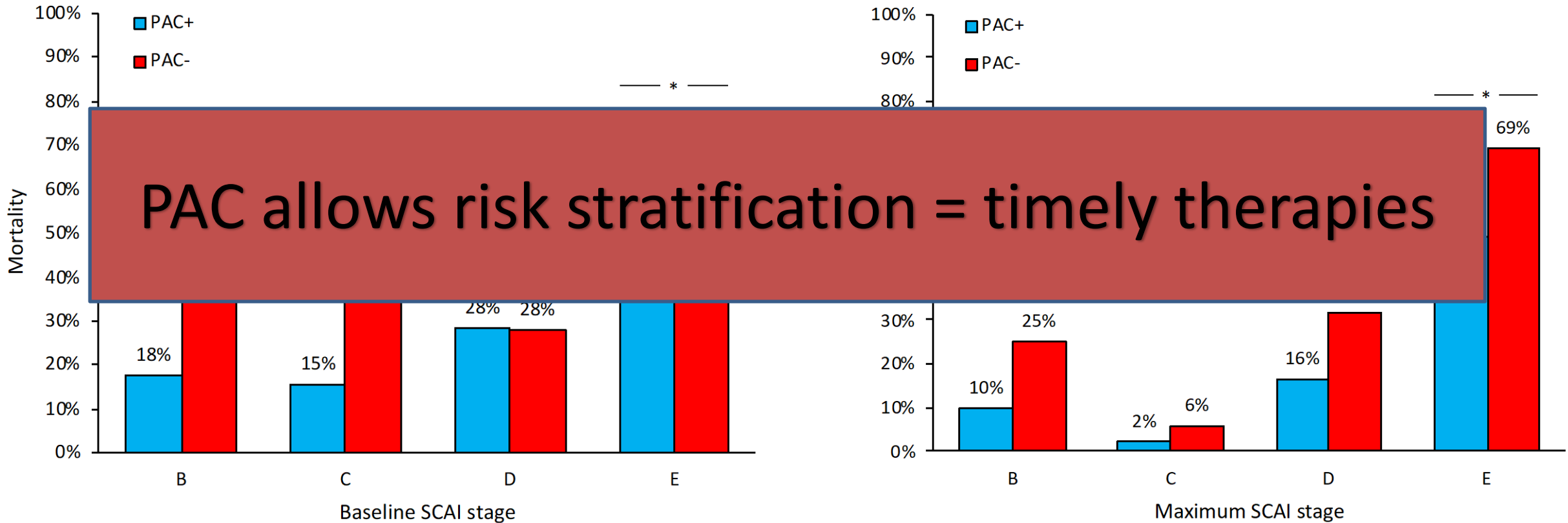
# Pulmonary Artery Catheter Use and Risk of In-hospital Death in Heart Failure Cardiogenic Shock

MANREET K. KANWAR, MD,<sup>1</sup> VANESSA BLUMER, MD,<sup>2</sup> YIJING ZHANG, MA,<sup>3</sup> SHASHANK S. SINHA, MD, MSc,<sup>4</sup> ARTHUR R. GARAN, MD,<sup>5</sup> JAIME HERNANDEZ-MONTFORT, MD,<sup>6</sup> ADNAN KHALIF, MD,<sup>1</sup> GAVIN W. HICKEY, MD,<sup>7</sup> JACOB ABRAHAM, MD,<sup>8</sup> CLAUDIUS MAHR, MD,<sup>9</sup> BORUI LI, MA,<sup>3</sup> PAAVNI SANGAL, MPH,<sup>3</sup> KAROL D. WALEC, BS,<sup>3</sup> PETER ZAZZALI, MS, MPH,<sup>3</sup> RACHNA KATARIA, MD,<sup>10</sup> MOHIT PAHUJA, MD,<sup>11</sup> VAN-KHUE TON, MD, PhD,<sup>12</sup> NEIL M. HARWANI, MS,<sup>3</sup> DETLEF WENCKER, MD,<sup>13</sup> SANDEEP NATHAN, MD,<sup>14</sup> ESTHER VOROVICH, MD,<sup>15</sup> SHELLEY HALL, MD,<sup>13</sup> WISSAM KHALIFE, MD,<sup>16</sup> SONG LI, MD,<sup>9</sup> ANDREW SCHWARTZMAN, MD,<sup>17</sup> JU KIM, MD,<sup>18</sup> OLEG ALEC VISHNEVSKY, MD,<sup>19</sup> LUDOVIC TRINQUART, PhD,<sup>20</sup> DANIEL BURKHOFF, MD, PhD,<sup>21</sup> AND NAVIN K. KAPUR, MD<sup>3</sup>

## Early PAC was associated with lower mortality in HF-CS



# PAC was associated with lower mortality across SCAI stages



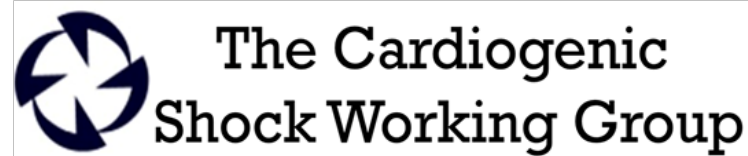
# PAC-CS Trial

## Pulmonary Artery Catheters in Cardiogenic Shock Trial

A prospective, multi-center, randomized, parallel-controlled, open-label, two-arm Trial

National PIs: Navin K. Kapur, MD; Manreet Kanwar MD; Daniel Burkhoff MD PhD

Co-PI's: A. Reshad Garan, MD; Shashank Sinha MD MSc; Jaime Hernandez-Montfort MD MPH



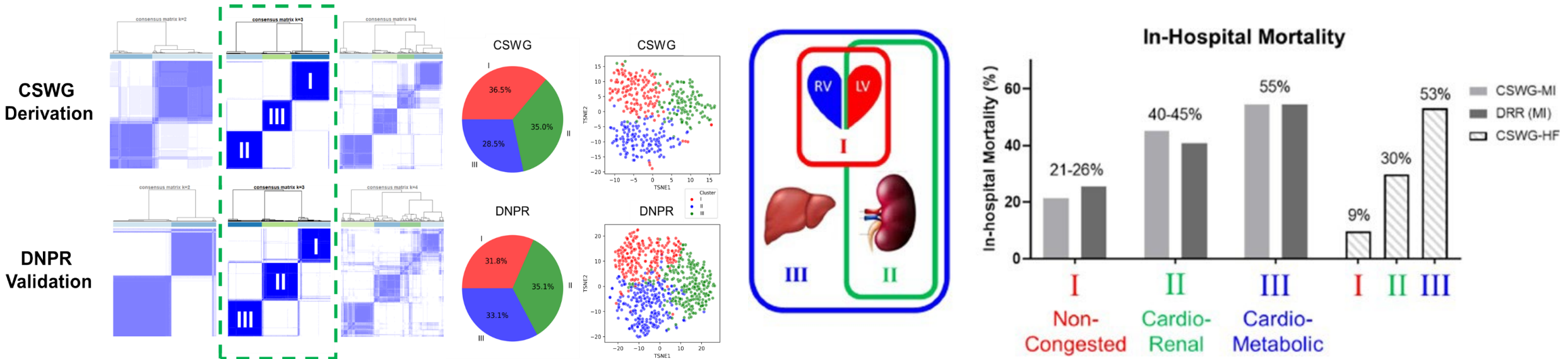


# Phenotyping Cardiogenic Shock

Eric Zweck <sup>1</sup>, MD; Katherine L. Thayer <sup>1</sup>, MPH; Ole K. L. Helgestad <sup>1</sup>, MD, PhD; Manreet Kanwar <sup>1</sup>, MD; Mohyee Ayouty, MSc; A. Reshad Garan <sup>1</sup>, MD; Jaime Hernandez-Montfort <sup>1</sup>, MD; Claudius Mahr <sup>1</sup>, MD; Detlef Wencker <sup>1</sup>, MD; Shashank S. Sinha, MD; Esther Vorovich <sup>1</sup>, MD; Jacob Abraham, MD; William O'Neill, MD; Song Li <sup>1</sup>, MD; Gavin W. Hickey <sup>1</sup>, MD; Jakob Josiassen <sup>1</sup>, MD; Christian Hassager, MD, DMSci; Lisette O. Jensen <sup>1</sup>, MD, PhD, DMSci; Lene Holmvang, MD, DMSci; Henrik Schmidt, MD, DMSci; Hanne B. Ravn, MD, PhD, DMSci; Jacob E. Møller, MD, PhD, DMSci; Daniel Burkhoff <sup>1</sup>, MD, PhD; Navin K. Kapur <sup>1</sup>, MD

Machine learning algorithms identified 3 distinct phenotypes associated with increasing mortality in the CSWG dataset, which were then validated in collaboration with a Danish Shock Registry

*J Am Heart Assoc.* 2021;10:e020085.



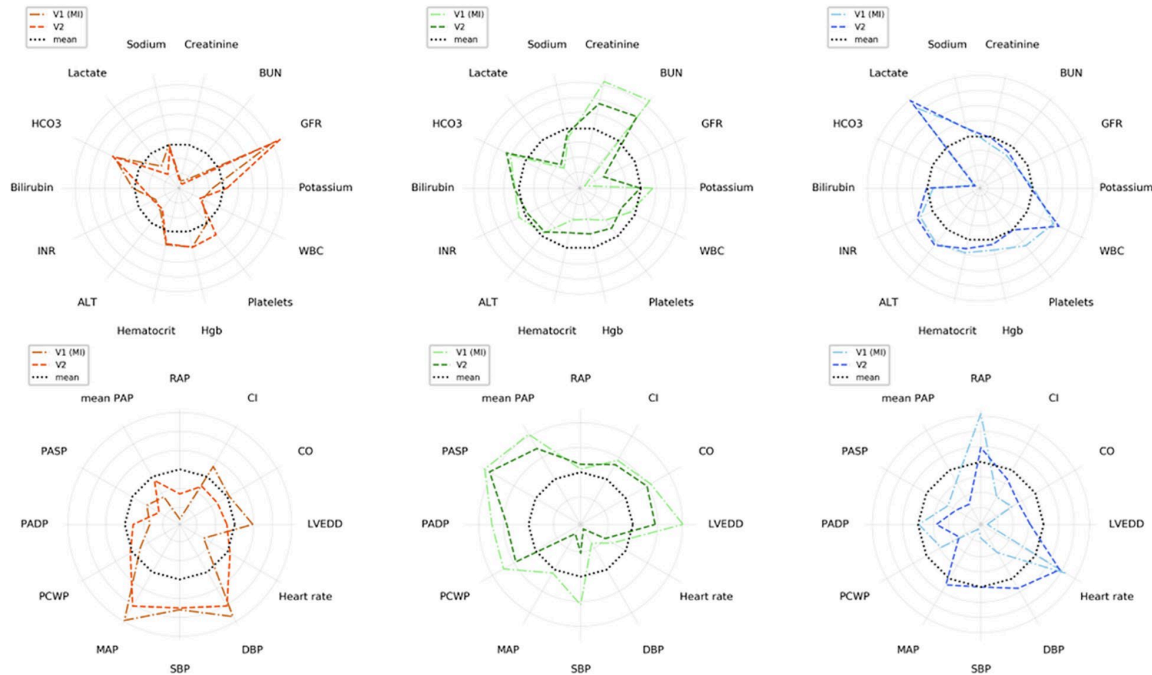
# Clinical Course of Patients in Cardiogenic Shock Stratified by Phenotype

Eric Zweck, MD,<sup>a,b</sup> Manreet Kanwar, MD,<sup>c</sup> Song Li, MD,<sup>d</sup> Shashank S. Sinha, MD, MSc,<sup>e</sup> A. Reshad Garan, MD,<sup>f</sup> Jaime Hernandez-Montfort, MD, MPH,<sup>g</sup> Yijing Zhang, MA,<sup>h</sup> Borui Li, MA,<sup>h</sup> Paulina Baca, MS,<sup>h</sup> Fatou Dieng, BA,<sup>h</sup> Neil M. Harwani, MS,<sup>a</sup> Jacob Abraham, MD,<sup>h</sup> Gavin Hickey, MD,<sup>l</sup> Sandeep Nathan, MD,<sup>l</sup> Detlef Wencker, MD,<sup>k</sup> Shelley Hall, MD,<sup>k</sup> Andrew Schwartzman, MD,<sup>l</sup> Wissam Khalife, MD,<sup>m</sup> Claudius Mahr, DO,<sup>d</sup> Ju H. Kim, MD,<sup>n</sup> Esther Vorovich, MD, MSCE,<sup>o</sup> Evan H. Whitehead, MD,<sup>p</sup> Vanessa Blumer, MD,<sup>q</sup> Ralf Westenfeld, MD,<sup>b</sup> Daniel Burkhoff, MD, PhD,<sup>f</sup> Navin K. Kapur, MD<sup>a</sup>

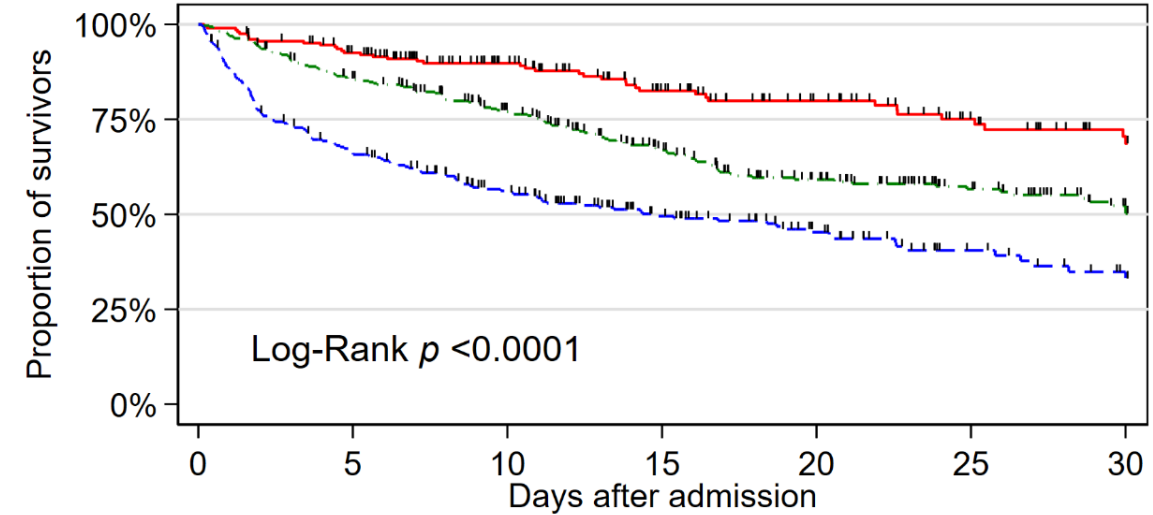
## Non-Congested CS

## Cardiorenal CS

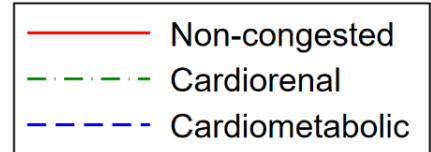
## Cardiometabolic CS



## 30-day Survival in CS Phenotypes

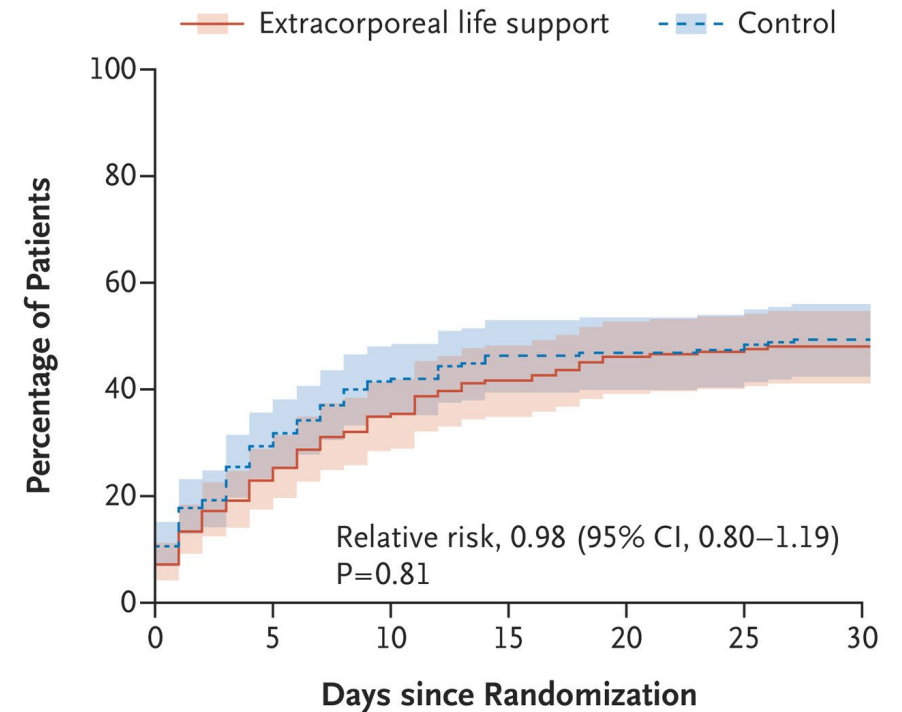


Number at risk	0	5	10	15	20	25	30
Non-congested	204	179	138	102	76	55	39
Cardiorenal	327	270	214	153	113	78	51
Cardiometabolic	264	168	123	83	56	31	20



# Extracorporeal Life Support in Infarct-Related Cardiogenic Shock

H. Thiele, U. Zeymer, I. Akin, M. Behnes, T. Rassaf, A.A. Mahabadi, R. Lehmann, I. Eitel, T. Graf, T. Seidler, A. Schuster, C. Skurk, D. Duerschmied, P. Clemmensen, M. Hennersdorf, S. Fichtlscherer, I. Voigt, M. Seyfarth, S. John, S. Ewen, A. Linke, E. Tigges, P. Nordbeck, L. Bruch, C. Jung, J. Franz, P. Lauten, T. Goslar, H.-J. Feistritz, J. Pöss, E. Kirchhof, T. Ouarrak, S. Schneider, S. Desch, and A. Freund, for the ECLS-SHOCK Investigators\*



### No. at Risk

Control	208	146	120	109	105	104	100
Extracorporeal life support	209	161	136	119	109	107	105

## *But first, a story*

- A 40-some year old male with PMHx of chemotherapy induced early CAD + Cardiomyopathy
- On GMDT + primary prevention ICD
- Initial presentation to hospital with ICD shocks..