



# Effect of Arterial Catheters on Outcomes in the ICU

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**SCCM Datathon**  
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# ~36 % of all ICU admits

- Infections

- Catheter-related sepsis in 4%
- Bloodstream infections  
*(1.6 per 1000 catheter days)*
- Femoral > Radial

- Vascular Complications

- Limb ischemia and bleeding < 1 %
- Localized hematoma 14 %
- Pseudoaneurysm 0.05 %

- Discomfort

- Insertion, phlebotomy, limb risk

- Reduced mobility

- Barrier to mobilization in ICU
- Associated with mortality



Luis Fernández García. [https://commons.wikimedia.org/wiki/File:Radial\\_artery\\_pseudaneurysm\\_20180607b.jpg](https://commons.wikimedia.org/wiki/File:Radial_artery_pseudaneurysm_20180607b.jpg)

Garland A, Connors AF Jr. Am J Respir Crit Care Med 2010;182:133–134. Maki DG, et al. Mayo Clinic Proceedings. 2006;81(9):1159-1171  
Annane D, et al. JAMA. 2009;301:2362-2375. Gu WJ, et al. Chest. 2016;149:1661-179. Leditschke IA, et al. Cardioplum Phys Ther J. 2012;23((1)):26–29

# SCCM

“...all patients requiring vasopressors (should) have an arterial catheter...”

Weak recommendation, very low quality of evidence

# ESICM

“...arterial and CVC insertion in cases of shock unresponsive to initial therapy and/or requiring vasopressor infusion”

Expert opinion



# IMPACT Database

# MIMIC Database

Primary Cohorts	No. of Matched Pairs
MV medical patients	13 603
MV medical patients by illness severity	
Lowest tertile MPM <sub>0</sub> -III	4223
Middle tertile MPM <sub>0</sub> -III	4564
Highest tertile MPM <sub>0</sub> -III	4783
Secondary cohorts	
MV medical patients in combined medical-surgical ICUs	4336
All patients	47 756
All patients in combined medical-surgical ICUs	29 014
Patients requiring vasopressors	10 840
Patients with septic shock	2358
MV surgical patients	5202



Outcomes	Non-IAC	IAC	P Value	Effect Size
<b>Primary outcome</b>				
28-d mortality	15.2%	14.7%	.83	0.96 (0.62-1.47) <sup>a</sup>
<b>Secondary outcomes, mean (SD)</b>				
ICU LOS (survivors)	2.2 (1.4)	3.7 (3.1)	< .0001	1.65 (1.24-2.07) <sup>b</sup>
Hospital LOS (survivors)	5.7 (4.8)	9.4 (7.5)	< .0001	3.47 (2.34-4.59) <sup>b</sup>
Mechanical ventilation time (survivors)	1.0 (1.0)	2.1 (2.6)	< .0001	1.10 (0.76-1.42) <sup>b</sup>
Blood gas measurements (per 24 h)	1.0 (0.8)	2.4 (1.4)	< .0001	1.44 (1.27-1.62) <sup>b</sup>

# Research Question

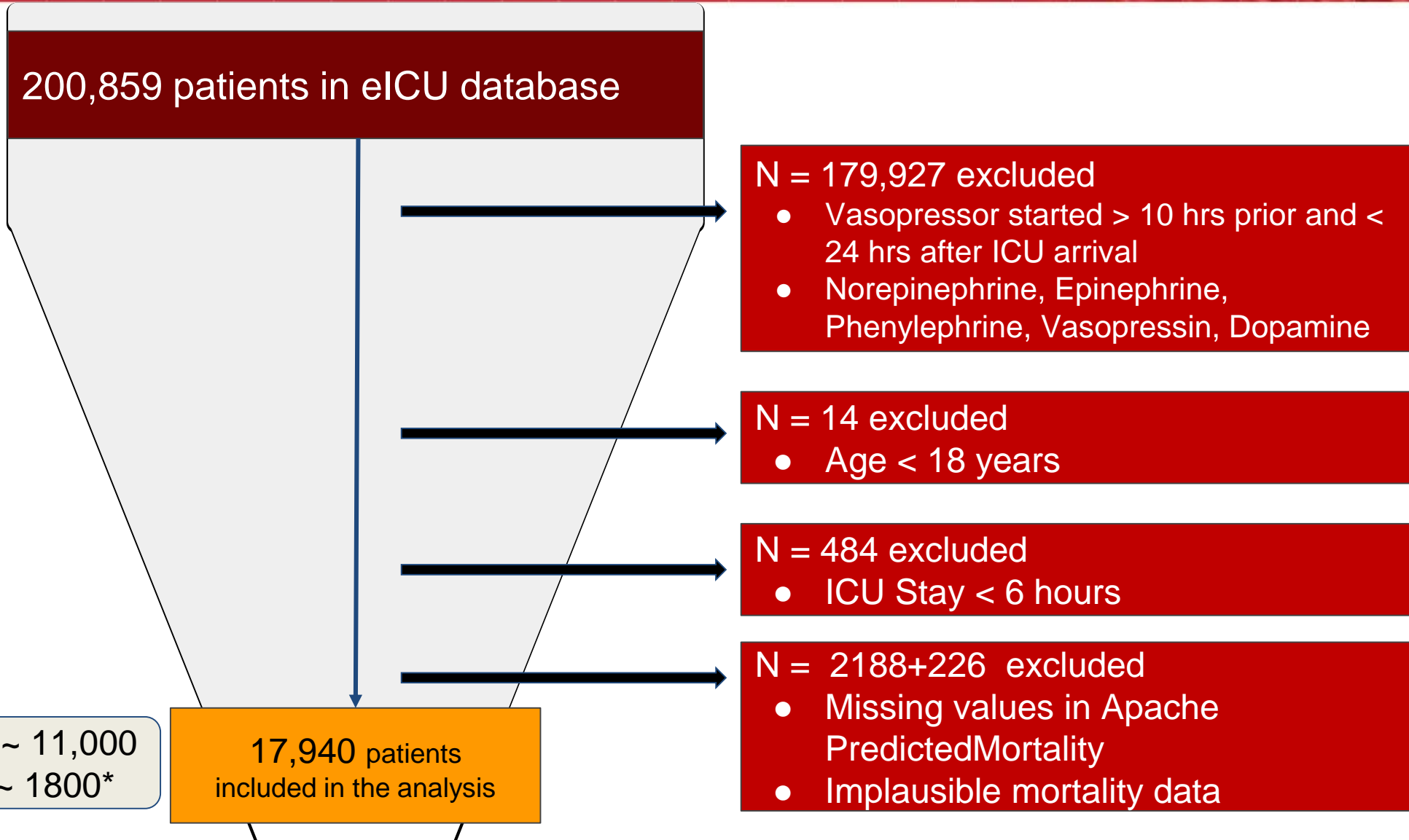
**Among patients admitted to ICU on vasopressors, what is the association between arterial line and ICU outcomes?**

eICU Collaborative Research Database

## **Primary Outcome**

Number of days alive and free of vasopressors (up to day 7)

# Design Flowchart



# Demographics and Baseline Characteristics

	<b>Arterial Line</b>	<b>No Arterial Line</b>	<b>p-value</b>
	10,256	7,864	
Age, years	64.7	66.7	<0.0001
Gender, Male	6,170 (60.2%)	3990 (50.7%)	<0.0001
Race, Caucasians	8420 (82.1%)	6230 (79.2%)	<0.0001
Comorbidities			
DM	3,110 (30.3%)	2,466 (31.4%)	<0.0001
CABG	621 (6.1%)	567 (7.2%)	<0.0001
CHF	1,731 (16.9%)	1,638 (20.8%)	<0.0001

# Demographics and Baseline Characteristics

	<b>Arterial Line</b>	<b>No Arterial Line</b>	<b>p-value</b>
	10,256	7,864	
Number of Beds			<0.0001
<100	61 (0.5%)	262 (2.5%)	
100-249	1,908 (14.5%)	2,382 (22.9%)	
250-499	2,983 (22.6%)	3,029 (29.1%)	
≥500	7,079 (53.6%)	3,742 (35.9%)	
Hospital Type			<0.0001
Academic	4,552 (34.5%)	2,294 (22.0%)	
Community	8,650 (65.5%)	8,126 (70.0%)	



# Results

	<b>Arterial Line</b>	<b>No Arterial Line</b>	<b>p-value</b>
	10,256	7,864	
<b>Number of Days Alive and Free of Pressors</b> (Median [Q1, Q3])	5.96 [3.73, 6.62] days	6.11 [4.77, 6.65] days	<0.0001
<b>ICU Mortality</b>	2,953 (22.4%)	1,653 (15.9%)	<0.0001

# Analysis : Propensity Score Matching

Propensity Score =  $P(\text{Treatment} \mid \text{covariates})$

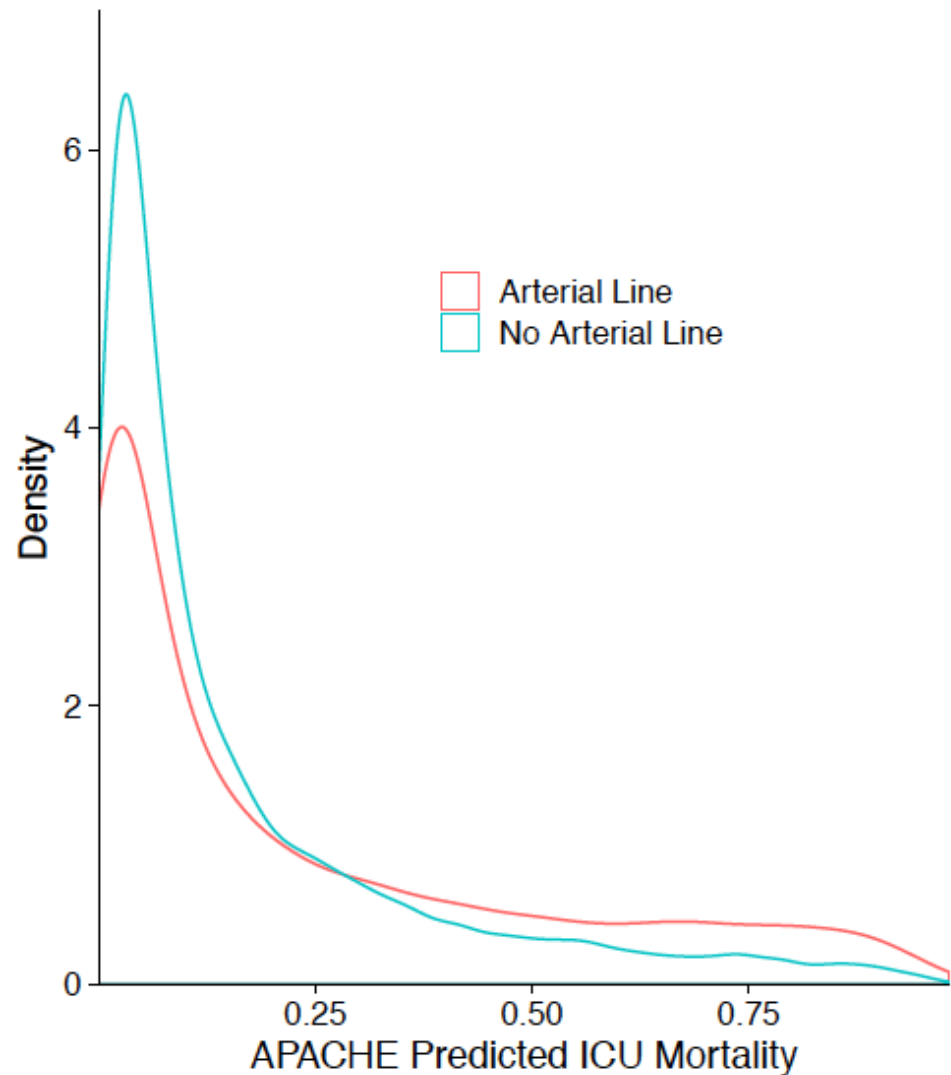
Covariates : 1) Predicted ICU Mortality  
2) Limitations to the Care on ICU  
3) Teaching Status of the Hospital (Academic /  
Community)

Treatment : **Arterial Line Usage**

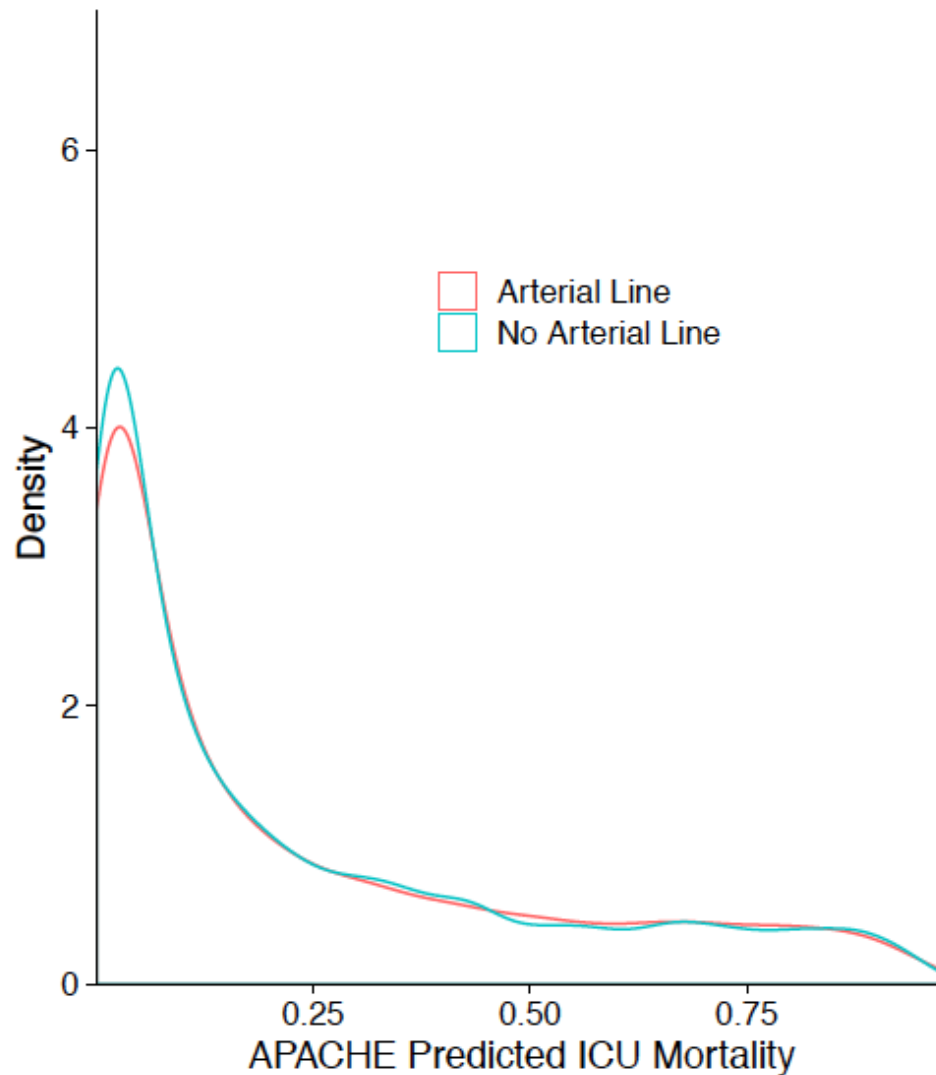
Outcome : 1) **Days Alive and Free of Vasopressors (in 7 Days)**  
2) **Mortality**

# Propensity Score Matching

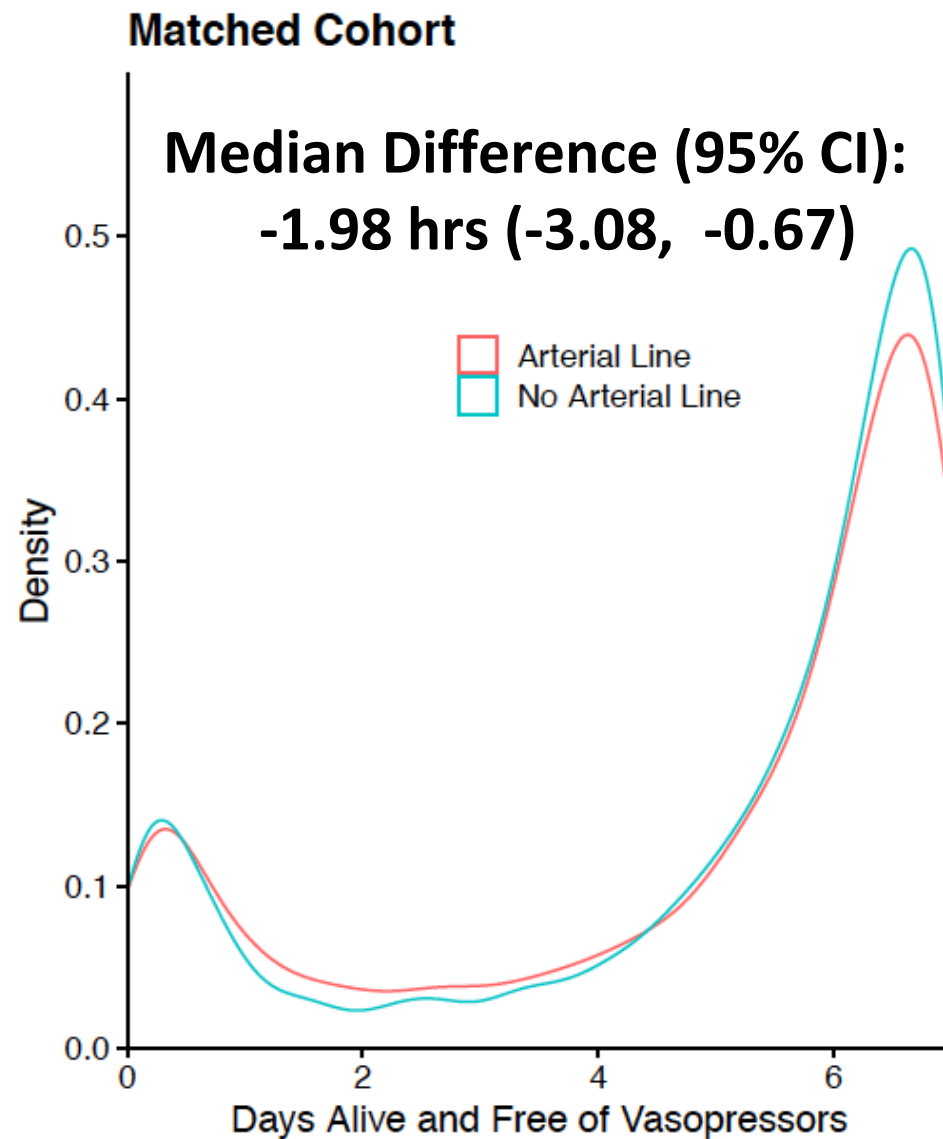
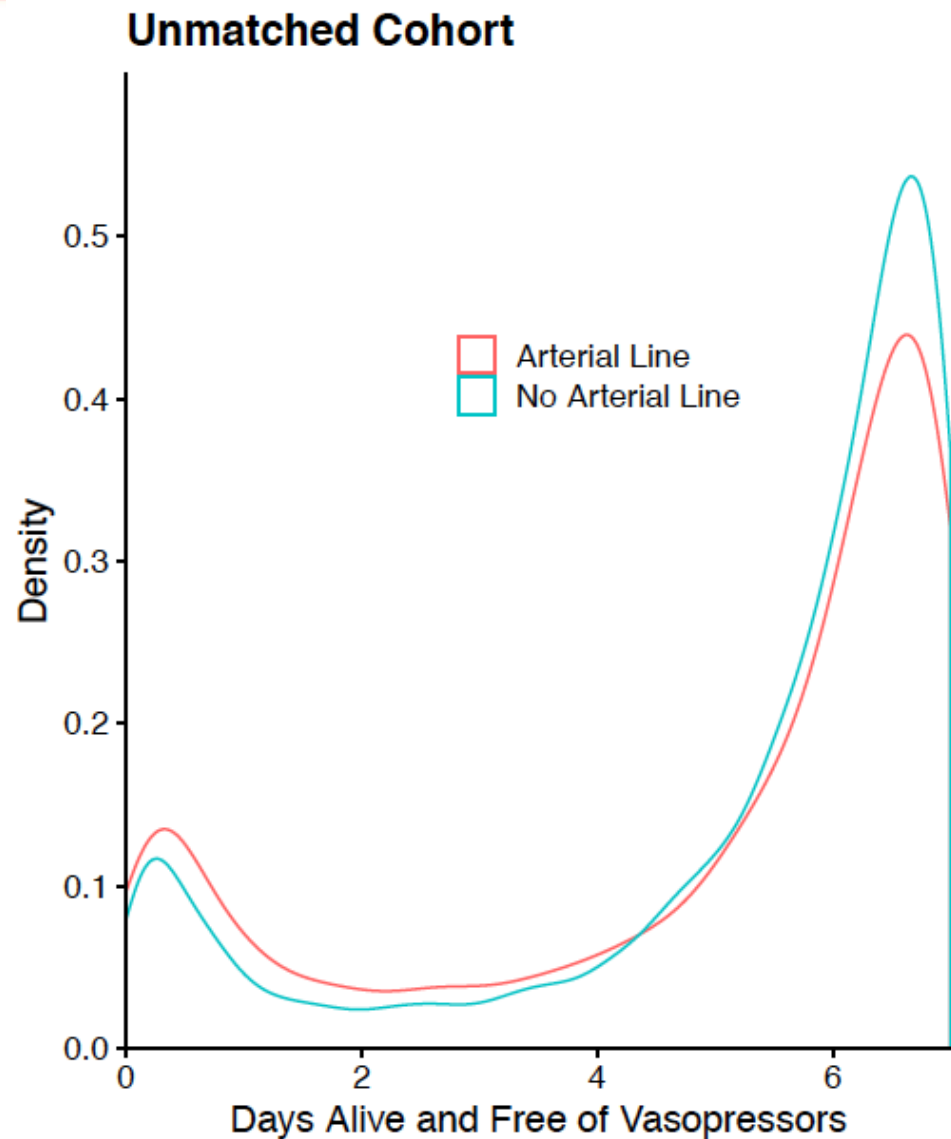
Unmatched Cohort



Matched Cohort



# Propensity Score Matching





# Propensity Score Matching

	<b>Arterial Line</b>	<b>No Arterial Line</b>
	9893	9893
<b>Number of Days Alive &amp; Free of Pressors (in 7 Days)</b>	5.96 [3.74, 6.06] days	6.04 [4.38, 6.63] days
<b>Difference in Days Alive &amp; Free of Pressors</b>	-1.98 hrs (-3.08, -0.67)	
<b>Mortality, ICU</b>	22.3%	18.5%
<b>Difference in Mortality (95% CI)</b>	1.8% [0.8% - 2.9%]	

# Clinical Implications

- Arterial lines associated with
  - Longer duration of vasopressor use (~2 hours)
  - Mortality...
- Limitations
  - Unmeasured confounders
  - 7 day outcome



Thank you for  
listening!