



# Using Predictive Mortality and Cardiogenic Shock Identification Tools to Support Team-Based Treatments

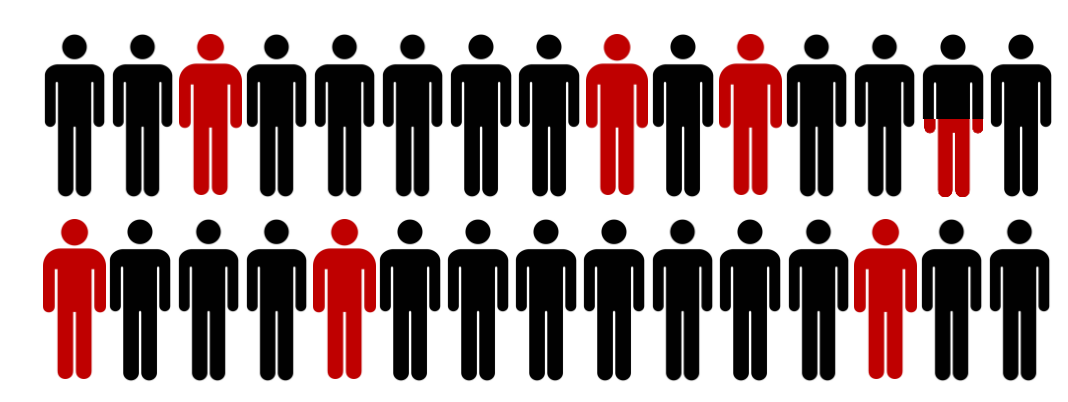
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## Background

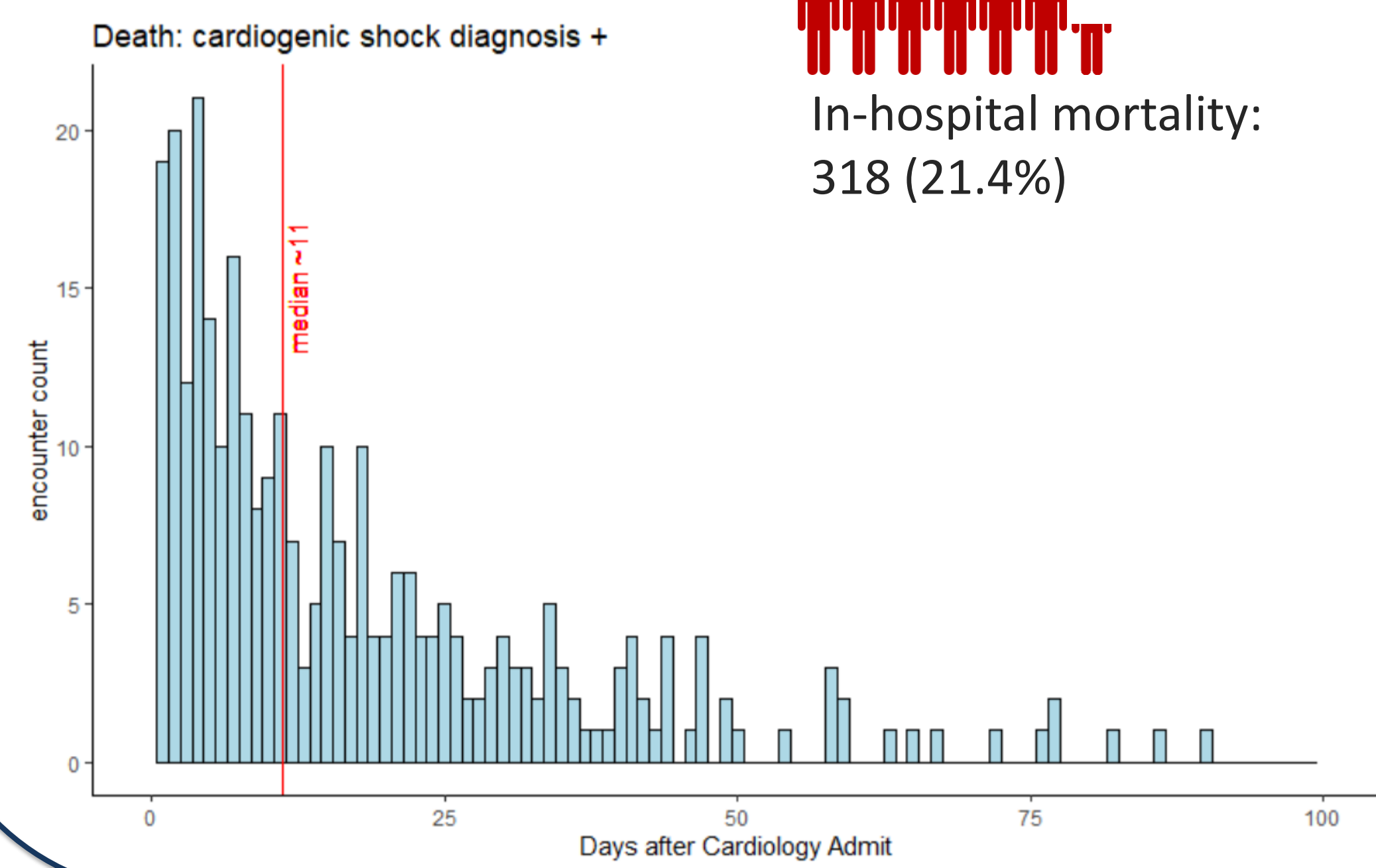
### Cardiogenic shock at Duke 10.2014 – 08.2018



DUH cohort of 1,485 Cardiogenic Shock encounters, 2014 - 2018:

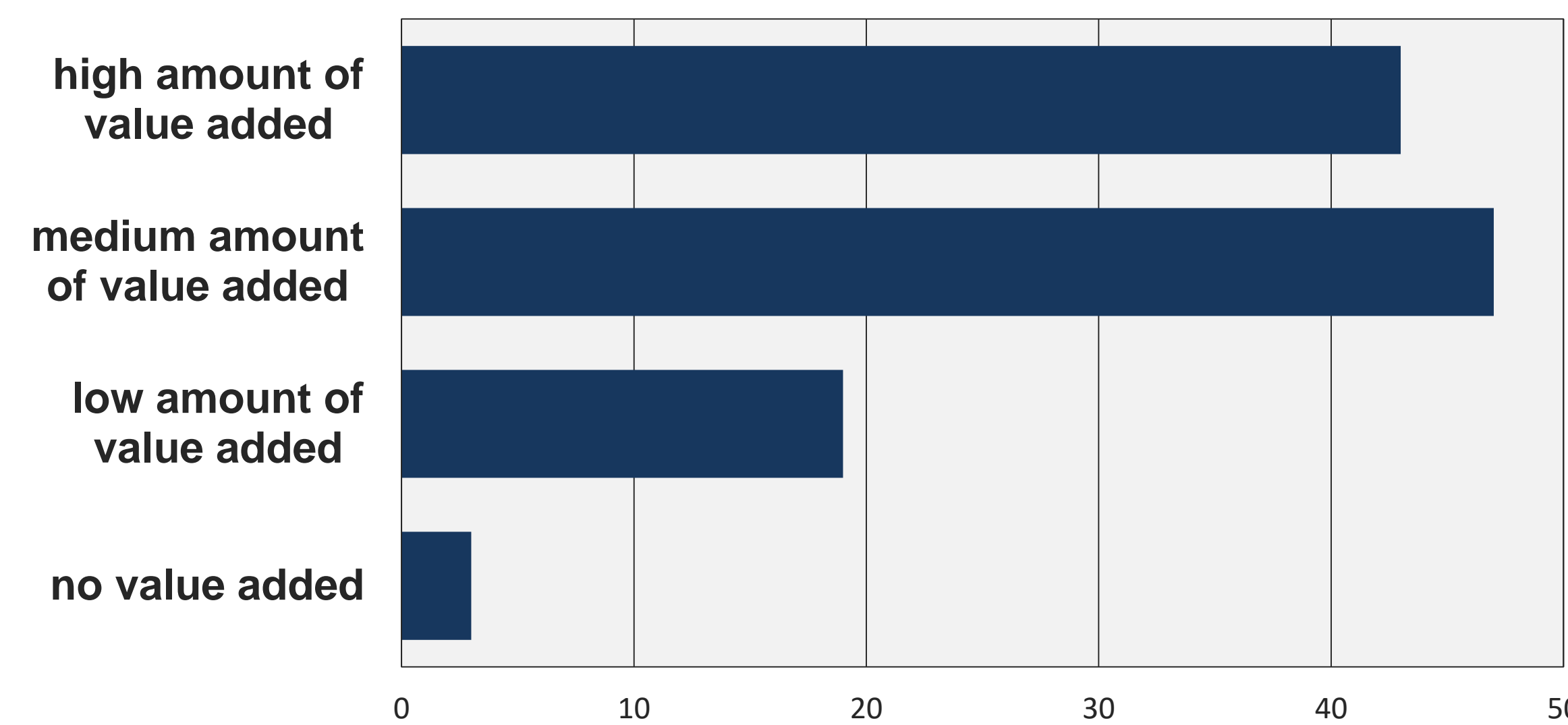
- 1,009 male, 476 female
- Mean age: 60.4

In-hospital mortality: 318 (21.4%)



## Duke Stakeholder Engagement

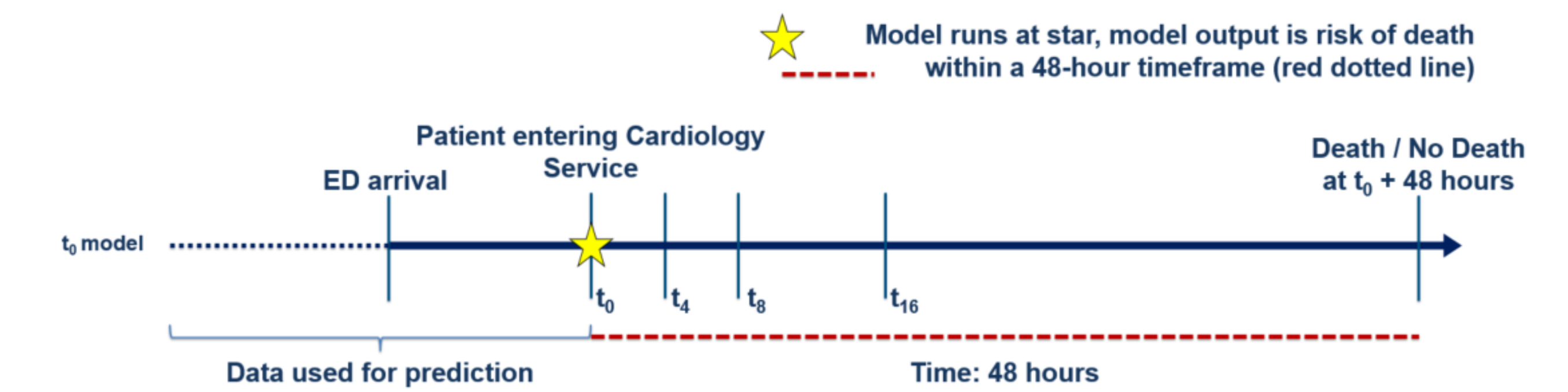
113 cardiology physicians surveyed at DUHS determined delay and fragmentation of care (proposed problem) for cardiogenic shock patients, and saw value in the **Shock Dashboard and integrated workflow** (proposed solution):



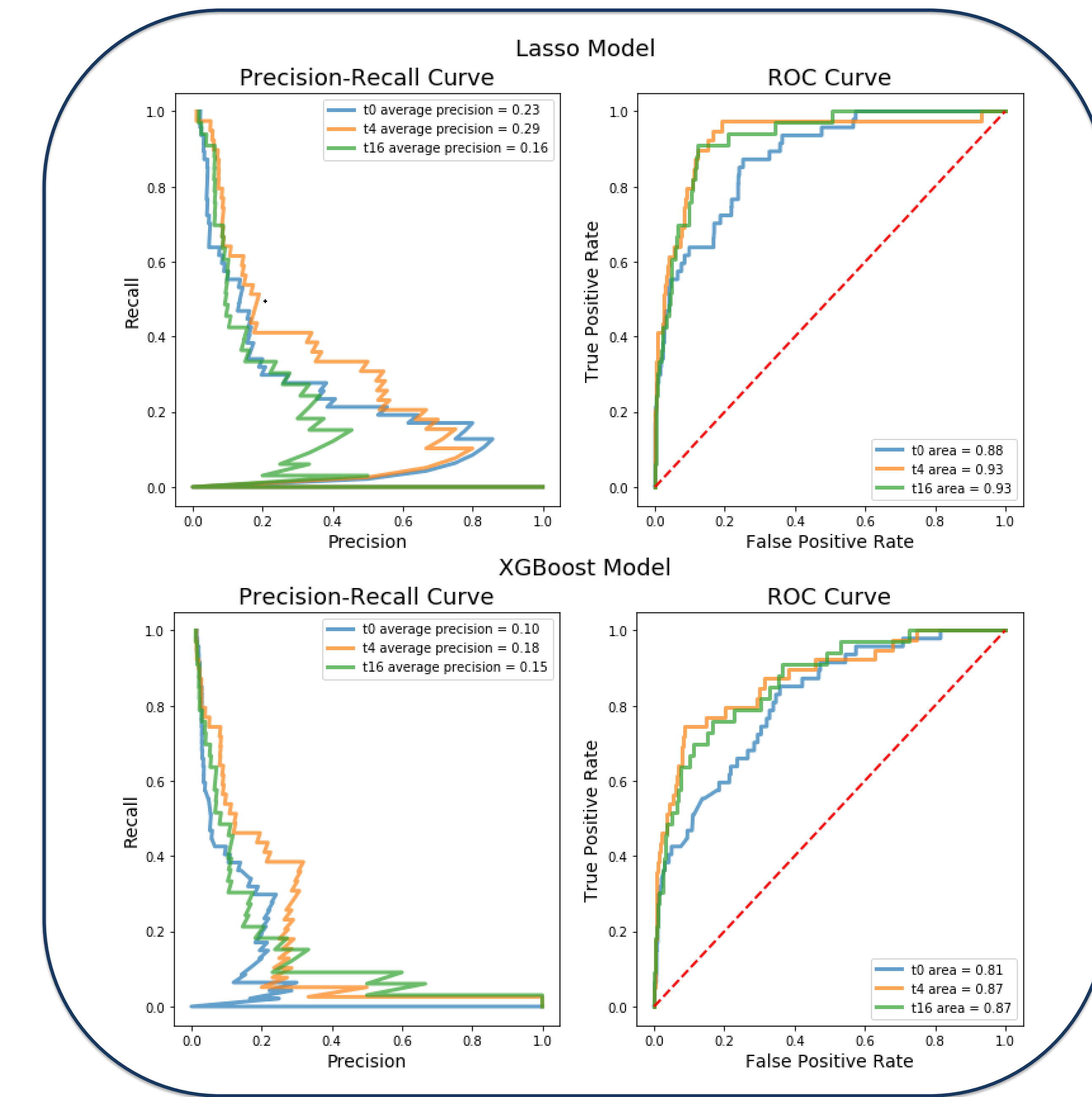
80% of cardiologists estimated a high or medium amount of value added

- Recognition and treatment of cardiogenic shock is difficult, as shown by an in-hospital mortality rate ranging from 27-51% nationally<sup>1</sup>
- We leveraged Duke's EHR, including angiographic data, to identify cardiology patients meeting shock criteria or at risk for in-hospital death
- Our model is able to accurately predict 48-hour mortality at admission, and improves as clinical data is captured into the encounter

## Mortality Model



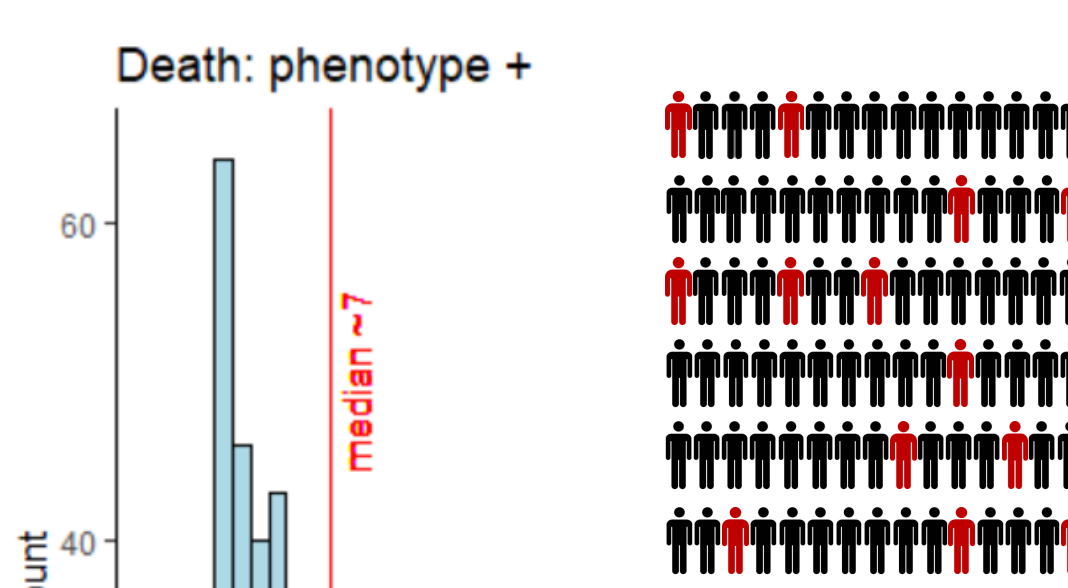
- 228 clinically determined predictors were used to fit a lasso, ridge, random forest, extreme gradient boosted decision tree models at time of admission into cardiology (t0), and at 4 hours (t4), 8 hours (t8), and 16 hours (t16).
- 48-hour mortality was 1.20%, 1.01%, 1.00%, and 0.97% respectively.
- For each cohort, results of models are shown for held out sets of most recent encounters (N = 3722, 3713, 3703, 3672).



## Phenotype

Phenotype	Definition criteria
Definition 1	Patient has hypotension and hypoperfusion criteria, and no sign of fever
Definition 2	Patient receives new administration or increased dose of a vasopressor
Definition 3	Patient is on a mechanical support device
Definition 4	Patient has poor hemodynamic parameter for to cardiac output

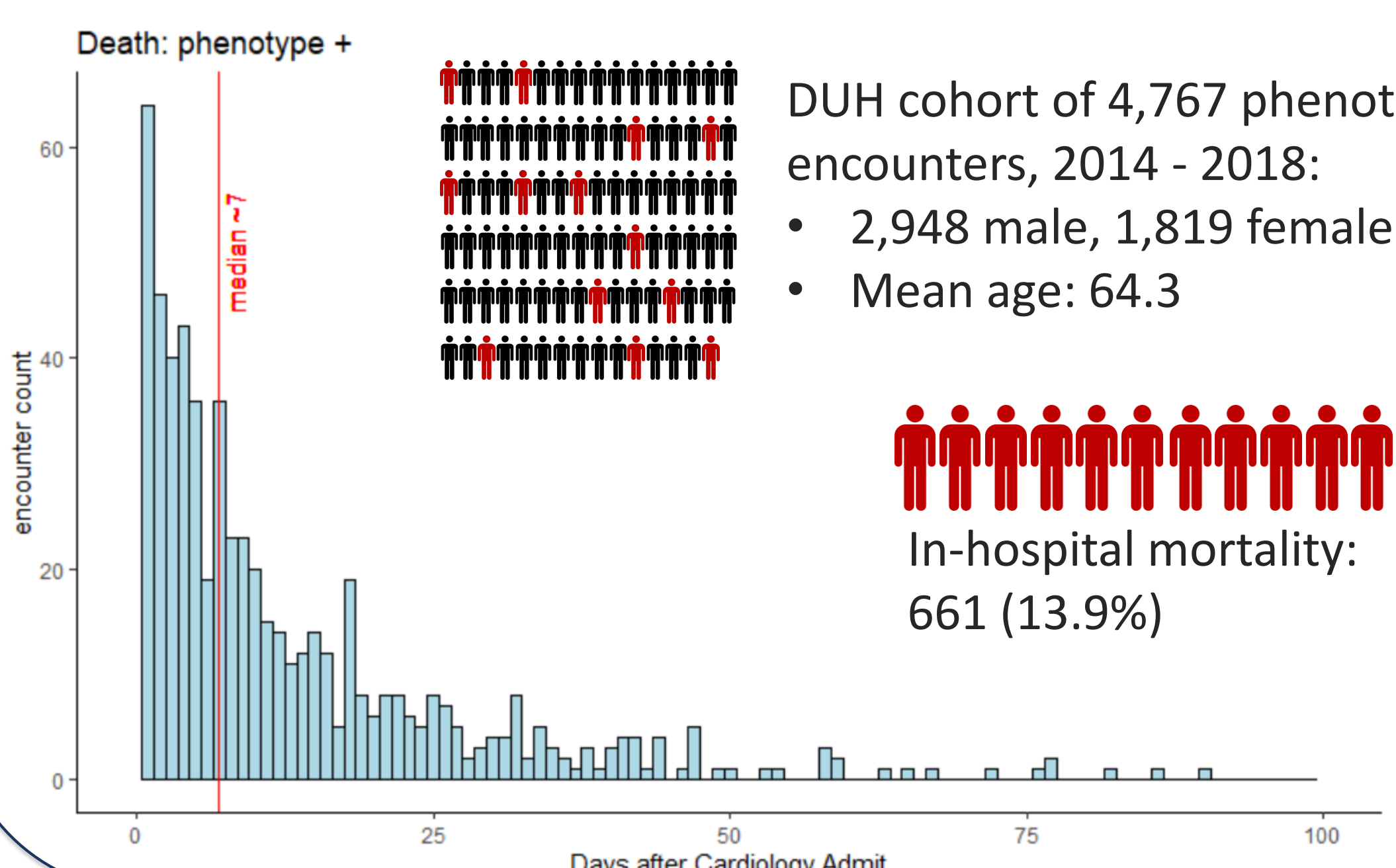
### Phenotype at Duke 10.2014 – 08.2018



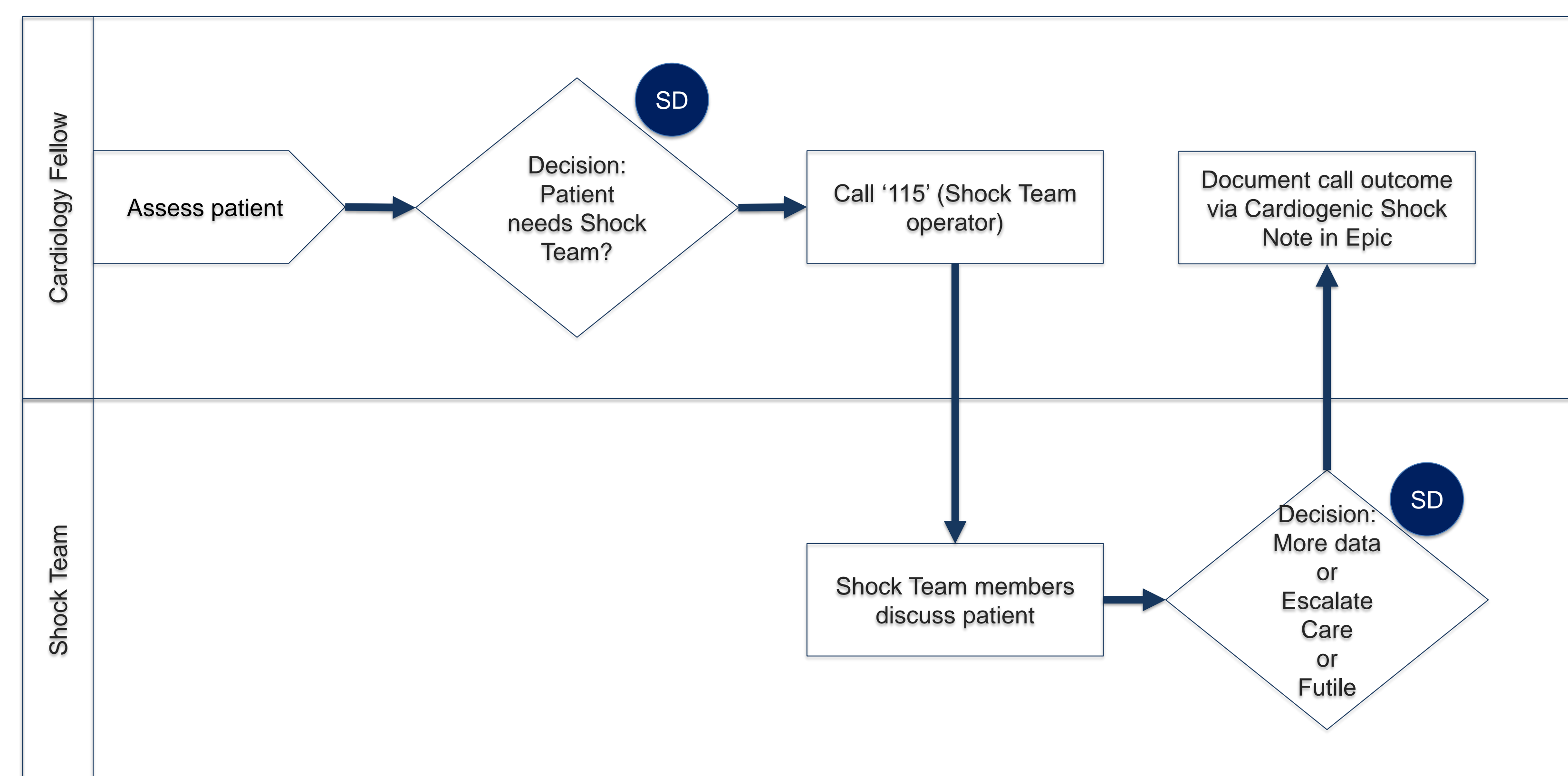
DUH cohort of 4,767 phenotype encounters, 2014 - 2018:

- 2,948 male, 1,819 female
- Mean age: 64.3

In-hospital mortality: 661 (13.9%)



## Clinical Workflow Integration



	T0 model	T4 model	T8 model	T16 model
	AURC (AUPRC)	AURC (AUPRC)	AURC (AUPRC)	AURC (AUPRC)

Lasso	0.88 (0.23)	0.93 (0.29)	0.94 (0.32)	0.93 (0.16)
Ridge	0.86 (0.26)	0.93 (0.30)	0.94 (0.27)	0.93 (0.16)
Random Forest	0.86 (0.13)	0.92 (0.18)	0.93 (0.20)	0.93 (0.21)
XGBoost	0.81 (0.10)	0.87 (0.18)	0.94 (0.25)	0.87 (0.15)

50 patients

<sup>1</sup>Diepen SV, Katz JN, Albert NM, et al. Contemporary Management of Cardiogenic Shock: A Scientific Statement From the American Heart Association. Circulation. 2017;136(16). doi:10.1161/cir.0000000000000525

SD: Shock Dashboard (phenotype & model) included in decision point