

## Background

- Pulmonary embolism (PE) is the third most common cause of cardiovascular mortality worldwide,<sup>1</sup> with 4% 30-day and 13% 1-year mortality rates.<sup>2</sup>
- Outcomes for patients with PE rely on accurate risk stratification and timely initiation of appropriate treatment.<sup>3</sup> While decision-making pathways for low and high-risk PEs are relatively straightforward, the intermediate-risk group remains contentious.<sup>4</sup>
- Numerous reputable associations have issued clinical guidelines, and consensus PE treatment algorithms have been shown to improve overall outcomes.<sup>5-6</sup>
- European Society of Cardiology (ESC) guidelines<sup>7</sup>, which are the gold standard at our institution, rely heavily upon RV:LV ratios (RV dysfunction), while older systems like the Pulmonary Embolism Severity Index<sup>8</sup> utilize a multifactorial (and non-RV:LV dependent) approach.

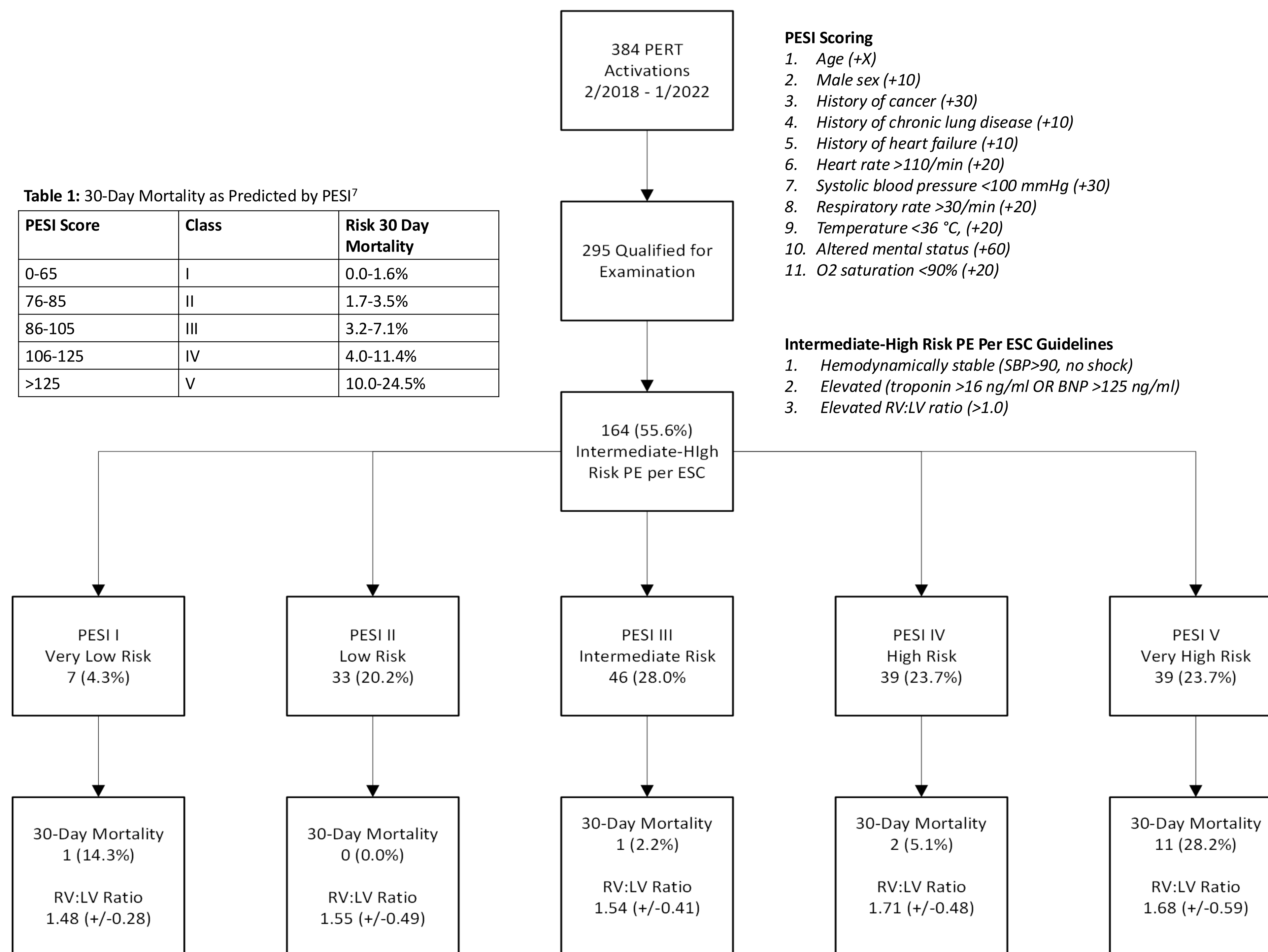
## Purpose

The purpose of this study is to evaluate the prognostic value contributed by RV dysfunction (ESC guidelines) in the clinical trajectory of intermediate-high risk pulmonary embolism patients as compared to PESI.

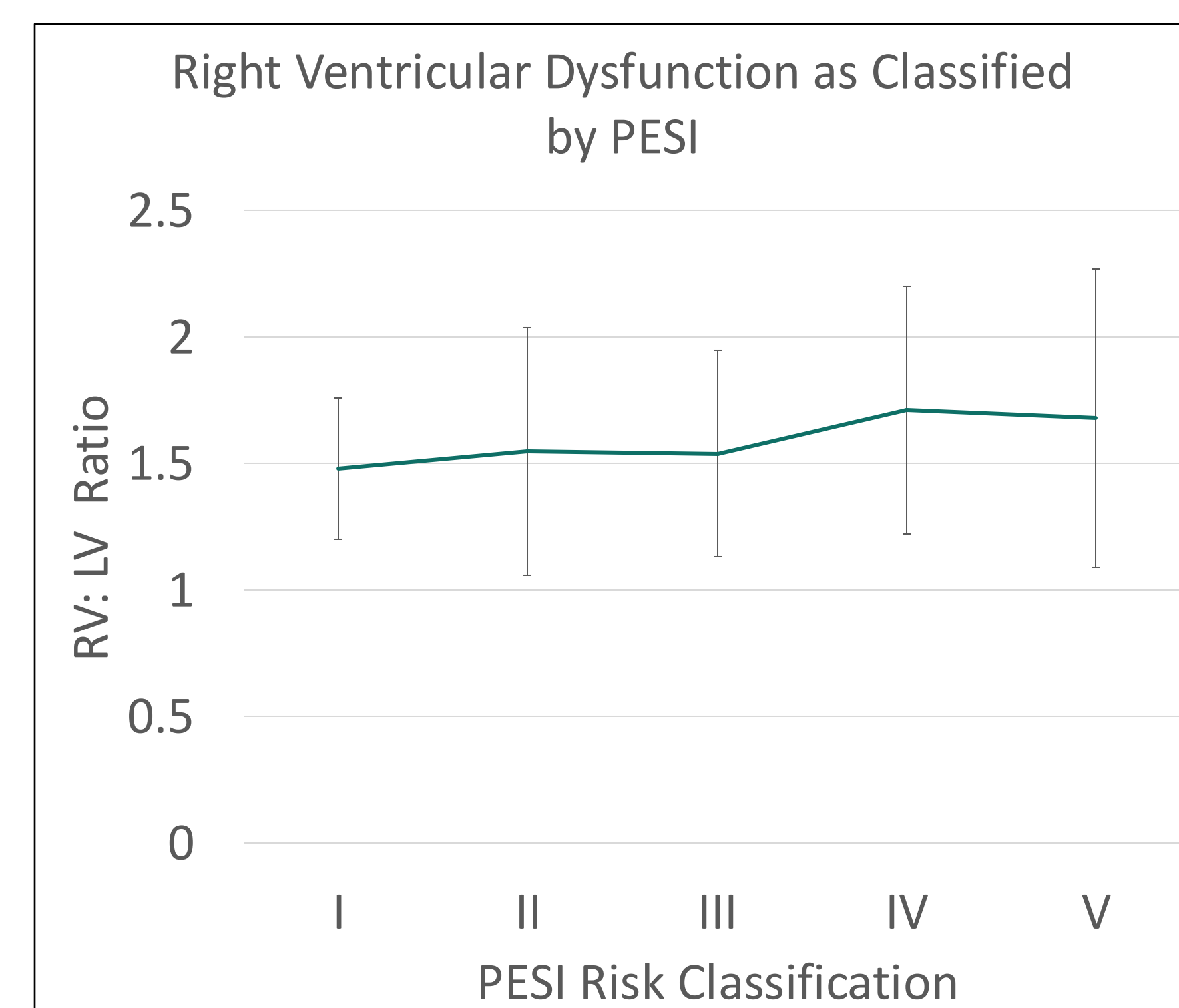
## Methods

- A log of all PERT activations between 2/21/18 and 1/18/22 at Froedtert Hospital was reviewed for cases of intermediate-high risk PE as stratified by ESC guidelines using cardiac biomarkers (TRP/BNP/RV:LV) and patient hemodynamic status.
- PESI scores were then calculated for all patients that met intermediate-high risk as per ESC guidelines, and this subgroup was further stratified into PESI levels I-V which reflect very low, low, intermediate, high, and very high-risk PE; respectively.
- Quantitative classifications of acute PE as intermediate-high risk as per ESC guidelines, and subsequent PESI risk classifications on the I-V severity scale were compared.
- 30-day mortality and RV:LV ratio were recorded and analyzed for inter-group differences.

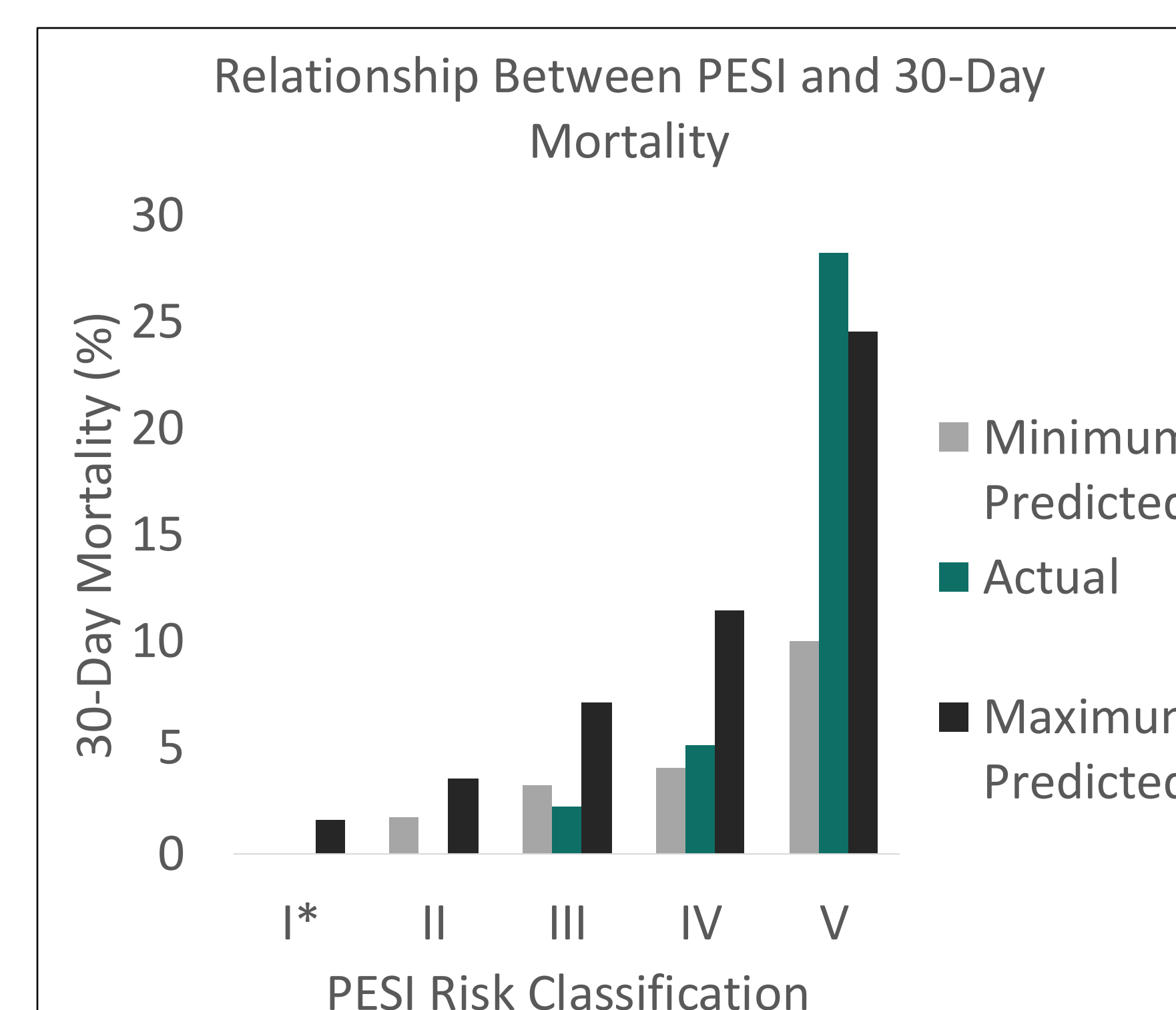
## Results



**Figure 1:** Overview of study design including initial stratification by ESC intermediate-high risk PE guidelines followed subsequently by gradation on the PESI index. 30-day mortalities and RV:LV ratio were reported as percents and average (+/- standard deviation), respectively.



**Figure 2:** Right ventricular dysfunction as classified by PESI. This graph shows a negligible difference between RV strain between respective risk groups, despite a trend of increasing mortality as the risk category increased. There was no significant difference between any group, as per ANOVA with resultant  $p=0.546$ .



**Figure 3:** Relationship between PESI and 30-day mortality. While it does not perfectly follow the expected distribution as outlined in Table 1, there is a clear trendline that adheres to the predicted mortality risk.

\* Denotes singular outlier removed from PESI I

## Discussion

- Only 51.7% of patients classified as intermediate-high risk per ESC guidelines were also classified as such according to PESI criteria.
- As PESI risk level increased, 30-day mortality followed an expected exponential relationship, apart from a single outlier mortality in the PESI I category.
- A lack of concordance was observed between right heart strain and patient 30-day mortality.
- This discrepancy may be attributed to the possibility that once the RV:LV ratio (or RV dysfunction overall) surpasses a certain threshold of dysfunctionality, its differential predictive value diminishes.<sup>9</sup>
- Additionally, RV dysfunction might represent the patient's baseline condition rather than a response to acute PE.<sup>10</sup>
- Limitations include non corroborated RV:LV ratio and nongeneralizable results due to selection bias from a single academic center.
- PESI is competent and potentially superior in predicting 30-day mortality among intermediate-high risk patients than the RV dysfunction reliant ESC guidelines.

## Future Work

A prospective study that uses PESI criteria exclusively for PE risk stratification, as compared to traditionally used ESC guidelines, would be warranted with relevant endpoints including 30-day mortality, one year mortality, length of stay, and cost analysis of patient stay.

## References

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