

# Title: Application of Bayesian Model to Predict Outcomes in Pulmonary Arterial Hypertension

Authors: M. Kanwar, L. Lohmueller, P. Correa, J. Kraisangka, M. Druzdzal, J. Antaki, R. Benza.

Allegheny General Hospital, Pittsburgh, PA, Carnegie Mellon University, Pittsburgh, PA, University of Pittsburgh, Pittsburgh, PA,

**Purpose:** In spite of emerging new therapeutic options, pulmonary arterial hypertension (PAH) remains a highly fatal and morbid disease. The Registry to Evaluate Early and Long-Term PAH Disease Management (REVEAL) developed a multivariable, weighted risk formula to predict the risk of one year survival using 11 variables. The REVEAL formula has been used clinically for several years; however, its accuracy is limited. This study aimed to develop an improved prognostic model by employing dynamic machine learning tools and Bayesian statistics.

**Methods:** Data sets from the REVEAL registry, comprising 54 US sites and 2,964 adult patients with PAH were used to develop a Tree Augmented Naive (TAN) Bayesian model to predict 1 year survival. We used the same 11 variables found in the initial REVEAL calculator and the same discretization cut points.

**Results:** The resulting model demonstrated an accuracy of 88.7% with an area under curve (AUC) of 0.74 for predicting 1 year. This was an improvement to the existing AUC of 0.71 for the original REVEAL calculator.

**Conclusion:** A Bayesian model for PAH demonstrated a modest improvement in accuracy over the existing multivariate model of the REVEAL calculator. We anticipate that the performance of the Bayesian model will improve further by optimization with additional clinical trial data, which will also reveal additional independent variables. Our long-term goal is to generate a decision algorithm for bedside clinical use of PAH management.

