INPLASY

Systematic review of prognostic scores and individual predictor variables for short-term mortality after acute pulmonary embolism

INPLASY202560031
doi: 10.37766/inplasy2025.6.0031
Received: 7 June 2025
Published: 7 June 2025

Corresponding author:
David Jimenez

djimenez.hrc@gmail.com

Author Affiliation:
Hospital Ramon y Cajal.

Jimenez, D; Bikdeli, B; Tapson, V; Becattini, C; Moores, L; Barnes, GD; Monreal, M; Konstantinides, S; Piazza, G; Morillo, R; Alvarez-Diaz, N; Yusen, RD.

ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - Data analysis.

Conflicts of interest - D.J. is a Section Editor for Thrombosis and Haemostasis (no compensation). V.T. is Vice President of Inari Medical; and serves as a consultant for Janssen. G.D.B. has received grant funding from Boston Scientific; has served as an advisor or consultant for Pfizer, Bristol-Myers Squibb, Janssen, Bayer, AstraZeneca, Sanofi, Anthos, Abbott Vascular, Boston Scientific; and serves on the Board of Directors for the Anticoagulation Forum. G.P. received grants for clinical research from BMS/Pfizer, Janssen, Alexion, Bayer, Amgen, BSC, Esperion, NIH 1R01HL164717-01; has served as an advisor or consultant for BSC, Amgen, BCRI, PERC, NAMSA, BMS, Janssen, and Regeneron. B.B. is supported by a Career Development Award from the American Heart Association and VIVA Physicians (#938814). Dr. Bikdeli was supported by the Scott Schoen and Nancy Adams IGNITE Award and is supported by the Mary Ann Tynan Research Scientist award from the Mary Horrigan Connors Center for Women's Health and Gender Biology at Brigham and Women's Hospital.

INPLASY registration number: INPLASY202560031

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 7 June 2025 and was last updated on 7 June 2025.

INTRODUCTION

Review question / Objective What are the prognostic models and individual factors associated with short-term outcomes after acute symptomatic PE?

Background Early mortality rates for patients diagnosed with acute symptomatic pulmonary embolism (PE) range from less than 5% in clinically stable patients to greater than 30% in patients that have cardiogenic shock. At the time of PE diagnosis, clinicians should integrate patient-specific clinical, hemodynamic, imaging, and blood biomarker parameters in order to guide discussion of prognosis and goals of care with patients and their families, and to select intensity of care (i.e., outpatient treatment, hospitalization, intermediate care unit, intensive care unit) and optimal treatment (i.e., anticoagulation, systemic thrombolysis, percutaneous interventions, surgical embolectomy) strategies.

To facilitate assessment of prognosis, several risk scores have been developed for use in patients diagnosed with PE, including the European Society of Cardiology risk schema (which classifies patients into low-risk, intermediate-low risk, intermediate-high risk, and high-risk categories). Current risk classification schemas for patients with acute symptomatic PE have a number of shortcomings, such as use of a limited number of predictor variables to identify risk subgroups, heterogeneity in actual risk of adverse events for patients categorized in each subgroup, and undifferentiated recommendations for/against reperfusion therapies for patients categorized in higher-risk strata despite the potentially distinct feasibility, risk, and benefit attributes for each type of advanced therapy. Accordingly, new paradigms for severity classification of PE require systematic characterization of currently available scores and individual parameters for risk stratification. In addition, clinical research studies (including randomized clinical trials) have increasingly utilized prognostic covariates to increase the efficiency of data use without affecting appropriate treatment decisions. Thus, increased certainty in the association of prognostic scores and factors with outcomes after PE has important implications for both clinical care and research.

Therefore, we conducted a comprehensive systematic review to provide an overview of the prognostic models and individual predictive factors associated with short-term mortality in patients with acute symptomatic PE.

Rationale For patients with acute pulmonary embolism (PE), assessment of prognosis helps with risk stratification, triage for level of care, management strategy, and communication among healthcare workers and patients. We sought to identify prognostic models and individual factors associated with short-term outcomes after acute symptomatic PE.

METHODS

Strategy of data synthesis From inception to June 01, 2024, we included all English-language full-text articles from retrospective and prospective observational studies, and ran-domized controlled trials (RCTs) that evaluated prognostic models or variables associated with short-term (e.g., 30-day) mortality in adult patients (aged >18 years) diagnosed with acute symptomatic PE. We excluded studies that only assessed a specific population (i.e., cancer, coronavirus disease, or pediatric populations), evaluated models exclusively involving radiological parameters, or postmortem investigations. We excluded models that did not undergo evaluation in at least two studies. We also excluded studies that only evaluated individual predictive variables that were already contained in the included predictive models. We searched MEDLINE (using the Ovid platform), Embase (Elsevier), Web of Science, and reference lists of included papers. The search strategy combined terms for (i) PE and (ii) prediction, risk, prognosis, or models. Two independent reviewers screened studies for inclusion by using Rayyan to evaluate titles and abstracts . The reviewers resolved study eligibility discrepancies by consensus. The reviewers then independently conducted a full review of each eligible article. When the independent reviewers did not reach consensus regarding final study eligibility, a third reviewer (principal investigator) resolved the conflict.

We used the CHARMS checklist to design a data extraction form. Investigators extracted the following variables from each article: author information, year of publication, study design, single-center or multicenter, enrollment countries, years of recruitment, sample size, prognostic model and or individual predictor variable study, primary outcome, timing of primary outcome, and incidence of short-term mortality. For studies evaluating individual prognostic factors, investigators independently collected unadjusted odds ratios (ORs) or, if unavailable, hazard ratios (HRs) for survival.

Model performance (discrimination, calibration) in the derivation studies were reported by tables and compared across different models for short-term PE prognosis. We used bar plots to illustrate frequency of individual predictor variables among the identified prognostic models, and number of validation studies per prognostic score.

For individual predictors, we pooled estimates of ORs. We performed the analysis by calculating the log(OR) with their associated standard errors and pooled using the generic inverse variance method. We report pooled ORs for short-term mortality with 95% confidence intervals (CIs). We used the Quality in Prognosis Studies (QUIPS) tool to assess the quality of the studies used to pool estimates of ORs. We used bar plots to illustrate the number of studies that showed an association between an individual predictor with mortality.

Eligibility criteria From inception to June 01, 2024, we included all English-language full-text articles from retrospective and prospective observational studies, and ran-domized controlled

trials (RCTs) that evaluated prognostic models or variables associated with short-term (e.g., 30-day) mortality in adult patients (aged >18 years) diagnosed with acute symptomatic PE. We excluded studies that only assessed a specific population (i.e., cancer, coronavirus disease, or pediatric populations), evaluated models exclusively involving radiological parameters, or postmortem investigations. We excluded models that did not undergo evaluation in at least two studies. We also excluded studies that only evaluated individual predictive variables that were already contained in the included predictive models.

Source of evidence screening and selection Two independent reviewers screened studies for inclusion by using Rayyan to evaluate titles and abstracts. The reviewers resolved study eligibility discrepancies by consensus. The reviewers then independently conducted a full review of each eligible article. When the independent reviewers did not reach consensus regarding final study eligibility, a third reviewer (principal investigator) resolved the conflict.

Data management We used the CHARMS checklist to design a data extraction form. Investigators extracted the following variables from each article: author information, year of publication, study design, single-center or multicenter, enrollment countries, years of recruitment, sample size, prognostic model and or individual predictor variable study, primary outcome, timing of primary outcome, and incidence of short-term mortality. For studies evaluating individual prognostic factors, investigators independently collected unadjusted odds ratios (ORs) or, if unavailable, hazard ratios (HRs) for survival.

Reporting results / Analysis of the evidence For individual predictors, we pooled estimates of ORs. We performed the analysis by calculating the log(OR) with their associated standard errors and pooled using the generic inverse variance method. We report pooled ORs for short-term mortality with 95% confidence intervals (CIs). We used the Quality in Prognosis Studies (QUIPS) tool to assess the quality of the studies used to pool estimates of ORs. We used bar plots to illustrate the number of studies that showed an association between an individual predictor with mortality.

Presentation of the results Model performance (discrimination, calibration) in the derivation studies were reported by tables and compared across different models for short-term PE prognosis. We used bar plots to illustrate frequency of individual predictor variables among the identified prognostic models, and number of validation studies per prognostic score.

Language restriction None.

Country(ies) involved Spain, Italy, Germany, United States of America.

Keywords Pulmonary embolism, prognosis, prediction, mortality, survival.

Contributions of each author

Author 1 - David Jimenez - Concept and design Acquisition, analysis, or interpretation of data; statistical analysis Drafting of the manuscript Study supervision.
Email: djimenez.hrc@gmail.com
Author 2 - Behnood Bikdeli - Concept and design; Acquisition, analysis, or interpretation of data; statistical analysis.
Author 3 - Victor Tapson - Acquisition, analysis, or interpretation of data; statistical analysis.
Author 4 - Cecilia Becattini - Acquisition, analysis, or interpretation of data; statistical analysis.
Author 5 - Lisa Moores - Acquisition, analysis, or interpretation of data; statistical analysis.
Author 6 - Geoffrey Barnes - Acquisition, analysis, or interpretation of data; statistical analysis.
Author 7 - Manuel Monreal - Acquisition, analysis, or interpretation of data; statistical analysis.
Author 8 - Stavros Konstantinides - Acquisition, analysis, or interpretation of data; statistical analysis.
Author 9 - Gregory Piazza - Acquisition, analysis, or interpretation of data; statistical analysis.
Author 10 - Acquisition, analysis, or interpretation of data; statistical analysis.
Author 11 - Noelia Alvarez-Diaz - Acquisition, analysis, or interpretation of data; statistical analysis.
Author 12 - Roger Yusen - Acquisition, analysis, or interpretation of data; statistical analysis; Drafting of the manuscript.