Predicting mortality of 2273 COVID-19 confirmed patients in a multicenter Dutch cohort

poster

Maarten Ottenhoff

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Abstract

Objective: To develop and validate multivariate models to predict mortality of individual Dutch COVID-19 patients within 21 days of hospital admission, to aid the decision making process during a hospital bed shortage in a crisis situation.
Design: Measures of premorbidity, clinical presentation, laboratory and radiology findings at admission and the combination thereof, as well as the 10 best features determined by feature selection, were used to develop linear and non-linear models, which were tested on independent data from new hospitals using leave-one-hospital-out cross validation.
Setting: A multicenter, retrospective cohort study with data from 10 Dutch hospitals during the period February 27 to June 8, 2020.
Participants: 2273 hospitalized adult COVID-19 positive patients were included, of whom 516 died within 21 days.
Main Outcome Measures: The models were evaluated by the area under the receiver operator curve (AUC), sensitivity, specificity, positive predictive value and negative predictive value. In addition, the best performing models were compared with age-based decision rules. Furthermore, the necessity of using age as predictor was assessed by excluding it from the feature set, to contribute to the ongoing Dutch societal and ethical debate about utilizing age as criterion during a hospital bed shortage.
Results: A tree-based gradient boosting model trained on the 10 best features showed an AUC of 0.82 (95% confidence interval (95%-CI) 0.79 to 0.85) and showed better performance than age-based rules (0.69, 0.65 - 0.74 for age > 70). Furthermore, the performance remained stable when excluding age as predictor (AUC 0.78, 0.75 to 0.81).
Conclusion: The presented models show robust and interpretable results that predict early mortality of individual hospitalized Dutch COVID-19 patients based on hospital admission features.