



Letters to the Editor

□ PROBLEMS IN CONDUCTING AND REPORTING LOGISTIC REGRESSION ANALYSIS

□ To the Editor:

I read the article by Thoppil et al. (1) entitled “SARS-CoV-2 positivity in ambulatory symptomatic patients is not associated with increased venous or arterial thrombotic events in the subsequent 30 days,” published in the June 2022 issue of the *Journal* (1). This article is a retrospective cohort study aiming to evaluate the relationship between SARS-CoV-2 test positivity and acute vascular thrombosis using the RECOVER registry. Although the study was based on a fairly large sample, the multivariable modeling used for venous and arterial thromboembolic disease does not meet the essential requirements of logistic regression analysis.

In a study using multivariable logistic regression analysis, all possible variables that may affect the predictor variable should be included in the final analysis. In addition, the number of events per variable should be as large as possible for the validity of the model (2). In this study, only 7 variables were included in the model (presence of cancer, age, gender, hospital length of stay, intubation, intensive care unit stay, and SARS-CoV-2 positivity). It is not possible to claim that only these variables affect patient outcomes (the occurrence of arterial or venous thromboembolism). Both conditions occur with different pathophysiological processes, and the risk factors for each condition also differ. In a regression model, it should be stated whether the variables included in the multivariable model in logistic regression analysis were taken from previous studies or from univariate analysis results. In Thoppil et al. (1), it is not clear how these variables were included in the final analysis (1). In addition, the event rates in the groups are at the level of 0.3% to 0.4%, which can seriously affect the reliability of the model.

One of the analyses that should be done in logistic regression analysis is multicollinearity. This analysis evaluates the effect of variables that correlate with each other in the multivariable model (2,3). In the absence of this analysis, the final result may appear statistically insignificant if there is a strong relationship between the 2 independent variables. In Thoppil et al. (1), the interaction of possibly correlated variables such as intubation and intensive care unit admission was not evaluated (1).

Finally, in both models, goodness of fit should have been presented by a test such as receiver operating characteristic analysis or the Hosmer-Lemeshow test. Since these test results are not presented in the article, we have no chance to evaluate the goodness of fit.

The problems mentioned here are not only the limitations of the article but are also the main problems that directly affect the study results. Basal characteristics of patients from a large registry cannot be evaluated accurately, possible confounding factors cannot be eliminated, and information about the severity of the predictor variable cannot be obtained. Statistical analysis was made in the article without fulfilling the basic requirements of logistic regression analysis. Instead, the results focused on odds ratios and *p* values. In addition, Tan et al. have reached opposite results in the meta-analysis they recently published (4). For this reason, I think that the conclusion put forward by Thoppil et al. (1) should be carefully evaluated (1).

Nurettin Özgür Doğan
Department of Emergency Medicine, Faculty of
Medicine, Kocaeli University, Kocaeli, Turkey

E-mail address: nurettinozgurdogan@gmail.com
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References

1. Thoppil JJ, Courtney DM, McDonald S, et al. SARS-CoV-2 positivity in ambulatory symptomatic patients is not associated with increased

-
- venous or arterial thrombotic events in the subsequent 30 days. *J Emerg Med* 2022;62:716–24.
2. Bagley SC, White H, Golomb BA. Logistic regression in the medical literature: standards for use and reporting, with particular attention to one medical domain. *J Clin Epidemiol* 2001;54:979–85.
 3. Tanboğa IH, Kurt M, Işık T, et al. Assessment of multivariate logistic regression analysis in articles published in Turkish cardiology journals. *Turk Kardiyol Dern Ars* 2012;40:129–34.
 4. Tan BK, Mainbourg S, Friggeri A, et al. Arterial and venous thromboembolism in COVID-19: a study-level meta-analysis. *Thorax* 2021;76:970–9.