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Response to Er and Tez: the use of artificial neural networks in medical prognostication

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The authors thank Drs Er and Tez for their interest in the use of artificial neural networks (ANNs) in the hospital setting. We agree that any discussion of ANN for clinical prognostication should be accompanied by a discussion of ANN limitations.

As previously discussed by Tez *et al.*,¹ ANN may be overtrained, particularly when exposed to a small amount of data that does not accurately represent the larger data set from which it was drawn. This weakness is also applicable to regression-based models. We sought to avoid overtraining by limiting the number of hidden nodes, as proposed by Drs Er and Tez in their letter, and agree that this method also limits the power of the ANNs to model complex nonlinear relationships. Even so, the ANN demonstrated considerable accuracy in predicting severe lower intestinal bleeding using variables present on admission.²

We agree that it is inherently difficult to interpret the relative importance of ANN covariates. One advantage of using the SPSS (IBM, Armonk, NY) platform is that the contributions of each independent variable are reported as normalized importance values, representing the degree to which the predicted value is affected by changing the independent variable, relative to model covariates. This information may not be as easily interpretable as an odds ratio or relative risk value, but it does provide a general framework for interpreting the relative importance of ANN covariates.

The authors also agree that genetic algorithm and fuzzy logic optimization methods³ have the potential to improve model performance and that these methods should be applied when appropriate. By ensuring that ANNs are trained on high-quality data, seeking to understand the relative importance of model covariates, and improving prognostic accuracy with optimization methods, we remain hopeful that the application of neural networks to the hospital setting may continue to improve clinical prognostication, giving healthcare providers, patients, and their families' better information to make better decisions.

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