

A computer program to estimate over-optimism in measures of discrimination and calibration for predicting the risk of cardiovascular diseases

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Aims and objectives: Development of chronic disease risk prediction models has become a growing area of research in recent years. The external validity of such models is commonly lower than estimated from the development sample. Overfitting or overoptimism of the developed model and/or differences between the samples are likely causes for this. In small samples, Efron's bootstrapping for overoptimism is the preferred method for afterwards shrinking of regression coefficients and the model's discrimination and calibration for overoptimism. We therefore developed SAS macro programs for evaluating the degree of overoptimism in regression coefficients in the Cox proportional hazards model and its discriminative and calibration ability.

Method: A SAS macro program for Cox model using Proc PHREG was developed for estimating overoptimism in regression coefficients, Harrel's C statistic and Hosmer Lemeshow statistic (with their confidence limits).

Results: The computer program was applied to data on cardiovascular disease incidence for a Framingham population cohort. The five risk factors considered were current smoking, age, systolic blood pressure, HDL cholesterol and obesity. The regression coefficients and both the statistics were corrected for overoptimism by subtracting overoptimism from their observed values.

Conclusion: The program is very useful for evaluating the 'overoptimism corrected' predictive performance of Cox proportional hazards model.

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