

POSTER PRESENTATION

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# Risk calculation charts for multiclass prediction models

Vanya Van Belle\*, Ben Van Calster

From Methods in Epidemiology Symposium  
Leuven, Belgium. 17 September 2015

## Aim

Visual representation of risk prediction models is crucial for these models to be implemented in daily clinical practice. We propose to use color charts to represent the risk estimation process of multinomial logistic regression models.

## Methods

Binary logistic regression models, where the estimated risk equals  $p=1/(1+\exp(-b_0-xb))$  can be visualized by representing the contribution of each predictor ( $x_{ib_i}$ ) with a colorbar, the color of which represents the value of the contribution. An additional colorbar is used to transform the sum of these contributions to a risk.

For multinomial models, the linear predictors ( $lp_l=b_0^l+xb^l$ ) are dependent on the outcome level  $l$  and a chart as described above can be made for each outcome level. For the reference level  $lp_{ref}=0$  such that a chart to represent the calculation of  $lp_{ref}$  is not necessary. The risk on the reference level is given by  $p_{ref}=1/(1+\sum_{l=1}^{k-1}\exp(lp_l))$ , and can be visualized using  $k-1$  colorbars, with colors encoding  $\exp(lp_l)$ . The conversion of the sum of these contributions  $\exp(lp_l)$  to the risk can again be made by means of a monotonic transformation that can be represented in a colorbar. To visualize the risk calculation for the other outcome levels, we use the following relation:  $p_l=p_{ref}\exp(lp_l)$ , which can be written as  $\ln(p_l)=\ln(p_{ref})+lp_l$ . Using two colorbars to represent  $\ln(p_{ref})$  and  $lp_l$ , the estimated risk can again be formed by means of a monotonic function of the sum of these and represented as an additional colorbar.

## Conclusion

The complete risk prediction process of multinomial regression models can be visualized by means of colorbars. Through this visualization the understanding and involvement of clinicians and patients in statistical modelling can improve. As a result, risk prediction models might be more integrated in daily clinical practice.

Published: 17 September 2015

doi:10.1186/2049-3258-73-S1-P28

**Cite this article as:** Van Belle and Van Calster: Risk calculation charts for multiclass prediction models. *Archives of Public Health* 2015 **73**(Suppl 1):P28.

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